HANDBOOK of CHEMISTRY and PHYSICS

EIGHTH EDITION

1920-1921

C. H. Hutson.

Protein 5.7

HANDBOOK
OF
CHEMISTRY AND PHYSICS

A READY-REFERENCE POCKET BOOK OF CHEMICAL AND PHYSICAL DATA

EIGHTH EDITION

COMPILED FROM THE MOST RECENT AUTHORITATIVE SOURCES

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PREFACE

In compliance with the requests of hundreds of our friends for a small but comprehensive book of reference on chemical and physical topics, we have designed and compiled this Handbook of Chemistry and Physics.

In its new and revised form we have aimed to present in one compact, easily portable volume a comparatively comprehensive reference book for use in the laboratory or classroom. While more complete and broader in scope than the reference material ordinarily found in the laboratory manual, it is still not a competitor of the many large and complete reference books already published, but fills, we believe, a place not hitherto occupied by any publication in this country.

We shall feel amply rewarded for our effort and expense if this volume proves to be of use and convenience to the profession whose support has been a conspicuous factor in the growth of our establishment.

The material here included has been carefully selected by W. R. Veazey, Ph.D., of the Chemistry Department, and Charles D. Hodgman, B.S., of the Department of Physics of the Case School of Applied Science. The compilers have been guided in their selections by the suggestions of more than a thousand members of high standing in the Chemical and Physical profession.

A large number of the tables are the result of compilation from various sources: the original authority or the source of information being stated where possible. Special mention should be made of the use of the "Smithsonian Physical Tables," from which several tables have been taken without alteration, while others are partly compiled from similar tables in that volume.

Material has also been copied by special permission from the following: Collins, "The Design and Construction of Induction Coils," Munn and Co., publisher; Miller, "Laboratory

Physics," Ginn and Co., publisher; Noyes, "Qualitative Analysis," Macmillan and Co., publisher; Perkins, "Introduction to General Thermodynamics," John Wiley and Sons, publisher; Talbot, "Quantitative Analysis," Macmillan and Co., publisher; Young, "General Astronomy," Ginn and Co., publisher; Cohn, "Indicators and Test-papers," John Wiley and Sons, publisher.

PREFACE TO SIXTH EDITION

The sixth edition of the Handbook presents several important changes and additions. The change in arrangement of material is the result of an attempt to make more convenient the use of the mathematical tables and especially the table of logarithms which is used by both branches of science and in such a way as to make it important that it should be easy of access.

The table of physical constants of inorganic compounds has been entirely rewritten. Data are now given for about one thousand compounds and it is believed that the list fully meets the requirements of the high school or college laboratory.

Another notable addition is a new and unusually complete table of heats of formation and solution. The arrangement of the material is original and its convenience will, we believe, appeal to users of the Handbook.

Among the more important tables added are the following:

Properties of Saturated Steam.
Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight.
Specific Gravity of Aqueous Solutions of Sodium Chloride.
Composition and Physical Properties of Alloys.
Decomposition of Anhydrous Metallic Sulphates.
Dehydration of Metallic Sulphates.
Solubility of Inorganic Salts at various Temperatures.
Molecular Elevation of Boiling Point and Depression of Freezing Point.
Exponentials.
Degree-Radian Conversion Table; etc.

A large number of minor changes, corrections, and additions have been made.

The revision has been directly along the line of numerous suggestions received from users of the book. Many other valuable suggestions have been received and while it is impossible to add further material to the present edition they serve to indicate the possibilities of future growth.

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THE CHEMICAL RUBBER COMPANY.

Cleveland, Ohio,
August 15, 1917.

PREFACE TO THE EIGHTH EDITION

Suggestions which have been made as to the additional matter to be included in the new edition of the Handbook have been unusually varied in character. An effort has been made, however, to meet the wishes of as many as possible without materially departing from the principles heretofore followed.

Two notable additions are the new and enlarged numerical table and the complete and exceedingly convenient set of Metric-English and English-Metric conversion tables.

Other tables incorporated in the Handbook for the first time in the present edition are:

Common Names of Chemicals, their Correct Names and Formulæ.

Sulphuric Acid, Nitric Acid, Hydrochloric Acid and Aqua Ammonia Tables of the Manufacturing Chemists' Association.

Heats of Formation and Combustion of Organic Compounds.

Constants of Oils, Fats, and Waxes.

Conductivity of Standard Solutions.

Equivalent Conductivity of Aqueous Solutions.

Equivalent Conductivity of the Separate Ions.

Ionization due to X-Rays.

Mean Absorption Coefficient for X-Rays.

X-Ray Spectra and Atomic Numbers.

Many other tables, although appearing in previous editions, have been entirely rewritten and greatly enlarged. Among them are the following:

Heat Conductivity.
Thermal Expansion.
Specific Heat of Aqueous Solutions.
Specific Heat of the Elements.
Compressibility of Liquids.
Radioactivity.
Photographic Formulæ, etc.

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ANTIDOTES OF POISONS

Acetic Acid.—Emetics, magnesia, chalk, soap, oil.

Arsenic, Rat Poison, Paris Green.—Milk, raw egg, sweet oil, lime water, flour and water.

Carbolic Acid.—Any soluble non-toxic sulphate, after provoking vomiting with zinc sulphate; uncooked white of egg in abundance, milk of lime, saccharate of calcium, olive or castor oil with magnesia in suspension, ice, washing the stomach with equal parts water and vinegar; give alcohol or whiskey or about four fluid ounces camphorated oil at one dose.

Chloroform, Chloral, Ether.—Dash cold water on head and chest, artificial respiration.

Hydrochloric Acid.—Magnesia, alkali carbonates, albumen, ice.

Hydrocyanic or Prussic Acid.—Hydrogen peroxide internally, and artificial respiration, breathing ammonia or chlorine from chlorinated lime, ferrous sulphate followed by potassium carbonate, emetics, warmth.

Iodine.—Emetics, stomach siphon, starchy foods in abundance, sodium thiosulphate.

Lead Acetate.—Emetics, stomach siphon, sodium, potassium or magnesium sulphates, milk, albumen.

Mercuric Chloride or Corrosive Sublimate.—Zinc sulphate, emetics, stomach siphon, white of egg, milk, chalk, castor oil, table salt, reduced iron.

Nitrate of Silver.—Salt and water.

Nitric Acid.—Same as for hydrochloric acid.

Opium, Morphine, Laudanum, Paregoric, etc.—Strong coffee, hot bath. Keep awake and moving at any cost.

Phosphoric Acid.—Same as for hydrochloric.

Sodium Hydroxide or Potassium Hydroxide.—Vinegar, lemon juice, orange juice, oil, milk.

Sulphuric Acid.—Same as for hydrochloric acid with the addition of soap or oil.

Sulphurous Acid or Sulphur Dioxide.—Mustard plaster on chest; narcotics, expectorants.

BURNS AND SCALDS

Exclude air by thin paste of starch, flour, or baking soda. Ordinary oils such as vaseline, olive or castor oil, lard or cream may also be used. Lime water mixed with an equal part of raw linseed oil makes an excellent dressing. An especially valuable material for all burns is picric acid gauze which may be applied in the form of a compress.

After treatment with any of the above materials, cover with a cloth or with cotton and hold in place with a light bandage.

ACID AND ALKALI BURNS

With either, wash off as quickly as possible with a large quantity of water. Water from a tap may be allowed to flow over burns.

Acids

While the injury is being washed, have procured, lime water or lime water and raw linseed oil mixed together in equal proportions or a mixture of baking soda and water or soap suds and apply freely. For acid in the eye wash as quickly as possible with water and then with lime water.

Alkalis

Wash with a large quantity of water as for acid burns. Neutralize with weak vinegar, hard cider or lemon juice. For lime or other strong alkali burns in the eye wash with weak solution of vinegar or with olive oil or a saturated solution of boric acid.

MATHEMATICAL TABLES

ALGEBRA

Factors

$$(a \pm b)^2 = a^2 \pm 2ab + b^2$$
$$(a \pm b)^3 = a^3 \pm 3a^2b + 3ab^2 \pm b^3$$
$$a^2 - b^2 = (a - b)(a + b)$$
$$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$
$$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$
$$a^n - b^n = (a - b)(a^{n-1} + a^{n-2}b + \dots + b^{n-1})$$
$$a^n - b^n = (a + b)(a^{n-1} - a^{n-2}b + \dots - b^{n-1}),$$
for even values of n.
$$a^n + b^n = (a + b)(a^{n-1} - a^{n-2}b + \dots + b^{n-1}),$$
for odd values of n.
$$a^4 + a^2b^2 + b^4 = (a^2 + ab + b^2)(a^2 - ab + b^2)$$
$$(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2ac + 2bc$$
$$(a + b + c)^3 = a^3 + b^3 + c^3 + 3a^2(b + c) + 3b^2(a + c) + 3c^2(a + b) + 6abc$$

Quadratic Equations

Any quadratic equation may be reduced to the form,—

$$ax^2 + bx + c = 0$$

Then $$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

If $b^2 - 4ac$ is positive the roots are real and unequal.
If $b^2 - 4ac$ is zero the roots are real and equal.
If $b^2 - 4ac$ is negative the roots are imaginary and unequal.
If $b^2 - 4ac$ is a perfect square the roots are rational and unequal.

Exponents

$$a^x \times a^y = a^{(x+y)} \qquad a^{-x} = \frac{1}{a^x}$$

$$\frac{a^x}{a^y} = a^{(x-y)} \qquad a^0 = 1$$

$$(a^x)^y = a^{xy} \qquad a^{\frac{x}{y}} = \sqrt[y]{a^x}$$

Proportion

If $$\frac{a}{b} = \frac{c}{d}$$

Then $$\frac{a+b}{b} = \frac{c+d}{d}$$

$$\frac{a-b}{b} = \frac{c-d}{d}$$

$$\frac{a-b}{a+b} = \frac{c-d}{c+d}$$

ALGEBRA (Continued)

Sums of Numbers

The sum of the first n numbers, —

$$\Sigma(n) = 1 + 2 + 3 + 4 + 5 \ldots\ldots + n = \frac{n(n+1)}{2}$$

The sum of the squares of the first n numbers,

$$\Sigma(n^2) = 1^2 + 2^2 + 3^2 + 4^2 + 5^2 \ldots\ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

The sum of the cubes of the first n numbers,

$$\Sigma(n^3) = 1^3 + 2^3 + 3^3 + 4^3 + 5^3 \ldots\ldots + n^3 = \frac{n^2(n+1)^2}{4}$$

Arithmetical Progression

If a is the first term; l, the last term; d, the common difference; n, the number of terms and s, the sum of n terms, —

$$l = a + (n-1)d$$

$$s = \frac{n}{2}(a + l)$$

$$s = \frac{n}{2}\left\{2a + (n-1)d\right\}$$

Geometrical Progression

If a is the first term; l, the last term; r, the common ratio; n, the number of terms and s, the sum of n terms, —

$$l = ar^{n-1}$$

$$s = \frac{a(r^n - 1)}{r - 1}$$

$$s = \frac{a(1 - r^n)}{1 - r}$$

If n is infinity and r less than unity, —

$$s = \frac{a}{1 - r}$$

Permutations

If M denote the number of permutations of n things taken p at a time, —

$$M = n(n-1)(n-2)\ldots\ldots(n-p+1)$$

Combinations

If M denote the number of combinations of n things taken p at a time, —

$$M = \frac{n(n-1)(n-2)\ldots\ldots(n-p+1)}{\underline{|p}}$$

$$M = \frac{\underline{|n}}{\underline{|p}\;\underline{|n-p}}$$

ALGEBRA (Continued)

Approximations

If a and b are small quantities, the following relations are approximately true,—

$$(1 \pm a)^m = 1 \pm ma$$
$$(1 \pm a)^m(1 \pm b)^n = 1 \pm ma \pm nb$$

If n is nearly equal to m,

$$\sqrt{nm} = \frac{n+m}{2}, \text{ approximately.}$$

If θ is a very small angle expressed in radians, —

$$\frac{\sin\theta}{\theta} = 1 \text{ and } \frac{\tan\theta}{\theta} = 1, \text{ approximately.}$$

Series

Binomial

$$(x+y)^n = x^n + nx^{n-1}y + \frac{n(n-1)}{\underline{|2}}x^{n-2}y^2 + \ldots.$$
$$\frac{n(n-1)\ldots(n-m+1)}{\underline{|m}}x^{n-m}y^m + \ldots \qquad (y^2 < x^2)$$
$$(1 \pm x)^n = 1 \pm nx + \frac{n(n-1)x^2}{\underline{|2}} \pm \frac{n(n-1)(n-2)x^3}{\underline{|3}} + \ldots \text{etc.} \qquad (x^2 < 1)$$
$$(1 \pm x)^{-n} = 1\ n \mp x + \frac{n(n+1)x^2}{\underline{|2}} \mp \frac{n(n-1)(n-2)x^3}{\underline{|3}} + \ldots \text{etc.} \qquad (x^2 < 1)$$
$$(1 \pm x)^{-1} = 1 \mp x + x^2 \mp x^3 + x^4 \mp x^5 + \ldots \qquad (x^2 < 1)$$
$$(1 \pm x)^{-2} = 1 \mp 2x + 3x^2 \mp 4x^3 + 5x^4 \mp 6x^5 + \ldots \qquad (x^2 < 1)$$

Taylor's Series

$$f(x+h) = f(x) + hf'(x) + \frac{h^2}{\underline{|2}}f''(x) + \frac{h^3}{\underline{|3}}f'''(x) + \ldots$$

Maclaurin's Series

$$f(x) = f(o) + \frac{x}{1}f'(o) + \frac{x^2}{\underline{|2}}f''(o) + \frac{x^3}{\underline{|3}}f'''(o) + \ldots$$

Exponential

$$e = 1 + \frac{1}{1} + \frac{1}{\underline{|2}} + \frac{1}{\underline{|3}} + \frac{1}{\underline{|4}} + \ldots$$
$$e^x = 1 + x + \frac{x^2}{\underline{|2}} + \frac{x^3}{\underline{|3}} + \frac{x^4}{\underline{|4}} + \ldots$$
$$a^x = 1 + x\log a + \frac{(x\log a)^2}{\underline{|2}} + \frac{(x\log a)^3}{\underline{|3}} + \ldots$$

ALGEBRA (Continued)

Logarithmic

$$\log_e x = \frac{x-1}{x} + \frac{1}{2}\left(\frac{x-1}{x}\right)^2 + \frac{1}{3}\left(\frac{x-1}{x}\right)^3 + \ldots \qquad (x > \tfrac{1}{2})$$

$$\log_e x = (x-1) - \tfrac{1}{2}(x-1)^2 + \tfrac{1}{3}(x-1)^3 - \ldots \qquad (2 > x > 0)$$

$$\log_e x = 2\left[\frac{x-1}{x+1} + \frac{1}{3}\left(\frac{x-1}{x+1}\right)^3 + \frac{1}{5}\left(\frac{x-1}{x+1}\right)^5 + \ldots\right] \qquad (x > 0)$$

$$\log_e(1+x) = x - \tfrac{1}{2}x^2 + \tfrac{1}{3}x^3 - \tfrac{1}{4}x^4 + \ldots$$

$$\log_e(n+1) - \log_e(n-1) = 2\left[\frac{1}{n} + \frac{1}{3n^3} + \frac{1}{5n^5} + \ldots\right]$$

$$\log_{10}(n+1) - \log_{10} n = \frac{k}{n} + \frac{k}{2n^2} + \frac{k}{3n^3} + \ldots \quad \text{where } k = .4343\ldots$$

Trigonometric

$$\sin x = x - \frac{x^3}{|\underline{3}} + \frac{x^5}{|\underline{5}} - \frac{x^7}{|\underline{7}} + \ldots$$

$$\cos x = 1 - \frac{x^2}{|\underline{2}} + \frac{x^4}{|\underline{4}} - \frac{x^6}{|\underline{6}} + \ldots$$

$$\tan x = x + \frac{x^3}{3} + \frac{2x^5}{15} + \frac{17x^7}{315} + \frac{62x^9}{2835} + \ldots \qquad \left(x^2 < \frac{\pi^2}{4}\right)$$

$$\sin^{-1}x = x + \frac{x^3}{6} + \frac{1}{2}\cdot\frac{3}{4}\cdot\frac{x^5}{|\underline{5}} + \frac{1}{2}\cdot\frac{3}{4}\cdot\frac{5}{6}\cdot\frac{x^7}{|\underline{7}} + \ldots \qquad (x^2 < 1)$$

$$\tan^{-1}x = x - \frac{1}{3}x^3 + \frac{1}{5}x^5 - \frac{1}{7}x^7 + \ldots \qquad (x^2 < 1)$$

$$= \frac{\pi}{2} - \frac{1}{x} + \frac{1}{3x^3} - \frac{1}{5x^5} + \ldots \qquad (x^2 > 1)$$

MENSURATION FORMULÆ

Plain Figures Bounded by Straight Lines

The **area of a triangle** whose base is b and altitude h

$$=\frac{hb}{2}.$$

The area of a **triangle** with angles A, B, and C and sides opposite a, b, and c, respectively

$$=\tfrac{1}{2}ab \sin C.$$

or

$$=\sqrt{s(s-a)(s-b)(s-c)},$$

where $s = 1/2(a+b+c)$.

A **rectangle** with sides a and b has an area $=ab$.

The area of a **parallelogram** with side b and the perpendicular distance to the parallel side h

$$=bh.$$

The area of a **parallelogram** with sides a and b and the included angle θ

$$=ab \sin \theta.$$

The area of a **rhombus** with diagonals c and d,

$$=\tfrac{1}{2}cd.$$

The area of any **quadrilateral** with diagonals a and b and the angle between them θ

$$=\tfrac{1}{2}ab \sin \theta.$$

The area of a **regular polygon** with n sides, each of length l,

$$=\tfrac{1}{4}nl^2 \cot \frac{180}{n}.$$

For a regular polygon of n sides, each side of length l, the radius of the **inscribed circle**,

$$=\frac{l}{2}\cot \frac{180}{n}.$$

The radius of the **circumscribed circle**,

$$=\frac{l}{2}\operatorname{cosec} \frac{180}{n}.$$

Area, Radius of Inscribed and Circumscribed Circles for Regular Polygons

l = length of one side.

Name.	Number of sides.	Area.	Radius of inscribed circle.	Radius of circumscribed circle.
Triangle, equilateral	3	$0.43301l^2$	$0.28867l$	$0.57735l$
Square............	4	$1.00000l^2$	$0.50000l$	$0.70710l$
Pentagon..........	5	$1.72048l^2$	$0.68819l$	$0.85065l$
Hexagon..........	6	$2.59808l^2$	$0.86602l$	$1.0000l$
Heptagon..........	7	$3.63391l^2$	$1.0383l$	$1.1523l$
Octagon..........	8	$4.82843l^2$	$1.2071l$	$1.3065l$
Nonagon..........	9	$6.18182l^2$	$1.3737l$	$1.4619l$
Decagon..........	10	$7.69421l^2$	$1.5388l$	$1.6180l$
Undecagon........	11	$9.36564l^2$	$1.7028l$	$1.7747l$
Dodecagon........	12	$11.19615l^2$	$1.8660l$	$1.9318l$

Radius of circle inscribed in any triangle, whose sides are a, b, and c, where $s = \frac{1}{2}(a+b+c)$

$$= \frac{\sqrt{s(s-a)(s-b)(s-c)}}{s}.$$

The radius of the **circumscribed** circle

$$= \frac{abc}{4\sqrt{s(s-a)(s-b)(s-c)}}.$$

The perimeter of a polygon inscribed in a circle of radius r, where n is the number of sides,

$$= 2nr \sin \frac{\pi}{n}.$$

The **area** of the **inscribed** polygon,

$$= \frac{1}{2}nr^2 \sin \frac{2\pi}{n}.$$

The perimeter of a polygon circumscribed about a circle of radius r, number of sides n

$$= 2nr \tan \frac{\pi}{n}.$$

The area of the circumscribed polygon

$$= nr^2 \tan \frac{\pi}{n}.$$

Plane Figures Bounded by Curved Lines

The **circumference of a circle** whose radius is r and diameter $d(d=2r)$

$$=2\pi r=\pi d.$$

The **area of a circle**

$$=\pi r^2=\tfrac{1}{4}\pi d^2=.7854d^2.$$

The **length of an arc** of a circle for an arc of θ degrees

$$=\frac{\pi r\theta}{180}.$$

NOTE.—In this and following similar formulæ r denotes the radius of the circle, (OC, Fig. 1).

For an arc of θ radians the length

$$=r\theta.$$

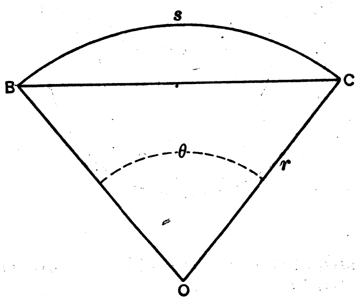

FIG 1.

The **length of a chord** subtending an angle θ

$$=2r\sin\tfrac{1}{2}\theta.$$

The **area of a sector** where θ is the angle between the radii in degrees

$$=\frac{\pi r^2\theta}{360}.$$

If s is the length of the arc, the area of the sector

$$=\frac{sr}{2}.$$

The **area of a segment** where θ is the angle between the two radii in degrees

$$=\frac{\pi r^2\theta}{360}-\frac{r^2\sin\theta}{2}.$$

If θ is in radians the area

$$=\tfrac{1}{2}r^2(\theta-\sin\theta).$$

The **area of the ring** between two circles of radius r_1 and r_2, one of which encloses the other,

$$=\pi(r_1+r_2)(r_1-r_2).$$

The two cricles are not necessarily concentric.

Area of the sector of an annulus. (Fig. 2.)—If angle $GOH=\theta$ and the lines GO and $JO=r_1$ and r_2 respectively, the area $GHIJ$

$$=\tfrac{1}{2}\theta(r_1+r_2)(r_1-r_2).$$

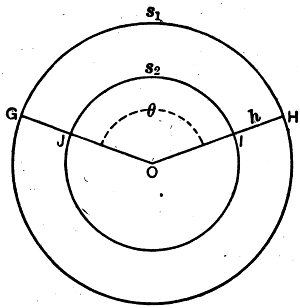

FIG. 2.

If s_1 = the length of the arc GH and s_2 = the arc JI and $h=HI=r_1-r_2$, the area $GHIJ$

$$=\tfrac{1}{2}h(s_1+s_2).$$

The **circumference of an ellipse** whose semiaxes are a and b

$$=2\pi\sqrt{\frac{a^2+b^2}{2}}, \text{ approximately.}$$

The **area of an ellipse**

$$=\pi ab.$$

The length of the **arc of a parabola,** as arc SPQ in Fig. 3, where $x=PR$, and $y=QR$

$$=2\sqrt{y^2+\frac{4x^2}{3}}.$$

The **area of the section of the parabola** $PQRS$,

$$=\frac{4}{3}xy.$$

Solids Bounded by Planes

The lateral area of a regular prism = perimeter of a right section × the length.

The volume of a regular prism = area of base × the altitude.

The lateral area of a regular pyramid, slant height l and length of one side of base a,

$$= \tfrac{1}{2}nal.$$

The volume of a pyramid = $\frac{1}{3}$ area of base × altitude.

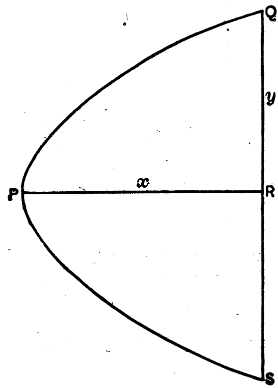

FIG. 3.

Surface and Volume of Regular Polyhedra

Surface and volume of regular polyhedra in terms of the length of one edge l.

Name.	Nature of surface.	Surface.	Volume.
Tetrahedron...	4 equilateral triangles	$1.73205l^2$	$0.11785l^3$
Hexahedron or cube.......	6 squares..........	$6.00000l^2$	$1.00000l^3$
Octahedron....	8 equilateral triangles	$3.46410l^2$	$0.47140l^3$
Dodecahedron .	10 pentagons.......	$20.64578l^2$	$7.66312l^3$
Icosahedron ...	20 equilat.-triangles.	$8.66025l^2$	$2.18170l^3$

Solids Bounded by Curved Surfaces

The surface of a sphere of radius r and diameter $d(=2r)$

$$=4\pi r^2=\pi d^2=12.57r^2.$$

The volume of a sphere

$$=\tfrac{4}{3}\pi r^3=\tfrac{1}{6}\pi d^3=4.189r^3.$$

The **area of a lune** on the surface of a sphere of radius r, included between two great circles whose inclination is θ radians

$$=2r^2\theta.$$

The **area of a spherical triangle** whose angles are A, B, and C (radians) on a sphere of radius r

$$=(A+B+C-\pi)r^2.$$

The **area of a spherical polygon** of n sides where θ is the sum of its angles in radians

$$=[\theta-(n-2)\pi]r^2.$$

The area of the curved surface of a **spherical segment** of height h, radius of sphere r

$$=2\pi rh.$$

The **volume of a spherical segment,** data as above

$$=\tfrac{1}{3}\pi h^2(3r-h).$$

If a = radius of the base of the segment, the volume

$$=\tfrac{1}{6}\pi h(h^2+3a^2).$$

The **curved surface of a right cylinder** where r = the radius of the base and h, the altitude,

$$=2\pi rh.$$

The **volume of a cylinder,** data as above,

$$=\pi r^2h.$$

The **curved surface of a right cone** whose altitude is h and radius of base r

$$=\pi r\sqrt{r^2+h^2}.$$

The **volume of a cone,** data as above,

$$=\frac{\pi}{3}r^2h=1.047r^2h.$$

The curved surface of the frustum of a right cone, radius of base r, of top r^2 and altitude h,

$$=\pi(r_1+r_2)\sqrt{h^2+r^2}.$$

The volume of the frustum of a cone, data as above,

$$=\pi\frac{h}{3}(r_1^2+r_1r_2+r_2^2).$$

The **oblate spheroid** is formed by the rotation of an ellipse about its minor axis. If a and b are the major and minor semiaxes respectively, and e the eccentricity, the surface

$$=2\pi a^2+\pi\frac{b^2}{c}\log_e\frac{1+e}{1-e},$$

and volume $=\tfrac{4}{3}\pi a^2b.$

The prolate spheroid is formed by the rotation of an ellipse about its major axis ($2a$), data as above.

Surface $= 2\pi b^2 + 2\pi \frac{ab}{e} \sin^{-1} e$,

volume $= 4/3 \pi a b^2$.

TRIGONOMETRIC FUNCTIONS IN A RIGHT-ANGLED TRIANGLE

If A, B, and C are the vertices (C the right angle), and a, b, and h the sides opposite respectively,

$\sin A = \frac{a}{h}$, $\cos A = \frac{b}{h}$,

$\tan A = \frac{a}{b}$, $\cot A = \frac{b}{a}$,

secant $A = \frac{h}{b}$, cosec $A = \frac{h}{a}$.

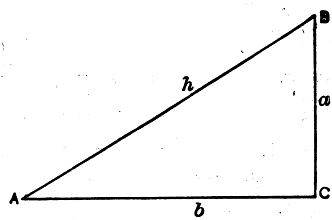

FIG. 4.

SIGNS AND LIMITS OF VALUE ASSUMED BY THE FUNCTIONS

Funtion.	Quadrant I.		Quadrant II.		Quadrant III.		Quadrant IV.	
	Sign.	Value.	Sign.	Value.	Sign.	Value.	Sign.	Value.
sin	+	0 to 1	+	1 to 0	−	0 to 1	−	1 to 0
cos.	+	1 to 0	−	0 to 1	−	1 to 0	+	0 to 1
tan.	+	0 to ∞	−	∞ to 0	+	0 to ∞	−	∞ to 0
cot.	+	∞ to 0	−	0 to ∞	+	∞ to 0	−	0 to ∞
sec	+	1 to ∞	−	∞ to 1	−	1 to ∞	+	∞ to 1
cosec. . . .	+	∞ to 1	+	1 to ∞	−	∞ to 1	−	1 to ∞

VALUE OF THE FUNCTIONS OF VARIOUS ANGLES

	0°	30°	45°	60°	90°	180°	270°
sin......	0	1/2	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}\sqrt{3}$	1	0	−1
cos......	1	$\frac{1}{2}\sqrt{3}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0	−1	0
tan......	0	$1/\sqrt{3}$	1	$\sqrt{3}$	∞	0	∞
cot......	∞	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0	∞	0

RELATIONS OF THE FUNCTIONS

$$\sin x = \frac{1}{\operatorname{cosec} x}. \qquad \operatorname{cosec} x = \frac{1}{\sin x}.$$

$$\cos x = \frac{1}{\sec x}. \qquad \sec x = \frac{1}{\cos x}.$$

$$\tan x = \frac{1}{\cot x} = \frac{\sin x}{\cos x}.$$

$$\cot x = \frac{1}{\tan x} = \frac{\cos x}{\sin x}.$$

$$\sin x = \sqrt{1-\cos^2 x}. \qquad \cos x = \sqrt{1-\sin^2 x}.$$

$$\tan x = \sqrt{\sec^2 - 1}. \qquad \sec x = \sqrt{\tan^2 + 1}.$$

$$\cot x = \sqrt{\operatorname{cosec}^2 x - 1}. \qquad \operatorname{cosec} x = \sqrt{\cot^2 x + 1}.$$

$$\sin x = \cos(90-x) = \sin(180-x).$$

$$\cos x = \sin(90-x) = -\cos(180-x).$$

$$\tan x = \cot(90-x) = -\tan(180-x).$$

$$\cot x = \tan(90-x) = -\cot(180-x).$$

FUNCTIONS OF SUMS OF ANGLES

$$\sin(x+y) = \sin x \cos y + \cos x \sin y.$$

$$\sin(x-y) = \sin x \cos y - \cos x \sin y.$$

$$\cos(x+y) = \cos x \cos y - \sin x \sin y.$$

$$\cos(x-y) = \cos x \cos y + \sin x \sin y.$$

$$\tan(x+y) = \frac{\tan x + \tan y}{1 - \tan x \tan y}.$$

$$\tan(x-y) = \frac{\tan x - \tan y}{1 + \tan x \tan y}.$$

FUNCTIONS OF MULTIPLE ANGLES

$\sin 2x = 2 \sin x \cos x.$

$\cos 2x = \cos^2 x - \sin^2 x = 2 \cos^2 x - 1 = 1 - 2 \sin^2 x.$

$\sin 3x = 3 \sin x - 4 \sin^3 x.$

$\cos 3x = 4 \cos^3 x - 3 \cos x.$

$$\tan 2x = \frac{2 \tan x}{1 - \tan^2 x}.$$

$$\tan 3x = \frac{3 \tan x - \tan^3 x}{1 - 3 \tan^2 x}.$$

$$\sin \tfrac{1}{2}x = \pm\sqrt{\frac{1 - \cos x}{2}}.$$

$$\cos \tfrac{1}{2}x = \pm\sqrt{\frac{1 + \cos x}{2}}.$$

$$\tan \tfrac{1}{2}x = \pm\sqrt{\frac{1 - \cos x}{1 + \cos x}}.$$

RELATIONS BETWEEN SIDES AND ANGLES OF ANY TRIANGLE

In a triangle with angles A, B, and C and sides opposite a, b, and c respectively,

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}.$$

$$a^2 = b^2 + c^2 - 2bc \cos A.$$

$$a = b \cos C + c \cos B.$$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}.$$

$$\tan \frac{A - B}{2} = \frac{a - b}{a + b} \cot \frac{C}{2}.$$

$$\sin A = \frac{2}{bc}\sqrt{s(s-a)(s-b)(s-c)},$$

where $s = \tfrac{1}{2}(a + b + c).$

$$\sin \frac{A}{2} = \sqrt{\frac{(s-b)(s-c)}{bc}}.$$

$$\cos \frac{A}{2} = \sqrt{\frac{s(s-a)}{bc}}.$$

$$\tan \frac{A}{2} = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}}.$$

CALCULUS

Derivatives

$$d\,ax = a\,dx$$

$$d\,uv = \left(u\frac{dv}{dx} + v\frac{du}{dx}\right)dx$$

$$d\,\frac{u}{v} = \left(\frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}\right)dx$$

$$dx^n = n\,x^{n-1}dx$$

$$d\,f(u) = d\frac{f(u)}{du} \cdot \frac{du}{dx} \cdot dx$$

$$d\,e^x = e^x dx$$

$$d\,e^{ax} = a\,e^{ax}dx$$

$$d\log_e x = \frac{1}{x}dx$$

$$d\,x^x = x^x(1 + \log_e x)$$

$$d\sin x = \cos x\,dx$$

$$d\cos x = -\sin x\,dx$$

$$d\tan x = \sec^2 x\,dx$$

$$d\cot x = -\csc^2 x\,dx$$

$$d\sec x = \tan x \sec x\,dx$$

$$d\csc x = -\cot x \cdot \csc x\,dx$$

$$d\sin^{-1}x = (1 - x^2)^{-\frac{1}{2}}dx$$

$$d\cos^{-1}x = -(1 - x^2)^{-\frac{1}{2}}dx$$

$$d\tan^{-1}x = (1 + x^2)^{-1}dx$$

$$d\cot^{-1}x = -(1 + x^2)^{-1}dx$$

$$d\sec^{-1}x = x^{-1}(x^2 - 1)^{-\frac{1}{2}}dx$$

$$d\csc^{-1}x = -x^{-1}(x^2 - 1)^{-\frac{1}{2}}dx$$

Integrals

$$\int x^n\,dx = \frac{x^{n+1}}{n+1} \qquad \text{except } n = -1$$

$$\int \frac{dx}{x} = \log x$$

$$\int e^x dx = e^x$$

$$\int e^{ax}dx = \frac{1}{a}e^{ax}$$

$$\int x\,e^{ax}dx = \frac{e^{ax}}{a^2}(ax - 1)$$

$$\int \log x\,dx = x\log x - x$$

$$\int u\,dv = uv - \int v\,du$$

Integrals (Continued)

$$\int (a + bx)^n dx = \frac{(a + bx)^{n+1}}{(n + 1)b}$$

$$\int (a^2 + x^2)^{-1} dx = \frac{1}{a} \tan^{-1} \frac{x}{a} = \frac{1}{a} \sin^{-1} \frac{x}{\sqrt{x^2 + a^2}}$$

$$\int (a^2 - x^2)^{-1} dx = \frac{1}{2a} \log \frac{a + x}{a - x}$$

$$\int (a^2 - x^2)^{-\frac{1}{2}} dx = \sin^{-1} \frac{x}{a} = -\cos^{-1} \frac{x}{a}$$

$$\int x(a^2 \pm x^2)^{-\frac{1}{2}} dx = \pm (a^2 \pm x^2)^{\frac{1}{2}}$$

$$\int \sin^2 x dx = -\tfrac{1}{2} \cos x \sin x + \tfrac{1}{2} x$$

$$\int \cos^2 x \, dx = \tfrac{1}{2} \sin x \cos x + \tfrac{1}{2} x$$

$$\int \sin x \cos x \, dx = \tfrac{1}{2} \sin^2 x$$

$$\int (\sin x \cos x)^{-1} dx = \log \tan x$$

$$\int \tan x dx = -\log \cos x$$

$$\int \tan^2 x \, dx = \tan x - x$$

$$\int \cot x \, dx = \log \sin x$$

$$\int \cot^2 x dx = -\cot x - x$$

$$\int \csc x dx = \log \tan \tfrac{1}{2} x$$

$$\int x \sin x \, dx = \sin x - x \cos x$$

$$\int x \cos x \, dx = \cos x + x \sin x$$

ANALYTICAL GEOMETRY

The distance between two points x_1, y_1, and x_2, y_2, — rectangular coördinates:

$$d = \pm \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

For polar coördinates and points r_1, θ_1, and r_2, θ_2:

$$d = \pm \sqrt{r_1^2 + r_2^2 - 2r_1r_2 \cos(\theta_1 - \theta_2)}$$

The area of a triangle whose vertices are x_1, y_1; x_2, y_2, and x_3, y_3:

$$A = \tfrac{1}{2}(x_1y_2 - x_2y_1 + x_2y_3 - x_3y_2 + x_3y_1 - x_1y_3)$$

For polar coördinates and vertices, r_1, θ_1; r_2, θ_2, and r_3, θ_3:

$$A = \tfrac{1}{2}\{(r_1r_2 \sin(\theta_2 - \theta_1) + r_2r_3 \sin(\theta_3 - \theta_2) + r_3r_1 \sin(\theta_1 - \theta_3)\}$$

The equation of a straight line where m is the tangent of the angle of inclination and c, the distance of intersection with the axis from the origin:

$$y = mx + c$$

If a line of inclination m passes through the point x_1, y_1 its equation is:

$$y - y_1 = m(x - x_1)$$

The equation of a line through the points x_1, y_1, and x_2, y_2 is:

$$\frac{y - y_1}{y_2 - y_1} = \frac{x - x_1}{x_2 - x_1}$$

If the intercepts on the axes are a and b, the equation is:

$$\frac{x}{a} + \frac{y}{b} = 1$$

If the length of the perpendicular from the origin is p and its angle of inclination θ the equation is:

$$x \cos\theta + y \sin\theta = p$$

General equation of the straight line:

$$Ax + By + C = 0$$

The equation of a circle whose center is at a, b:

$$(x - a)^2 + (y - b)^2 = c^2$$

If the origin is at the center:

$$x^2 + y^2 = c^2$$

The polar equation of a circle with the origin on the circumference and its center at point c, α:

$$r = 2c \cos(\theta - \alpha).$$

If the origin is not on the circumference, the radius a and the center at a point l, α, the equation becomes:

$$a^2 = r^2 + l^2 - 2rl \cos (\theta - \alpha)$$

The equation of a parabola with the origin at the vertex, where p is the distance from the focus to the vertex:

$$y^2 = 4px$$

The polar equation where the pole is at the focus and l the semi-latus rectum is:

$$\frac{l}{r} = 1 - \cos \theta$$

If the pole is at the vertex and p as above:

$$r = \frac{4p \cos \theta}{\sin^2 \theta}$$

The equation of the ellipse with the origin at the center and semi-axes a and b:

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

Polar equation where the pole is at the center:

$$r^2 = \frac{a^2b^2}{a^2 \sin^2 \theta + b^2 \cos^2 \theta}$$

The equation of the hyperbola with the origin at the center, semi-axes a and b:

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

Polar equation, pole at center:

$$r^2 = \frac{a^2b^2}{a^2 \sin^2 \theta - b^2 \cos^2 \theta}$$

EXPLANATION OF LOGARITHM TABLES

The logarithm of a number is the exponent of that power to which another number, the base, must be raised to give the number first named. The base commonly used is 10 and as most numbers are incommensurable powers of ten a common logarithm, in general, consists of an integer which is called the characteristic and an endless decimal, the mantissa.

It is to be observed that the common logarithms of all numbers expressed by the same figures in the same order with the decimal point in different positions have different characteristics but the same mantissa. To illustrate: — if the decimal point stand after the first figure of a number, counting from the left, the characteristic is 0; if after two figures, it is 1; if after three figures, it is 2, and so forth. If the decimal point stand before the first significant figure the characteristic is -1, usually written $\bar{1}$; if there is one zero between the decimal point and the first significant figure it is $\bar{2}$ and so on. For example: $\log 256 = 2.40824$, $\log 2.56 = 0.40824$, $\log 0.256 = \bar{1}.40824$, $\log 0.00256 = \bar{3}.40824$. Inasmuch as the characteristic may be determined by inspection the mantissas only are given in tables of common logarithms.

To find the logarithm of a number.

For a number of four figures take out the tabular mantissa on a line with the first three figures of the number and under its third figure. The characteristic is determined as previously explained.

For a number of less than four figures supply zeros to make a four figure number and take the value of the mantissa from the tables as before. For example: $\log 2 = \log 2.000 = 0.30103$.

For a number of more than four figures take the tabular value of the mantissa for the first four figures; find the difference between this mantissa and the next greater tabular mantissa and multiply the difference so found by the remaining figures of the number as a decimal and add the product to the mantissa of the first four figures. For example: to find log 46.762.

$$\log 46.76 = 1.66987$$

Tabular difference between this mantissa and that for 4677 is .00010.

$$\begin{aligned} \therefore \log 46.762 &= 1.66987 + .2 \times .00010 \\ &= 1.66987 + .00002 \\ &= 1.66989 \end{aligned}$$

To find the number corresponding to a given logarithm.

If the mantissa is found exactly in the table, join the figure at the top which is directly above the given mantissa to the three figures on the line at the left and place the decimal point according to the characteristic of the logarithm. For example, $\log^{-1}$ (antilogarithm) $3.39967 = 2510$.

If the mantissa is not found exactly in the table it is necessary to interpolate. For example, $\log^{-1} 3.40028 = 2513. + \frac{9}{18} = 2513.5$.

The column of proportional parts at the right of each page of the table shows, under the heading of the various tabular differences, the parts of these differences which correspond to the digits from 1 to 9 in the fifth place. This makes it possible to take out a logarithm for a five figure number or to find an antilogarithm of the same number of significant figures with increased facility, usually by inspection.

The following formulæ express the relations on which the use of logarithms is based.

$$\log ab = \log a + \log b$$

$$\log \frac{a}{b} = \log a - \log b$$

$$\log a^n = n \times \log a$$

$$\log \sqrt[n]{a} = \frac{\log a}{n}$$

FIVE-PLACE LOGARITHMS

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts			
100	00 000	043	087	130	173	217	260	303	346	389		**44**	**43**	**42**
101	432	475	518	561	604	647	689	732	775	817	1	4,4	4,3	4,2
102	860	903	945	988	*030	*072	*115	*157	*199	*242	2	8,8	8,6	8,4
103	01 284	326	368	410	452	494	536	578	620	662	3	13,2	12,9	12,6
104	703	745	787	828	870	912	953	995	*036	*078	4	17,6	17,2	16,8
105	02 119	160	202	243	284	325	366	407	449	490	5	22,0	21,5	21,0
106	531	572	612	653	694	735	776	816	857	898	6	26,4	25,8	25,2
107	938	979	*019	*060	*100	*141	*181	*222	*262	*302	7	30,8	30,1	29,4
108	03 342	383	423	463	503	543	583	623	663	703	8	35,2	34,4	33,6
109	743	782	822	862	902	941	981	*021	*060	*100	9	39,6	38,7	37,8
110	04 139	179	218	258	297	336	376	415	454	493		**41**	**40**	**39**
111	532	571	610	650	689	727	766	805	844	883	1	4,1	4,0	3,9
112	922	961	999	*038	*077	*115	*154	*192	*231	*269	2	8,2	8,0	7,8
113	05 308	346	385	423	461	500	538	576	614	652	3	12,3	12,0	11,7
114	690	729	767	805	843	881	918	956	994	*032	4	16,4	16,0	15,6
115	06 070	108	145	183	221	258	296	333	371	408	5	20,5	20,0	19,5
116	446	483	521	558	595	633	670	707	744	781	6	24,6	24,0	23,4
117	819	856	893	930	967	*004	*041	*078	*115	*151	7	28,7	28,0	27,3
118	07 188	225	262	298	335	372	408	445	482	518	8	32,8	32,0	31,2
119	555	591	628	664	700	737	773	809	846	882	9	36,9	36,0	35,1
120	918	954	990	*027	*063	*099	*135	*171	*207	*243		**38**	**37**	**36**
121	08 279	314	350	386	422	458	493	529	565	600	1	3,8	3,7	3,6
122	636	672	707	743	778	814	849	884	920	955	2	7,6	7,4	7,2
123	991	*026	*061	*096	*132	*167	*202	*237	*272	*307	3	11,4	11,1	10,8
124	09 342	377	412	447	482	517	552	587	621	656	4	15,2	14,8	14,4
125	691	726	760	795	830	864	899	934	968	*003	5	19,0	18,5	18,0
126	10 037	072	106	140	175	209	243	278	312	346	6	22,8	22,2	21,6
127	380	415	449	483	517	551	585	619	653	687	7	26,6	25,9	25,2
128	721	755	789	823	857	890	924	958	992	*025	8	30,4	29,6	28,8
129	11 059	093	126	160	193	227	261	294	327	361	9	34,2	33,3	32,4
130	394	428	461	494	528	561	594	628	661	694		**35**	**34**	**33**
131	727	760	793	826	860	893	926	959	992	*024	1	3,5	3,4	3,3
132	12 057	090	123	156	189	222	254	287	320	352	2	7,0	6,8	6,6
133	385	418	450	483	516	548	581	613	646	678	3	10,5	10,2	9,9
134	710	743	775	808	840	872	905	937	969	*001	4	14,0	13,6	13,2
135	13 033	066	098	130	162	194	226	258	290	322	5	17,5	17,0	16,5
136	354	386	418	450	481	513	545	577	609	640	6	21,0	20,4	19,8
137	672	704	735	767	799	830	862	893	925	956	7	24,5	23,8	23,1
138	988	*019	*051	*082	*114	*145	*176	*208	*239	*270	8	28,0	27,2	26,4
139	14 301	333	364	395	426	457	489	520	551	582	9	31,5	30,6	29,7
140	613	644	675	706	737	768	799	829	860	891		**32**	**31**	**30**
141	922	953	983	*014	*045	*076	*106	*137	*168	*198	1	3,2	3,1	3,0
142	15 229	259	290	320	351	381	412	442	473	503	2	6,4	6,2	6,0
143	534	564	594	625	655	685	715	746	776	806	3	9,6	9,3	9,0
144	836	866	897	927	957	987	*017	*047	*077	*107	4	12,8	12,4	12,0
145	16 137	167	197	227	256	286	316	346	376	406	5	16,0	15,5	15,0
146	435	465	495	524	554	584	613	643	673	702	6	19,2	18,6	18,0
147	732	761	791	820	850	879	909	938	967	997	7	22,4	21,7	21,0
148	17 026	056	085	114	143	173	202	231	260	289	8	25,6	24,8	24,0
149	319	348	377	406	435	464	493	522	551	580	9	28,8	27,9	27,0
150	609	638	667	696	725	754	782	811	840	869				
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts			

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9
150	17 609	638	667	696	725	754	782	811	840	869
151	898	926	955	984	*013	*041	*070	*099	*127	*156
152	18 184	213	241	270	298	327	355	384	412	441
153	469	498	526	554	583	611	639	667	696	724
154	752	780	808	837	865	893	921	949	977	*005
155	19 033	061	089	117	145	173	201	229	257	285
156	312	340	368	396	424	451	479	507	535	562
157	590	618	645	673	700	728	756	783	811	838
158	866	893	921	948	976	*003	*030	*058	*085	*112
159	20 140	167	194	222	249	276	303	330	358	385
160	412	439	466	493	520	548	575	602	629	656
161	683	710	737	763	790	817	844	871	898	925
162	952	978	*005	*032	*059	*085	*112	*139	*165	*192
163	21 219	245	272	299	325	352	378	405	431	458
164	484	511	537	564	590	617	643	669	696	722
165	748	775	801	827	854	880	906	932	958	985
166	22 011	037	063	089	115	141	167	194	220	246
167	272	298	324	350	376	401	427	453	479	505
168	531	557	583	608	634	660	686	712	737	763
169	789	814	840	866	891	917	943	968	994	*019
170	23 045	070	096	121	147	172	198	223	249	274
171	300	325	350	376	401	426	452	477	502	528
172	553	578	603	629	654	679	704	729	754	779
173	805	830	855	880	905	930	955	980	*005	*030
174	24 055	080	105	130	155	180	204	229	254	279
175	304	329	353	378	403	428	452	477	502	527
176	551	576	601	625	650	674	699	724	748	773
177	797	822	846	871	895	920	944	969	993	*018
178	25 042	066	091	115	139	164	188	212	237	261
179	285	310	334	358	382	406	431	455	479	503
180	527	551	575	600	624	648	672	696	720	744
181	768	792	816	840	864	888	912	935	959	983
182	26 007	031	055	079	102	126	150	174	198	221
183	245	269	293	316	340	364	387	411	435	458
184	482	505	529	553	576	600	623	647	670	694
185	717	741	764	788	811	834	858	881	905	928
186	951	975	998	*021	*045	*068	*091	*114	*138	*161
187	27 184	207	231	254	277	300	323	346	370	393
188	416	439	462	485	508	531	554	577	600	623
189	646	669	692	715	738	761	784	807	830	852
190	875	898	921	944	967	989	*012	*035	*058	*081
191	28 103	126	149	171	194	217	240	262	285	307
192	330	353	375	398	421	443	466	488	511	533
193	556	578	601	623	646	668	691	713	735	758
194	780	803	825	847	870	892	914	937	959	981
195	29 003	026	048	070	092	115	137	159	181	203
196	226	248	270	292	314	336	358	380	403	425
197	447	469	491	513	535	557	579	601	623	645
198	667	688	710	732	754	776	798	820	842	863
199	885	907	929	951	973	994	*016	*038	*060	*081
200	30 103	125	146	168	190	211	233	255	276	298
N.	0	1	2	3	4	5	6	7	8	9

Proportional parts

	29	**28**
1	2,9	2,8
2	5,8	5,6
3	8,7	8,4
4	11,6	11,2
5	14,5	14,0
6	17,4	16,8
7	20,3	19,6
8	23,2	22,4
9	26,1	25,2

	27	**26**
1	2,7	2,6
2	5,4	5,2
3	8,1	7,8
4	10,8	10,4
5	13,5	13,0
6	16,2	15,6
7	18,9	18,2
8	21,6	20,8
9	24,3	23,4

	25
1	2,5
2	5,0
3	7,5
4	10,0
5	12,5
6	15,0
7	17,5
8	20,0
9	22,5

	24	**23**
1	2,4	2,3
2	4,8	4,6
3	7,2	6,9
4	9,6	9,2
5	12,0	11,5
6	14,4	13,8
7	16,8	16,1
8	19,2	18,4
9	21,6	20,7

	22	**21**
1	2,2	2,1
2	4,4	4,2
3	6,6	6,3
4	8,8	8,4
5	11,0	10,5
6	13,2	12,6
7	15,4	14,7
8	17,6	16,8
9	19,8	18,9

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts		
200	30 103	125	146	168	190	211	233	255	276	298		**22**	**21**
201	320	341	363	384	406	428	449	471	492	514	1	2,2	2,1
202	535	557	578	600	621	643	664	685	707	728	2	4,4	4,2
203	750	771	792	814	835	856	878	899	920	942	3	6,6	6,3
204	963	984	*006	*027	*048	*069	*091	*112	*133	*154	4	8,8	8,4
205	31 175	197	218	239	260	281	302	323	345	366	5	11,0	10,5
206	387	408	429	450	471	492	513	534	555	576	6	13,2	12,6
207	597	618	639	660	681	702	723	744	765	785	7	15,4	14,7
208	806	827	848	869	890	911	931	952	973	994	8	17,6	16,8
209	32 015	035	056	077	098	118	139	160	181	201	9	19,8	18,9
210	222	243	263	284	305	325	346	366	387	408		**20**	
211	428	449	469	490	510	531	552	572	593	613	1	2,0	
212	634	654	675	695	715	736	756	777	797	818	2	4,0	
213	838	858	879	899	919	940	960	980	*001	*021	3	6,0	
214	33 041	062	082	102	122	143	163	183	203	224	4	8,0	
215	244	264	284	304	325	345	365	385	405	425	5	10,0	
216	445	465	486	506	526	546	566	586	606	626	6	12,0	
217	646	666	686	706	726	746	766	786	806	826	7	14,0	
218	846	866	885	905	925	945	965	985	*005	*025	8	16,0	
219	34 044	064	084	104	124	143	163	183	203	223	9	18,0	
220	242	262	282	301	321	341	361	380	400	420		**19**	
221	439	459	479	498	518	537	557	577	596	616	1	1,9	
222	635	655	674	694	713	733	753	772	792	811	2	3,8	
223	830	850	869	889	908	928	947	967	986	*005	3	5,7	
224	35 025	044	064	083	102	122	141	160	180	199	4	7,6	
225	218	238	257	276	295	315	334	353	372	392	5	9,5	
226	411	430	449	468	488	507	526	545	564	583	6	11,4	
227	603	622	641	660	679	698	717	736	755	774	7	13,3	
228	793	813	832	851	870	889	908	927	946	965	8	15,2	
229	984	*003	*021	*040	*059	*078	*097	*116	*135	*154	9	17,1	
230	36 173	192	211	229	248	267	286	305	324	342		**18**	
231	361	380	399	418	436	455	474	493	511	530	1	1,8	
232	549	568	586	605	624	642	661	680	698	717	2	3,6	
233	736	754	773	791	810	829	847	866	884	903	3	5,4	
234	922	940	959	977	996	*014	*033	*051	*070	*088	4	7,2	
235	37 107	125	144	162	181	199	218	236	254	273	5	9,0	
236	291	310	328	346	365	383	401	420	438	457	6	10,8	
237	475	493	511	530	548	566	585	603	621	639	7	12,6	
238	658	676	694	712	731	749	767	785	803	822	8	14,4	
239	840	858	876	894	912	931	949	967	985	*003	9	16,2	
240	38 021	039	057	075	093	112	130	148	166	184		**17**	
241	202	220	238	256	274	292	310	328	346	364	1	1,7	
242	382	399	417	435	453	471	489	507	525	543	2	3,4	
243	561	578	596	614	632	650	668	686	703	721	3	5,1	
244	739	757	775	792	810	828	846	863	881	899	4	6,8	
245	917	934	952	970	987	*005	*023	*041	*058	*076	5	8,5	
246	39 094	111	129	146	164	182	199	217	235	252	6	10,2	
247	270	287	305	322	340	358	375	393	410	428	7	11,9	
248	445	463	480	498	515	533	550	568	585	602	8	13,6	
249	620	637	655	672	690	707	724	742	759	777	9	15,3	
250	794	811	829	846	863	881	898	915	933	950			
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts		

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	
250	39 794	811	829	846	863	881	898	915	933	950		**18**
251	967	985	*002	*019	*037	*054	*071	*088	*106	*123	1	1,8
252	40 140	157	175	192	209	226	243	261	278	295	2	3,6
253	312	329	346	364	381	398	415	432	449	466	3	5,4
254	483	500	518	535	552	569	586	603	620	637	4	7,2
255	654	671	688	705	722	739	756	773	790	807	5	9,0
256	824	841	858	875	892	909	926	943	960	976	6	10,8
257	993	*010	*027	*044	*061	*078	*095	*111	*128	*145	7	12,6
258	41 162	179	196	212	229	246	263	280	296	313	8	14,4
259	330	347	363	380	397	414	430	447	464	481	9	16,2
260	497	514	531	547	564	581	597	614	631	647		**17**
261	664	681	697	714	731	747	764	780	797	814	1	1,7
262	830	847	863	880	896	913	929	946	963	979	2	3,4
263	996	*012	*029	*045	*062	*078	*095	*111	*127	*144	3	5,1
264	42 160	177	193	210	226	243	259	275	292	308	4	6,8
265	325	341	357	374	390	406	423	439	455	472	5	8,5
266	488	504	521	537	553	570	586	602	619	635	6	10,2
267	651	667	684	700	716	732	749	765	781	797	7	11,9
268	813	830	846	862	878	894	911	927	943	959	8	13,6
269	975	991	*008	*024	*040	*056	*072	*088	*104	*120	9	15,3
270	43 136	152	169	185	201	217	233	249	265	281		**16**
271	297	313	329	345	361	377	393	409	425	441	1	1,6
272	457	473	489	505	521	537	553	569	584	600	2	3,2
273	616	632	648	664	680	696	712	727	743	759	3	4,8
274	775	791	807	823	838	854	870	886	902	917	4	6,4
275	933	949	965	981	996	*012	*028	*044	*059	*075	5	8,0
276	44 091	107	122	138	154	170	185	201	217	232	6	9,6
277	248	264	279	295	311	326	342	358	373	389	7	11,2
278	404	420	436	451	467	483	498	514	529	545	8	12,8
279	560	576	592	607	623	638	654	669	685	700	9	14,4
280	716	731	747	762	778	793	809	824	840	855		**15**
281	871	886	902	917	932	948	963	979	994	*010	1	1,5
282	45 025	040	056	071	086	102	117	133	148	163	2	3,0
283	179	194	209	225	240	255	271	286	301	317	3	4,5
284	332	347	362	378	393	408	423	439	454	469	4	6,0
285	484	500	515	530	545	561	576	591	606	621	5	7,5
286	637	652	667	682	697	712	728	743	758	773	6	9,0
287	788	803	818	834	849	864	879	894	909	924	7	10,5
288	939	954	969	984	*000	*015	*030	*045	*060	*075	8	12,0
289	46 090	105	120	135	150	165	180	195	210	225	9	13,5
290	240	255	270	285	300	315	330	345	359	374		**14**
291	389	404	419	434	449	464	479	494	509	523	1	1,4
292	538	553	568	583	598	613	627	642	657	672	2	2,8
293	687	702	716	731	746	761	776	790	805	820	3	4,2
294	835	850	864	879	894	909	923	938	953	967	4	5,6
295	982	997	*012	*026	*041	*056	*070	*085	*100	*114	5	7,0
296	47 129	144	159	173	188	202	217	232	246	261	6	8,4
297	276	290	305	319	334	349	363	378	392	407	7	9,8
298	422	436	451	465	480	494	509	524	538	553	8	11,2
299	567	582	596	611	625	640	654	669	683	698	9	12,6
300	712	727	741	756	770	784	799	813	828	842		
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9
300	47 712	727	741	756	770	784	799	813	828	842
301	857	871	885	900	914	929	943	958	972	986
302	48 001	015	029	044	058	073	087	101	116	130
303	144	159	173	187	202	216	230	244	259	273
304	287	302	316	330	344	359	373	387	401	416
305	430	444	458	473	487	501	515	530	544	558
306	572	586	601	615	629	643	657	671	686	700
307	714	728	742	756	770	785	799	813	827	841
308	855	869	883	897	911	926	940	954	968	982
309	996	*010	*024	*038	*052	*066	*080	*094	*108	*122
310	49 136	150	164	178	192	206	220	234	248	262
311	276	290	304	318	332	346	360	374	388	402
312	415	429	443	457	471	485	499	513	527	541
313	554	568	582	596	610	624	638	651	665	679
314	693	707	721	734	748	762	776	790	803	817
315	831	845	859	872	886	900	914	927	941	955
316	969	982	996	*010	*024	*037	*051	*065	*079	*092
317	50 106	120	133	147	161	174	188	202	215	229
318	243	256	270	284	297	311	325	338	352	365
319	379	393	406	420	433	447	461	474	488	501
320	515	529	542	556	569	583	596	610	623	637
321	651	664	678	691	705	718	732	745	759	772
322	786	799	813	826	840	853	866	880	893	907
323	920	934	947	961	974	987	*001	*014	*028	*041
324	51 055	068	081	095	108	121	135	148	162	175
325	188	202	215	228	242	255	268	282	295	308
326	322	335	348	362	375	388	402	415	428	441
327	455	468	481	495	508	521	534	548	561	574
328	587	601	614	627	640	654	667	680	693	706
329	720	733	746	759	772	786	799	812	825	838
330	851	865	878	891	904	917	930	943	957	970
331	983	996	*009	*022	*035	*048	*061	*075	*088	*101
332	52 114	127	140	153	166	179	192	205	218	231
333	244	257	270	284	297	310	323	336	349	362
334	375	388	401	414	427	440	453	466	479	492
335	504	517	530	543	556	569	582	595	608	621
336	634	647	660	673	686	699	711	724	737	750
337	763	776	789	802	815	827	840	853	866	879
338	892	905	917	930	943	956	969	982	994	*007
339	53 020	033	046	058	071	084	097	110	122	135
340	148	161	173	186	199	212	224	237	250	263
341	275	288	301	314	326	339	352	364	377	390
342	403	415	428	441	453	466	479	491	504	517
343	529	542	555	567	580	593	605	618	631	643
344	656	668	681	694	706	719	732	744	757	769
345	782	794	807	820	832	845	857	870	882	895
346	908	920	933	945	958	970	983	995	*008	*020
347	54 033	045	058	070	083	095	108	120	133	145
348	158	170	183	195	208	220	233	245	258	270
349	283	295	307	320	332	345	357	370	382	394
350	407	419	432	444	456	469	481	494	506	518
N.	0	1	2	3	4	5	6	7	8	9

Proportional parts

	15
1	1,5
2	3,0
3	4,5
4	6,0
5	7,5
6	9,0
7	10,5
8	12,0
9	13,5

	14
1	1,4
2	2,8
3	4,2
4	5,6
5	7,0
6	8,4
7	9,8
8	11,2
9	12,6

	13
1	1,3
2	2,6
3	3,9
4	5,2
5	6,5
6	7,8
7	9,1
8	10,4
9	11,7

	12
1	1,2
2	2,4
3	3,6
4	4,8
5	6,0
6	7,2
7	8,4
8	9,6
9	10,8

Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
350	54 407	419	432	444	456	469	481	494	506	518	
351	531	543	555	568	580	593	605	617	630	642	
352	654	667	679	691	704	716	728	741	753	765	
353	777	790	802	814	827	839	851	864	876	888	**13**
354	900	913	925	937	949	962	974	986	998	*011	1 | 1,3
355	55 023	035	047	060	072	084	096	108	121	133	2 | 2,6
356	145	157	169	182	194	206	218	230	242	255	3 | 3,9
357	267	279	291	303	315	328	340	352	364	376	4 | 5,2
358	388	400	413	425	437	449	461	473	485	497	5 | 6,5
359	509	522	534	546	558	570	582	594	606	618	6 | 7,8
360	630	642	654	666	678	691	703	715	727	739	7 | 9,1
361	751	763	775	787	799	811	823	835	847	859	8 | 10,4
362	871	883	895	907	919	931	943	955	967	979	9 | 11,7
363	991	*003	*015	*027	*038	*050	*062	*074	*086	*098	
364	56 110	122	134	146	158	170	182	194	205	217	
365	229	241	253	265	277	289	301	312	324	336	**12**
366	348	360	372	384	396	407	419	431	443	455	1 | 1,2
367	467	478	490	502	514	526	538	549	561	573	2 | 2,4
368	585	597	608	620	632	644	656	667	679	691	3 | 3,6
369	703	714	726	738	750	761	773	785	797	808	4 | 4,8
370	820	832	844	855	867	879	891	902	914	926	5 | 6,0
371	937	949	961	972	984	996	*008	*019	*031	*043	6 | 7,2
372	57 054	066	078	089	101	113	124	136	148	159	7 | 8,4
373	171	183	194	206	217	229	241	252	264	276	8 | 9,6
374	287	299	310	322	334	345	357	368	380	392	9 | 10,8
375	403	415	426	438	449	461	473	484	496	507	
376	519	530	542	553	565	576	588	600	611	623	
377	634	646	657	669	680	692	703	715	726	738	**11**
378	749	761	772	784	795	807	818	830	841	852	1 | 1,1
379	864	875	887	898	910	921	933	944	955	967	2 | 2,2
380	978	990	*001	*013	*024	*035	*047	*058	*070	*081	3 | 3,3
381	58 092	104	115	127	138	149	161	172	184	195	4 | 4,4
382	206	218	229	240	252	263	274	286	297	309	5 | 5,5
383	320	331	343	354	365	377	388	399	410	422	6 | 6,6
384	433	444	456	467	478	490	501	512	524	535	7 | 7,7
385	546	557	569	580	591	602	614	625	636	647	8 | 8,8
386	659	670	681	692	704	715	726	737	749	760	9 | 9,9
387	771	782	794	805	816	827	838	850	861	872	
388	883	894	906	917	928	939	950	961	973	984	
389	995	*006	*017	*028	*040	*051	*062	*073	*084	*095	**10**
390	59 106	118	129	140	151	162	173	184	195	207	1 | 1,0
391	218	229	240	251	262	273	284	295	306	318	2 | 2,0
392	329	340	351	362	373	384	395	406	417	428	3 | 3,0
393	439	450	461	472	483	494	506	517	528	539	4 | 4,0
394	550	561	572	583	594	605	616	627	638	649	5 | 5,0
395	660	671	682	693	704	715	726	737	748	759	6 | 6,0
396	770	780	791	802	813	824	835	846	857	868	7 | 7,0
397	879	890	901	912	923	934	945	956	966	977	8 | 8,0
398	988	999	*010	*021	*032	*043	*054	*065	*076	*086	9 | 9,0
399	60 097	108	119	130	141	152	163	173	184	195	
400	206	217	228	239	249	260	271	282	293	304	

N. 0 1 2 3 4 5 6 7 8 9 Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9
400	60 206	217	228	239	249	260	271	282	293	304
401	314	325	336	347	358	369	379	390	401	412
402	423	433	444	455	466	477	487	498	509	520
403	531	541	552	563	574	584	595	606	617	627
404	638	649	660	670	681	692	703	713	724	735
405	746	756	767	778	788	799	810	821	831	842
406	853	863	874	885	895	906	917	927	938	949
407	959	970	981	991	*002	*013	*023	*034	*045	*055
408	61 066	077	087	098	109	119	130	140	151	162
409	172	183	194	204	215	225	236	247	257	268
410	278	289	300	310	321	331	342	352	363	374
411	384	395	405	416	426	437	448	458	469	479
412	490	500	511	521	532	542	553	563	574	584
413	595	606	616	627	637	648	658	669	679	690
414	700	711	721	731	742	752	763	773	784	794
415	805	815	826	836	847	857	868	878	888	899
416	909	920	930	941	951	962	972	982	996	*003
417	62 014	024	034	045	055	066	076	086	097	107
418	118	128	138	149	159	170	180	190	201	211
419	221	232	242	252	263	273	284	294	304	315
420	325	335	346	356	366	377	387	397	408	418
421	428	439	449	459	469	480	490	500	511	521
422	531	542	552	562	572	583	593	603	613	624
423	634	644	655	665	675	685	696	706	716	726
424	737	747	757	767	778	788	798	808	818	829
425	839	849	859	870	880	890	900	910	921	931
426	941	951	961	972	982	992	*002	*012	*022	*033
427	63 043	053	063	073	083	094	104	114	124	134
428	144	155	165	175	185	195	205	215	225	236
429	246	256	266	276	286	296	306	317	327	337
430	347	357	367	377	387	397	407	417	428	438
431	448	458	468	478	488	498	508	518	528	538
432	548	558	568	579	589	599	609	619	629	639
433	649	659	669	679	689	699	709	719	729	739
434	749	759	769	779	789	799	809	819	829	839
435	849	859	869	879	889	899	909	919	929	939
436	949	959	969	979	988	998	*008	*018	*028	*038
437	64 048	058	068	078	088	098	108	118	128	137
438	147	157	167	177	187	197	207	217	227	237
439	246	256	266	276	286	296	306	316	326	335
440	345	355	365	375	385	395	404	414	424	434
441	444	454	464	473	483	493	503	513	523	532
442	542	552	562	572	582	591	601	611	621	631
443	640	650	660	670	680	689	699	709	719	729
444	738	748	758	768	777	787	797	807	816	826
445	836	846	856	865	875	885	895	904	914	924
446	933	943	953	963	972	982	992	*002	*011	*021
447	65 031	040	050	060	070	079	089	099	108	118
448	128	137	147	157	167	176	186	196	205	215
449	225	234	244	254	263	273	283	292	302	312
450	321	331	341	350	360	369	379	389	398	408
N.	0	1	2	3	4	5	6	7	8	9

Proportional parts

	11
1	1,1
2	2,2
3	3,3
4	4,4
5	5,5
6	6,6
7	7,7
8	8,8
9	9,9

	10
1	1,0
2	2,0
3	3,0
4	4,0
5	5,0
6	6,0
7	7,0
8	8,0
9	9,0

	9
1	0,9
2	1,8
3	2,7
4	3,6
5	4,5
6	5,4
7	6,3
8	7,2
9	8,1

Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9
450	65 321	331	341	350	360	369	379	389	398	408
451	418	427	437	447	456	466	475	485	495	504
452	514	523	533	543	552	562	571	581	591	600
453	610	619	629	639	648	658	667	677	686	696
454	706	715	725	734	744	753	763	772	782	792
455	801	811	820	830	839	849	858	868	877	887
456	896	906	916	925	935	944	954	963	973	982
457	992	*001	*011	*020	*030	*039	*049	*058	*068	*077
458	66 087	096	106	115	124	134	143	153	162	172
459	181	191	200	210	219	229	238	247	257	266
460	276	285	295	304	314	323	332	342	351	361
461	370	380	389	398	408	417	427	436	445	455
462	464	474	483	492	502	511	521	530	539	549
463	558	567	577	586	596	605	614	624	633	642
464	652	661	671	680	689	699	708	717	727	736
465	745	755	764	773	783	792	801	811	820	829
466	839	848	857	867	876	885	894	904	913	922
467	932	941	950	960	969	978	987	997	*006	*015
468	67 025	034	043	052	062	071	080	089	099	108
469	117	127	136	145	154	164	173	182	191	201
470	210	219	228	237	247	256	265	274	284	293
471	302	311	321	330	339	348	357	367	376	385
472	394	403	413	422	431	440	449	459	468	477
473	486	495	504	514	523	532	541	550	560	569
474	578	587	596	605	614	624	633	642	651	660
475	669	679	688	697	706	715	724	733	742	752
476	761	770	779	788	797	806	815	825	834	843
477	852	861	870	879	888	897	906	916	925	934
478	943	952	961	970	979	988	997	*006	*015	*024
479	68 034	043	052	061	070	079	088	097	106	115
480	124	133	142	151	160	169	178	187	196	205
481	215	224	233	242	251	260	269	278	287	296
482	305	314	323	332	341	350	359	368	377	386
483	395	404	413	422	431	440	449	458	467	476
484	485	494	502	511	520	529	538	547	556	565
485	574	583	592	601	610	619	628	637	646	655
486	664	673	681	690	699	708	717	726	735	744
487	753	762	771	780	789	797	806	815	824	833
488	842	851	860	869	878	886	895	904	913	922
489	931	940	949	958	966	975	984	993	*002	*011
490	69 020	028	037	046	055	064	073	082	090	099
491	108	117	126	135	144	152	161	170	179	188
492	197	205	214	223	232	241	249	258	267	276
493	285	294	302	311	320	329	338	346	355	364
494	373	381	390	399	408	417	425	434	443	452
495	461	469	478	487	496	504	513	522	531	539
496	548	557	566	574	583	592	601	609	618	627
497	636	644	653	662	671	679	688	697	705	714
498	723	732	740	749	758	767	775	784	793	801
499	810	819	827	836	845	854	862	871	880	888
500	897	906	914	923	932	940	949	958	966	975
N.	0	1	2	3	4	5	6	7	8	9

Proportional parts

	10
1	1,0
2	2,0
3	3,0
4	4,0
5	5,0
6	6,0
7	7,0
8	8,0
9	9,0

	9
1	0,9
2	1,8
3	2,7
4	3,6
5	4,5
6	5,4
7	6,3
8	7,2
9	8,1

	8
1	0,8
2	1,6
3	2,4
4	3,2
5	4,0
6	4,8
7	5,6
8	6,4
9	7,2

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9
500	69 897	906	914	923	932	940	949	958	966	975
501	984	992	*001	*010	*018	*027	*036	*044	*053	*062
502	70 070	079	088	096	105	114	122	131	140	148
503	157	165	174	183	191	200	209	217	226	234
504	243	252	260	269	278	286	295	303	312	321
505	329	338	346	355	364	372	381	389	398	406
506	415	424	432	441	449	458	467	475	484	492
507	501	509	518	526	535	544	552	561	569	578
508	586	595	603	612	621	629	638	646	655	663
509	672	680	689	697	706	714	723	731	740	749
510	757	766	774	783	791	800	808	817	825	834
511	842	851	859	868	876	885	893	902	910	919
512	927	935	944	952	961	969	978	986	995	*003
513	71 012	020	029	037	046	054	063	071	079	088
514	096	105	113	122	130	139	147	155	164	172
515	181	189	198	206	214	223	231	240	248	257
516	265	273	282	290	299	307	315	324	332	341
517	349	357	366	374	383	391	399	408	416	425
518	433	441	450	458	466	475	483	492	500	508
519	517	525	533	542	550	559	567	575	584	592
520	600	609	617	625	634	642	650	659	667	675
521	684	692	700	709	717	725	734	742	750	759
522	767	775	784	792	800	809	817	825	834	842
523	850	858	867	875	883	892	900	908	917	925
524	933	941	950	958	966	975	983	991	999	*008
525	72 016	024	032	041	049	057	066	074	082	090
526	099	107	115	123	132	140	148	156	165	173
527	181	189	198	206	214	222	230	239	247	255
528	263	272	280	288	296	304	313	321	329	337
529	346	354	362	370	378	387	395	403	411	419
530	428	436	444	452	460	469	477	485	493	501
531	509	518	526	534	542	550	558	567	575	583
532	591	599	607	616	624	632	640	648	656	665
533	673	681	689	697	705	713	722	730	738	746
534	754	762	770	779	787	795	803	811	819	827
535	835	843	852	860	868	876	884	892	900	908
536	916	925	933	941	949	957	965	973	981	989
537	997	*006	*014	*022	*030	*038	*046	*054	*062	*070
538	73 078	086	094	102	111	119	127	135	143	151
539	159	167	175	183	191	199	207	215	223	231
540	239	247	255	263	272	280	288	296	304	312
541	320	328	336	344	352	360	368	376	384	392
542	400	408	416	424	432	440	448	456	464	472
543	480	488	496	504	512	520	528	536	544	552
544	560	568	576	584	592	600	608	616	624	632
545	640	648	656	664	672	679	687	695	703	711
546	719	727	735	743	751	759	767	775	783	791
547	799	807	815	823	830	838	846	854	862	870
548	878	886	894	902	910	918	926	933	941	949
549	957	965	973	981	989	997	*005	*013	*020	*028
550	74 036	044	052	060	068	076	084	092	099	107
N.	0	1	2	3	4	5	6	7	8	9

Proportional parts

	9
1	0,9
2	1,8
3	2,7
4	3,6
5	4,5
6	5,4
7	6,3
8	7,2
9	8,1

	8
1	0,8
2	1,6
3	2,4
4	3,2
5	4,0
6	4,8
7	5,6
8	6,4
9	7,2

	7
1	0,7
2	1,4
3	2,1
4	2,8
5	3,5
6	4,2
7	4,9
8	5,6
9	6,3

Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
550	74 036	044	052	060	068	076	084	092	099	107	
551	115	123	131	139	147	155	162	170	178	186	
552	194	202	210	218	225	233	241	249	257	265	
553	273	280	288	296	304	312	320	327	335	343	
554	351	359	367	374	382	390	398	406	414	421	
555	429	437	445	453	461	468	476	484	492	500	
556	507	515	523	531	539	547	554	562	570	578	
557	586	593	601	609	617	624	632	640	648	656	
558	663	671	679	687	695	702	710	718	726	733	
559	741	749	757	764	772	780	788	796	803	811	
560	819	827	834	842	850	858	865	873	881	889	**8**
561	896	904	912	920	927	935	943	950	958	966	1 | 0,8
562	974	981	989	997	*005	*012	*020	*028	*035	*043	2 | 1,6
563	75 051	059	066	074	082	089	097	105	113	120	3 | 2,4
564	128	136	143	151	159	166	174	182	189	197	4 | 3,2
565	205	213	220	228	236	243	251	259	266	274	5 | 4,0
566	282	289	297	305	312	320	328	335	343	351	6 | 4,8
567	358	366	374	381	389	397	404	412	420	427	7 | 5,6
568	435	442	450	458	465	473	481	488	496	504	8 | 6,4
569	511	519	526	534	542	549	557	565	572	580	9 | 7,2
570	587	595	603	610	618	626	633	641	648	656	
571	664	671	679	686	694	702	709	717	724	732	
572	740	747	755	762	770	778	785	793	800	808	
573	815	823	831	838	846	853	861	868	876	884	
574	891	899	906	914	921	929	937	944	952	959	
575	967	974	982	989	997	*005	*012	*020	*027	*035	
576	76 042	050	057	065	072	080	087	095	103	110	
577	118	125	133	140	148	155	163	170	178	185	
578	193	200	208	215	223	230	238	245	253	260	
579	268	275	283	290	298	305	313	320	328	335	
580	343	350	358	365	373	380	388	395	403	410	**7**
581	418	425	433	440	448	455	462	470	477	485	1 | 0,7
582	492	500	507	515	522	530	537	545	552	559	2 | 1,4
583	567	574	582	589	597	604	612	619	626	634	3 | 2,1
584	641	649	656	664	671	678	686	693	701	708	4 | 2,8
585	716	723	730	738	745	753	760	768	775	782	5 | 3,5
586	790	797	805	812	819	827	834	842	849	856	6 | 4,2
587	864	871	879	886	893	901	908	916	923	930	7 | 4,9
588	938	945	953	960	967	975	982	989	997	*004	8 | 5,6
589	77 012	019	026	034	041	048	056	063	070	078	9 | 6,3
590	085	093	100	107	115	122	129	137	144	151	
591	159	166	173	181	188	195	203	210	217	225	
592	232	240	247	254	262	269	276	283	291	298	
593	305	313	320	327	335	342	349	357	364	371	
594	379	386	393	401	408	415	422	430	437	444	
595	452	459	466	474	481	488	495	503	510	517	
596	525	532	539	546	554	561	568	576	583	590	
597	597	605	612	619	627	634	641	648	656	663	
598	670	677	685	692	699	706	714	721	728	735	
599	743	750	757	764	772	779	786	793	801	808	
600	815	822	830	837	844	851	859	866	873	880	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9
600	77 815	822	830	837	844	851	859	866	873	880
601	887	895	902	909	916	924	931	938	945	952
602	960	967	974	981	988	996	*003	*010	*017	*025
603	78 032	039	046	053	061	068	075	082	089	097
604	104	111	118	125	132	140	147	154	161	168
605	176	183	190	197	204	211	219	226	233	240
606	247	254	262	269	276	283	290	297	305	312
607	319	326	333	340	347	355	362	369	376	383
608	390	398	405	412	419	426	433	440	447	455
609	462	469	476	483	490	497	504	512	519	526
610	533	540	547	554	561	569	576	583	590	597
611	604	611	618	625	633	640	647	654	661	668
612	675	682	689	696	704	711	718	725	732	739
613	746	753	760	767	774	781	789	796	803	810
614	817	824	831	838	845	852	859	866	873	880
615	888	895	902	909	916	923	930	937	944	951
616	958	965	972	979	986	993	*000	*007	*014	*021
617	79 029	036	043	050	057	064	071	078	085	092
618	099	106	113	120	127	134	141	148	155	162
619	169	176	183	190	197	204	211	218	225	232
620	239	246	253	260	267	274	281	288	295	302
621	309	316	323	330	337	344	351	358	365	372
622	379	386	393	400	407	414	421	428	435	442
623	449	456	463	470	477	484	491	498	505	511
624	518	525	532	539	546	553	560	567	574	581
625	588	595	602	609	616	623	630	637	644	650
626	657	664	671	678	685	692	699	706	713	720
627	727	734	741	748	754	761	768	775	782	789
628	796	803	810	817	824	831	837	844	851	858
629	865	872	879	886	893	900	906	913	920	927
630	934	941	948	955	962	969	975	982	989	996
631	80 003	010	017	024	030	037	044	051	058	065
632	072	079	085	092	099	106	113	120	127	134
633	140	147	154	161	168	175	182	188	195	202
634	209	216	223	229	236	243	250	257	264	271
635	277	284	291	298	305	312	318	325	332	339
636	346	353	359	366	373	380	387	393	400	407
637	414	421	428	434	441	448	455	462	468	475
638	482	489	496	502	509	516	523	530	536	543
639	550	557	564	570	577	584	591	598	604	611
640	618	625	632	638	645	652	659	665	672	679
641	686	693	699	706	713	720	726	733	740	747
642	754	760	767	774	781	787	794	801	808	814
643	821	828	835	841	848	855	862	868	875	882
644	889	895	902	909	916	922	929	936	943	949
645	956	963	969	976	983	990	996	*003	*010	*017
646	81 023	030	037	043	050	057	064	070	077	084
647	090	097	104	111	117	124	131	137	144	151
648	158	164	171	178	184	191	198	204	211	218
649	224	231	238	245	251	258	265	271	278	285
650	291	298	305	311	318	325	331	338	345	351
N.	0	1	2	3	4	5	6	7	8	9

Proportional parts

	8
1	0,8
2	1,6
3	2,4
4	3,2
5	4,0
6	4,8
7	5,6
8	6,4
9	7,2

	7
1	0,7
2	1,4
3	2,1
4	2,8
5	3,5
6	4,2
7	4,9
8	5,6
9	6,3

	6
1	0,6
2	1,2
3	1,8
4	2,4
5	3,0
6	3,6
7	4,2
8	4,8
9	5,4

Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
650	81 291	298	305	311	318	325	331	338	345	351	
651	358	365	371	378	385	391	398	405	411	418	
652	425	431	438	445	451	458	465	471	478	485	
653	491	498	505	511	518	525	531	538	544	551	
654	558	564	571	578	584	591	598	604	611	617	
655	624	631	637	644	651	657	664	671	677	684	
656	690	697	704	710	717	723	730	737	743	750	
657	757	763	770	776	783	790	796	803	809	816	
658	823	829	836	842	849	856	862	869	875	882	
659	889	895	902	908	915	921	928	935	941	948	
660	954	961	968	974	981	987	994	*000	*007	*014	**7**
661	82 020	027	033	040	046	053	060	066	073	079	1 | 0,7
662	086	092	099	105	112	119	125	132	138	145	2 | 1,4
663	151	158	164	171	178	184	191	197	204	210	3 | 2,1
664	217	223	230	236	243	249	256	263	269	276	4 | 2,8
665	282	289	295	302	308	315	321	328	334	341	5 | 3,5
666	347	354	360	367	373	380	387	393	400	406	6 | 4,2
667	413	419	426	432	439	445	452	458	465	471	7 | 4,9
668	478	484	491	497	504	510	517	523	530	536	8 | 5,6
669	543	549	556	562	569	575	582	588	595	601	9 | 6,3
670	607	614	620	627	633	640	646	653	659	666	
671	672	679	685	692	698	705	711	718	724	730	
672	737	743	750	756	763	769	776	782	789	795	
673	802	808	814	821	827	835	840	847	853	860	
674	866	872	879	885	892	898	905	911	918	924	
675	930	937	943	950	956	963	969	975	982	988	
676	995	*001	*008	*014	*020	*027	*033	*040	*046	*052	
677	83 059	065	072	078	085	091	097	104	110	117	
678	123	129	136	142	149	155	161	168	174	181	
679	187	193	200	206	213	219	225	232	238	245	
680	251	257	264	270	276	283	289	296	302	308	**6**
681	315	321	327	334	340	347	353	359	366	372	1 | 0,6
682	378	385	391	398	404	410	417	423	429	436	2 | 1,2
683	442	448	455	461	467	474	480	487	493	499	3 | 1,8
684	506	512	518	525	531	537	544	550	556	563	4 | 2,4
685	569	575	582	588	594	601	607	613	620	626	5 | 3,0
686	632	639	645	651	658	664	670	677	683	689	6 | 3,6
687	696	702	708	715	721	727	734	740	746	753	7 | 4,2
688	759	765	771	778	784	790	797	803	809	816	8 | 4,8
689	822	828	835	841	847	853	860	866	872	879	9 | 5,4
690	885	891	897	904	910	916	923	929	935	942	
691	948	954	960	967	973	979	985	992	998	*004	
692	84 011	017	023	029	036	042	048	055	061	067	
693	073	080	086	092	098	105	111	117	123	130	
694	136	142	148	155	161	167	173	180	186	192	
695	198	205	211	217	223	230	236	242	248	255	
696	261	267	273	280	286	292	298	305	311	317	
697	323	330	336	342	348	354	361	367	373	379	
698	386	392	398	404	410	417	423	429	435	442	
699	448	454	460	466	473	479	485	491	497	504	
700	510	516	522	528	535	541	547	553	559	566	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
700	84 510	516	522	528	535	541	547	553	559	566	
701	572	578	584	590	597	603	609	615	621	628	
702	634	640	646	652	658	665	671	677	683	689	
703	696	702	708	714	720	726	733	739	745	751	
704	757	763	770	776	782	788	794	800	807	813	
705	819	825	831	837	844	850	856	862	868	874	
706	880	887	893	899	905	911	917	924	930	936	
707	942	948	954	960	967	973	979	985	991	997	**7**
708	85 003	009	016	022	028	034	040	046	052	058	1 | 0,7
709	065	071	077	083	089	095	101	107	114	120	2 | 1,4
											3 | 2,1
710	126	132	138	144	150	156	163	169	175	181	4 | 2,8
711	187	193	199	205	211	217	224	230	236	242	5 | 3,5
712	248	254	260	266	272	278	285	291	297	303	6 | 4,2
713	309	315	321	327	333	339	345	352	358	364	7 | 4,9
714	370	376	382	388	394	400	406	412	418	425	8 | 5,6
715	431	437	443	449	455	461	467	473	479	485	9 | 6,3
716	491	497	503	509	516	522	528	534	540	546	
717	552	558	564	570	576	582	588	594	600	606	
718	612	618	625	631	637	643	649	655	661	667	
719	673	679	685	691	697	703	709	715	721	727	
720	733	739	745	751	757	763	769	775	781	788	
721	794	800	806	812	818	824	830	836	842	848	**6**
722	854	860	866	872	878	884	890	896	902	908	1 | 0,6
723	914	920	926	932	938	944	950	956	962	968	2 | 1,2
724	974	980	986	992	998	*004	*010	*016	*022	*028	3 | 1,8
725	86 034	040	046	052	058	064	070	076	082	088	4 | 2,4
726	094	100	106	112	118	124	130	136	141	147	5 | 3,0
727	153	159	165	171	177	183	189	195	201	207	6 | 3,6
728	213	219	225	231	237	243	249	255	261	267	7 | 4,2
729	273	279	285	291	297	303	308	314	320	326	8 | 4,8
											9 | 5,4
730	332	338	344	350	356	362	368	374	380	386	
731	392	398	404	410	415	421	427	433	439	445	
732	451	457	463	469	475	481	487	493	499	504	
733	510	516	522	528	534	540	546	552	558	564	
734	570	576	581	587	593	599	605	611	617	623	
735	629	635	641	646	652	658	664	670	676	682	**5**
736	688	694	700	705	711	717	723	729	735	741	1 | 0,5
737	747	753	759	764	770	776	782	788	794	800	2 | 1,0
738	806	812	817	823	829	835	841	847	853	859	3 | 1,5
739	864	870	876	882	888	894	900	906	911	917	4 | 2,0
											5 | 2,5
740	923	929	935	941	947	953	958	964	970	976	6 | 3,0
741	982	988	994	999	*005	*011	*017	*023	*029	*035	7 | 3,5
742	87 040	046	052	058	064	070	075	081	087	093	8 | 4,0
743	099	105	111	116	122	128	134	140	146	151	9 | 4,5
744	157	163	169	175	181	186	192	198	204	210	
745	216	221	227	233	239	245	251	256	262	268	
746	274	280	286	291	297	303	309	315	320	326	
747	332	338	344	349	355	361	367	373	379	384	
748	390	396	402	408	413	419	425	431	437	442	
749	448	454	460	466	471	477	483	489	495	500	
750	506	512	518	523	529	535	541	547	552	558	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
750	87 506	512	518	523	529	535	541	547	552	558	
751	564	570	576	581	587	593	599	604	610	616	
752	622	628	633	639	645	651	656	662	668	674	
753	679	685	691	697	703	708	714	720	726	731	
754	737	743	749	754	760	766	772	777	783	789	
755	795	800	806	812	818	823	829	835	841	846	
756	852	858	864	869	875	881	887	892	898	904	
757	910	915	921	927	933	938	944	950	955	961	
758	967	973	978	984	990	996	*001	*007	*013	*018	
759	88 024	030	036	041	047	053	058	064	070	076	
760	081	087	093	098	104	110	116	121	127	133	**6**
761	138	144	150	156	161	167	173	178	184	190	1 | 0,6
762	195	201	207	213	218	224	230	235	241	247	2 | 1,2
763	252	258	264	270	275	281	287	292	298	304	3 | 1,8
764	309	316	321	326	332	338	343	349	355	360	4 | 2,4
765	366	372	377	383	389	395	400	406	412	417	5 | 3,0
766	423	429	434	440	446	451	457	463	468	474	6 | 3,6
767	480	485	491	497	502	508	513	519	525	530	7 | 4,2
768	536	542	547	553	559	564	570	576	581	587	8 | 4,8
769	593	598	604	610	615	621	627	632	638	643	9 | 5,4
770	649	655	660	666	672	677	683	689	694	700	
771	705	711	717	722	728	734	739	745	750	756	
772	762	767	773	779	784	790	795	801	807	812	
773	818	824	829	835	840	846	852	857	863	868	
774	874	880	885	891	897	902	908	913	919	925	
775	930	936	941	947	953	958	964	969	975	981	
776	986	992	997	*003	*009	*014	*020	*025	*031	*037	
777	89 042	048	053	059	064	070	076	081	087	092	
778	098	104	109	115	120	126	131	137	143	148	
779	154	159	165	170	176	182	187	193	198	204	
780	209	215	221	226	232	237	243	248	254	260	**5**
781	265	271	276	282	287	293	298	304	310	315	1 | 0,5
782	321	326	332	337	343	348	354	360	365	371	2 | 1,0
783	376	382	387	393	398	404	409	415	421	426	3 | 1,5
784	432	437	443	448	454	459	465	470	476	481	4 | 2,0
785	487	492	498	504	509	515	520	526	531	537	5 | 2,5
786	542	548	553	559	564	570	575	581	586	592	6 | 3,0
787	597	603	609	614	620	625	631	636	642	647	7 | 3,5
788	653	658	664	669	675	680	686	691	697	702	8 | 4,0
789	708	713	719	724	730	735	741	746	752	757	9 | 4,5
790	763	768	774	779	785	790	796	801	807	812	
791	818	823	829	834	840	845	851	856	862	867	
792	873	878	883	889	894	900	905	911	916	922	
793	927	933	938	944	949	955	960	966	971	977	
794	982	988	993	998	*004	*009	*015	*020	*026	*031	
795	90 037	042	048	053	059	064	069	075	080	086	
796	091	097	102	108	113	119	124	129	135	140	
797	146	151	157	162	168	173	179	184	189	195	
798	200	206	211	217	222	227	233	238	244	249	
799	255	260	266	271	276	282	287	293	298	304	
800	309	314	320	325	331	336	342	347	352	358	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
800	90 309	314	320	325	331	336	342	347	352	358	
801	363	369	374	380	385	390	396	401	407	412	
802	417	423	428	434	439	445	450	455	461	466	
803	472	477	482	488	493	499	504	509	515	520	
804	526	531	536	542	547	553	558	563	569	574	
805	580	585	590	596	601	607	612	617	623	628	
806	634	639	644	650	655	660	666	671	677	682	
807	687	693	698	703	709	714	720	725	730	736	
808	741	747	752	757	763	768	773	779	784	789	
809	795	800	806	811	816	822	827	832	838	843	
810	849	854	859	865	870	875	881	886	891	897	**6**
811	902	907	913	918	924	929	934	940	945	950	1 | 0,6
812	956	961	966	972	977	982	988	993	998	*004	2 | 1,2
813	91 009	014	020	025	030	036	041	046	052	057	3 | 1,8
814	062	068	073	078	084	089	094	100	105	110	4 | 2,4
815	116	121	126	132	137	142	148	153	158	164	5 | 3,0
816	169	174	180	185	190	196	201	206	212	217	6 | 3,6
817	222	228	233	238	243	249	254	259	265	270	7 | 4,2
818	275	281	286	291	297	302	307	312	318	323	8 | 4,8
819	328	334	339	344	350	355	360	365	371	376	9 | 5,4
820	381	387	392	397	403	408	413	418	424	429	
821	434	440	445	450	455	461	466	471	477	482	
822	487	492	498	503	508	514	519	524	529	535	
823	540	545	551	556	561	566	572	577	582	587	
824	593	598	603	609	614	619	624	630	635	640	
825	645	651	656	661	666	672	677	682	687	693	
826	698	703	709	714	719	724	730	735	740	745	
827	751	756	761	766	772	777	782	787	793	798	
828	803	808	814	819	824	829	834	840	845	850	
829	855	861	866	871	876	882	887	892	897	903	
830	908	913	918	924	929	934	939	944	950	955	**5**
831	960	965	971	976	981	986	991	997	*002	*007	1 | 0,5
832	92 012	018	023	028	033	038	044	049	054	059	2 | 1,0
833	065	070	075	080	085	091	096	101	106	111	3 | 1,5
834	117	122	127	132	137	143	148	153	158	163	4 | 2,0
835	169	174	179	184	189	195	200	205	210	215	5 | 2,5
836	221	226	231	236	241	247	252	257	262	267	6 | 3,0
837	273	278	283	288	293	298	304	309	314	319	7 | 3,5
838	324	330	335	340	345	350	355	361	366	371	8 | 4,0
839	376	381	387	392	397	402	407	412	418	423	9 | 4,5
840	428	433	438	443	449	454	459	464	469	474	
841	480	485	490	495	500	505	511	516	521	526	
842	531	536	542	547	552	557	562	567	572	578	
843	583	588	593	598	603	609	614	619	624	629	
844	634	639	645	650	655	660	665	670	675	681	
845	686	691	696	701	706	711	716	722	727	732	
846	737	742	747	752	758	763	768	773	778	783	
847	788	793	799	804	809	814	819	824	829	834	
848	840	845	850	855	860	865	870	875	881	886	
849	891	896	901	906	911	916	921	927	932	937	
850	942	947	952	957	962	967	973	978	983	988	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9
850	92 942	947	952	957	962	967	973	978	983	988
851	993	998	*003	*008	*013	*018	*024	*029	*034	*039
852	93 044	049	054	059	064	069	075	080	085	090
853	095	100	105	110	115	120	125	131	136	141
854	146	151	156	161	166	171	176	181	186	192
855	197	202	207	212	217	222	227	232	237	242
856	247	252	258	263	268	273	278	283	288	293
857	298	303	308	313	318	323	328	334	339	344
858	349	354	359	364	369	374	379	384	389	394
859	399	404	409	414	420	425	430	435	440	445
860	450	455	460	465	470	475	480	485	490	495
861	500	505	510	515	520	526	531	536	541	546
862	551	556	561	566	571	576	581	586	591	596
863	601	606	611	616	621	626	631	636	641	646
864	651	656	661	666	671	676	682	687	692	697
865	702	707	712	717	722	727	732	737	742	747
866	752	757	762	767	772	777	782	787	792	797
867	802	807	812	817	822	827	832	837	842	847
868	852	857	862	867	872	877	882	887	892	897
869	902	907	912	917	922	927	932	937	942	947
870	952	957	962	967	972	977	982	987	992	997
871	94 002	007	012	017	022	027	032	037	042	047
872	052	057	062	067	072	077	082	086	091	096
873	101	106	111	116	121	126	131	136	141	146
874	151	156	161	166	171	176	181	186	191	196
875	201	206	211	216	221	226	231	236	240	245
876	250	255	260	265	270	275	280	285	290	295
877	300	305	310	315	320	325	330	335	340	345
878	349	354	359	364	369	374	379	384	389	394
879	399	404	409	414	419	424	429	433	438	443
880	448	453	458	463	468	473	478	483	488	493
881	498	503	507	512	517	522	527	532	537	542
882	547	552	557	562	567	571	576	581	586	591
883	596	601	606	611	616	621	626	630	635	640
884	645	650	655	660	665	670	675	680	685	689
885	694	699	704	709	714	719	724	729	734	738
886	743	748	753	758	763	768	773	778	783	787
887	792	797	802	807	812	817	822	827	832	836
888	841	846	851	856	861	866	871	876	880	885
889	890	895	900	905	910	915	919	924	929	934
890	939	944	949	954	959	963	968	973	978	983
891	988	993	998	*002	*007	*012	*017	*022	*027	*032
892	95 036	041	046	051	056	061	066	071	075	080
893	085	090	095	100	105	109	114	119	124	129
894	134	139	143	148	153	158	163	168	173	177
895	182	187	192	197	202	207	211	216	221	226
896	231	236	240	245	250	255	260	265	270	274
897	279	284	289	294	299	303	308	313	318	323
898	328	332	337	342	347	352	357	361	366	371
899	376	381	386	390	395	400	405	410	415	419
900	424	429	434	439	444	448	453	458	463	468

| N. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

Proportional parts

	6
1	0,6
2	1,2
3	1,8
4	2,4
5	3,0
6	3,6
7	4,2
8	4,8
9	5,4

	5
1	0,5
2	1,0
3	1,5
4	2,0
5	2,5
6	3,0
7	3,5
8	4,0
9	4,5

	4
1	0,4
2	0,8
3	1,2
4	1,6
5	2,0
6	2,4
7	2,8
8	3,2
9	3,6

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
900	95 424	429	434	439	444	448	453	458	463	468	
901	472	477	482	487	492	497	501	506	511	516	
902	521	525	530	535	540	545	550	554	559	564	
903	569	574	578	583	588	593	598	602	607	612	
904	617	622	626	631	636	641	646	650	655	660	
905	665	670	674	679	684	689	694	698	703	708	
906	713	718	722	727	732	737	742	746	751	756	
907	761	766	770	775	780	785	789	794	799	804	
908	809	813	818	823	828	832	837	842	847	852	
909	856	861	866	871	875	880	885	890	895	899	
910	904	909	914	918	923	928	933	938	942	947	**5**
911	952	957	961	966	971	976	980	985	990	995	1 | 0,5
912	999	*004	*009	*014	*019	*023	*028	*033	*038	*042	2 | 1,0
913	96 047	052	057	061	066	071	076	080	085	090	3 | 1,5
914	095	099	104	109	114	118	123	128	133	137	4 | 2,0
915	142	147	152	156	161	166	171	175	180	185	5 | 2,5
916	190	194	199	204	209	213	218	223	227	232	6 | 3,0
917	237	242	246	251	256	261	265	270	275	280	7 | 3,5
918	284	289	294	298	303	308	313	317	322	327	8 | 4,0
919	332	336	341	346	350	355	360	365	369	374	9 | 4,5
920	379	384	388	393	398	402	407	412	417	421	
921	426	431	435	440	445	450	454	459	464	468	
922	473	478	483	487	492	497	501	506	511	515	
923	520	525	530	534	539	544	548	553	558	562	
924	567	572	577	581	586	591	595	600	605	609	
925	614	619	624	628	633	638	642	647	652	656	
926	661	666	670	675	680	685	689	694	699	703	
927	708	713	717	722	727	731	736	741	745	750	
928	755	759	764	769	774	778	783	788	792	797	
929	802	806	811	816	820	825	830	834	839	844	
930	848	853	858	862	867	872	876	881	886	890	**4**
931	895	900	904	909	914	918	923	928	932	937	1 | 0,4
932	942	946	951	956	960	965	970	974	979	984	2 | 0,8
933	988	993	997	*002	*007	*011	*016	*021	*025	*030	3 | 1,2
934	97 035	039	044	049	053	058	063	067	072	077	4 | 1,6
935	081	086	090	095	100	104	109	114	118	123	5 | 2,0
936	128	132	137	142	146	151	155	160	165	169	6 | 2,4
937	174	179	183	188	192	197	202	206	211	216	7 | 2,8
938	220	225	230	234	239	243	248	253	257	262	8 | 3,2
939	267	271	276	280	285	290	294	299	304	308	9 | 3,6
940	313	317	322	327	331	336	340	345	350	354	
941	359	364	368	373	377	382	387	391	396	400	
942	405	410	414	419	424	428	433	437	442	447	
943	451	456	460	465	470	474	479	483	488	493	
944	497	502	506	511	516	520	525	529	534	539	
945	543	548	552	557	562	566	571	575	580	585	
946	589	594	598	603	607	612	617	621	626	630	
947	635	640	644	649	653	658	663	667	672	676	
948	681	685	690	695	699	704	708	713	717	722	
949	727	731	736	740	745	749	754	759	763	768	
950	772	777	782	786	791	795	800	804	809	813	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
950	97 772	777	782	786	791	795	800	804	809	813	
951	818	823	827	832	836	841	845	850	855	859	
952	864	868	873	877	882	886	891	896	900	905	
953	909	914	918	923	928	932	937	941	946	950	
954	955	959	964	968	973	978	982	987	991	996	
955	98 000	005	009	014	019	023	028	032	037	041	
956	046	050	055	059	064	068	073	078	082	087	
957	091	096	100	105	109	114	118	123	127	132	
958	137	141	146	150	155	159	164	168	173	177	
959	182	186	191	195	200	204	209	214	218	223	
960	227	232	236	241	245	250	254	259	263	268	**5**
961	272	277	281	286	290	295	299	304	308	313	1 0,5
962	318	322	327	331	336	340	345	349	354	358	2 1,0
963	363	367	372	376	381	385	390	394	399	403	3 1,5
964	408	412	417	421	426	430	435	439	444	448	4 2,0
965	453	457	462	466	471	475	480	484	489	493	5 2,5
966	498	502	507	511	516	520	525	529	534	538	6 3,0
967	543	547	552	556	561	565	570	574	579	583	7 3,5
968	588	592	597	601	605	610	614	619	623	628	8 4,0
969	632	637	641	646	650	655	659	664	668	673	9 4,5
970	677	682	686	691	695	700	704	709	713	717	
971	722	726	731	735	740	744	749	753	758	762	
972	767	771	776	780	784	789	793	798	802	807	
973	811	816	820	825	829	834	838	843	847	851	
974	856	860	865	869	874	878	883	887	892	896	
975	900	905	909	914	918	923	927	932	936	941	
976	945	949	954	958	963	967	972	976	981	985	
977	989	994	998	*003	*007	*012	*016	*021	*025	*029	
978	99 034	038	043	047	052	056	061	065	069	074	
979	078	083	087	092	096	100	105	109	114	118	
980	123	127	131	136	140	145	149	154	158	162	**4**
981	167	171	176	180	185	189	193	198	202	207	1 0,4
982	211	216	220	224	229	233	238	242	247	251	2 0,8
983	255	260	264	269	273	277	282	286	291	295	3 1,2
984	300	304	308	313	317	322	326	330	335	339	4 1,6
985	344	348	352	357	361	366	370	374	379	383	5 2,0
986	388	392	396	401	405	410	414	419	423	427	6 2,4
987	432	436	441	445	449	454	458	463	467	471	7 2,8
988	476	480	484	489	493	498	502	506	511	515	8 3,2
989	520	524	528	533	537	542	546	550	555	559	9 3,6
990	564	568	572	577	581	585	590	594	599	603	
991	607	612	616	621	625	629	634	638	642	647	
992	651	656	660	664	669	673	677	682	686	691	
993	695	699	704	708	712	717	721	726	730	734	
994	739	743	747	752	756	760	765	769	774	778	
995	782	787	791	795	800	804	808	813	817	822	
996	826	830	835	839	843	848	852	856	861	865	
997	870	874	878	883	887	891	896	900	904	909	
998	913	917	922	926	930	935	939	944	948	952	
999	957	961	965	970	974	978	983	987	991	996	
1000	00 000	004	009	013	017	022	026	030	035	039	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts

NATURAL LOGARITHMS

NATURAL OR NAPERIAN LOGARITHMS OF THE NUMBERS FROM 1 TO 1109

To find the logarithm of a number which is $\frac{1}{10}$ or 10 times etc. a number whose logarithm is given, subtract from or add to the given logarithm the logarithm of 10.

Thus log 1.6 = log 16 − log 10
log 160 = log 16 + log 10 etc.

N	Log	N	Log	N	Log	N	Log	N	Log
0	—	**20**	2. 99 573	**40**	3. 68 888	**60**	4. 09 434	**80**	4. 38 203
1	0. 00 000	21	3. 04 452	41	3. 71 357	61	4. 11 087	81	4. 39 445
2	0. 69 315	22	3. 09 104	42	3. 73 767	62	4. 12 713	82	4. 40 672
3	1. 09 861	23	3. 13 459	43	3. 76 120	63	4. 14 313	83	4. 41 884
4	1. 38 629	24	3. 17 805	44	3. 78 419	64	4. 15 888	84	4. 43 082
5	1. 60 944	25	3. 21 888	45	3. 80 666	65	4. 17 439	85	4. 44 265
6	1. 79 176	26	3. 25 810	46	3. 82 864	66	4. 18 965	86	4. 45 435
7	1. 94 591	27	3. 29 584	47	3. 85 015	67	4. 20 469	87	4. 46 591
8	2. 07 944	28	3. 33 220	48	3. 87 120	68	4. 21 951	88	4. 47 734
9	2. 19 722	29	3. 36 730	49	3. 89 182	69	4. 23 411	89	4. 48 864
10	2. 30 259	**30**	3. 40 120	**50**	3. 91 202	**70**	4. 24 850	**90**	4. 49 981
11	2. 39 790	31	3. 43 399	51	3. 93 183	71	4. 26 268	91	4. 51 086
12	2. 48 491	32	3. 46 574	52	3. 95 124	72	4. 27 667	92	4. 52 179
13	2. 56 495	33	3. 49 651	53	3. 97 029	73	4. 29 046	93	4. 53 260
14	2. 63 906	34	3. 52 636	54	3. 98 898	74	4. 30 407	94	4. 54 329
15	2. 70 805	35	3. 55 535	55	4. 00 733	75	4. 31 749	95	4. 55 388
16	2. 77 259	36	3. 58 352	56	4. 02 535	76	4. 33 073	96	4. 56 435
17	2. 83 321	37	3. 61 092	57	4. 04 305	77	4. 34 381	97	4. 57 471
18	2. 89 037	38	3. 63 759	58	4. 06 044	78	4. 35 671	98	4. 58 497
19	2. 94 444	39	3. 66 356	59	4. 07 754	79	4. 36 945	99	4. 59 512
20	2. 99 573	**40**	3. 68 888	**60**	4. 09 434	**80**	4. 38 203	**100**	4. 60 517

NATURAL LOGARITHMS (Continued)

N	Log 0	1	2	3	4	5	6	7	8	9
10	4.6 0517	1512	2497	3473	4439	5396	6344	7283	8213	9135
11	4.7 0048	0953	1850	2739	3620	4493	5359	6217	7068	7912
12	8749	9579	*0402	*1218	*2028	*2831	*3628	*4419	*5203	*5981
13	4.8 6753	7520	8280	9035	9784	*0527	*1265	*1998	*2725	*3447
14	4.9 4164	4876	5583	6284	6981	7673	8361	9043	9721	*0395
15	5.0 1064	1728	2388	3044	3695	4343	4986	5625	6260	6890
16	7517	8140	8760	9375	9987	*0595	*1199	*1799	*2396	*2990
17	5.1 3580	4166	4749	5329	5906	6479	7048	7615	8178	8739
18	9296	9850	*0401	*0949	*1494	*2036	*2575	*3111	*3644	*4175
19	5.2 4702	5227	5750	6269	6786	7300	7811	8320	8827	9330
20	9832	*0330	*0827	*1321	*1812	*2301	*2788	*3272	*3754	*4233
21	5.3 4711	5186	5659	6129	6598	7064	7528	7990	8450	8907
22	9363	9816	*0268	*0717	*1165	*1610	*2053	*2495	*2935	*3372
23	5.4 3808	4242	4674	5104	5532	5959	6383	6806	7227	7646
24	8064	8480	8894	9306	9717	*0126	*0533	*0939	*1343	*1745
25	5.5 2146	2545	2943	3339	3733	4126	4518	4908	5296	5683
26	6068	6452	6834	7215	7595	7973	8350	8725	9099	9471
27	9842	*0212	*0580	*0947	*1313	*1677	*2040	*2402	*2762	*3121
28	5.6 3479	3835	4191	4545	4897	5249	5599	5948	6296	6643
29	6988	7332	7675	8017	8358	8698	9036	9373	9709	*0044
30	5.7 0378	0711	1043	1373	1703	2031	2359	2685	3010	3334
31	3657	3979	4300	4620	4939	5257	5574	5890	6205	6519
32	6832	7144	7455	7765	8074	8383	8690	8996	9301	9606
33	9909	*0212	*0513	*0814	*1114	*1413	*1711	*2008	*2305	*2600
34	5.8 2895	3188	3481	3773	4064	4354	4644	4932	5220	5507
35	5793	6079	6363	6647	6930	7212	7493	7774	8053	8332
36	8610	8888	9164	9440	9715	9990	*0263	*0536	*0808	*1080
37	5.9 1350	1620	1889	2158	2426	2693	2959	3225	3489	3754
38	4017	4280	4542	4803	5064	5324	5584	5842	6101	6358
39	6615	6871	7126	7381	7635	7889	8141	8394	8645	8899
40	9146	9396	9645	9894	*0141	*0389	*0635	*0881	*1127	*1372
41	6.0 1616	1859	2102	2345	2587	2828	3069	3309	3548	3787
42	4025	4263	4501	4737	4973	5209	5444	5678	5912	6146
43	6379	6611	6843	7074	7304	7535	7764	7993	8222	8450
44	8677	8904	9131	9357	9582	9807	*0032	*0256	*0479	*0702
45	6.1 0925	1147	1368	1589	1810	2030	2249	2468	2687	2905
46	3123	3340	3556	3773	3988	4204	4419	4633	4847	5060
47	5273	5486	5698	5910	6121	6331	6542	6752	6961	7170
48	7379	7587	7794	8002	8208	8415	8621	8826	9032	9236
49	9441	9644	9848	*0051	*0254	*0456	*0658	*0859	*1060	*1261
50	6.2 1461	1661	1860	2059	2258	2456	2654	2851	3048	3245
51	3441	3637	3832	4028	4222	4417	4611	4804	4998	5190
52	5383	5575	5767	5958	6149	6340	6530	6720	6910	7099
53	7288	7476	7664	7852	8040	8227	8413	8600	8786	8972
54	9157	9342	9527	9711	9895	*0079	*0262	*0445	*0628	*0810
55	6.3 0992	1173	1355	1536	1716	1897	2077	2257	2436	2615
56	2794	2972	3150	3328	3505	3683	3859	4036	4212	4388
57	4564	4739	4914	5089	5263	5437	5611	5784	5957	6130
58	6303	6475	6647	6819	6990	7161	7332	7502	7673	7843
59	8012	8182	8351	8519	8688	8856	9024	9192	9359	9526
60	9693	9859	*0026	*0192	*0357	*0523	*0688	*0853	*1017	*1182
N	Log 0	1	2	3	4	5	6	7	8	9

NATURAL LOGARITHMS (Continued)

N	Log	0	1	2	3	4	5	6	7	8	9
60	6. 3	9693	9859	*0026	*0192	*0357	*0523	*0688	*0853	*1017	*1182
61	6. 4	1346	1510	1673	1836	1999	2162	2325	2487	2649	2811
62		2972	3133	3294	3455	3615	3775	3935	4095	4254	4413
63		4572	4731	4889	5047	5205	5362	5520	5677	5834	5990
64		6147	6303	6459	6614	6770	6925	7080	7235	7389	7543
65		7697	7851	8004	8158	8311	8464	8616	8768	8920	9072
66		9224	9375	9527	9677	9828	9979	*0129	*0279	*0429	*0578
67	6. 5	0728	0877	1026	1175	1323	1471	1619	1767	1915	2062
68		2209	2356	2503	2649	2796	2942	3088	3233	3379	3524
69		3669	3814	3959	4103	4247	4391	4535	4679	4822	4965
70		5108	5251	5393	5536	5678	5820	5962	6103	6244	6386
71		6526	6667	6808	6948	7088	7228	7368	7508	7647	7786
72		7925	8064	8203	8341	8479	8617	8755	8893	9030	9167
73		9304	9441	9578	9715	9851	9987	*0123	*0259	*0394	*0530
74	6. 6	0665	0800	0935	1070	1204	1338	1473	1607	1740	1874
75		2007	2141	2274	2407	2539	2672	2804	2936	3068	3200
76		3332	3463	3595	3726	3857	3988	4118	4249	4379	4509
77		4639	4769	4898	5028	5157	5286	5415	5544	5673	5801
78		5929	6058	6185	6313	6441	6568	6696	6823	6950	7077
79		7203	7330	7456	7582	7870	7834	7960	8085	8211	8336
80		8461	8586	8711	8835	8960	9084	9208	9332	9456	9580
81		9703	9827	9950	*0073	*0196	*0319	*0441	*0564	*0686	*0808
82	6. 7	0930	1052	1174	1296	1417	1538	1659	1780	1901	2022
83		2143	2263	2383	2503	2623	2743	2863	2982	3102	3221
84		3340	3459	3578	3697	3815	3934	4052	4170	4288	4406
85		4524	4641	4759	4876	4993	5110	5227	5344	5460	5577
86		5693	5809	5926	6041	6157	6273	6388	6504	6619	6734
87		6849	6964	7079	7194	7308	7422	7537	7651	7765	7878
88		7992	8106	8219	8333	8446	8559	8672	8784	8897	9010
89		9122	9234	9347	9459	9571	9682	9794	9906	*0017	*0128
90	6. 8	0239	0351	0461	0572	0683	0793	0904	1014	1124	1235
91		1344	1454	1564	1674	1783	1892	2002	2111	2220	2329
92		2437	2546	2655	2763	2871	2979	3087	3195	3303	3411
93		3518	3626	3733	3841	3948	4055	4162	4268	4375	4482
94		4588	4694	4801	4907	5013	5118	5224	5330	5435	5541
95		5646	5751	5857	5961	6066	6171	6276	6380	6485	6589
96		6693	6797	6901	7005	7109	7213	7316	7420	7523	7626
97		7730	7833	7936	8038	8141	8244	8346	8449	8551	8653
98		8755	8857	8959	9061	9163	9264	9366	9467	9568	9669
99		9770	9871	9972	*0073	*0174	*0274	*0375	*0475	*0575	*0675
100	6. 9	0776	0875	0975	1075	1175	1274	1374	1473	1572	1672
101		1771	1870	1968	2067	2166	2264	2363	2461	2560	2658
102		2756	2854	2952	3049	3147	3245	3342	3440	3537	3634
103		3731	3828	3925	4022	4119	4216	4312	4409	4505	4601
104		4698	4794	4890	4986	5081	5177	5273	5368	5464	5559
105		5655	5750	5845	5940	6035	6130	6224	6319	6414	6508
106		6602	6697	6791	6885	6979	7073	7167	7261	7354	7448
107		7541	7635	7728	7821	7915	8008	8101	8193	8286	8379
108		8472	8564	8657	8749	8841	8934	9026	9118	9210	9302
109		9393	9485	9577	9668	9760	9851	9942	*0033	*0125	*0216
110	7. 0	0307	0397	0488	0579	0670	0760	0851	0941	1031	1121
N	Log	0	1	2	3	4	5	6	7	8	9

EXPONENTIALS

This table gives the values of e^n for the values of n shown at the side and top.

	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	1.000	1.010	1.020	1.030	1.041	1.051	1.062	1.073	1.083	1.094
0.1	1.105	1.116	1.127	1.139	1.150	1.162	1.174	1.185	1.197	1.209
0.2	1.221	1.234	1.246	1.259	1.271	1.284	1.297	1.310	1.323	1.336
0.3	1.350	1.363	1.377	1.391	1.405	1.419	1.433	1.448	1.462	1.477
0.4	1.492	1.507	1.522	1.537	1.553	1.568	1.584	1.600	1.616	1.632
0.5	1.649	1.665	1.682	1.699	1.716	1.733	1.751	1.768	1.786	1.804
0.6	1.822	1.840	1.859	1.878	1.896	1.916	1.935	1.954	1.974	1.994
0.7	2.014	2.034	2.054	2.075	2.096	2.117	2.138	2.160	2.181	2.203
0.8	2.226	2.248	2.270	2.293	2.316	2.340	2.363	2.387	2.411	2.435
0.9	2.460	2.484	2.509	2.535	2.560	2.586	2.612	2.638	2.664	2.691

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1	2.718	3.004	3.320	3.669	4.055	4.482	4.953	5.474	6.050	6.686
2	7.389	8.166	9.025	9.974	11.02	12.18	13.46	14.88	16.44	18.17
3	20.09	22.20	24.53	27.11	29.96	33.12	36.60	40.45	44.70	49.40
4	54.60	60.34	66.69	73.70	81.45	90.02	99.48	110.0	121.5	134.3
5	148.4	164.0	181.3	200.3	221.4	244.7	270.4	298.9	330.3	365.0
6	403.4	445.9	492.8	544.6	601.9	665.1	735.1	812.4	897.9	992.3
7	1097	1212	1339	1480	1636	1808	1998	2208	2441	2697
8	2981	3295	3641	4024	4447	4915	5432	6003	6634	7332
9	8103	8955	9897	10938	12088	13360	14765	16318	18034	19930
10	22026									

EXPONENTIALS (Continued)

This table gives the values of e^{-n} for the values of n shown at the side and top.

	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	1.000	0.990	0.980	0.970	0.961	0.951	0.942	0.932	0.923	0.914
0.1	0.905	0.896	0.887	0.878	0.869	0.861	0.852	0.844	0.835	0.827
0.2	0.819	0.811	0.803	0.795	0.787	0.779	0.771	0.763	0.756	0.748
0.3	0.741	0.733	0.726	0.719	0.712	0.705	0.698	0.691	0.684	0.677
0.4	0.670	0.664	0.657	0.651	0.644	0.638	0.631	0.625	0.619	0.613
0.5	0.607	0.600	0.595	0.589	0.583	0.577	0.571	0.566	0.560	0.554
0.6	0.549	0.543	0.538	0.533	0.527	0.522	0.517	0.512	0.507	0.502
0.7	0.497	0.492	0.487	0.482	0.477	0.472	0.468	0.463	0.458	0.454
0.8	0.449	0.445	0.440	0.436	0.432	0.427	0.423	0.419	0.415	0.411
0.9	0.407	0.403	0.399	0.395	0.391	0.387	0.383	0.379	0.375	0.372
1.0	0.368									

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1.0	0.368	0.333	0.301	0.273	0.247	0.223	0.202	0.183	0.165	0.150
2.0	0.135	0.122	0.111	0.100	0.0907	0.0821	0.0743	0.0672	0.0608	0.0550
3.0	0.0498	0.0450	0.0408	0.0369	0.0334	0.0302	0.0273	0.0247	0.0224	0.0202
4.0	0.0183	0.0166	0.0150	0.0136	0.0123	0.0111	0.0101	0.00910	0.00823	0.00745
5.0	0.00674	0.00610	0.00552	0.00499	0.00452	0.00409	0.00370	0.00335	0.00303	0.00274
6.0	0.00248	0.00224	0.00203	0.00184	0.00166	0.00150	0.00136	0.00123	0.00111	0.00101
7.0	0.000912	0.000825	0.000747	0.000676	0.000611	0.000553	0.000500	0.000453	0.000410	0.000371
8.0	0.000335	0.000304	0.000275	0.000249	0.000225	0.000203	0.000184	0.000167	0.000151	0.000136
9.0	0.000123	0.000112	0.000101	0.000091	0.000083	0.000075	0.000068	0.000061	0.000055	0.000050
10.0	0.000045									

NATURAL SINES, COSINES, TANGENTS AND COTANGENTS

Degrees.	Sin.	Cos.	Tan.	Cot.	Degrees.
0° 00′	0.0000	1.0000	0.0000	∞	90° 00′
10	.0029	1.0000	.0029	343.77	50
20	.0058	1.0000	.0058	171.89	40
30	.0087	1.0000	.0087	114.59	30
40	.0116	.9999	.0116	85.940	20
50	.0145	.9999	.0145	68.750	10
1° 00′	0.0175	0.9998	0.0175	57.290	89° 00′
10	.0204	.9998	.0204	49.104	50
20	.0233	.9997	.0233	42.964	40
30	.0262	.9997	.0262	38.188	30
40	.0291	.9996	.0291	34.368	20
50	.0320	.9995	.0320	31.242	10
2° 00′	0.0349	0.9994	0.0349	28.636	88° 00′
10	.0378	.9993	.0378	26.432	50
20	.0407	.9992	.0407	24.542	40
30	.0436	.9990	.0437	22.904	30
40	.0465	.9989	.0466	21.470	20
50	.0494	.9988	.0495	20.206	10
3° 00′	0.0523	0.9986	0.0524	19.081	87° 00′
10	.0552	.9985	.0553	18.075	50
20	.0581	.9983	.0582	17.169	40
30	.0610	.9981	.0612	16.350	30
40	.0640	.9980	.0641	15.605	20
50	.0669	.9978	.0670	14.924	10
4° 00′	0.0698	0.9976	0.0699	14.301	86° 00′
10	.0727	.9974	.0729	13.727	50
20	.0756	.9971	.0758	13.197	40
30	.0785	.9969	.0787	12.706	30
40	.0814	.9967	.0816	12.251	20
50	.0843	.9964	.0846	11.826	10
5° 00′	0.0872	0.9962	0.0875	11.430	85° 00′
10	.0901	.9959	.0904	11.059	50
20	.0929	.9957	.0934	10.712	40
30	.0958	.9954	.0963	10.385	30
40	.0987	.9951	.0992	10.078	20
50	.1016	.9948	.1022	9.7882	10
6° 00′	0.1045	0.9945	0.1051	9.5144	84° 00′
10	.1074	.9942	.1080	9.2553	50
20	.1103	.9939	.1110	9.0098	40
30	.1132	.9936	.1139	8.7769	30
40	.1161	.9932	.1169	8.5555	20
50	.1190	.9929	.1198	8.3450	10
7° 00′	0.1219	0.9925	0.1228	8.1443	83° 00′
10	.1248	.9922	.1257	7.9530	50
20	.1276	.9918	.1287	7.7704	40
30	.1305	.9914	.1317	7.5958	30
40	.1334	.9911	.1346	7.4287	20
50	.1363	.9907	.1376	7.2687	10
8° 00′	0.1392	0.9903	0.1405	7.1154	82° 00′
10	.1421	.9899	.1435	6.9682	50
20	.1449	.9894	.1465	6.8269	40
30	.1478	.9890	.1495	6.6912	30
40	.1507	.9886	.1524	6.5606	20
50	.1536	.9881	.1554	6.4348	10
9° 00′	0.1564	0.9877	0.1584	6.3138	81° 00′
Degrees.	Cos.	Sin.	Cot.	Tan.	Degrees.

NATURAL SINES, COSINES, TANGENTS AND COTANGENTS (Continued)

Degrees.	Sin.	Cos.	Tan.	Cot.	Degrees.
9° 00′	0.1564	0.9877	0.1584	6.3138	81° 00′
10	.1593	.9872	.1614	6.1970	50
20	.1622	.9868	.1644	6.0844	40
30	.1650	.9863	.1673	5.9758	30
40	.1679	.9858	.1703	5.8708	20
50	.1708	.9853	.1733	5.7694	10
10° 00′	0.1736	0.9848	0.1763	5.6713	80° 00
10	.1765	.9843	.1793	5.5764	50
20	.1794	.9838	.1823	5.4845	40
30	.1822	.9833	.1853	5.3955	30
40	.1851	.9827	.1883	5.3093	20
50	.1880	.9822	.1914	5.2257	10
11° 00′	0.1908	0.9816	0.1944	5.1446	79° 00′
10	.1937	.9811	.1974	5.0658	50
20	.1965	.9805	.2004	4.9894	40
30	.1994	.9799	.2035	4.9152	30
40	.2022	.9793	.2065	4.8430	20
50	.2051	.9787	.2095	.7729	10
12° 00′	0.2079	0.9781	0.2126	4.7046	78° 00′
10	.2108	.9775	.2156	4.6382	50
20	.2136	.9769	.2186	4.5736	40
30	.2164	.9763	.2217	4.5107	30
40	.2193	.9757	.2247	4.4494	20
50	.2221	.9750	.2278	4.3897	10
13° 00′	0.2250	0.9744	0.2309	4.3315	77° 00′
10	.2278	.9737	.2339	4.2747	50
20	.2306	.9730	.2370	4.2193	40
30	.2334	.9724	.2401	4.1653	30
40	.2363	.9717	.2432	4.1126	20
50	.2391	.9710	.2462	4.0611	10
14° 00′	0.2419	0.9703	0.2493	4.0108	76° 00′
10	.2447	.9696	.2524	3.9617	50
20	.2476	.9689	.2555	3.9136	40
30	.2504	.9681	.2586	3.8667	30
40	.2532	.9674	.2617	3.8208	20
50	.2560	.9667	.2648	3.7760	10
15° 00′	0.2588	0.9659	0.2679	3.7321	75° 00′
10	.2616	.9652	.2711	3.6891	50
20	.2644	.9644	.2742	3.6470	40
30	.2672	.9636	.2773	3.6059	30
40	.2700	.9628	.2805	3.5656	20
50	.2728	.9621	.2836	3.5261	10
16° 00′	0.2756	0.9613	0.2867	3.4874	74° 00′
10	.2784	.9605	.2899	3.4495	50
20	.2812	.9596	.2931	3.4124	40
30	.2840	.9588	.2962	3.3759	30
40	.2868	.9580	.2994	3.3402	20
50	.2896	.9572	.3026	3.3052	10
17° 00′	0.2924	0.9563	0.3057	3.2709	73° 00′
10	.2952	.9555	.3089	3.2371	50
20	.2979	.9546	.3121	3.2041	40
30	.3007	.9537	.3153	3.1716	30
40	.3035	.9528	.3185	3.1397	20
50	.3062	.9520	.3217	3.1084	10
18° 00′	0.3090	0.9511	0.3249	3.0777	72° 00′
Degrees.	Cos.	Sin.	Cot.	Tan.	Degrees.

NATURAL SINES, COSINES, TANGENTS AND COTANGENTS (Continued)

Degrees.	Sin.	Cos.	Tan.	Cot.	Degrees.
18° 00′	0.3090	0.9511	0.3249	3.0777	72° 00′
10	.3118	.9502	.3281	3.0475	50
20	.3145	.9492	.3314	3.0178	40
30	.3173	.9483	.3346	2.9887	30
40	.3201	.9474	.3378	2.9600	20
50	.3228	.9465	.3411	2.9319	10
19° 00′	0.3256	0.9455	0.3443	2.9042	71° 00′
10	.3283	.9446	.3476	2.8770	50
20	.3311	.9436	.3508	2.8502	40
30	.3338	.9426	.3541	2.8239	30
40	.3365	.9417	.3574	2.7980	20
50	.3393	.9407	.3607	2.7725	10
20° 00′	0.3420	0.9397	0.3640	2.7475	70° 00′
10	.3448	.9387	.3673	2.7228	50
20	.3475	.9377	.3706	2.6985	40
30	.3502	.9367	.3739	2.6746	30
40	.3529	.9356	.3772	2.6511	20
50	.3557	.9346	.3805	2.6279	10
21° 00′	0.3584	0.9336	0.3839	2.6051	69° 00′
10	.3611	.9325	.3872	2.5826	50
20	.3638	.9315	.3906	2.5605	40
30	.3665	.9304	.3939	2.5386	30
40	.3692	.9293	.3973	2.5172	20
50	.3719	.9283	.4006	2.4960	10
22° 00′	0.3746	0.9272	0.4040	2.4751	68° 00′
10	.3773	.9261	.4074	2.4545	50
20	.3800	.9250	.4108	2.4342	40
30	.3827	.9239	.4142	2.4142	30
40	.3854	.9228	.4176	2.3945	20
50	.3881	.9216	.4210	2.3750	10
23° 00′	0.3907	0.9205	0.4245	2.3559	67° 00′
10	.3934	.9194	.4279	2.3369	50
20	.3961	.9182	.4314	2.3183	40
30	.3987	.9171	.4348	2.2998	30
40	.4014	.9159	.4383	2.2817	20
50	.4041	.9147	.4417	2.2637	10
24° 00′	0.4067	0.9135	0.4452	2.2460	66° 00′
10	.4094	.9124	.4487	2.2286	50
20	.4120	.9112	.4522	2.2113	40
30	.4147	.9100	.4557	2.1943	30
40	.4173	.9088	.4592	2.1775	20
50	.4200	.9075	.4628	2.1609	10
25° 00	0.4226	0.9063	0.4663	2.1445	65° 00′
10	.4253	.9051	.4699	2.1283	50
20	.4279	.9038	.4734	2.1123	40
30	.4305	.9026	.4770	2.0965	30
40	.4331	.9013	.4806	2.0809	20
50	.4358	.9001	.4841	2.0655	10
26° 00′	0.4384	0.8988	0.4877	2.0503	64° 00′
10	.4410	.8975	.4913	2.0353	50
20	.4436	.8962	.4950	2.0204	40
30	.4462	.8949	.4986	2.0057	30
40	.4488	.8936	.5022	1.9912	20
50	.4514	.8923	.5059	1.9768	10
27° 00	0.4540	0.8910	0.5095	1.9626	63° 00′
Degrees.	Cos.	Sin.	Cot.	Tan.	Degrees.

NATURAL SINES, COSINES, TANGENTS AND COTANGENTS (Continued)

Degrees.	Sin.	Cos.	Tan.	Cot.	Degrees.
27° 00′	0.4540	0.8910	0.5095	1.9626	63° 00′
10	.4566	.8897	.5132	1.9486	50
20	.4592	.8884	.5169	1.9347	40
30	.4617	.8870	.5206	1.9210	30
40	.4643	.8857	.5243	1.9074	20
50	.4669	.8843	.5280	1.8940	10
28° 00′	0.4695	0.8829	0.5317	1.8807	62° 00′
10	.4720	.8816	.5354	1.8676	50
20	.4746	.8802	.5392	1.8546	40
30	.4772	.8788	.5430	1.8418	30
40	.4797	.8774	.5467	1.8291	20
50	.4823	.8760	.5505	1.8165	10
29° 00′	0.4848	0.8746	0.5543	1.8040	61° 00′
10	.4874	.8732	.5581	1.7917	50
20	.4899	.8718	.5619	1.7796	40
30	.4924	.8704	.5658	1.7675	30
40	.4950	.8689	.5696	1.7556	20
50	.4975	.8675	.5735	1.7437	10
30° 00′	0.5000	0.8660	0.5774	1.7321	60° 00′
10	.5025	.8646	.5812	1.7205	50
20	.5050	.8631	.5851	1.7090	40
30	.5075	.8616	.5890	1.6977	30
40	.5100	.8601	.5930	1.6864	20
50	.5125	.8587	.5969	1.6753	10
31° 00′	0.5150	0.8572	0.6009	1.6643	59° 00′
10	.5175	.8557	.6048	1.6534	50
20	.5200	.8542	.6088	1.6426	40
30	.5225	.8526	.6128	1.6319	30
40	.5250	.8511	.6168	1.6212	20
50	.5275	.8496	.6208	1.6107	10
32° 00′	0.5299	0.8480	0.6249	1.6003	58° 00′
10	.5324	.8465	.6289	1.5900	50
20	.5348	.8450	.6330	1.5798	40
30	.5373	.8434	.6371	1.5697	30
40	.5398	.8418	.6412	1.5597	20
50	.5422	.8403	.6453	1.5497	10
33° 00′	0.5446	0.8387	0.6494	1.5399	57° 00′
10	.5471	.8371	.6536	1.5301	50
20	.5495	.8355	.6577	1.5204	40
30	.5519	.8339	.6619	1.5108	30
40	.5544	.8323	.6661	1.5013	20
50	.5568	.8307	.6703	1.4919	10
34° 00′	0.5592	0.8290	0.6745	1.4826	56° 00′
10	.5616	.8274	.6787	1.4733	50
20	.5640	.8258	.6830	1.4641	40
30	.5664	.8241	.6873	1.4550	30
40	.5688	.8225	.6916	1.4460	20
50	.5712	.8208	.6959	1.4370	10
35° 00′	0.5736	0.8192	0.7002	1.4281	55° 00′
10	.5760	.8175	.7046	1.4193	50
20	.5783	.8158	.7089	1.4106	40
30	.5807	.8141	.7133	1.4019	30
40	.5831	.8124	.7177	1.3934	20
50	.5854	.8107	.7221	1.3848	10
36° 00′	0.5878	0.8090	0.7265	1.3764	54° 00′
Degrees.	Cos.	Sin.	Cot.	Tan.	Degrees.

NATURAL SINES, COSINES, TANGENTS AND TANGENTS (Continued)

Degrees.	Sin.	Cos.	Tan.	Cot.	Degrees.
36° 00′	0.5878	0.8090	0.7265	1.3764	54° 00′
10	.5901	.8073	.7310	1.3680	50
20	.5925	.8056	.7355	1.3597	40
30	.5948	.8039	.7400	1.3514	30
40	.5972	.8021	.7445	1.3432	20
50	.5995	.8004	.7490	1.3351	10
37° 00′	.6018	.7986	.7536	1.3270	53° 00′
10	.6041	.7969	.7581	1.3190	50
20	.6065	.7951	.7627	1.3111	40
30	.6088	.7934	.7673	1.3032	30
40	.6111	.7916	.7720	1.2954	20
50	.6134	.7898	.7766	1.2876	10
38° 00′	0.6157	0.7880	0.7813	1.2799	52° 00′
10	.6180	.7862	.7860	1.2723	50
20	.6202	.7844	.7907	1.2647	40
30	.6225	.7826	.7954	1.2572	30
40	.6248	.7808	.8002	1.2497	20
50	.6271	.7790	.8050	1.2423	10
39° 00′	0.6293	0.7771	0.8098	1.2349	51° 00′
10	.6316	.7753	.8146	1.2276	50
20	.6338	.7735	.8195	1.2203	40
30	.6361	.7716	.8243	1.2131	30
40	.6383	.7698	.8292	1.2059	20
50	.6406	.7679	.8342	1.1988	10
40° 00′	0.6428	0.7660	0.8391	1.1918	50° 00′
10	.6450	.7642	.8441	1.1847	50
20	.6472	.7623	.8491	1.1778	40
30	.6494	.7604	.8541	1.1708	30
40	.6517	.7585	.8591	1.1640	20
50	.6539	.7566	.8642	1.1571	10
41° 00′	0.6561	0.7547	0.8693	1.1504	49° 00′
10	.6583	.7528	.8744	1.1436	50
20	.6604	.7509	.8796	1.1369	40
30	.6626	.7490	.8847	1.1303	30
40	.6648	.7470	.8899	1.1237	20
50	.6670	.7451	.8952	1.1171	10
42° 00′	0.6691	0.7431	0.9004	1.1106	48° 00′
10	.6713	.7412	.9057	1.1041	50
20	.6734	.7392	.9110	1.0977	40
30	.6756	.7373	.9163	1.0913	30
40	.6777	.7353	.9217	1.0850	20
50	.6799	.7333	.9271	1.0786	10
43° 00′	0.6820	0.7314	0.9325	1.0724	47° 00′
10	.6841	.7294	.9380	1.0661	50
20	.6862	.7274	.9435	1.0599	40
30	.6884	.7254	.9490	1.0538	30
40	.6905	.7234	.9545	1.0477	20
50	.6926	.7214	.9601	1.0416	10
44° 00′	0.6947	0.7193	0.9657	1.0355	46° 00′
10	.6967	.7173	.9713	1.0295	50
20	.6988	.7163	.9770	1.0235	40
30	.7009	.7133	.9827	1.0176	30
40	.7030	.7112	.9884	1.0117	20
50	.7050	.7092	.9942	1.0058	10
45° 00′	0.7071	0.7071	1.0000	1.0000	45° 00′
Degrees.	Cos.	Sin.	Cot.	Tan.	Degrees.

LOGARITHMS OF THE TRIGONOMETRICAL FUNCTIONS

Degrees.	Log sin	Log cos	Log tan	Log cot	Degrees.
0° 00′	∞	0.0000	∞	∞	90° 00′
10	7.4637	.0000	7.4637	2.5363	50
20	.7648	.0000	.7648	.2352	40
30	.9408	.0000	.9409	.0591	30
40	8.0658	.0000	8.0658	1.9342	20
50	.1627	.0000	.1627	.8373	10
1° 00′	8.2419	9.9999	8.2419	1.7581	89° 00′
10	.3088	.9999	.3089	.6911	50
20	.3668	.9999	.3669	.6331	40
30	.4179	.9999	.4181	.5819	30
40	.4637	.9998	.4638	.5362	20
50	.5050	.9998	.5053	.4947	10
2° 00′	8.5428	9.9997	8.5431	1.4569	88° 00′
10	.5776	.9997	.5779	.4221	50
20	.6097	.9996	.6101	.3899	40
30	.6397	.9996	.6401	.3599	30
40	.6677	.9995	.6682	.3318	20
50	.6940	.9995	.6945	.3055	10
3° 00′	8.7188	9.9994	8.7194	1.2806	87° 00′
10	.7423	.9993	.7429	.2571	50
20	.7645	.9993	.7652	.2348	40
30	.7857	.9992	.7865	.2135	30
40	.8059	.9991	.8067	.1933	20
50	.8251	.9990	.8261	.1739	10
4° 00′	8.8436	9.9989	8.8446	1.1554	86° 00′
10	.8613	.9989	.8624	.1376	50
20	.8783	.9988	.8795	.1205	40
30	.8946	.9987	.8960	.1040	30
40	.9104	.9986	.9118	.0882	20
50	.9256	.9985	.9272	.0728	10
5° 00′	8.9403	9.9983	8.9420	1.0580	85° 00′
10	.9545	.9982	.9563	.0437	50
20	.9682	.9981	.9701	.0299	40
30	.9816	.9980	.9836	.0164	30
40	.9945	.9979	.9966	.0034	20
50	9.0070	.9977	9.0093	0.9907	10
6° 00′	9.0192	9.9976	9.0216	0.9784	84° 00′
10	.0311	.9975	.0336	.9664	50
20	.0426	.9973	.0453	.9547	40
30	.0539	.9972	.0567	.9433	30
40	.0648	.9971	.0678	.9322	20
50	.0755	.9969	.0786	.9214	10
7° 00′	9.0859	9.9968	9.0891	0.9109	83° 00′
10	.0961	.9966	.0995	.9005	50
20	.1060	.9964	.1096	.8904	40
30	.1157	.9963	.1194	.8806	30
40	.1252	.9961	.1291	.8709	20
50	.1345	.9959	.1385	.8615	10
8° 00′	9.1436	9.9958	9.1478	0.8522	82° 00′
10	.1525	.9956	.1569	.8431	50
20	.1612	.9954	.1658	.8342	40
30	.1697	.9952	.1745	.8255	30
40	.1781	.9950	.1831	.8169	20
50	.1863	.9948	.1915	.8085	10
9° 00′	9.1943	9.9946	9.1997	0.8003	81° 00′
Degrees.	Log cos	Log sin	Log cot	Log tan	Degrees.

LOGARITHMS OF THE TRIGONOMETRICAL FUNCTIONS
(Continued)

Degrees.	Log sin	Log cos	Log tan	Log cot	Degrees.
9° 00′	9.1943	9.9946	9.1997	0.8003	81° 00′
10	.2022	.9944	.2078	.7922	50
20	.2100	.9942	.2158	.7842	40
30	.2176	.9940	.2236	.7764	30
40	.2251	.9938	.2313	.7687	20
50	.2324	.9936	.2389	.7611	10
10° 00′	9.2397	9.9934	9.2463	0.7537	80° 00′
10	.2468	.9931	.2536	.7464	50
20	.2538	.9929	.2609	.7391	40
30	.2606	.9927	.2680	.7320	30
40	.2674	.9924	.2750	.7250	20
50	.2740	.9922	.2819	.7181	10
11° 00′	9.2806	9.9919	9.2887	0.7113	79° 00′
10	.2870	.9917	.2953	.7047	50
20	.2934	.9914	.3020	.6980	40
30	.2997	.9912	.3085	.6915	30
40	.3058	.9909	.3149	.6851	20
50	.3119	.9907	.3212	.6788	10
12° 00′	9.3179	9.9904	9.3275	0.6725	78° 00′
10	.3238	.9901	.3336	.6664	50
20	.3296	.9899	.3397	.6603	40
30	.3353	.9896	.3458	.6542	30
40	.3410	.9893	.3517	.6483	20
50	.3466	.9890	.3576	.6424	10
13° 00′	9.3521	9.9887	9.3634	0.6366	77° 00′
10	.3575	.9984	.3691	.6309	50
20	.3629	.9881	.3748	.6252	40
30	.3682	.9878	.3804	.6196	30
40	.3734	.9875	.3859	.6141	20
50	.3786	.9872	.3914	.6086	10
14° 00′	9.3837	9.9869	9.3968	0.6032	76° 00
10	.3887	.9866	.4021	.5979	50
20	.3937	.9863	.4074	.5926	40
30	.3986	.9859	.4127	.5873	30
40	.4035	.9856	.4178	.5822	20
50	.4083	.9853	.4230	.5770	10
15° 00′	9.4130	9.9849	9.4281	0.5719	75° 00′
10	.4177	.9846	.4331	.5669	50
20	.4223	.9843	.4381	.5619	40
30	.4269	.9839	.4430	.5570	30
40	.4314	.9836	.4479	.5521	20
50	.4359	.9832	.4527	.5473	10
16° 00′	9.4403	9.9828	9.4575	0.5425	74° 00′
10	.4447	.9825	.4622	.5378	50
20	.4491	.9821	.4669	.5331	40
30	.4533	.9817	.4716	.5284	30
40	.4576	.9814	.4762	.5238	20
50	.4618	.9810	.4808	.5192	10
17° 00′	9.4659	9.9806	9.4853	0.5147	73° 00′
10	.4700	.9802	.4898	.5102	50
20	.4741	.9798	.4943	.5057	40
30	.4781	.9794	.4987	.5013	30
40	.4821	.9790	.5031	.4969	20
50	.4861	.9786	.5075	.4925	10
18° 00′	9.4900	9.9782	9.5118	0.4882	72° 00′
Degrees.	**Log cos**	**Log sin**	**Log cot**	**Log tan**	**Degrees.**

LOGARITHMS OF THE TRIGONOMETRICAL FUNCTIONS
(Continued)

Degrees.	Log sin	Log cos	Log tan	Log cot	Degrees.
18° 00′	9.4900	9.9782	9.5118	0.4882	72° 00′
10	.4939	.9778	.5161	.4839	50
20	.4977	.9774	.5203	.4797	40
30	.5015	.9770	.5245	.4755	30
40	.5052	.9765	.5287	.4713	20
50	.5090	.9761	.5329	.4671	10
19° 00′	9.5126	9.9757	9.5370	0.4630	71° 00′
10	.5163	.9752	.5411	.4589	50
20	.5199	.9748	.5451	.4549	40
30	.5235	.9743	.5491	.4509	30
40	.5270	.9739	.5531	.4469	20
50	.5306	.9734	.5571	.4429	10
20° 00′	9.5341	9.9730	9.5611	0.4389	70° 00′
10	.5375	.9725	.5650	.4350	50
20	.5409	.9721	.5689	.4311	40
30	.5443	.9716	.5727	.4273	30
40	.5477	.9711	.5766	.4234	20
50	.5510	.9706	.5804	.4196	10
21° 00′	9.5543	9.9702	9.5842	0.4158	69° 00′
10	.5576	.9697	.5879	.4121	50
20	.5609	.9692	.5917	.4083	40
30	.5641	.9687	.5954	.4046	30
40	.5673	.9682	.5991	.4009	20
50	.5704	.9677	.6028	.3972	10
22° 00′	9.5736	9.9672	9.6064	0.3936	68° 00′
10	.5767	.9667	.6100	.3900	50
20	.5798	.9661	.6136	.3864	40
30	.5828	.9656	.6172	.3828	30
40	.5859	.9651	.6208	.3792	20
50	.5889	.9646	.6243	.3757	10
23° 00′	9.5919	9.9640	9.6279	0.3721	67° 00′
10	.5948	.9635	.6314	.3686	50
20	.5978	.9629	.6348	.3652	40
30	.6007	.9624	.6383	.3617	30
40	.6036	.9618	.6417	.3583	20
50	.6065	.9613	.6452	.3548	10
24° 00′	9.6093	9.9607	9.6486	0.3514	66° 00′
10	.6121	.9602	.6520	.3480	50
20	.6149	.9596	.6553	.3447	40
30	.6177	.9590	.6587	.3413	30
40	.6205	.9584	.6620	.3380	20
50	.6232	.9579	.6654	.3346	10
25° 00′	9.6259	9.9573	9.6687	0.3313	65° 00′
10	.6286	.9567	.6720	.3280	50
20	.6313	.9561	.6752	.3248	40
30	.6340	.9555	.6785	.3215	30
40	.6366	.9549	.6817	.3183	20
50	.6392	.9543	.6850	.3150	10
26° 00′	9.6418	9.9537	9.6882	0.3118	64° 00′
10	.6444	.9530	.6914	.3086	50
20	.6470	.9524	.6946	.3054	40
30	.6495	.9518	.6977	.3023	30
40	.6521	.9512	.7009	.2991	20
50	.6546	.9505	.7040	.2960	10
27° 00′	9.6570	9.9499	9.7072	0.2928	63° 00′
Degrees.	Log cos	Log sin	Log cot	Log tan	Degrees.

LOGARITHMS OF THE TRIGONOMETRICAL FUNCTIONS
(Continued)

Degrees.	Log sin	Log cos	Log tan	Log cot	Degrees.
27° 00′	9.6570	9.9499	9.7072	0.2928	63° 00′
10	.6595	.9492	.7103	.2897	50
20	.6620	.9486	.7134	.2866	40
30	.6644	.9479	.7165	.2835	30
40	.6668	.9473	.7196	.2804	20
50	.6692	.9466	.7226	.2774	10
28° 00′	9.6716	9.9459	9.7257	0.2743	62° 00′
10	.6740	.8453	.7287	.2713	50
20	.6763	.9446	.7317	.2683	40
30	.6787	.9439	.7348	.2652	30
40	.6810	.9432	.7378	.2622	20
50	.6833	.9425	.7408	.2592	10
29° 00′	9.6856	9.9418	9.7438	0.2562	61° 00′
10	.6878	.9411	.7467	.2533	50
20	.6901	.9404	.7497	.2503	40
30	.6923	.9397	.7526	.2474	30
40	.6946	.9390	.7556	.2444	20
50	.6968	.9383	.7585	.2415	10
30° 00′	9.6990	9.9375	9.7614	0.2386	60° 00′
10	.7012	.9368	.7644	.2356	50
20	.7033	.9361	.7673	.2327	40
30	.7055	.9353	.7701	.2299	30
40	.7076	.9346	.7730	.2270	20
50	.7097	.9338	.7759	.2241	10
31° 00′	9.7118	9.9331	9.7788	0.2212	59° 00′
10	.7139	.9323	.7816	.2184	50
20	.7160	.9315	.7845	.2155	40
30	.7181	.9308	.7873	.2127	30
40	.7201	.9300	.7902	.2098	20
50	.7222	.9292	.7930	.2070	10
32° 00′	9.7242	9.9284	9.7958	0.2042	58° 00′
10	.7262	.9276	.7986	.2014	50
20	.7282	.9268	.8014	.1986	40
30	.7302	.9260	.8042	.1958	30
40	.7322	.9252	.8070	.1930	20
50	.7342	.9244	.8097	.1903	10
33° 00′	9.7361	9.9236	9.8125	0.1875	57° 00′
10	.7380	.9228	.8153	.1847	50
20	.7400	.9219	.8180	.1820	40
30	.7419	.9211	.8208	.1792	30
40	.7438	.9203	.8235	.1765	20
50	.7457	.9194	.8263	.1737	10
34° 00′	9.7476	9.9186	9.8290	0.1710	56° 00′
10	.7494	.9177	.8317	.1683	50
20	.7513	.9169	.8344	.1656	40
30	.7531	.9160	.8371	.1629	30
40	.7550	.9151	.8398	.1602	20
50	.7568	.9142	.8425	.1575	10
35° 00′	9.7586	9.9134	9.8452	0.1548	55° 00′
10	.7604	.9125	.8479	.1521	50
20	.7622	.9116	.8506	.1494	40
30	.7640	.9107	.8533	.1467	30
40	.7657	.9098	.8559	.1441	20
50	.7675	.9089	.8586	.1414	10
36° 00′	9.7692	9.9080	9.8613	0.1387	54° 00′
Degrees.	Log cos	Log sin	Log cot	Log tan	Degrees.

LOGARITHMS OF THE TRIGONOMETRICAL FUNCTIONS (Continued)

Degrees.	Log sin	Log cos	Log tan	Log cot	Degrees.
36° 00′	9.7692	9.9080	9.8613	0.1387	54° 00′
10	.7710	.9070	.8639	.1361	50
20	.7727	.9061	.8666	.1334	40
30	.7744	.9052	.8692	.1308	30
40	.7761	.9042	.8718	.1282	20
50	.7778	.9033	.8745	.1255	10
37° 00′	9.7795	9.9023	9.8771	0.1229	53° 00′
10	.7811	.9014	.8797	.1203	50
20	.7828	.9004	.8824	.1176	40
30	.7844	.8995	.8850	.1150	30
40	.7861	.8985	.8876	.1124	20
50	.7877	.8975	.8902	.1098	10
38° 00′	9.7893	9.8965	9.8928	0.1072	52° 00′
10	.7910	.8955	.8954	.1046	50
20	.7926	.8945	.8980	.1020	40
30	.7941	.8935	.9006	.0994	30
40	.7957	.8925	.9032	.0968	20
50	.7973	.8915	.9058	.0942	10
39° 00′	9.7989	9.8905	9.9084	0.0916	51° 00′
10	.8004	.8895	.9110	.0890	50
20	.8020	.8884	.9135	.0865	40
30	.8035	.8874	.9161	.0839	30
40	.8050	.8864	.9187	.0813	20
50	.8066	.8853	.9212	.0788	10
40° 00′	9.8081	9.8843	9.9238	0.0762	50° 00′
10	.8096	.8832	.9264	.0736	50
20	.8111	.8821	.9289	.0711	40
30	.8125	.8810	.9315	.0685	30
40	.8140	.8800	.9341	.0659	20
50	.8155	.8789	.9366	.0634	10
41° 00′	9.8169	9.8778	9.9392	0.0608	49° 00′
10	.8184	.8767	.9417	.0583	50
20	.8198	.8756	.9443	.0557	40
30	.8213	.8745	.9468	.0532	30
40	.8227	.8733	.9494	.0506	20
50	.8241	.8722	.9519	.0481	10
42° 00′	9.8255	9.8711	9.9544	0.0456	48° 00′
10	.8269	.8699	.9570	.0430	50
20	.8283	.8688	.9595	.0405	40
30	.8297	.8676	.9621	.0379	30
40	.8311	.8665	.9646	.0354	20
50	.8324	.8653	.9671	.0329	10
43° 00′	9.8338	9.8641	9.9697	0.0303	47° 00′
10	.8351	.8629	.9722	.0278	50
20	.8365	.8618	.9747	.0253	40
30	.8378	.8606	.9773	.0228	30
40	.8391	.8594	.9798	.0202	20
50	.8405	.8582	.9823	.0177	10
44° 00′	9.8418	9.8569	9.9848	0.0152	46° 00′
10	.8431	.8557	.9874	.0126	50
20	.8444	.8545	.9899	.0101	40
30	.8457	.8532	.9927	.0076	30
40	.8469	.8520	.9949	.0051	20
50	.8482	.8507	.9975	.0025	10
45° 00′	9.8495	9.8495	0.0000	0.0000	45° 00′
Degrees.	Log cos	Log sin	Log cot	Log tan	Degrees.

DEGREES — RADIANS

The table gives in radians the angle which is expressed in degrees and minutes at the side and top.

°	00′	10	20	30	40	50
0	0.0000	0.0029	0.0058	0.0087	0.0116	0.0145
1	0.0175	0.0204	0.0233	0.0262	0.0291	0.0320
2	0.0349	0.0378	0.0407	0.0436	0.0465	0.0495
3	0.0524	0.0553	0.0582	0.0611	0.0640	0.0669
4	0.0698	0.0727	0.0756	0.0785	0.0814	0.0844
5	0.0873	0.0902	0.0931	0.0960	0.0989	0.1018
6	0.1047	0.1076	0.1105	0.1134	0.1164	0.1193
7	0.1222	0.1251	0.1280	0.1309	0.1338	0.1367
8	0.1396	0.1425	0.1454	0.1484	0.1513	0.1542
9	0.1571	0.1600	0.1629	0.1658	0.1687	0.1716
10	0.1745	0.1774	0.1804	0.1833	0.1862	0.1891
11	0.1920	0.1949	0.1978	0.2007	0.2036	0.2065
12	0.2094	0.2123	0.2153	0.2182	0.2211	0.2240
13	0.2269	0.2298	0.2327	0.2356	0.2385	0.2414
14	0.2443	0.2473	0.2502	0.2531	0.2560	0.2589
15	0.2618	0.2647	0.2676	0.2705	0.2734	0.2763
16	0.2793	0.2822	0.2851	0.2880	0.2909	0.2938
17	0.2967	0.2996	0.3025	0.3054	0.3083	0.3113
18	0.3142	0.3171	0.3200	0.3229	0.3258	0.3287
19	0.3316	0.3345	0.3374	0.3403	0.3432	0.3462
20	0.3491	0.3520	0.3549	0.3578	0.3607	0.3636
21	0.3665	0.3694	0.3723	0.3752	0.3782	0.3811
22	0.3840	0.3869	0.3898	0.3927	0.3956	0.3985
23	0.4014	0.4043	0.4072	0.4102	0.4131	0.4160
24	0.4189	0.4218	0.4247	0.4276	0.4305	0.4334
25	0.4363	0.4392	0.4422	0.4451	0.4480	0.4509
26	0.4538	0.4567	0.4596	0.4625	0.4654	0.4683
27	0.4712	0.4741	0.4771	0.4800	0.4829	0.4858
28	0.4887	0.4916	0.4945	0.4974	0.5003	0.5032
29	0.5061	0.5091	0.5120	0.5149	0.5178	0.5207
30	0.5236	0.5265	0.5294	0.5323	0.5352	0.5381
31	0.5411	0.5440	0.5469	0.5498	0.5527	0.5556
32	0.5585	0.5614	0.5643	0.5672	0.5701	0.5730
33	0.5760	0.5789	0.5818	0.5847	0.5876	0.5905
34	0.5934	0.5963	0.5992	0.6021	0.6050	0.6080
35	0.6109	0.6138	0.6167	0.6196	0.6225	0.6254
36	0.6283	0.6312	0.6341	0.6370	0.6400	0.6429
37	0.6458	0.6487	0.6516	0.6545	0.6574	0.6603
38	0.6632	0.6661	0.6690	0.6720	0.6749	0.6778
39	0.6807	0.6836	0.6865	0.6894	0.6923	0.6952
40	0.6981	0.7010	0.7039	0.7069	0.7098	0.7127
41	0.7156	0.7185	0.7214	0.7243	0.7272	0.7301
42	0.7330	0.7359	0.7389	0.7418	0.7447	0.7476
43	0.7505	0.7534	0.7563	0.7592	0.7621	0.7650
44	0.7679	0.7709	0.7738	0.7767	0.7796	0.7825

DEGREES — RADIANS (Continued)

°	00′	10	20	30	40	50
45	0.7854	0.7883	0.7912	0.7941	0.7970	0.7999
46	0.8029	0.8058	0.8087	0.8116	0.8145	0.8174
47	0.8203	0.8232	0.8261	0.8290	0.8319	0.8348
48	0.8378	0.8407	0.8436	0.8465	0.8494	0.8523
49	0.8552	0.8581	0.8610	0.8639	0.8668	0.8698
50	0.8727	0.8756	0.8785	0.8814	0.8843	0.8872
51	0.8901	0.8930	0.8959	0.8988	0.9018	0.9047
52	0.9076	0.9105	0.9134	0.9163	0.9192	0.9221
53	0.9250	0.9279	0.9308	0.9338	0.9367	0.9396
54	0.9425	0.9454	0.9483	0.9512	0.9541	0.9570
55	0.9599	0.9628	0.9657	0.9687	0.9716	0.9745
56	0.9774	0.9803	0.9832	0.9861	0.9890	0.9919
57	0.9948	0.9977	1.0007	1.0036	1.0065	1.0094
58	1.0123	1.0152	1.0181	1.0210	1.0239	1.0268
59	1.0297	1.0327	1.0356	1.0385	1.0414	1.0443
60	1.0472	1.0501	1.0530	1.0559	1.0588	1.0617
61	1.0647	1.0676	1.0705	1.0734	1.0763	1.0792
62	1.0821	1.0850	1.0879	1.0908	1.0937	1.0966
63	1.0996	1.1025	1.1054	1.1083	1.1112	1.1141
64	1.1170	1.1199	1.1228	1.1257	1.1286	1.1316
65	1.1345	1.1374	1.1403	1.1432	1.1461	1.1490
66	1.1519	1.1548	1.1577	1.1606	1.1636	1.1665
67	1.1694	1.1723	1.1752	1.1781	1.1810	1.1839
68	1.1868	1.1897	1.1926	1.1956	1.1985	1.2014
69	1.2043	1.2072	1.2101	1.2130	1.2159	1.2188
70	1.2217	1.2246	1.2275	1.2305	1.2334	1.2363
71	1.2392	1.2421	1.2450	1.2479	1.2508	1.2537
72	1.2566	1.2595	1.2625	1.2654	1.2683	1.2712
73	1.2741	1.2770	1.2799	1.2828	1.2857	1.2886
74	1.2915	1.2945	1.2974	1.3003	1.3032	1.3061
75	1.3090	1.3119	1.3148	1.3177	1.3206	1.3235
76	1.3265	1.3294	1.3323	1.3352	1.3381	1.3410
77	1.3439	1.3468	1.3497	1.3526	1.3555	1.3584
78	1.3614	1.3643	1.3672	1.3701	1.3730	1.3759
79	1.3788	1.3817	1.3846	1.3875	1.3904	1.3934
80	1.3963	1.3992	1.4021	1.4050	1.4079	1.4108
81	1.4137	1.4166	1.4195	1.4224	1.4254	1.4283
82	1.4312	1.4341	1.4370	1.4399	1.4428	1.4457
83	1.4486	1.4515	1.4544	1.4574	1.4603	1.4632
84	1.4661	1.4690	1.4719	1.4748	1.4777	1.4806
85	1.4835	1.4864	1.4893	1.4923	1.4952	1.4981
86	1.5010	1.5039	1.5068	1.5097	1.5126	1.5155
87	1.5184	1.5213	1.5243	1.5272	1.5301	1.5330
88	1.5359	1.5388	1.5417	1.5446	1.5475	1.5504
89	1.5533	1.5563	1.5592	1.5621	1.5650	1.5679
90	1.5708					

DEGREES — RADIANS (Concluded)

Deg.	Radians.	Deg.	Radians.	Deg.	Radians.	Deg.	Radians.
90	1.5708	160	2.7925	230	4.0143	300	5.2360
100	1.7453	170	2.9671	240	4.1888	310	5.4105
110	1.9199	180	3.1416	250	4.3633	320	5.5851
120	2.0944	190	3.3161	260	4.5379	330	5.7596
130	2.2689	200	3.4907	270	4.7124	340	5.9341
140	2.4435	210	3.6652	280	4.8869	350	6.1087
150	2.6180	220	3.8397	290	5.0615	360	6.2832

NUMERICAL CONSTANTS

$$\pi = 3.14159$$

$$\log \pi = 0.497150$$

$4\pi = 12.56637$ — $\log 4\pi = 1.099210$

$\frac{\pi}{2} = 1.57080$ — $\log \frac{\pi}{2} = 0.196120$

$\frac{\pi}{3} = 1.04720$ — $\log \frac{\pi}{3} = 0.020029$

$\frac{4}{3}\pi = 4.18879$ — $\log \frac{4}{3}\pi = 0.622089$

$\frac{\pi}{4} = 0.78540$ — $\log \frac{\pi}{4} = 9.895090 - 10$

$\frac{1}{\pi} = 0.31831$ — $\log \frac{1}{\pi} = 9.502850 - 10$

$\pi^2 = 9.86960$ — $\log \pi^2 = 0.994300$

$\frac{1}{\pi^2} = 0.10132$ — $\log \frac{1}{\pi^2} = 9.005700 - 10$

$\sqrt{\pi} = 1.77245$ — $\log \sqrt{\pi} = 0.248575$

$\frac{1}{\sqrt{\pi}} = 0.56419$ — $\log \frac{1}{\sqrt{\pi}} = 9.751425 - 10$

$\sqrt[3]{\pi} = 1.46459$ — $\log \sqrt[3]{\pi} = 0.165717$

BASE OF NATURAL LOGARITHMS

$e = 2.71828$ $\quad \log_{10} e = 0.434294$

Natural log of $x = \log_e x = 2.30259 \log_{10} x$.

For conversion or reduction factors see under *Measures and Units*.
For miscellaneous physical constants see under *Miscellaneous Tables*.

NUMERICAL TABLE

RECIPROCALS, POWERS AND ROOTS OF NUMBERS, CIRCUMFERENCES AND AREAS FOR NUMBERS (DIAMETERS) FROM 1 TO 1000

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
1	000.00	1	1	1.	1.00000	3.14159	.79
2	500.00	4	8	1.414	1.25992	6.28319	3.14
3	333.33	9	27	1.732	1.44225	9.42478	7.07
4	250.00	16	64	2.000	1.58740	12.5664	12.57
5	200.00	25	125	2.236	1.70998	15.7080	19.64
6	166.67	36	216	2.449	1.81712	18.8496	28.27
7	142.86	49	343	2.646	1.91293	21.9911	38.49
8	125.00	64	512	2.828	2.00000	25.1327	50.27
9	111.11	81	729	3.000	2.08008	28.2743	63.62
10	100.00	100	1000	3.162	2.15443	31.4159	78.5
11	90.9091	121	1331	3.3166	2.22398	34.5575	95.0
12	83.3333	144	1728	3.4641	2.28943	37.6991	113.1
13	76.9231	169	2197	3.6056	2.35133	40.8407	132.7
14	71.4286	196	2744	3.7417	2.41014	43.9823	153.9
15	66.6667	225	3375	3.8730	2.46621	47.1239	176.7
16	62.5000	256	4096	4.0000	2.51984	50.2655	201.1
17	58.8235	289	4913	4.1231	2.57128	53.4071	227.0
18	55.5556	324	5832	4.2426	2.62074	56.5487	254.5
19	52.6316	361	6859	4.3589	2.66840	59.6903	283.5
20	50.0000	400	8000	4.4721	2.71442	62.8319	314.2
21	47.6190	441	9261	4.5826	2.75892	65.9734	346.4
22	45.4545	484	10648	4.6904	2.80204	69.1150	380.1
23	43.4783	529	12167	4.7958	2.84387	72.2566	415.5
24	41.6667	576	13824	4.8990	2.88450	75.3982	452.4
25	40.0000	625	15625	5.0000	2.92402	78.5398	490.9
26	38.4615	676	17576	5.0990	2.96250	81.6814	530.9
27	37.0370	729	19683	5.1962	3.00000	84.8230	572.6
28	35.7143	784	21952	5.2915	3.03659	87.9646	615.8
29	34.4828	841	24389	5.3852	3.07232	91.1062	660.5
30	33.3333	900	27000	5.4772	3.10723	94.2478	706.9
31	32.2581	961	29791	5.5678	3.14138	97.3894	754.8
32	31.2500	1024	32768	5.6569	3.17480	100.531	804.3
33	30.3030	1089	35937	5.7446	3.20753	103.673	855.3
34	29.4118	1156	39304	5.8310	3.23961	106.814	907.9
35	28.5714	1225	42875	5.9161	3.27107	109.956	962.1
36	27.7778	1296	46656	6.0000	3.30193	113.097	1017.9
37	27.0270	1369	50653	6.0828	3.33222	116.239	1075.2
38	26.3158	1444	54872	6.1644	3.36198	119.381	1134.1
39	25.6410	1521	59319	6.2450	3.39121	122.522	1194.6
40	25.0000	1600	64000	6.3246	3.41995	125.664	1256.6
41	24.3902	1681	68921	6.4031	3.44822	128.805	1320.3
42	23.8095	1764	74088	6.4807	3.47603	131.947	1385.4
43	23.2558	1849	79507	6.5574	3.50340	135.088	1452.2
44	22.7273	1936	85184	6.6332	3.53035	138.230	1520.5
45	22.2222	2025	91125	6.7082	3.55689	141.372	1590.4
46	21.7391	2116	97336	6.7823	3.58305	144.513	1661.9
47	21.2766	2209	103823	6.8557	3.60883	147.655	1734.9
48	20.8333	2304	110592	6.9282	3.63424	150.796	1809.6
49	20.4082	2401	117649	7.0000	3.65931	153.938	1885.7
50	20.0000	2500	125000	7.0711	3.68403	157.080	1963.5

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
51	19.6078	2601	132651	7.1414	3.70843	160.221	2042.8
52	19.2308	2704	140608	7.2111	3.73251	163.363	2123.7
53	18.8679	2809	148877	7.2801	3.75628	166.504	2206.2
54	18.5185	2916	157464	7.3485	3.77976	169.646	2290.2
55	18.1818	3025	166375	7.4162	3.80295	172.788	2375.8
56	17.8571	3136	175616	7.4833	3.82586	175.929	2463.0
57	17.5439	3249	185193	7.5498	3.84850	179.071	2551.8
58	17.2414	3364	195112	7.6158	3.87088	182.212	2642.1
59	16.9492	3481	205379	7.6811	3.89300	185.354	2734.0
60	16.6667	3600	216000	7.7460	3.91487	188.496	2827.4
61	16.3934	3721	226981	7.8102	3.93650	191.637	2922.5
62	16.1290	3844	238328	7.8740	3.95789	194.779	3019.1
63	15.8730	3969	250047	7.9373	3.97906	197.920	3117.3
64	15.6250	4096	262144	8.0000	4.00000	201.062	3217.0
65	15.3846	4225	274625	8.0623	4.02073	204.204	3318.3
66	15.1515	4356	287496	8.1240	4.04124	207.345	3421.2
67	14.9254	4489	300763	8.1854	4.06155	210.487	3525.7
68	14.7059	4624	314432	8.2462	4.08166	213.628	3631.7
69	14.4928	4761	328509	8.3066	4.10157	216.770	3739.3
70	14.2857	4900	343000	8.3666	4.12129	219.911	3848.5
71	14.0845	5041	357911	8.4261	4.14082	223.053	3959.2
72	13.8889	5184	373248	8.4853	4.16017	226.195	4071.5
73	13.6986	5329	389017	8.5440	4.17934	229.336	4185.4
74	13.5135	5476	405224	8.6023	4.19834	232.478	4300.8
75	13.3333	5625	421875	8.6603	4.21716	235.619	4417.9
76	13.1579	5776	438976	8.7178	4.23582	238.761	4536.5
77	12.9870	5929	456533	8.7750	4.25432	241.903	4656.6
78	12.8205	6084	474552	8.8318	4.27266	245.044	4778.4
79	12.6582	6241	493039	8.8882	4.29084	248.186	4901.7
80	12.5000	6400	512000	8.9443	4.30887	251.327	5026.6
81	12.3457	6561	531441	9.0000	4.32675	254.469	5153.0
82	12.1951	6724	551368	9.0554	4.34448	257.611	5281.0
83	12.0482	6889	571787	9.1104	4.36207	260.752	5410.6
84	11.9048	7056	592704	9.1652	4.37952	263.894	5541.8
85	11.7647	7225	614125	9.2195	4.39683	267.035	5674.5
86	11.6279	7396	636056	9.2736	4.41400	270.177	5808.8
87	11.4943	7569	658503	9.3274	4.43105	273.319	5944.7
88	11.3636	7744	681472	9.3808	4.44796	276.460	6082.1
89	11.2360	7921	704969	9.4340	4.46475	279.602	6221.1
90	11.1111	8100	729000	9.4868	4.48140	282.743	6361.7
91	10.9890	8281	753571	9.5394	4.49794	285.885	6503.9
92	10.8696	8464	778688	9.5917	4.51436	289.027	6647.6
93	10.7527	8649	804357	9.6437	4.53065	292.168	6792.9
94	10.6383	8836	830584	9.6954	4.54684	295.310	6939.8
95	10.5263	9025	857375	9.7468	4.56290	298.451	7088.2
96	10.4167	9216	884736	9.7980	4.57886	301.593	7238.2
97	10.3093	9409	912673	9.8489	4.59470	304.734	7389.8
98	10.2041	9604	941192	9.8995	4.61044	307.876	7543.0
99	10.1010	9801	970299	9.9499	4.62607	311.018	7697.7
100	10.0000	10000	1000000	10.0000	4.64159	314.159	7554.0

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
101	9.90099	10201	1030301	10.0499	4.65701	317.301	8011.9
102	9.80392	10404	1061208	10.0995	4.67233	320.442	8171.3
103	9.70874	10609	1092727	10.1489	4.68755	323.584	8332.3
104	9.61538	10816	1124864	10.1980	4.70267	326.726	8494.9
105	9.52381	11025	1157625	10.2470	4.71769	329.867	8659.0
106	9.43396	11236	1191016	10.2956	4.73262	333.009	8824.7
107	9.34579	11449	1225043	10.3441	4.74746	336.150	8992.0
108	9.25926	11664	1259712	10.3923	4.76220	339.292	9160.9
109	9.17431	11881	1295029	10.4403	4.77686	342.434	9331.3
110	9.09091	12100	1331000	10.4881	4.79142	345.575	9503.3
111	9.00901	12321	1367631	10.5357	4.80590	348.717	9676.9
112	8.92857	12544	1404928	10.5830	4.82028	351.858	9852.0
113	8.84956	12769	1442897	10.6301	4.83459	355.000	10028.8
114	8.77193	12996	1481544	10.6771	4.84881	358.142	10207.0
115	8.69565	13225	1520875	10.7238	4.86294	361.283	10386.9
116	8.62069	13456	1560896	10.7703	4.87700	364.425	10568.3
117	8.54701	13689	1601613	10.8167	4.89097	367.566	10751.3
118	8.47458	13924	1643032	10.8628	4.90487	370.708	10935.9
119	8.40336	14161	1685159	10.9087	4.91868	373.850	11122.0
120	8.33333	14400	1728000	10.9545	4.93242	376.991	11309.7
121	8.26446	14641	1771561	11.0000	4.94609	380.133	11499.0
122	8.19672	14884	1815848	11.0454	4.95968	383.274	11689.9
123	8.13008	15129	1860867	11.0905	4.97319	386.416	11882.3
124	8.06452	15376	1906624	11.1355	4.98663	389.557	12076.3
125	8.00000	15625	1953125	11.1803	5.00000	392.699	12271.9
126	7.93651	15876	2000376	11.2250	5.01330	395.841	12469.0
127	7.87402	16129	2048383	11.2694	5.02653	398.982	12667.7
128	7.81250	16384	2097152	11.3137	5.03968	402.124	12868.0
129	7.75194	16641	2146689	11.3578	5.05277	405.265	13069.8
130	7.69231	16900	2197000	11.4018	5.06580	408.407	13273.2
131	7.63359	17161	2248091	11.4455	5.07875	411.549	13478.2
132	7.57576	17424	2299968	11.4891	5.09164	414.690	13684.8
133	7.51880	17689	2352637	11.5326	5.10447	417.832	13892.9
134	7.46269	17956	2406104	11.5758	5.11723	420.973	14102.6
135	7.40741	18225	2460375	11.6190	5.12993	424.115	14313.9
136	7.35294	18496	2515456	11.6619	5.14256	427.257	14526.7
137	7.29927	18769	2571353	11.7047	5.15514	430.398	14741.1
138	7.24638	19044	2628072	11.7473	5.16765	433.540	14957.1
139	7.19424	19321	2685619	11.7898	5.18010	436.681	15174.7
140	7.14286	19600	2744000	11.8322	5.19249	439.823	15393.8
141	7.09220	19881	2803221	11.8743	5.20483	442.965	15614.5
142	7.04225	20164	2863288	11.9164	5.21710	446.106	15836.8
143	6.99301	20449	2924207	11.9583	5.22932	449.248	16060.6
144	6.94444	20736	2985984	12.0000	5.24148	452.389	16286.0
145	6.89655	21025	3048625	12.0416	5.25359	455.531	16513.0
146	6.84932	21316	3112136	12.0830	5.26564	458.673	16741.6
147	6.80272	21609	3176523	12.1244	5.27763	461.814	16971.7
148	6.75676	21904	3241792	12.1655	5.28957	464.956	17203.4
149	6.71141	22201	3307949	12.2066	5.30146	468.097	17436.6
150	6.66667	22500	3375000	12.2474	5.31329	471.239	17671.5

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
151	6.62252	22801	3442951	12.2882	5.32507	474.380	17907.9
152	6.57895	23104	3511808	12.3288	5.33680	477.522	18145.8
153	6.53595	23409	3581577	12.3693	5.34848	480.664	18385.4
154	6.49351	23716	3652264	12.4097	5.36011	483.805	18626.5
155	6.45161	24025	3723875	12.4499	5.37169	486.947	18869.2
156	6.41026	24336	3796416	12.4900	5.38321	490.088	19113.5
157	6.36943	24649	3869893	12.5300	5.39469	493.230	19359.3
158	6.32911	24964	3944312	12.5698	5.40612	496.372	19606.7
159	6.28931	25281	4019679	12.6095	5.41750	499.513	19855.7
160	6.25000	25600	4096000	12.6491	5.42884	502.655	20106.2
161	6.21118	25921	4173281	12.6886	5.44012	505.796	20358.3
162	6.17284	26244	4251528	12.7279	5.45136	508.938	20612.0
163	6.13497	26569	4330747	12.7671	5.46256	512.080	20867.2
164	6.09756	26896	4410944	12.8062	5.47370	515.221	21124.1
165	6.06061	27225	4492125	12.8452	5.48481	518.363	21382.5
166	6.02410	27556	4574296	12.8841	5.49586	521.504	21642.4
167	5.98802	27889	4657463	12.9228	5.50688	524.646	21904.0
168	5.95238	28224	4741632	12.9615	5.51785	527.788	22167.1
169	5.91716	28561	4826809	13.0000	5.52877	530.929	22431.8
170	5.88235	28900	4913000	13.0384	5.53966	534.071	22698.0
171	5.84795	29241	5000211	13.0767	5.55050	537.212	22965.8
172	5.81395	29584	5088448	13.1149	5.56130	540.354	23235.2
173	5.78035	29929	5177717	13.1529	5.57205	543.496	23506.2
174	5.74713	30276	5268024	13.1909	5.58277	546.637	23778.7
175	5.71429	30625	5359375	13.2288	5.59344	549.779	24052.8
176	5.68182	30976	5451776	13.2665	5.60408	552.920	24328.5
177	5.64972	31329	5545233	13.3041	5.61467	556.062	24605.7
178	5.61798	31684	5639752	13.3417	5.62523	559.203	24884.6
179	5.58659	32041	5735339	13.3791	5.63574	562.345	25164.9
180	5.55556	32400	5832000	13.4164	5.64622	565.487	25446.9
181	5.52486	32761	5929741	13.4536	5.65665	568.628	25730.4
182	5.49451	33124	6028568	13.4907	5.66705	571.770	26015.5
183	5.46448	33489	6128487	13.5277	5.67741	574.911	26302.2
184	5.43478	33856	6229504	13.5647	5.68773	578.053	26590.4
185	5.40541	34225	6331625	13.6015	5.69802	581.195	26880.3
186	5.37634	34596	6434856	13.6382	5.70827	584.336	27171.6
187	5.34759	34969	6539203	13.6748	5.71850	587.478	27464.6
188	5.31915	35344	6644672	13.7113	5.72865	590.619	27759.1
189	5.29101	35721	6751269	13.7477	5.73879	593.761	28055.2
190	5.26316	36100	6859000	13.7840	5.74890	596.903	28352.9
191	5.23560	36481	6967871	13.8203	5.75897	600.044	28652.1
192	5.20833	36864	7077888	13.8564	5.76900	603.186	28952.9
193	5.18135	37249	7189057	13.8924	5.77900	606.327	29255.3
194	5.15464	37636	7301384	13.9284	5.78896	609.469	29559.3
195	5.12821	38025	7414875	13.9642	5.79889	612.611	29864.8
196	5.10204	38416	7529536	14.0000	5.80879	615.752	30171.9
197	5.07614	38809	7645373	14.0357	5.81865	618.894	30480.5
198	5.05051	39204	7762392	14.0712	5.82848	622.035	30790.8
199	5.02513	39601	7880599	14.1067	5.83827	625.177	31102.6
200	5.00000	40000	8000000	14.1421	5.84804	628.319	31415.9

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
201	4.97512	40401	8120601	14.1774	5.85777	631.460	31730.9
202	4.95050	40804	8242408	14.2127	5.86746	634.602	32047.4
203	4.92611	41209	8365427	14.2478	5.87713	637.743	32365.5
204	4.90196	41616	8489664	14.2829	5.88677	640.885	32685.1
205	4.87805	42025	8615125	14.3178	5.89637	644.026	33006.4
206	4.85437	42436	8741816	14.3527	5.90594	647.168	33329.2
207	4.83092	42849	8869743	14.3875	5.91548	650.310	33653.5
208	4.80769	43264	8998912	14.4222	5.92499	653.451	33979.5
209	4.78469	43681	9129329	14.4568	5.93447	656.593	34307.0
210	4.76190	44100	9261000	14.4914	5.94392	659.734	34636.1
211	4.73934	44521	9393931	14.5258	5.95334	662.876	34966.7
212	4.71698	44944	9528128	14.5602	5.96273	666.018	35298.9
213	4.69484	45369	9663597	14.5945	5.97209	669.159	35632.7
214	4.67290	45796	9800344	14.6287	5.98142	672.301	35968.1
215	4.65116	46225	9938375	14.6629	5.99073	675.442	36305.0
216	4.62963	46656	10077696	14.6969	6.00000	678.584	36643.5
217	4.60829	47089	10218313	14.7309	6.00925	681.726	36983.6
218	4.58716	47524	10360232	14.7648	6.01846	684.867	37325.3
219	4.56621	47961	10503459	14.7986	6.02765	688.009	37668.5
220	4.54545	48400	10648000	14.8324	6.03681	691.150	38013.3
221	4.52489	48841	10793861	14.8661	6.04594	694.292	38359.6
222	4.50450	49284	10941048	14.8997	6.05505	697.434	38707.6
223	4.48430	49729	11089567	14.9332	6.06413	700.575	39057.1
224	4.46429	50176	11239424	14.9666	6.07318	703.717	39408.1
225	4.44444	50625	11390625	15.0000	6.08220	706.858	39760.8
226	4.42478	51076	11543176	15.0333	6.09120	710.000	40115.0
227	4.40529	51529	11697083	15.0665	6.10017	713.142	40470.8
228	4.38529	51984	11852352	15.0997	6.10911	716.283	40828.1
229	4.36681	52441	12008989	15.1327	6.11803	719.425	41187.1
230	4.34783	52900	12167000	15.1658	6.12693	722.566	41547.6
231	4.32900	53361	12326391	15.1987	6.13579	725.708	41909.6
232	4.31034	53824	12487168	15.2315	6.14463	728.849	42273.3
233	4.29185	54289	12649337	15.2643	6.15345	731.991	42638.5
234	4.27350	54756	12812904	15.2971	6.16224	735.133	43005.3
235	4.25532	55225	12977875	15.3297	6.17101	738.274	43373.6
236	4.23729	55696	13144256	15.3623	6.17975	741.416	43743.5
237	4.21941	56169	13312053	15.3948	6.18846	744.557	44115.0
238	4.20168	56644	13481272	15.4272	6.19715	747.699	44488.1
239	4.18410	57121	13651919	15.4596	6.20582	750.841	44862.7
240	4.16667	57600	13824000	15.4919	6.21447	753.982	45238.9
241	4.14938	58081	13997521	15.5242	6.22308	757.124	45616.7
242	4.13223	58564	14172488	15.5563	6.23168	760.265	45996.1
243	4.11523	59049	14348907	15.5885	6.24025	763.407	46377.0
244	4.09836	59536	14526784	15.6205	6.24880	766.549	46759.5
245	4.08163	60025	14706125	15.6525	6.25732	769.690	47143.5
246	4.06504	60516	14880936	15.6844	6.26583	772.832	47529.2
247	4.04858	61009	15069223	15.7162	6.27431	775.973	47916.4
248	4.03226	61504	15252992	15.7480	6.28276	779.115	48305.1
249	4.01606	62001	15438249	15.7797	6.29119	782.257	48695.5
250	4.00000	62500	15625000	15.8114	6.29961	785.398	49087.4

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
251	3.98406	63001	15813251	15.8430	6.30799	788.540	49480.9
252	3.96825	63504	16003008	15.8745	6.31636	791.681	49875.9
253	3.95257	64009	16194277	15.9060	6.32470	794.823	50272.6
254	3.93701	64516	16387064	15.9374	6.33303	797.965	50670.8
255	3.92157	65025	16581375	15.9687	6.34133	801.106	51070.5
256	3.90625	65536	16777216	16.0000	6.34960	804.248	51471.9
257	3.89105	66049	16974593	16.0312	6.35786	807.389	51874.8
258	3.87597	66564	17173512	16.0624	6.36610	810.531	52279.2
259	3.86100	67081	17373979	16.0935	6.37431	813.672	52685.3
260	3.84615	67600	17576000	16.1245	6.38250	816.814	53092.9
261	3.83142	68121	17779581	16.1555	6.39068	819.956	53502.1
262	3.81679	68644	17984728	16.1864	6.39883	823.097	53912.9
263	3.80228	69169	18191447	16.2173	6.40696	826.239	54325.2
264	3.78788	69696	18399744	16.2481	6.41507	829.380	54739.1
265	3.77358	70225	18609625	16.2788	6.42316	832.522	55154.6
266	3.75940	70756	18821096	16.3095	6.43123	835.664	55571.6
267	3.74532	71289	19034163	16.3401	6.43928	838.805	55990.3
268	3.73134	71824	19248832	16.3707	6.44731	841.947	56410.4
269	3.71747	72361	19465109	16.4012	6.45531	845.088	56832.2
270	3.70370	72900	19683000	16.4317	6.46330	848.230	57255.5
271	3.69004	73441	19902511	16.4621	6.47127	851.372	57680.4
272	3.67647	73984	20123648	16.4924	6.47922	854.513	58106.9
273	3.66300	74529	20346417	16.5227	6.48715	857.655	58534.9
274	3.64964	75076	20570824	16.5529	6.49507	860.796	58964.6
275	3.63636	75625	20796875	16.5831	6.50296	863.938	59395.7
276	3.62319	76176	21024576	16.6132	6.51083	867.080	59828.5
277	3.61011	76729	21253933	16.6433	6.51868	870.221	60262.8
278	3.59712	77284	21484952	16.6733	6.52652	873.363	60698.7
279	3.58423	77841	21717639	16.7033	6.53934	876.504	61136.2
280	3.57143	78400	21952000	16.7332	6.54213	879.646	61575.2
281	3.55872	78961	22188041	16.7631	6.54991	882.788	62015.8
282	3.54610	79524	22425768	16.7929	6.55767	885.929	62458.0
283	3.53357	80089	22665187	16.8226	6.56541	889.071	62901.8
284	3.52113	80656	22906304	16.8523	6.57314	892.212	63347.1
285	3.50877	81225	23149125	16.8819	6.58084	895.354	63794.0
286	3.49650	81796	23393656	16.9115	6.58853	898.495	63242.4
287	3.48432	82369	23639903	16.9411	6.59620	901.637	64692.5
288	3.47222	82944	23887872	16.9706	6.60385	904.779	65144.1
289	3.46021	83521	24137569	17.0000	6.61150	907.920	65597.2
290	3.44828	84100	24389000	17.0294	6.61911	911.062	66052.0
291	3.43643	84681	24642171	17.0587	6.62671	914.203	66508.3
292	3.42466	85264	24897088	17.0880	6.63429	917.345	66966.2
293	3.41297	85849	25153757	17.1172	6.64185	920.487	67425.7
294	3.40136	86436	25412184	17.1464	6.64940	923.628	67886.7
295	3.38983	87025	25672375	17.1756	6.65693	926.770	68349.3
296	3.37838	87616	25934336	17.2047	6.66444	929.911	68813.5
297	3.36700	88209	26198073	17.2337	6.67194	933.053	69279.2
298	3.35570	88804	26463592	17.2627	6.67942	936.195	69746.5
299	3.34448	89401	26730899	17.2916	6.68688	939.336	70215.4
300	3.33333	90000	27000000	17.3205	6.69433	942.478	70685.8

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
301	3.32226	90601	27270901	17.3494	6.70186	945.619	71157.9
302	3.31126	91204	27543608	17.3781	6.70917	948.761	71631.5
303	3.30033	91809	27818127	17.4069	6.71657	951.903	72106.6
304	3.28947	92416	28094464	17.4356	6.72395	955.044	72583.4
305	3.27869	93025	28372625	17.4642	6.73132	958.186	73061.7
306	3.26797	93636	28652616	17.4929	6.73866	961.327	73541.5
307	3.25733	94249	28934443	17.5214	6.74600	964.469	74023.0
308	3.24675	94864	29218112	17.5499	6.75331	967.611	74506.0
309	3.23625	95481	29503629	17.5784	6.76061	970.752	74990.6
310	3.22581	96100	29791000	17.6068	6.76790	973.894	75476.8
311	3.21543	96721	30080231	17.6352	6.77517	977.035	75964.5
312	3.20513	97344	30371328	17.6635	6.78242	980.177	76453.8
313	3.19489	97969	30664297	17.6918	6.78966	983.318	76944.7
314	3.18471	98596	30959144	17.7200	6.79688	986.460	77437.1
315	3.17460	99225	31255875	17.7482	6.80409	989.602	77931.1
316	3.16456	99856	31554496	17.7764	6.81128	992.743	78426.7
317	3.15457	100489	31855013	17.8045	6.81846	995.885	78923.9
318	3.14465	101124	32157432	17.8326	6.82562	999.026	79422.6
319	3.13480	101761	32461759	17.8606	6.83277	1002.17	79922.9
320	3.12500	102400	32768000	17.8885	6.83990	1005.31	80424.8
321	3.11526	103041	33076161	17.9165	6.84702	1008.45	80928.2
322	3.10559	103684	33386248	17.9444	6.85412	1011.59	81433.2
323	3.09598	104329	33698267	17.9722	6.86121	1014.73	81939.8
324	3.08642	104976	34012224	18.0000	6.86829	1017.88	82448.0
325	3.07692	105625	34328125	18.0278	6.87534	1021.02	82957.7
326	3.06748	106276	34645976	18.0555	6.88239	1024.16	83469.0
327	3.05810	106929	34965783	18.0831	6.88942	1027.30	83981.8
328	3.04878	107584	35287552	18.1108	6.89643	1030.44	84496.3
329	3.03951	108241	35611289	18.1384	6.90344	1033.58	85012.3
330	3.03030	108900	35937000	18.1659	6.91042	1036.73	85529.9
331	3.02115	109561	36264691	18.1934	6.91740	1039.87	86049.0
332	3.01205	110224	36594368	18.2209	6.92436	1043.01	86569.7
333	3.00300	110889	36926037	18.2483	6.93130	1046.15	87092.0
334	2.99401	111556	37259704	18.2757	6.93823	1049.29	87615.9
335	2.98507	112225	37595375	18.3030	6.94515	1052.43	88141.3
336	2.97619	112896	37933056	18.3303	6.95205	1055.58	88668.3
337	2.96736	113569	38272753	18.3576	6.95894	1058.72	89196.9
338	2.95858	114244	38614472	18.3848	6.96582	1061.86	89727.0
339	2.94985	114921	38958219	18.4120	6.97268	1065.00	90258.7
340	2.94118	115600	39304000	18.4391	6.97953	1068.14	90792.0
341	2.93255	116281	39651821	18.4662	6.98637	1071.28	91326.9
342	2.92398	116964	40001688	18.4932	6.99319	1074.42	91863.3
343	2.91545	117649	40353607	18.5203	7.00000	1077.57	92401.3
344	2.90698	118336	40707584	18.5472	7.00680	1080.71	92940.9
345	2.89855	119025	41063625	18.5742	7.01358	1083.85	93482.0
346	2.89017	119716	41421736	18.6011	7.02035	1086.99	94024.7
347	2.88184	120409	41781923	18.6279	7.02711	1090.13	94569.0
348	2.87356	121104	42144192	18.6548	7.03385	1093.27	95114.9
349	2.86533	121801	42508549	18.6815	7.04058	1096.42	95662.3
350	2.85714	122500	42875000	18.7083	7.04730	1099.56	96211.3

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
351	2.84900	123201	43243551	18.7350	7.05400	1102.70	96761.8
352	2.84091	123904	43614208	18.7617	7.06070	1105.84	97314.0
353	2.83286	124600	43986977	18.7883	7.06738	1108.98	97867.7
354	2.82486	125316	44361864	18.8149	7.07404	1112.12	98423.0
355	2.81690	126025	44738875	18.8414	7.08070	1115.27	98979.8
356	2.80899	126736	45118016	18.8680	7.08734	1118.41	99538.2
357	2.80112	127449	45499293	18.8944	7.09397	1121.55	100098.
358	2.79330	128164	45882712	18.9209	7.10059	1124.69	100660.
359	2.78552	128881	46268279	18.9473	7.10719	1127.83	101223.
360	2.77778	129600	46656000	18.9737	7.11379	1130.97	101788.
361	2.77008	130321	47045881	19.0000	7.12037	1134.11	102354.
362	2.76243	131044	47437928	19.0263	7.12694	1137.26	102922.
363	2.75482	131769	47832147	19.0526	7.13349	1140.40	103491.
364	2.74725	132496	48228544	19.0788	7.14004	1143.54	104062.
365	2.73973	133225	48627125	19.1050	7.14657	1146.68	104635.
366	2.73224	133956	49027896	19.1311	7.15309	1149.82	105209.
367	2.72480	134689	49430863	19.1572	7.15960	1152.96	105784.
368	2.71739	135424	49836032	19.1833	7.16610	1156.11	106362.
369	2.71003	136161	50244309	19.2094	7.17258	1159.25	106941.
370	2.70270	136900	50653000	19.2354	7.17905	1162.39	107521.
371	2.69542	137641	51064811	19.2614	7.18552	1165.53	108103.
372	2.68817	138384	51478848	19.2873	7.19197	1168.67	108687.
373	2.68097	139129	51895117	19.3132	7.19841	1171.81	109272.
374	2.67380	139876	52313624	19.3391	7.20483	1174.96	109858.
375	2.66667	140625	52734375	19.3649	7.21125	1178.10	110447.
376	2.65957	141376	53157376	19.3907	7.21765	1181.24	111036.
377	2.65252	142129	53582633	19.4165	7.22405	1184.38	111628.
378	2.64550	142884	54010152	19.4422	7.23043	1187.52	112221.
379	2.63852	143641	54439939	19.4679	7.23680	1190.66	112815.
380	2.63158	144400	54872000	19.4936	7.24316	1193.81	113411.
381	2.62467	145161	55306341	19.5192	7.24950	1196.95	114009.
382	2.61780	145924	55742968	19.5448	7.25584	1200.09	114608.
383	2.61097	146689	56181887	19.5704	7.26217	1203.23	115209.
384	2.60417	147456	56623104	19.5959	7.26848	1206.37	115812.
385	2.59740	148225	57066625	19.6214	7.27479	1209.51	116416.
386	2.59067	148996	57512456	19.6469	7.28108	1212.65	117021.
387	2.58398	149769	57960603	19.6723	7.28736	1215.80	117628.
388	2.57732	150544	58411072	19.6977	7.29363	1218.94	118237.
389	2.57069	151321	58863869	19.7231	7.29989	1222.08	118847.
390	2.56410	152100	59319000	19.7484	7.30614	1225.22	119459.
391	2.55754	152881	59776471	19.7737	7.31238	1228.36	120072.
392	2.55102	153664	60236288	19.7990	7.31861	1231.50	120687.
393	2.54453	154449	60698457	19.8242	7.32483	1234.65	121304.
394	2.53807	155236	61162984	19.8494	7.33104	1237.79	121922.
395	2.53165	156025	61629875	19.8746	7.33723	1240.93	122542.
396	2.52525	156816	62099136	19.8997	7.34342	1244.07	123163.
397	2.51889	157609	62570773	19.9249	7.34960	1247.21	123786.
398	2.51256	158404	63044792	19.9499	7.35576	1250.35	124410.
399	2.50627	159201	63521199	19.9750	7.36192	1253.50	125036.
400	2.50000	160000	64000000	20.0000	7.36806	1256.64	125664.

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
401	2.49377	160801	64481201	20.0250	7.37420	1259.78	126293.
402	2.48756	161604	64964808	20.0499	7.38032	1262.92	126923.
403	2.48139	163409	65450827	20.0749	7.38644	1266.06	127556.
404	2.47525	163216	65939264	20.0998	7.39254	1269.20	128190.
405	2.46914	164025	66430125	20.1246	7.39864	1272.35	128825.
406	2.46305	164836	66923416	20.1494	7.40472	1275.49	129462.
407	2.45700	165649	67419143	20.1742	7.41080	1278.63	130100.
408	2.45098	166464	67917312	20.1990	7.41686	1281.77	130741.
409	2.44499	167281	68417929	20.2237	7.42291	1284.91	131382.
410	2.43902	168100	68921000	20.2485	7.42896	1288.05	132025.
411	2.43309	168921	69426531	20.2731	7.43499	1291.19	132670.
412	2.42718	169744	69934528	20.2978	7.44102	1294.34	133317.
413	2.42131	170569	70444997	20.3224	7.44703	1297.48	133965.
414	2.41546	171396	70957944	20.3470	7.45304	1300.62	134614.
415	2.40964	172225	71473375	20.3715	7.45904	1303.76	135265.
416	2.40385	173056	71991296	20.3961	7.46502	1306.90	135918.
417	2.39808	173889	72511713	20.4206	7.47100	1310.04	136572.
418	2.39234	174724	73034632	20.4450	7.47697	1313.19	137228.
419	2.38663	175561	73560059	20.4695	7.48292	1316.33	137885.
420	2.38095	176400	74088000	20.4939	7.48887	1319.47	138544.
421	2.37530	177241	74618461	20.5183	7.49481	1322.61	139205.
422	2.36967	178084	75151448	20.5426	7.50074	1325.75	139867.
423	2.36407	178929	75686967	20.5670	7.50666	1328.89	140531.
424	2.35849	179776	76225024	20.5913	7.51257	1332.04	141196.
425	2.35294	180625	76765625	20.6155	7.51847	1335.18	141863.
426	2.34742	181476	77308776	20.6398	7.52437	1338.32	142531.
427	2.34192	182329	77854483	20.6640	7.53025	1341.46	143201.
428	2.33645	183184	78402752	20.6882	7.53612	1344.60	143872.
429	2.33100	184041	78953589	20.7123	7.54199	1347.74	144545.
430	2.32558	184900	79507000	20.7364	7.54784	1350.88	145220.
431	2.32019	185761	80062991	20.7605	7.55369	1354.03	145896.
432	2.31481	186624	80621568	20.7846	7.55953	1357.17	146574.
433	2.30947	187489	81182737	20.8087	7.56535	1360.31	147254.
434	2.30415	188356	81746504	20.8327	7.57117	1363.45	147934.
435	2.29885	189225	82312875	20.8567	7.57698	1366.59	148617.
436	2.29358	190096	82881856	20.8806	7.58279	1369.73	149301.
437	2.28833	190969	83453453	20.9045	7.58858	1372.88	149987.
438	2.28311	191844	84027672	20.9284	7.59436	1376.02	150674.
439	2.27790	192721	84604519	20.9523	7.60014	1379.16	151363.
440	2.27273	193600	85184000	20.9762	7.60590	1382.30	152053.
441	2.26757	194481	85766121	21.0000	7.61166	1385.44	152745.
442	2.26244	195364	86350888	21.0238	7.61741	1388.58	153439.
443	2.25734	196249	86938307	21.0476	7.62315	1391.73	154134.
444	2.25225	197136	87528384	21.0713	7.62888	1394.87	154830.
445	2.24719	198025	88121125	21.0950	7.63461	1398.01	155528.
446	2.24215	198916	88716536	21.1187	7.64032	1401.15	156228.
447	2.23714	199809	89314623	21.1424	7.64603	1404.29	156930.
448	2.23214	200704	89915392	21.1660	7.65172	1407.43	157633.
449	2.22717	201601	90518849	21.1896	7.65741	1410.58	158337.
450	2.22222	202500	91125000	21.2132	7.66309	1413.72	159043.

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
451	2.21729	203401	91733851	21.2368	7.66877	1416.86	159751
452	2.21239	204304	92345408	21.2603	7.67443	1420.00	160460
453	2.20751	205209	92959677	21.2838	7.68009	1423.14	161171
454	2.20264	206116	93576664	21.3073	7.68573	1426.28	161883
455	2.19780	207025	94196375	21.3307	7.69137	1429.42	162597
456	2.19298	207936	94818816	21.3542	7.69700	1432.57	163313
457	2.18818	208849	95443993	21.3776	7.70262	1435.71	164030
458	2.18341	209764	96071912	21.4009	7.70824	1438.85	164748
459	2.17865	210681	96702579	21.4243	7.71384	1441.99	165468
460	2.17391	211600	97336000	21.4476	7.71944	1445.13	166190
461	2.16920	212521	97972181	21.4709	7.72503	1448.27	166914
462	2.16450	213444	98611128	21.4942	7.73061	1451.42	167639
463	2.15983	214369	99252847	21.5174	7.73619	1454.56	168365
464	2.15517	215296	99897344	21.5407	7.74175	1457.70	169093
465	2.15054	216225	100544625	21.5639	7.74731	1460.84	169823
466	2.14592	217156	101194696	21.5870	7.75286	1463.98	170554
467	2.14133	218098	101847563	21.6102	7.75840	1467.12	171287
468	2.13675	219024	102503232	21.6333	7.76394	1470.27	172021
469	2.13220	219961	103161709	21.6564	7.76946	1473.41	172757
470	2.12766	220900	103823000	21.6795	7.77498	1476.55	173494
471	2.12314	221841	104487111	21.7025	7.78049	1479.69	174234
472	2.11864	222784	105154048	21.7256	7.78599	1482.83	174974
473	2.11416	223729	105823817	21.7486	7.79149	1485.97	175716
474	2.10970	224676	106496424	21.7715	7.79697	1489.11	176460
475	2.10526	225625	107171875	21.7945	7.80245	1492.26	177205
476	2.10084	226576	107850176	21.8174	7.80793	1495.40	177952
477	2.09644	227529	108531333	21.8403	7.81339	1498.54	178701
478	2.09205	228484	109215352	21.8632	7.81885	1501.68	179451
479	2.08768	229441	109902239	21.8861	7.82429	1504.82	180203
480	2.08333	230400	110592000	21.9089	7.82974	1507.96	180956
481	2.07900	231361	111284641	21.9317	7.83517	1511.11	181711
482	2.07469	232324	111980168	21.9545	7.84059	1514.25	182467
483	2.07039	233289	112678587	21.9773	7.84601	1517.39	183225
484	2.06612	234256	113379904	22.0000	7.85142	1520.53	183984
485	2.06186	235225	114084125	22.0227	7.85683	1523.67	184745
486	2.05761	236196	114791256	22.0454	7.86222	1526.81	185508
487	2.05339	237169	115501303	22.0681	7.86761	1529.96	186272
488	2.04918	238144	116214272	22.0907	7.87299	1533.10	187038
489	2.04499	239121	116930169	22.1133	7.87837	1536.24	187805
490	2.04082	240100	117649000	22.1359	7.88374	1539.38	188574
491	2.03666	241081	118370771	22.1585	7.88909	1542.52	189345
492	2.03252	242064	119095488	22.1811	7.89445	1545.66	190117
493	2.02840	243049	119823157	22.2036	7.89979	1548.81	190890
494	2.02429	244036	120553784	22.2261	7.90513	1551.95	191665
495	2.02020	245025	121287375	22.2486	7.91046	1555.09	192442
496	2.01613	246016	122023936	22.2711	7.91578	1558.23	193221
497	2.01207	247009	122763473	22.2935	7.92110	1561.37	194000
498	2.00803	248004	123505992	22.3159	7.92641	1564.51	194782
499	2.00401	249001	124251499	22.3383	7.93179	1567.65	195565
500	2.00000	250000	125000000	22.3607	7.93701	1570.80	196350

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
501	1.99601	251001	125751501	22.3830	7.94229	1573.94	197136
502	1.99203	252004	126506008	22.4054	7.94757	1577.80	197923
503	1.98807	253009	127263527	22.4277	7.95285	1580.22	198713
504	1.98413	254016	128024064	22.4499	7.95811	1583.36	199504
505	1.98020	255025	128787625	22.4722	7.96337	1586.50	200296
506	1.97628	256036	129554216	22.4944	7.96863	1589.65	201090
507	1.97239	257049	130323843	22.5167	7.97387	1592.79	201886
508	1.96850	258064	131096512	22.5389	7.97911	1595.93	202683
509	1.96464	259081	131872229	22.5610	7.98434	1599.07	203482
510	1.96078	260100	132651000	22.5832	7.98957	1602.21	204282
511	1.95695	261121	133432831	22.6053	7.99479	1605.35	205084
512	1.95312	262144	134217728	22.6274	8.00000	1608.50	205887
513	1.94932	263169	135005697	22.6495	8.00520	1611.64	206692
514	1.94553	264196	135796744	22.6716	8.01040	1614.78	207499
515	1.94175	265225	136590875	22.6936	8.01559	1617.92	208307
516	1.93798	266256	137388096	22.7156	8.02078	1621.06	209117
517	1.93424	267289	138188413	22.7376	8.02596	1624.20	209928
518	1.93050	268324	138991832	22.7596	8.03113	1627.34	210741
519	1.92678	269361	139798359	22.7816	8.03629	1630.49	211556
520	1.92308	270400	140608000	22.8035	8.04145	1633.63	212372
521	1.91939	271441	141420761	22.8254	8.04660	1636.77	213189
522	1.91571	272484	142236648	22.8473	8.05175	1639.91	214008
523	1.91205	273529	143055667	22.8692	8.05689	1643.05	214829
524	1.90840	274576	143877824	22.8910	8.06202	1646.19	215651
525	1.90476	275625	144703125	22.9129	8.06714	1649.34	216475
526	1.90114	276676	145531576	22.9347	8.07226	1652.48	217301
527	1.89753	277729	146363183	22.9565	8.07737	1655.62	218128
528	1.89394	278784	147197952	22.9783	8.08248	1658.76	218956
529	1.89036	279841	148035889	23.0000	8.08758	1661.90	219787
530	1.88679	280900	148877000	23.0217	8.09267	1665.04	220618
531	1.88324	281961	149722291	23.0434	8.09776	1668.19	221452
532	1.87970	283024	150568768	23.0651	8.10284	1671.33	222287
533	1.87617	284089	151419437	23.0868	8.10791	1674.47	223123
534	1.87266	285156	152273304	23.1084	8.11298	1677.61	223961
535	1.86916	286225	153130375	23.1301	8.11804	1680.75	224801
536	1.86567	287296	153990656	23.1517	8.12310	1683.89	225642
537	1.86220	288369	154854153	23.1733	8.12814	1687.04	226484
538	1.85874	289444	155720872	23.1948	8.13319	1690.18	227329
539	1.85529	290521	156590819	23.2164	8.13822	1693.32	228175
540	1.85185	291600	157464000	23.2379	8.14325	1696.46	229022
541	1.84843	292681	158340421	23.2594	8.14828	1699.60	229871
542	1.84502	293764	159220088	23.2809	8.15329	1702.74	230722
543	1.84162	294849	160103007	23.3024	8.15831	1705.88	231574
544	1.83824	295936	166989184	23.3238	8.16331	1709.03	232428
545	1.83486	297025	161878625	23.3452	8.16831	1712.17	233283
546	1.83150	298116	162771336	23.3666	8.17330	1715.31	234140
547	1.82815	299209	163667323	23.3880	8.17829	1718.45	234998
548	1.82482	300304	164566592	23.4094	8.18327	1721.59	235858
549	1.82149	301401	165469149	23.4307	8.18824	1724.73	236720
550	1.81818	302500	166375000	23.4521	8.19321	1727.88	237583

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
551	1.81488	303601	167284151	23.4734	8.19818	1731.02	238448
552	1.81159	304704	168196608	23.4947	8.20313	1734.16	239314
553	1.80832	305809	169112377	23.5160	8.20808	1737.30	240182
554	1.80505	306916	170031464	23.5372	8.21303	1740.44	241051
555	1.80180	308025	170953875	23.5584	8.21797	1743.58	241922
556	1.79856	309136	171879616	23.5797	8.22290	1746.73	242795
557	1.79533	310249	172808693	23.6008	8.22783	1749.87	243669
558	1.79211	311364	173741112	23.6220	8.23275	1753.01	244545
559	1.78891	312481	174676879	23.6432	8.23766	1756.15	245422
560	1.78571	313600	175616000	23.6643	8.24257	1759.29	246301
561	1.78253	314721	176558481	23.6854	8.24747	1762.43	247181
562	1.77936	315844	177504328	23.7065	8.25237	1765.58	248063
563	1.77620	316969	178453547	23.7276	8.25726	1768.72	248947
564	1.77305	318096	179406144	23.7487	8.26215	1771.86	249832
565	1.76991	319225	180362125	23.7697	8.26703	1775.00	250719
566	1.76678	320356	181321496	23.7908	8.27190	1778.14	251607
567	1.76367	321489	182284263	23.8118	8.27677	1781.28	252497
568	1.76056	322624	183250432	23.8328	8.28164	1784.42	253388
569	1.75747	323761	184220009	23.8537	8.28649	1787.57	254281
570	1.75439	324900	185193000	23.8747	8.29134	1790.71	255176
571	1.75131	326041	186169411	23.8956	8.29619	1793.85	256072
572	1.74825	327184	187149248	23.9165	8.30103	1796.99	256970
573	1.74520	328329	188132517	23.9374	8.30587	1800.13	257869
574	1.74216	329476	189119224	23.9583	8.31069	1803.27	258770
575	1.73913	330625	190109375	23.9792	8.31552	1806.42	259672
576	1.73611	331776	191102976	24.0000	8.32034	1809.56	260576
577	1.73310	332929	192100033	24.0208	8.32515	1812.70	261482
578	1.73010	334084	193100552	24.0416	8.32995	1815.84	262389
579	1.72712	335241	194104539	24.0624	8.33476	1818.98	263298
580	1.72414	336400	195112000	24.0832	8.33955	1822.12	264208
581	1.72117	337561	196122941	24.1039	8.34434	1825.27	265120
582	1.71821	338724	197137368	24.1247	8.34913	1828.31	266033
583	1.71527	339889	198155287	24.1454	8.35390	1831.55	266948
584	1.71233	341056	199176704	24.1661	8.35868	1834.69	267865
585	1.70940	342225	200201625	24.1868	8.36345	1837.83	268783
586	1.70648	343396	201230056	24.2074	8.36821	1840.98	269703
587	1.70358	344569	202262003	24.2281	8.37297	1844.11	270624
588	1.70068	345744	203297472	24.2487	8.37772	1847.26	271547
589	1.69779	346921	204336469	24.2693	8.38247	1850.40	272471
590	1.69492	348100	205379000	24.2899	8.38721	1853.54	273397
591	1.69205	349281	206425071	24.3105	8.39194	1856.68	274325
592	1.68919	350464	207474688	24.3311	8.39667	1859.82	275254
593	1.68634	351649	208527857	24.3516	8.40140	1862.96	276184
594	1.68350	352836	209584584	24.3721	8.40612	1866.11	277117
595	1.68067	354025	210644875	24.3926	8.41083	1869.25	278051
596	1.67785	355216	211708736	24.4131	8.41554	1872.39	278986
587	1.67504	356409	212776173	24.4336	8.42025	1875.53	279923
598	1.67224	357604	213847192	24.4540	8.42494	1878.67	280862
599	1.66945	358801	214921799	24.4745	8.42964	1881.81	281802
600	1.66667	360000	216000000	24.4949	8.43433	1884.96	282743

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
601	1.66389	361201	217081801	24.5153	8.43901	1888.10	283687
602	1.66113	362404	218167208	24.5357	8.44369	1891.24	284631
603	1.65837	363609	219256227	24.5561	8.44836	1894.38	285578
604	1.65563	364816	220348864	24.5764	8.45303	1897.52	286526
605	1.65289	366025	221445125	24.5967	8.45769	1900.66	287475
606	1.65017	367236	222545016	24.6171	8.46235	1903.81	288426
607	1.64745	368449	223648543	24.6374	8.46700	1906.95	289379
608	1.64474	369664	224755712	24.6577	8.47165	1910.09	290333
609	1.64204	370881	225866529	24.6779	8.47629	1913.23	291289
610	1.63934	372100	226981000	24.6982	8.48093	1916.37	292247
611	1.63666	373321	228099131	24.7184	8.48556	1919.51	293206
612	1.63399	374544	229220928	24.7386	8.49018	1922.65	294166
613	1.63132	375769	230346397	24.7588	8.49481	1925.80	295128
614	1.62866	376996	231475544	24.7790	8.49942	1928.94	296092
615	1.62602	378225	232608375	24.7992	8.50404	1932.08	297057
616	1.62338	379456	233744896	24.8193	8.50864	1935.22	298024
617	1.62075	380689	234885113	24.8395	8.51324	1938.36	298992
618	1.61812	381924	236029032	24.8596	8.51784	1941.50	299962
619	1.61551	383161	237176659	24.8797	8.52243	1944.65	300934
620	1.61290	384400	238328000	24.8998	8.52702	1947.79	301907
621	1.61031	385641	239483061	24.9199	8.53160	1950.93	302882
622	1.60772	386884	240641848	24.9399	8.53618	1954.07	303858
623	1.60514	388129	241804367	24.9600	8.54075	1957.21	304836
624	1.60256	389376	242970624	24.9800	8.54532	1960.35	305815
625	1.60000	390625	244140625	25.0000	8.54988	1963.50	306796
626	1.59744	391876	245314376	25.0200	8.55444	1966.64	307779
627	1.59490	393129	246491883	25.0400	8.55899	1969.78	308763
628	1.59236	394384	247673152	25.0599	8.56354	1972.92	309748
629	1.58983	395641	248858189	25.0799	8.56808	1976.06	310736
630	1.58730	396900	250047000	25.0998	8.57262	1979.20	311725
631	1.58479	398161	251239591	25.1197	8.57715	1982.34	312715
632	1.58228	399424	252435968	25.1396	8.58168	1985.49	313707
633	1.57978	400689	253636137	25.1595	8.58620	1988.63	314700
634	1.57729	401956	254840104	25.1794	8.59072	1991.77	315696
635	1.57480	403225	256047875	25.1992	8.59524	1994.91	316692
636	1.57233	404496	257259456	25.2190	8.59975	1998.05	317690
637	1.56986	405769	258474853	25.2389	8.60425	2001.19	318690
638	1.56740	407044	259694072	25.2587	8.60875	2004.34	319692
639	1.56495	408321	260917119	25.2784	8.61325	2007.48	320695
640	1.56250	409600	262144000	25.2982	8.61774	2010.62	321699
641	1.56006	410881	263374721	25.3180	8.62222	2013.76	322705
642	1.55763	412164	264609288	25.3377	8.62671	2016.90	323713
643	1.55521	413449	265847707	25.3574	8.63118	2020.04	324722
644	1.55280	414736	267089984	25.3772	8.63566	2023.19	325733
645	1.55039	416025	268336125	25.3969	8.64012	2026.33	326745
646	1.54799	417316	269586136	25.4165	8.64459	2029.47	327759
647	1.54560	418609	270840023	25.4362	8.64904	2032.61	328775
648	1.54321	419904	272097792	25.4558	8.65350	2035.75	329792
649	1.54083	421201	273359449	25.4755	8.65795	2038.89	330810
650	1.53846	422500	274625000	25.4951	8.66239	2042.04	331831

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
651	1.53610	423801	275894451	25.5147	8.66683	2045.18	332853
652	1.53374	425104	277167808	25.5343	8.67127	2048.32	333876
653	1.53139	426409	278445077	25.5539	8.67570	2051.46	334901
654	1.52905	427716	279726264	25.5734	8.68012	2054.60	335927
655	1.52672	429025	281011375	25.5930	8.68455	2057.74	336955
656	1.52439	430336	282300416	25.6125	8.68896	2060.88	337985
657	1.52207	431649	283593393	25.6320	8.69338	2064.03	339016
658	1.51976	432964	284890312	25.6515	8.69778	2067.17	340049
659	1.51745	434281	286191179	25.6710	8.70219	2070.31	341084
660	1.51515	435600	287496000	25.6905	8.70659	2073.45	342119
661	1.51286	436921	288804781	25.7099	8.71098	2076.59	343157
662	1.51057	438244	290117528	25.7294	8.71537	2079.73	344196
663	1.50830	439569	291434247	25.7488	8.71976	2082.88	345237
664	1.50602	440896	292754944	25.7682	8.72414	2086.02	346279
665	1.50376	442225	294079625	25.7876	8.72852	2089.16	347323
666	1.50150	443556	295408296	25.8070	8.73289	2092.30	348368
667	1.49925	444889	296740963	25.8263	8.73726	2095.44	349415
668	1.49701	446224	298077632	25.8457	8.74162	2098.58	350464
669	1.49477	447561	299418309	25.8650	8.74598	2101.73	351514
670	1.49254	448900	300763000	25.8844	8.75034	2104.87	352565
671	1.49031	450241	302111711	25.9037	8.75469	2108.01	353618
672	1.48810	451584	303464448	25.9230	8.76904	2111.15	354673
673	1.48885	452929	304821217	25.9422	8.76338	2114.29	355730
674	1.48368	454276	306182024	25.9156	8.76772	2117.43	356788
675	1.48148	455625	307546875	25.9808	8.77205	2120.58	357847
676	1.47929	456976	308915776	26.0000	8.77638	2123.72	358908
677	1.47710	458329	310288733	26.0192	8.78071	2126.86	359971
678	1.47493	459684	311665752	26.0384	8.78503	2130.00	361035
679	1.47275	461041	313046839	26.0576	8.78935	2133.14	362101
680	1.47059	462400	314432000	26.0768	8.79366	2136.28	363168
681	1.46843	463761	315821241	26.0960	8.79797	2139.42	364237
682	1.46628	465124	317214558	26.1151	8.80227	2142.57	365308
683	1.46413	466489	318611987	26.1343	8.80657	2145.71	366380
684	1.46199	467856	320013504	26.1534	8.81087	2148.85	367453
685	1.45985	469225	321419125	26.1725	8.81516	2151.99	368528
686	1.45773	470596	322828856	26.1916	8.81945	2155.13	369605
687	1.45560	471969	324242703	26.2107	8.82373	2158.27	370684
688	1.45349	473344	325660672	26.2298	8.82801	2161.42	371764
689	1.45138	474721	327082769	26.2488	8.83229	2164.56	372845
690	1.44928	476100	328509000	26.2679	8.83656	2167.70	373928
691	1.44718	477481	329939371	26.2869	8.84082	2170.84	375031
692	1.44509	478864	331373888	26.3059	8.84509	2173.98	376099
693	1.44300	480249	332812557	26.3249	8.84934	2177.12	377187
694	1.44092	481636	334255384	26.3439	8.85360	2180.27	378276
695	1.43885	483025	335702375	26.3629	8.85785	2183.41	379367
696	1.43678	484416	337153536	26.3818	8.86210	2186.55	380459
697	1.43472	485809	338608873	26.4008	8.86634	2189.69	381554
698	1.43266	487204	340368392	26.4197	8.87058	2192.83	382649
699	1.43062	488601	341532099	26.4386	8.87481	2195.97	383746
700	1.42857	490000	343000000	26.4575	8.87904	2199.11	384845

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
701	1.42653	491401	344472101	26.4764	8.88327	2202.26	385945
702	1.42450	492804	345948408	26.4953	8.88749	2205.40	387047
703	1.42248	494209	347428927	26.5141	8.89171	2208.54	388151
704	1.42045	495616	348913664	26.5330	8.89592	2211.68	389256
705	1.41844	497025	350402625	26.5518	8.90013	2214.82	390363
706	1.41643	498436	351895816	26.5707	8.90434	2217.96	391471
707	1.41443	499849	353393243	26.5895	8.90854	2221.11	392580
708	1.41243	501264	354894912	26.6083	8.91274	2224.25	393692
709	1.41044	502681	356400829	26.6271	8.91693	2227.39	394805
710	1.40845	504100	357911000	26.6458	8.92112	2230.53	395919
711	1.40647	505521	359425431	26.6646	8.92531	2233.67	397035
712	1.40449	506944	360944128	26.6833	8.92949	2236.81	398153
713	1.40252	508369	362467097	26.7021	8.93367	2239.96	399272
714	1.40056	509796	363994344	26.7208	8.93784	2243.10	400393
715	1.39860	511225	365525875	26.7395	8.94201	2246.24	401515
716	1.39665	512656	367061696	26.7582	8.94618	2249.38	402639
717	1.39470	514089	368601813	26.7769	8.95034	2252.52	403765
718	1.39276	515524	370146232	26.7955	8.95450	2255.66	404892
719	1.39082	516961	371694959	26.8142	8.95866	2258.81	406020
720	1.38889	518400	373248000	26.8328	8.95281	2261.95	407150
721	1.38696	519841	374805361	26.8514	8.96696	2265.09	408282
722	1.38504	521284	376367048	26.8701	8.97110	2268.23	409416
723	1.38313	522729	377933067	26.8887	8.97524	2271.37	410550
724	1.38122	524176	379503424	26.9072	8.97938	2274.51	411687
725	1.37931	525625	381078125	26.9258	8.98351	2277.65	412825
726	1.37741	527076	382657176	26.9444	8.98764	2280.80	413965
727	1.37552	528529	384240583	26.9629	8.99176	2283.94	415106
728	1.37363	529984	385828352	26.9815	8.99588	2287.08	416248
729	1.37174	531441	387420489	27.0000	9.00000	2290.22	417393
730	1.36986	532900	389017000	27.0185	9.00411	2293.36	418539
731	1.36799	534361	390617891	27.0370	9.00822	2296.50	419686
732	1.36612	535824	392223168	27.0555	9.01233	2299.65	420835
733	1.36426	537289	393832837	27.0740	9.01643	2302.79	421986
734	1.36240	538756	395446904	27.0224	9.02043	2305.93	423138
735	1.36054	540225	397065375	27.1109	9.02462	2309.07	424292
736	1.35870	541696	398688256	27.1293	9.02871	2312.21	425447
737	1.35685	543169	400315553	27.1477	9.03280	2315.35	426604
738	1.35501	544644	401947272	27.1662	9.03689	2318.50	427762
739	1.35318	546121	403583419	27.1846	9.04097	2321.64	428922
740	1.35135	547600	405224000	27.2029	9.04504	2324.78	430084
741	1.34953	549081	406869021	27.2213	9.04911	2327.92	431247
742	1.34771	550564	408518488	27.2397	9.05318	2331.06	432412
743	1.34590	552049	410172407	27.2580	9.05725	2334.20	433578
744	1.34409	553536	411830784	27.2764	9.06131	2337.34	434746
745	1.34228	555025	413493625	27.2947	9.06537	2340.49	435916
746	1.34048	556516	415160936	27.3130	9.06942	2343.63	437087
747	1.33869	558009	416832723	27.3313	9.07347	2346.77	438259
748	1.33690	559504	418508992	27.3496	9.07752	2349.91	439433
749	1.33511	561001	420189749	27.3679	9.08156	2353.05	440609
750	1.33333	562500	421875000	27.3861	9.08560	2356.19	441786

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
751	1.33156	564001	423564751	27.4044	9.08964	2359.34	442965
752	1.32979	565504	425259008	27.4226	9.09367	2362.48	444146
753	1.32802	567009	426957777	27.4408	9.09770	2365.62	445328
754	1.32626	568516	428661064	27.4591	9.10173	2368.76	446511
755	1.32450	570025	430368875	27.4773	9.10575	2371.90	447697
756	1.32275	571536	432081216	27.4955	9.10977	2375.04	448883
757	1.32100	573049	433797093	27.5136	9.11378	2378.19	450072
758	1.31926	574564	435519512	27.5318	9.11779	2381.33	451262
759	1.31752	576081	437245479	27.5500	9.12180	2384.47	452453
760	1.31579	577600	438976000	27.5681	9.12581	2387.61	453646
761	1.31406	579121	440711081	27.5862	9.12981	2390.75	454841
762	1.31234	580644	442450728	27.6043	9.13380	2393.89	456037
763	1.31062	582169	444194947	27.6225	9.13780	2397.04	457234
764	1.30890	583696	445943744	27.6405	9.14179	2400.18	458434
765	1.30719	585225	447697125	27.6586	9.14577	2403.32	459635
766	1.30548	586756	449455096	27.6767	9.14976	2406.46	460837
767	1.30378	588289	451217663	27.6948	9.15374	2409.60	462041
768	1.30208	589824	452984832	27.7128	9.15771	2412.74	463247
769	1.30039	591361	454756609	27.7308	9.16169	2415.88	464454
770	1.29870	592900	456533000	27.7489	9.16566	2419.03	465663
771	1.29702	594441	458314011	27.7669	9.16962	2422.17	466873
772	1.29534	595984	460099648	27.7849	9.17359	2425.31	468085
773	1.29366	587529	461889917	27.8029	9.17754	2428.45	469298
774	1.29199	599076	463684824	27.8209	9.18150	2431.59	470513
775	1.29032	600625	465484375	27.8388	9.18545	2434.73	471730
776	1.28866	602176	467288576	27.8568	9.18940	2437.88	472948
777	1.28700	603729	469097433	27.8747	9.19335	2441.02	474168
778	1.28535	605284	470910952	27.8927	9.19729	2444.16	475389
779	1.28370	606841	472729139	27.9106	9.20123	2447.30	476612
780	1.28205	608400	474552000	27.9285	9.20516	2450.44	477836
781	1.28041	609961	476379541	27.9464	9.20910	2453.58	479062
782	1.27877	611524	478211768	27.9643	9.21303	2456.73	480290
783	1.27714	613089	480048687	27.9821	9.21695	2459.87	481519
784	1.27551	614656	481890304	28.0000	9.22087	2463.01	482750
785	1.27389	616225	483736625	28.0179	9.22479	2466.15	483982
786	1.27226	617796	485587656	28.0357	9.22871	2469.29	485216
787	1.27065	619369	487443403	28.0535	9.23262	2472.43	486451
788	1.26904	620944	489303872	28.0713	9.23653	2475.58	487688
789	1.26743	622521	491169069	28.0891	9.24043	2478.72	488927
790	1.26582	624100	493039000	28.1069	9.24434	2481.86	490167
791	1.26422	625681	494913671	28.1247	9.24823	2485.00	491409
792	1.26263	627264	496793088	28.1425	9.25213	2488.14	492652
793	1.26103	628849	498677257	28.1603	9.25602	2491.28	493897
794	1.25945	630436	500566184	82.1780	9.25991	2494.42	495143
795	1.25786	632025	502459875	28.1957	9.26380	2497.57	496391
796	1.25628	633616	504358336	28.2135	9.26758	2500.71	497641
797	1.25471	635209	506261573	28.2312	9.27156	2503.85	498892
798	1.25313	636812	508169592	28.2489	9.27544	2506.99	500145
799	1.25166	638401	510082399	28.2666	9.27931	2510.13	501399
800	1.25000	640000	512000000	28.2843	9.28318	2513.27	502655

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
801	1.24844	641601	513922401	28.3019	9.28704	2516.42	503912
802	1.24688	643204	515849608	28.3196	9.29091	2519.56	505171
803	1.24533	644809	517781627	28.3373	9.29477	2522.70	506432
804	1.24378	646416	519718464	28.3549	9.29862	2525.84	507694
805	1.24224	648025	521660125	28.3725	9.30248	2528.98	508958
806	1.24069	649636	523606616	28.3901	9.30633	2532.12	510223
807	1.23916	651249	525557943	28.4077	9.31018	2535.27	511490
808	1.23762	652864	527514112	28.4253	9.31402	2538.41	512758
809	1.23609	654481	529475129	28.4429	9.31786	2541.55	514028
810	1.23457	656100	531441000	28.4605	9.32170	2544.69	515300
811	1.23305	657721	533411731	28.4781	9.32553	2547.83	516573
812	1.23153	659344	535387328	28.4956	9.32936	2550.97	517848
813	1.23001	660969	537367797	28.5132	9.33319	2554.11	519124
814	1.22850	662596	539353144	28.5307	9.33702	2557.26	520402
815	1.22699	664225	541343375	28.5482	9.34084	2560.40	521681
816	1.22549	665856	543338496	28.5657	9.34466	2563.54	522962
817	1.22399	667489	545338513	28.5832	9.34847	2566.68	524245
818	1.22249	669124	547343432	28.6007	9.35229	2569.82	525529
819	1.22100	670761	549353259	28.6182	9.35610	2572.96	526814
820	1.21951	672400	551368000	28.6356	9.35990	2576.11	528102
821	1.21803	674041	553387661	28.6531	9.35370	2579.25	529391
822	1.21655	675684	555412248	28.6705	9.36751	2582.39	530681
823	1.21507	677329	557441767	28.6880	9.37130	2585.53	531973
824	1.21359	678976	559476224	28.7054	9.37510	2588.67	533267
825	1.21212	680625	561515625	28.7228	9.37889	2591.81	534562
826	1.21065	682276	563559976	28.7402	9.38268	2594.96	535858
827	1.20919	683929	565609283	28.7576	9.38646	2598.10	537157
828	1.20773	685584	567663552	28.7750	9.39024	2601.24	538456
829	1.20627	687241	569722789	28.7924	9.39402	2604.38	539758
830	1.20482	688900	571787000	28.8097	9.39780	2607.52	541061
831	1.20337	690561	573856191	28.8271	9.40157	2610.66	542365
832	1.20192	692224	575930368	28.8444	9.40534	2613.81	543671
833	1.20048	693889	578009537	28.8617	9.40911	2616.95	544979
834	1.19904	695556	580093704	28.8791	9.41287	2620.09	546288
835	1.19760	697225	582182875	28.8964	9.41663	2623.23	547599
836	1.19617	698896	584277056	28.9137	9.42039	2626.37	548912
837	1.19474	700569	586376253	28.9310	9.42414	2629.51	550226
838	1.19332	702244	588480472	28.9482	9.42789	2632.65	551541
839	1.19190	703921	590589719	28.9655	9.43164	2635.80	552858
840	1.19048	705600	592704000	28.9828	9.43539	2638.94	554177
841	1.18906	707281	594823321	29.0000	9.43913	2642.08	555497
842	1.18765	708964	596947688	29.0172	9.44287	2645.22	556819
843	1.18624	710649	599077107	29.0345	9.44661	2648.36	558142
844	1.18483	712336	601211584	29.0517	9.45034	2651.50	559467
845	1.18343	714025	603351125	29.0689	9.45407	2654.65	560794
846	1.18203	715716	605495736	29.0861	9.45780	2657.79	562122
847	1.18064	717409	607645423	29.1033	9.46152	2660.93	563452
848	1.17925	719104	609800192	29.1204	9.46525	2664.07	564783
849	1.17786	720801	611960049	29.1376	9.46897	2667.21	566116
850	1.17647	722500	614125000	29.1548	9.47268	2670.35	567450

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
851	1.17509	724201	616295051	29.1719	9.47640	2673.50	568786
852	1.17371	725904	618470208	29.1890	9.48011	2676.64	570124
853	1.17233	727609	620650477	29.2062	9.48381	2679.78	571463
854	1.17096	729136	622835864	29.2233	9.48752	2682.92	572803
855	1.16959	731025	625026375	29.2404	9.49122	2686.06	574146
856	1.16822	732736	627222016	29.2575	9.49492	2689.20	575490
857	1.16686	734449	629422973	29.2746	9.49861	2692.34	576835
858	1.16550	736164	631628712	29.2916	9.50231	2695.49	578182
859	1.16414	737881	633839779	29.3087	9.50600	2698.63	579530
860	1.16279	739600	636056000	29.3258	9.50969	2701.77	580880
861	1.16144	741321	638277381	29.3428	9.51337	2704.91	582232
862	1.16009	743044	640503928	29.3598	9.51705	2708.05	583585
863	1.15875	744769	642735647	29.3769	9.52073	2711.19	584940
864	1.15741	746496	644972544	29.3939	9.52441	2714.34	586297
865	1.15607	748225	647214625	29.4109	9.52808	2717.48	587655
866	1.15473	749956	649461896	29.4279	9.53175	2720.62	589014
867	1.15340	751689	651714363	29.4449	9.53542	2723.76	590375
868	1.15207	753424	653972032	29.4618	9.53908	2726.90	591738
869	1.15075	755161	656234909	29.4788	9.54274	2730.04	593102
870	1.14943	766900	658503000	29.4958	9.54640	2733.19	594468
871	1.14811	758641	660776311	29.5127	9.55006	2736.33	595835
872	1.14679	760384	663054848	29.5296	9.55371	2739.47	597204
873	1.14548	762129	665338617	29.5466	9.55736	2742.61	598575
874	1.14416	763876	667627624	29.5635	9.56101	2745.75	599947
875	1.14286	765625	669921875	29.5804	9.56466	2748.89	601320
876	1.14155	767376	672221376	29.5973	9.56830	2752.04	602696
877	1.14025	769129	674526133	29.5142	9.57194	2755.18	604073
878	1.13895	770884	676836152	29.6311	9.57557	2758.32	605451
879	1.13766	772641	679151439	29.6479	9.57921	2761.46	606831
880	1.13636	774400	681472000	29.6648	9.58284	2764.60	608212
881	1.13507	776161	683797841	29.6816	9.58646	2767.74	609595
882	1.13379	777924	686128968	29.6985	9.59009	2770.88	610980
883	1.13250	779689	688465387	29.7153	9.59372	2774.03	612366
884	1.13122	781456	690807104	29.7321	9.59734	2777.17	613754
885	1.12994	783225	693154125	29.7489	9.60095	2780.31	615143
886	1.12867	784996	695506456	29.7658	9.60457	2783.45	616534
887	1.12740	786769	697864103	29.7825	9.60818	2786.59	617927
888	1.12613	788544	700227072	29.7993	9.61179	2789.70	619321
889	1.12486	790321	702595369	29.8161	9.61540	2792.88	620717
890	1.12360	792100	704969000	29.8329	9.61900	2796.02	622114
891	1.12233	793881	707347971	29.8496	9.62260	2799.16	623513
892	1.12108	795664	709732288	29.8664	9.62620	2802.30	624913
893	1.11982	797449	712121957	29.8831	9.62980	2805.44	626315
894	1.11857	799236	714516984	29.8998	9.63339	2808.58	627718
895	1.11732	801025	716917375	29.9166	9.63698	2811.73	629124
896	1.11607	802816	719323136	29.9333	9.64057	2814.87	630530
897	1.11483	804609	721734273	29.9500	9.64415	2818.01	631938
898	1.11359	806404	724150792	29.9666	9.64774	2821.15	633348
899	1.11235	808201	726572699	29.9833	9.65132	2824.29	634760
900	1.11111	810000	729000000	30.0000	9.65489	2827.43	636173

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
901	1.10988	811801	731432701	30.0167	9.65847	2830.57	637587
902	1.10865	813604	733870808	30.0333	9.66204	2833.72	639003
903	1.10742	815409	736314327	30.0500	9.66561	2836.96	640421
904	1.10619	817216	738763264	30.0666	9.66918	2840.00	641840
905	1.10497	819025	741217625	30.0832	9.67274	2843.14	643261
906	1.10375	820836	743677416	30.0998	9.67630	2846.28	644683
907	1.10254	822649	746142643	30.1164	9.67986	2849.42	646107
908	1.10132	824464	748613312	30.1330	9.68342	2852 57	647533
909	1.10011	826281	751089429	30.1496	9.68697	2855.71	648960
910	1.09890	828100	753571000	30.1662	9.69052	2858.85	650388
911	1.09769	829921	756058031	30.1828	9.69407	2861.99	651818
912	1.09649	831744	758550528	30.1993	9.69762	2865.13	653250
913	1.09529	833569	761048497	30.2159	9.70116	2868.27	654684
914	1.09409	835396	763551944	30.2324	9.70470	2871.42	656118
915	1.09290	837225	766060875	30.2490	9.70824	2874.56	657555
916	1.09170	839056	768575296	30.2655	9.71177	2877.70	658993
917	1.09051	840889	771095213	30.2820	9.71531	2880.84	660433
918	1.08932	842724	773620632	30.2985	9.71884	2883.98	661874
919	1.08814	844561	776151559	30.3150	9.72236	2887.12	663317
920	1.08696	846400	778688000	30.3315	9.72589	2890.27	664761
921	1.08578	848241	781229961	30.3480	9.72941	2893.41	666207
922	1.08460	850084	783777448	30.3645	9.73293	2996.55	667654
923	1.08342	851929	786330467	30.3809	9.73645	2899.69	669103
924	1.08225	853776	788889024	30.3974	9.73996	2902.83	670554
925	1.08108	855625	791453125	30.4138	9.74348	2905.97	672006
926	1.07991	857476	794022776	30.4302	9.74699	2909.11	673460
927	1.07875	859329	796597983	30.4467	9.75049	2912.26	674915
928	1.07759	861184	799178752	30.4631	9.75400	2915.40	676372
929	1.07643	863041	801765089	20.4795	9.75750	2918.54	677831
930	1.07527	864900	804357000	30.4959	9.76100	2921.68	679291
931	1.07411	866761	806954491	30.5123	9.76450	2924.82	680753
932	1.07296	868624	809557568	30.5287	9.76799	2927.96	682216
933	1.07181	870489	812166237	30.5450	9.77148	2931.11	683680
934	1.07066	872356	814780504	30.5614	9.77497	2934.25	685147
935	1.06952	874225	817400375	30.5778	9.77846	2937.39	686615
936	1.06838	876096	820025856	30.5941	9.78195	2940.53	688084
937	1.06724	877969	822656953	30.6105	9.78543	2943.67	689555
938	1.06610	879844	825293672	30.6268	9.78891	2946.81	691028
939	1.06496	881721	827936019	30.6431	9.79239	2949.96	692502
940	1.06383	883600	830584000	30.6594	9.79586	2953.10	693978
941	1.06270	885481	833237621	30.6757	9.79933	2956.24	695455
942	1.06157	887364	835896888	30.6920	9.80280	2959.38	696934
943	1.06045	889249	838561807	30.7083	9.80627	2962.52	698415
944	1.05932	891136	841232384	30.7246	9.80974	2965.66	699897
945	1.05820	893025	843908625	30.7409	9.81320	2968.81	701380
946	1.05708	894916	846590536	30.7571	9.81666	2971.95	702865
947	1.05597	896809	849278123	30.7734	9.82012	2975.09	704352
948	1.05485	898704	851971392	30.7896	9.82357	2978.23	705840
949	1.05374	900601	854670349	30.8058	9.82703	2981.37	707330
950	1.05263	902500	857375000	30.8221	9.83048	2984.51	708822

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
951	1.05152	904401	860085351	30.8383	9.83392	2987.65	710315
952	1.05042	906304	862801408	30.8545	9.83737	2990.80	711810
953	1.04932	908209	865523177	30.8707	9.84081	2993.94	713306
954	1.04822	910116	868250664	30.8869	9.84425	2997.08	714803
955	1.04712	912025	870983875	30.9031	9.84769	3000.22	716303
956	1.04603	913936	873722816	30.9192	9.85113	3003.36	717804
957	1.04493	915849	876467493	30.9354	9.85456	3006.50	719306
958	1.04384	917764	879217912	30.9516	9.85799	3009.65	720810
959	1.04275	919681	881974079	30.9677	9.86142	3012.79	722316
960	1.04167	921600	884736000	30.9839	9.86485	3015.93	723823
961	1.04058	923521	887503681	31.0000	9.86827	3019.07	725332
962	1.03950	925444	890277128	31.0161	9.87169	3022.21	726842
963	1.03842	927369	893056347	31.0322	9.87511	3025.35	728354
964	1.03734	929296	895841344	31.0483	9.87853	3028.50	729867
965	1.03627	931225	898632125	31.0644	9.88195	3031.64	731382
966	1.03520	933156	901428696	31.0805	9.88536	3034.78	732899
967	1.03413	935089	904231063	31.0966	9.88877	3037.92	734417
968	1.03306	937024	907039232	31.1127	9.89217	3041.06	735937
969	1.03199	938961	909853209	31.1288	9.89558	3044.20	737458
970	1.03093	940900	912673000	31.1448	9.89898	3047.34	738981
971	1.02987	942841	915498611	31.1609	9.90235	3050.49	740506
972	1.02881	944784	918330048	31.1769	9.90578	3053.63	742032
973	1.02775	946729	921167317	31.1929	9.90918	3056.77	743559
974	1.02669	948676	924010424	31.2090	9.91257	3059.91	745088
975	1.02564	950625	926859375	31.2250	9.91596	3063.05	746619
976	1.02459	952576	929714176	31.2410	9.91935	3066.19	748151
977	1.02354	954529	932574833	31.2570	9.92274	3069.34	749685
978	1.02249	956484	935441352	31.2730	9.92612	3072.48	751221
979	1.02145	958441	938313739	31.2890	9.92950	3075.62	752758
980	1.02041	960400	941192000	31.3050	9.93288	3078.76	754296
981	1.01937	962361	944076141	31.3209	9.93626	3081.90	755837
982	1.01833	964324	946966168	31.3369	9.93964	3085.04	757378
983	1.01729	966289	949862087	31.3528	9.94301	3088.19	758922
984	1.01626	968256	952763904	31.3688	9.94638	3091.33	760466
985	1.01523	970225	955671625	31.3847	9.94975	3094.47	762013
986	1.01420	972196	958585256	31.4006	9.95311	3097.61	763561
987	1.01317	974169	961504803	31.4166	9.95648	3100.75	765111
988	1.01215	976144	964430272	31.4325	9.95984	3103.89	766662
989	1.01112	978121	967361669	31.4484	9.96320	3107.04	768214
990	1.01010	980100	970299000	31.4643	9.96655	3110.18	769769
991	1.00908	982081	973242271	31.4802	9.96991	3113.32	771325
992	1.00806	984046	976191488	31.4960	9.97326	3116.46	772882
993	1.00705	986049	979146657	31.5119	9.97661	3119.60	774441
994	1.00604	988036	982107784	31.5278	9.97996	3122.74	776002
995	1.00503	990025	985074875	31.5346	9.98331	3125.88	777564
996	1.00402	992016	988047936	31.5595	9.98665	3129.03	779128
997	1.00301	994009	991026973	31.5753	9.98999	3132.17	780693
998	1.00200	996004	994011992	31.5911	9.99333	3135.31	782260
999	1.00100	998001	997002999	31.6070	9.99667	3138.45	783828

GENERAL CHEMICAL TABLES

INTERNATIONAL ATOMIC WEIGHTS

1920

Name	Symbol	Atomic weight	Principal valence
Aluminum	Al	27.1	3
Antimony, stibium	Sb	120.2	3 or 5
Argon	A	39.9	0
Arsenic	As	74.96	3 or 5
Barium	Ba	137.37	2
Bismuth	Bi	208.0	3 or 5
Boron	B	11.0	3
Bromine	Br	79.92	1
Cadmium	Cd	112.40	2
Cæsium	Cs	132.81	1
Calcium	Ca	40.07	2
Carbon	C	12.005	**2 or 4**
Cerium	Ce	140.25	4 or 3
Chlorine	Cl	35.46	1
Chromium	Cr	52.0	2, 3 or 6
Cobalt	Co	58.97	2 or 3
Columbium, niobium	Cb	93.1	**3 or 5**
Copper	Cu	63.57	1 or 2
Dysprosium	Dy	162.5	3
Erbium	Er	167.7	3
Europium	Eu	152.0	3
Fluorine	F	19.0	1
Gadolinium	Gd	157.3	3
Gallium	Ga	70.1	3
Germanium	Ge	72.5	4
Glucinum, beryllium	Gl	9.1	2
Gold, aurum	Au	197.2	1 or 3
Helium	He	4.00	0
Holmium	Ho	163.5	3
Hydrogen	H	1.008	1
Indium	In	114.8	3
Iodine	I	126.92	1
Iridium	Ir	193.1	**3 or 4**
Iron, ferrum	Fe	55.84	2 or 3
Krypton	Kr	82.92	0
Lanthanum	La	139.0	3
Lead, plumbum	Pb	207.2	2 or 4
Lithium	Li	6.94	1
Lutecium	Lu	175.0	3
Magnesium	Mg	24.32	2
Manganese	Mn	54.93	2, 4, 6 or 7
Mercury, hydrargyrum	Hg	200.6	1 or 2
Molybdenum	Mo	96.0	3, 4 or 6
Neodymium	Nd	144.3	3
Neon	Ne	20.2	0
Nickel	Ni	58.68	2 or 3
Niton, Ra emanation	Nt	222.4	–
Nitrogen	N	14.008	3 or 5
Osmium	Os	190.9	2, 3, 4 or 8
Oxygen	O	16.00	2
Palladium	Pd	106.7	2 or 4
Phosphorus	P	31.04	3 or 5
Platinum	Pt	195.2	2 or 4
Potassium, kalium	K	39.10	1
Praseodymium	Pr	140.9	3
Radium	Ra	226.0	2
Rhodium	Rh	102.9	3
Rubidium	Rb	85.45	1
Ruthenium	Ru	101.7	**3, 4, 6 or 8**
Samarium	Sa	150.4	3
Scandium	Sc	44.1	3
Selenium	Se	79.2	2, 4 or 6
Silicon	Si	28.3	4
Silver, argentum	Ag	107.88	1
Sodium, natrium	Na	23.00	1
Strontium	Sr	87.63	2
Sulphur	S	32.06	2, 4 or 6
Tantalum	Ta	181.5	5
Tellurium	Te	127.5	2, 4 or 6
Terbium	Tb	159.2	3
Thallium	Tl	204.0	1 or 3
Thorium	Th	232.15	4
Thulium	Tm	168.5	3
Tin, stannum	Sn	118.7	2 or 4
Titanium	Ti	48.1	**3 or 4**
Tungsten, wolframium	W	184.0	6
Uranium	U	238.2	4 or 6
Vanadium	V	51.0	3 or 5
Xenon	Xe	130.2	0
Ytterbium	Yb	173.5	3
Yttrium	Yt	89.33	3
Zinc	Zn	65.37	2
Zirconium	Zr	90.6	4

MOLECULAR WEIGHTS AND THEIR LOGARITHMS

Compound	Mol. wt.	Log.	Compound	Mol. wt.	Log.
Aluminum			Hydrogen		
Al_2O_3	102.20	2.00945	H_2O	18.016	1.25565
$Al_2(OH)_6$	156.25	2.19381	Iodine		
Antimony			AgI	234.80	2.37070
Sb_2S_5	400.70	2.60382	HI	127.93	2.10697
Sb_2S_3	336.58	2.52609	PbI_2	461.04	2.66374
Sb_2O_3	288.40	2.46000	Iron		
Sb_2O_5	320.40	2.50569	FeO	71.84	1.85637
Arsenic			Fe_2O_3	159.68	2.20325
$Mg_2As_2O_7$	310.56	2.49214	Lead		
$(MgNH_4AsO_4)_2.$			$PbSO_4$	303.26	2.48182
H_2O	380.66	2.58054	PbS	239.26	2.37887
As_2S_5	310.22	2.49167	PbO	223.00	2.34830
As_2S_3	246.10	2.39111	$PbCl_2$	278.12	2.44423
As_2O_3	197.92	2.29649	$PbCrO_4$	323.20	2.50947
As_2O_5	229.92	2.36157	Lithium		
Barium			$LiCl$	42.40	1.62737
$BaSO_4$	233.43	2.36816	Li_2SO_4	109.94	2.04116
BaO	153.37	2.18574	Li_2O	29.88	1.47538
$BaCO_3$	197.37	2.29528	Li_2CO_3	73.88	1.86853
$BaCrO_4$	253.37	2.40374	Li_3PO_4	116.09	2.06479
Bismuth			Magnesium		
Bi_2O_3	464.00	2.66652	$Mg_2P_2O_7$	222.72	2.34772
Bi_2S_3	512.18	2.70942	MgO	40.32	1.60556
$BiOCl$	259.46	2.41407	$Mg(NH_4)AsO_4 +$		
Bromine			$6H_2O$	289.42	2.46153
$AgBr$	187.80	2.27370	$Mg_2As_2O_7$	310.56	2.49214
HBr	80.93	1.90811	$MgSO_4$	120.38	2.08055
Cadmium			Manganese		
CdS	144.45	2.15972	$MnSO_4$	150.99	2.17895
CdO	128.40	2.10857	MnS	86.99	1.93947
Calcium			Mn_3O_4	228.79	2.35944
CaO	56.07	1.74873	Mn_2O_3	157.86	2.19828
$CaSO_4$	136.13	2.13395	MnO	70.93	1.85083
$CaCO_3$	100.07	2.00030	$KMnO_4$	158.03	2.19874
Carbon			Mercury		
CO_2	44.00	1.64345	HgS	232.66	2.36672
CN	26.01	1.41514	HgO	216.60	2.33566
CO	28.00	1.44716	Hg_2O	417.20	2.62034
HCN	27.02	1.43169	Hg_2Cl_2	472.12	2.67405
Chlorine			Nickel		
$AgCl$	143.34	2.15637	NiO	74.68	1.87320
HCl	36.47	1.56194	$NiSO_4$	154.74	2.18960
Chromium			Nitrogen		
Cr_2O_3	152.00	2.18184	N_2O_5	108.02	2.03350
CrO_3	100.00	2.00000	N_2O_3	76.02	1.88093
$PbCrO_4$	323.10	2.50934	$(NH_4)Cl$	53.50	1.72835
$BaCrO_4$	253.37	2.40374	$(NH_4)_2SO_4$	132.14	2.12103
Cobalt			Phosphorus		
CoO	74.97	1.87489	$Mg_2P_2O_7$	222.72	2.34776
Co_3O_4	240.91	2.38186	$Ag_4P_2O_7$	605.60	2.78219
$K_3Co(NO_2)_6$	452.33	2.65546	P_2O_5	142.08	2.15253
Copper			PH_3	34.06	1.53225
CuO	79.57	1.90075	Ag_3PO_4	418.68	2.62188
Cu_2S	159.20	2.20194	Platinum		
Fluorine			K_2PtCl_6	486.16	2.68678
CaF_2	78.07	1.89248	$(NH_4)_2PtCl_6$	444.04	2.64742
HF	20.008	1.30121	Potassium		
$BaSiF_6$	279.67	2.44665	KCl	74.56	1.87251
K_2SiF_6	220.50	2.34341	K_2SO_4	174.26	2.24120
H_2SiF_6	144.32	2.15932	K_2PtCl_6	486.16	2.68678

MOLECULAR WEIGHTS AND THEIR LOGARITHMS (Cont.)

Compound	Mol. wt.	Log.	Compound	Mol. wt.	Log.
Potassium (*Cont.*)			Strontium		
K_2O	94.20	1.97405	$SrSO_4$	183.69	2.26409
K_2SiF_6	220.50	2.34341	$SrCO_3$	147.63	2.16917
Silicon			SrO	103.63	2.01550
SiO_2	60.30	1.78032	Sulphur		
SiF_4	104.30	2.01828	As_2S_3	246.10	2.39111
H_2SiF_6	144.32	2.15932	CdS	144.46	2.15975
K_2SiF_6	220.50	2.34341	H_2S	34.08	1.53250
$BaSiF_6$	279.67	2.44665	SO_2	64.06	1.80659
Silver			SO_3	80.06	1.90342
Ag_2O	231.76	2.36504	H_2SO_4	98.08	1.99158
$AgBr$	187.80	2.27370	Tin		
$AgCl$	143.34	2.15637	SnO_2	151.00	2.17898
AgI	234.80	2.37070	SnO	135.00	2.13033
$AgCN$	133.89	2.12675	Zinc		
Ag_3PO_4	418.68	2.62188	ZnS	97.43	1.98869
Sodium			ZnO	81.37	1.91046
$NaCl$	58.46	1.76686			
Na_2SO_4	142.06	2.15247			
Na_2CO_3	106.00	2.02531			
Na_2O	62.00	1.79239			

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS

Composition	Name	Sp. gr.	Thermal expansion coefficient	Melting-point °C.
Aluminum				
97Al, 3Cu	....	....	24×10^{-6}	640
90Al, 10Mg	Magnalium	2.50	24	608
70Al, 30Mg	Magnalium	2.00	....	....
91Al, 9Zn	....	2.80	....	....
70Al, 30Zn	....	....	....	600
Bismuth				
52.5Bi, 32Pb, 15.5Sn	....	....	....	96
50Bi, 27Pb, 13Sn, 10Cd	Lipowitz' alloy	....	....	65
50Bi, 25Pb, 12.5Sn, 12.5Cd	Wood's metal	9.70	....	65.5
50Bi, 27.1Pb, 22.9Sn	Rose metal	....	....	....
40Bi, 40Pb, 20Sn	Bismuth solder	....	....	111
Copper				
90Cu, 10Al	Aluminum bronze	7.6	16.5	1050
77Cu, 15Pb, 8Sn	"B" Alloy, P.R.R.	....	....	....
95Cu, 5Mn	Manganese bronze	8.8	....	1060
82Cu, 15Mn, 3Ni	Manganin	8.5	....	....
80Cu, 20Ni	Nickeline	8.5	....	1190
60Cu, 40Ni	Constantan	8.4	....	1290
90Cu, 10Sn	Bronze, gun metal	8.8	18	1010
78Cu, 22Sn	Bell metal	8.7	....	890
67Cu, 33Sn	Bronze, speculum metal	8.6	18.6	750
95Cu, 4Sn, 1Zn	Bronze coins	8.96	....	....
82Cu, 16Sn, 2Zn	Bronze bearings	....	....	....
79.7Cu, 10Sn, 9.5Sb, 0.8P	Phosphor bronze	8.8	....	....
90Cu, 10Zn	Red brass	8.60	....	....
67Cu, 33Zn	Brass, ordinary yellow	8.40	18.5	940
60Cu, 40Zn	Muntz metal	....	....	....
55Cu, 45Zn	For brazing	....	....	880
61.2Cu, 37.3Zn, 0.9Sn, 0.4Pb, 0.2Fe	Tobin bronze	....	....	....
52Cu, 26Zn, 22Ni	German silver	8.45	....	....
60Cu, 25Zn, 15Ni	German silver	....	18.4	....
Iridium				
95Ir, 5Pt	....	22.38	....	....
Iron				
80Fe, 20Al	Ferro-aluminum	6.30	....	1480
97Fe, 3C	Cast iron, white	7.60	....	1150
94Fe, 3.5C, 2.5Si	Cast iron, gray	7.0	11.2	1230
99Fe, 1C	Steel	7.83	12.0	1430
50Fe, 50Cr	Ferro-chromium	6.9	....	1458
50Fe, 50Mn	Ferro-manganese	....	....	1325
86Fe, 13Mn, 1C	Manganese steel	7.81	....	1510
96.5Fe, 3.5Ni	Nickel steel	....	....	....
74.2Fe, 25Ni, 0.8C	Ferro-nickel	8.1	18	1500
67.8Fe, 32Ni, 0.2C	Ferro-nickel, valve steel	8.0	4	1480
63.8Fe, 36Ni, 0.2C	Invar	8.0	0.8	1497
53.85Fe, 46Ni, 0.15C	Platinite	8.2	7.5	1470
95.1Fe, 3Ni, 1.5Cr. 0.4C	Nickel-chrome steel	....	....	....
97.6Fe, 2Si, 0.4C	Silicon steel	....	....	....
94.5Fe, 5W, 0.5C	Tungsten steel	....	....	....
75Fe, 18W, 6Cr, 0.3Va, 0.7C	High speed steel	....	....	....
Gold				
90Au, 10Cu	Coinage	17.17	....	940
84Au, 16Cu	Jewelry	....	....	....
75Au, 24Cu	Jewelry	....	....	....

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (Continued)

Composition.	Name.	Specific gravity.	Thermal expansion coefficient.	Melting point °C.
Lead				
90Pb, 10Sb	Magnolia	....	....	.....
85Pb, 15Sb	....	10.4	19.5	230
82Pb, 15Sb, 3Sn	Type metal	....	....	.....
67Pb, 33Sn	Solder	9.4	25.0	240
75Pb, 5Sn, 19Sb, 1Cu	White metal	9.5	....	238
84.33Pb, 14.38Sb, 0.61Fe, 0.68Zn	Carbox metal	....	....	.....
Mercury				
80Hg, 20Bi	Bismuth amalgam	....	....	.....
70Hg, 30Cu	Dentists' amalgam	....	....	.....
Platinum				
90Pt, 10Ir	Platinum-iridium	21.61	8.8	.....
90Pt, 10Rh	Platinum-rhodium	....	....	.....
Silver				
90Ag, 10Cu	Coinage	10.3	....	875
80Ag, 20Cu	Jewelry	....	....	.....
Tin				
90Sn, 10Sb	Britannia	....	....	260
80Sn, 20Sb	....	....	....	.....
90Sn, 7Sb, 3Cu	Babbitt	....	....	.....
75Sn, 12.5Sb, 12.5Cu	Antifriction	7.53	....	233
97Sn, 3Cu	Rhine metal	7.35	....	300
68Sn, 32Cd	....	7.70	....	.....
82Sn, 12Sb, 6Cu	White metal	....	....	.....
Zinc				
95Zn, 5Al	....	2.80	....	.....

PHYSICAL CONSTANTS OF

No.	Name.	Derivation.	Symbol.	At. wt.	Specific gravity.*	Principal valence.
1	Aluminum	L. *alumen*, alum	Al	27.1	2.70 20° C.	3
2	Antimony	L. *antimonium*	Sb	120.2	6.62 20°	3 or 5
3	Argon, gas	Gr. *argos*, inactive	A	39.88	1.38 A	0
4	liquid		A	39.88	1.405-186°	0
5	Arsenic, cryst.	L. *arsenicum*	As	74.96	5.73	3 or 5
6	amorph.		As	74.96	4.72 14°	3 or 5
7	Barium	Gr. *barys*, heavy	Ba	137.37	3.80 0°	2
8	Bismuth	Unknown	Bi	208.0	9.78 20°	3 or 5
9	Boron, amor.	*Borax*	B	11.0	2.45	3
10	crystal		B	11.0	2.54	3
11	Bromine, gas	Gr. *bromos*, stench	Br	79.92	5.87 A60°	1
12	liquid		Br	79.92	3.12 20°	1
13	Cadmium	Gr. *kadmia*, calamine	Cd	112.4	8.65 20°	2
14	Caesium	L. *caesius*, sky blue	Cs	132.81	1.87 26°	1
15	Calcium	L. *calx*, lime	Ca	40.07	1.54 29°	2
16	Carbon, amor.	L. *carbo*, charcoal	C	12.0	1.88	2 or 4
17	graphite		C	12.0	2.25	2 or 4
18	diamond		C	12.0	3.51	2 or 4
19	Cerium	Planet *Ceres*	Ce	140.25	6.92 25°	3 or 4
20	Chlorine, gas	Gr. *chloros*, green	Cl	35.46	2.49 A	1
21	liquid		Cl	35.46	1.51-34°	1
22	Chromium	Gr. *chroma*, color	Cr	52.0	6.92 20°	2, 3 or 6
23	Cobalt	G. *kobold*, goblin	Co	58.97	8.72 21°	2 or 3
24	Columbium, niobium	*Columbia*,	Cb	93.1	8.4	3 or 5
25	Copper	*Cyprus*	Cu	63.57	8.93-8.95	1 or 2
26	Dysprosium	Gr. hard to speak with	Dy	162.5	....	3
27	Erbium	*Yrtterby*, town in Sweden	Er	167.7	4.77	3
28	Europium	*Europe*	Eu	152.0	....	3
29	Fluorine, gas	L *fluor*, flow	F	19.0	1.31 A	1
30	liquid		F	19.0	1.14-200°	1
31	Gadolinium	*Gadolin*, a Russian	Gd	157.3	1.31	3
32	Gallium	L. *Gallia*, France	Ga	69.9	5.94 23°	3
33	Germanium	L. *Germania*, Germany	Ge	72.5	5.47 20°	4
34	Glucinum, beryllium	Gr. *glykys*, sweet	Gl	9.1	1.85	2
35	Gold	Anglo-Saxon, *gold*	Au	197.2	19.32 17.5°	1 or 3

* Specific gravities marked A are referred to air.

THE ELEMENTS

No.	Melting point °C.	Boiling point °C.	Discovered.	Discoverer.	Where found.
1	658	1800	1828	Wohler	In many rocks. Most abundant metal.
2	630	1440	1450	Valentine	Chiefly as sulphide and in various metallic ores.
3	−189	−186.1	1894	Rayleigh	Rare element in air.
4	....	....	....	....	....
5	sub.†	450	1694	Schroder	As sulphide and in metallic ores.
6	....	....	....	....	....
7	850	950	1808	Davy	In barite and witherite.
8	269.2	1436	1450	Valentine	As sulphide and in rare minerals.
9	2000–2500	subl. 3500	1808	Davy	In borax and some minerals.
10	....	....	....	....	....
11	−7.3	58.7	1828	Balard	In sea water and natural brines.
12	....	....	....	....	....
13	320	778	1817	Stromeyer	In zinc ores.
14	26.4	670	1860	Bunsen	In lepidolite, pollucite, and some mineral springs.
15	805	....	1808	Davy	In limestone and other rocks.
16	>3500	subl. 3500	Pre	historic	In coal, limestone and all organic matter.
17	....	....	....	....	....
18	....	....	....	....	....
19	623	....	1803	Berzelius	In cerite and rare minerals.
20	−102	−33.6	1774	Scheele	In common salt and other chlorides.
21	....	....	....	....	....
22	1505	2200	1797	Vauquelin	In chrome-iron ore.
23	1490	....	1773	Brandt	In many metallic ores.
24	1950	....	1801	Hatchett	In columbite and rare minerals.
25	1083	2310	Pre	historic	As metal and in many ores.
26	....	....	1886	Lecoq de Boisbaudran	In holmium, samarskite, gadolinite, etc.
27	....	....	1843	Mosander	In gadolinite and rare minerals.
28	....	....	1896	Demarcay	....
29	−223	−187	1771	Scheele	In fluorite and other minerals.
30	....	....	....	....	....
31	....	....	1886	Marignac	In rare minerals as gadolinite.
32	30.1	....	1875	Boisbaudran	In certain zinc blendes.
33	958	volat. at 1350	1886	Winkler	In argyrodite, a rare mineral.
34	960	....	1828	Wohler	In beryl and several rare minerals.
35	1065.6	2500	Pre	historic	Generally free; rarely combined in various ores.

† Melts at 500° C. under pressure.

PHYSICAL CONSTANTS OF

No.	Name.	Derivation.	Symbol.	At. wt.	Specific gravity.	Principal valence.
1	Helium, gas..	Gr. *helios*, the sun....	He	4.00	0.137 A	0
2	liquid......	....	He	4.00	0.15–269°	0
3	Hydrogen, gas	Gr. *hydro*, water, and *genes*, forming	H	1.008	0.0695 A	1
4	liquid......	....	H	1.008	0.070–252°	1
5	Indium......	From its *indigo* spectrum	In	114.8	7.12 13°	3
6	Iodine, gas...	Gr. *iodes*, violet......	I	126.92	8.72 A	1
7	solid.......	....	I	126.92	4.94 20°	1
8	Iridium......	L. *iris*, rainbow......	Ir	193.1	22.42 17°	3 or 4
9	Iron, pure....	Anglo-Saxon, *iron*.....	Fe	55.84	7.85–7.88	2 or 3
10	Krypton, gas	Gr. *Kryptos*, hidden..	Kr	82.92	2.818 A	0
11	liquid......	....	Kr	82.92	2.16–146°	0
12	Lanthanum..	Gr. *lanthano*, to conceal	La	139.0	6.155	3
13	Lead.........	Anglo-Saxon, *lead*.....	Pb	207.2	11.34	2 or 4
14	Lithium.....	Gr. *lithos*, stone......	Li	6.94	0.534	1
15	Lutecium....	*Lutetia*, ancient name of Paris	Lu	175.0	....	3
16	Magnesium...	*Magnesia*, district in Thessaly	Mg	24.32	1.74 5°	2
17	Manganese...	L. *magnes*, magnet....	Mn	54.93	7.42	2, 4, 6 or 7
18	Mercury.....	Planet *Mercury*.......	Hg	200.6	13.595 4°	1 or 2
19	Molybdenum	Gr. *molybdos*, lead....	Mo	96.0	9.01	3, 4 or 6
20	Neodymium.	Gr. *neos*, new and *didymos*, twin	Nd	144.3	6.95	3
21	Neon........	Gr. *neos*, new.........	Ne	20.2	0.674 A	0
22	Nickel......	Sw. abbr. of kupparnickel	Ni	58.68	8.60–8.90	2 or 3
23	Nitrogen, gas	N. L., niter forming..	N	14.01	0.967 A	3 or 5
24	liquid......	....	N	14.01	0.854–205°	3 or 5
25	Osmium.....	Gr. *osme*, odor.......	Os	190.9	22.48	2, 3, 4 or 8
26	Oxygen, gas..	Gr. acid former......	O	16.0	1.1053 A	2
27	liquid......	....	O	16.0	1.14–184°	2
28	Palladium....	Planet *Pallas*.........	Pd	106.7	12.16	2 or 4
29	Phosphorus, yellow	Gr. light bearing.....	P	31.04	1.83	3 or 5
30	red.........	....	P	31.04	2.20	3 or 5
31	Platinum....	Sp. *platina*...........	Pt	195.2	21.37	2 or 4
32	Potassium....	Eng. *potash*...........	K	39.10	0.870 20°	1

THE ELEMENTS (Continued)

No.	Melting point °C.	Boiling point °C.	Dis-cov-ered.	Discoverer.	Where found.
1	−272	−268.8	1895	Ramsey and Travers	Rare element in the air and in the sun.
2	....	....	....	....	....
3	−259	−252.8	1766	Cavendish	Mainly in water and organic substances.
4	....	....	....	....	....
5	155	red heat	1863	Reich and Richter	In certain zinc ores.
6	112–115	184	1811	Courtois	Mainly in ashes of seaweeds.
7	....	....	....	....	....
8	2360	....	1803	Tennant	In iridosmine.
9	1505	2450	Pre	historic	As oxide and sulphide in nearly all rocks.
10	−169	−151.7	1895	Ramsey and Travers	Rare element in air.
11	....	....	....	....	....
12	810	....	1839	Mosander	In cerite and other rare minerals.
13	327	1525	Pre	historic	In galena and other ores.
14	186	1400	1817	Arfvedson	In lepidolite, spodumene and other rare minerals.
15	....	....	1907	Urbain and Welsbach	In samarskite and gadolinite.
16	651	1120	1829	Bussy	In sea water, magnesite and other minerals.
17	1207	....	1774	Gahn	In pyrolusite and other minerals.
18	−38.85	357.25	Pre	historic	Native and in cinnabar.
19	2535	....	1782	Hjelm	Chiefly in molybdenite.
20	840	....	1885	Welsbach	In cerite and other rare minerals.
21	−253	−239	1895	Ramsey and Travers	Rare gas in air.
22	1452	....	1751	Cronstedt	Many metallic ores.
23	−210.5	−195	1772	Rutherford	In air and organic matter.
24	....	....	....	....	....
25	2700	white heat	1803	Tennant	In iridosmine and native platinum.
26	−227	−182.7	1774	Priestley	In air and forms about one half the earth's crust combined in rocks, etc.
27	....	....	....	....	....
28	1542	....	1804	Wollaston	Native and in platinum and gold ores.
29	44.2	290	1669	Brandt	In bones and apatite and many minerals.
30	....	....	....	....	....
31	1755	....	1741	Wood	As native platinum.
32	62.5	712	1807	Davy	In wood ashes and many rocks.

PHYSICAL CONSTANTS OF

No.	Name.	Derivation.	Symbol.	At. wt.	Specific gravity.	Principal valence.
1	Praseodymium	Gr. *praseos*, green, and *didymos*, twin	Pr	140.9	6.48	3
2	Radium	L. *radius*, ray	Ra	226.0	....	2
3	Rhodium	Gr. *rhodon*, rose	Rh	102.9	12.44	3
4	Rubidium	L. *rubidius*, red	Rb	85.45	1.52	1
5	Ruthenium	*Ruthenia*, Russia	Ru	101.7	12.06	3, 4, 6 or 8
6	Samarium	*Samarski*, a Russian	Sm	150.4	7.7–7.8	3
7	Scandium	*Scandinavia*	Sc	44.1	....	3
8	Selenium	Gr. *selene*, moon	Se	79.2	4.47–4.80	2, 4 or 6
9	Silicon	L. *silex*, flint	Si	28.3	2.42 cryst.	4
10	Silver	Anglo-Saxon, *soelfor*	Ag	107.88	10.50	1
11	Sodium	English, *soda*	Na	23.00	0.971	1
12	Strontium	*Strontian*, town in Scotland	Sr	87.63	2.54	2
13	Sulphur, amorphous.	L. *sulfur*	S	32.06	2.046	2, 4 or 6
14	rhombic	....	S	32.06	2.07	2, 4 or 6
15	monoclinic.	....	S	32.06	1.957	2, 4 or 6
16	Tantalum	Gr. *tantalus*, myth	Ta	181.5	16.6	5
17	Tellurium	L. *tellus*, earth	Te	127.5	6.25	4 or 6
18	Terbium	*Ytterby*, town in Sweden	Tb	159.2	....	3
19	Thallium	Gr. *thallos*, budding twig	Tl	204.0	11.85	1 or 3
20	Thorium	God *Thor*	Th	232.4	11.2	4
21	Thulium	*Thule*, Northland	Tm	168.5	....	....
22	Tin, gray	Anglo-Saxon, *tin*	Sn	118.7	5.85 15°	2 or 4
23	rhombic	....	Sn	119.0	6.55	2 or 4
24	tetragonal	....	Sn	119.0	7.298 15°	2 or 4
25	Titanium	L. *Titanes*, sons of the earth	Ti	48.1	4.5	3 or 4
26	Tungsten, wolframium	Sw. heavy stone	W	184.0	18.7	6
27	Uranium	Planet *Uranus*	U	238.2	18.68	4 or 6
28	Vanadium	Goddess *Vanadis*	V	51.0	5.69	3 or 5
29	Xenon, gas	Gr. *xenos*, strange	Xe	130.2	4.422	0
30	liquid	....	Xe	130.2	3.52	0
31	Ytterbium	*Ytterby*, town in Sweden	Yb	173.5	....	3
32	Yttrium	*Ytterby*	Y	88.7	3.80	3
33	Zinc	G. *Zink*	Zn	65.37	7.00–7.19	2
34	Zirconium	Per. *argun*, gold-color	Zr	90.6	4.15 amor.	4

THE ELEMENTS (Continued)

No.	Melting point °C.	Boiling point °C.	Discovered.	Discoverer.	Where found.
1	940	....	1885	Welsbach	In cerite and other rare minerals.
2	700	....	1903	Mme. Curie	In pitchblende.
3	1970	....	1804	Wollaston	With platinum and iridosmine.
4	38.5	696	1860	Bunsen	In lepidolite and some mineral springs.
5	2000	....	1845	Claus	With platinum and iridosmine.
6	1300–1400	....	1879	Boisbaudran	In samarskite, cerite and other rare minerals.
7	1350	....	1879	Nilson	In gadolinite and other rare minerals.
8	217	690	1817	Berzelius	Mainly as impurity in sulphur.
9	1420	3500	1823	Berzelius	In quartz, most abundant after oxygen.
10	961	1955	Pre	historic	Native and in many ores.
11	97	750	1807	Davy	In common salt, sea water and many rocks.
12	900	white heat	1808	Davy	In strontianite and rare minerals.
13	120	444.7	Pre	historic	Native and in many sulphides and sulphates.
14	114.5	444.7	....	....	....
15	119.3	444.7	....	....	....
16	2850	....	1802	Ekeberg	In tantalite and other rare minerals.
17	451	1390	1782	Reichenstein	In several rare minerals.
18	....	....	1843	Mosander	In gadolinite.
19	301.7	1280	1862	Crookes	In pyrites and flue dust of sulphuric acid works.
20	1700	....	1828	Berzelius	In thorite and other rare minerals.
21	....	....	1879	Cleve	In gadolinite.
22	231.9	2270	Pre	historic	In cassiterite (SnO_2).
23	....	....	....	....	....
24	....	....	....	....	....
25	1800–1850	....	1789	Gregor	In rocks and clays in small amounts.
26	3350	....	1781	d'Elhujar	In wolframite.
27	Near Mo	....	1789	Klaproth	In pitchblende and other rare minerals.
28	1710	....	1830	Sefström	In vanadinite and other minerals.
29	−140	−109	1895	Ramsey and Travers	Rare element in air.
30	....	....	....	....	....
31	....	....	1878	Marignac	In gadolinite and other rare minerals.
32	....	....	1828	Wohler	In gadolinite and other rare minerals.
33	419.4	918	1520	Paracelsus	In ores as oxide, carbonate, sulphide and silicate.
34	2350	....	1824	Berzelius	In zircon and other rare minerals.

PHYSICAL CONSTANTS OF

The following table gives data for about one thousand compounds. It is believed that the list covered is sufficiently complete to more than meet the needs of the high school or college laboratory and is intended to include all inorganic compounds which are commercially obtainable. Certain rare substances, especially those for which practically no data are obtainable, are intentionally omitted.

Specific gravities are given at definite temperatures where possible, the temperature in degrees Centigrade being indicated by the small figure appearing in the position of an exponent. Unless otherwise indicated the figures are referred to water at 4° C. The figures $5.63^{20°}_{15}$ indicate a specific gravity of 5.63 at 20° C. referred to water at 15° C.

	Name.	Formula.	Mol. wt.	Crystalline form and color.
1	Acetic acid	$HC_2H_3O_2$	60.03	
2	Aluminum	Al	27.1	regular, bluish white.
3	acetate, normal	$Al(C_2H_3O_2)_3$	204.17	
4	arsenate	$AlAsO_4$	166.02	
5	bromide	$AlBr_3.6H_2O$	374.96	colorless
6	carbide	Al_4C_3	144.4	
7	chloride	$AlCl_3$	133.48	
8	chloride	$AlCl_3.6H_2O$	241.54	white
9	fluoride	AlF_3	84.1	
10	hydroxide	$Al(OH)_3$	72.2	amorphous, white
11	iodide	AlI_3	407.86	
12	iodide	$AlI_3.6H_2O$	515.9	white
13	nitrate	$Al(NO_3)_3.9H_2O$	375.27	rhombic
14	oxide	Al_2O_3	102.2	hexagonal, amorphous
15	phosphate	$AlPO_4$	122.1	hexagonal, amorphous
16	sulphate	$Al_2(SO_4)_3$	342.4	white
17	sulphate	$Al_2(SO_4)_3.18H_2O$	666.7	monoclinic, colorless.
18	sulphide	Al_2S_3	150.4	yellow crystals
19	Alum, ammonium	$Al_2(SO_4)_3.(NH_4)_2SO_4.24H_2O$	906.9	regular
20	ammonium, chrome	$Cr_2(SO_4)_3.(NH_4)_2SO_4.24H_2O$	956.7	regular, green or violet
21	ammonium, iron	$Fe_2(SO_4)_3.(NH_4)_2SO_4.24H_2O$	964.4	regular
22	potassium	$Al_2(SO_4)_3.K_2SO_4.24H_2O$.	949	regular
23	potassium, chrome	$Cr_2(SO_4)_3.K_2SO_4.24H_2O$.	998.9	regular, green
24	potassium, iron	$Fe_2(SO_4)_3.K_2SO_4.24H_2O$.	1006.5	regular, violet
25	potassium, manganese	$Mn_2(SO_4)_3.K_2SO_4.24H_2O$	1004.7	regular, violet
26	sodium	$Al_2(SO_4)_3.Na_2SO_4.24H_2O$	916.9	regular
27	Ammonia	NH_3	17	
28	Ammonium acetate	$NH_4C_2H_3O_2$	77.1	
29	arsenate	$(NH_4)_3AsO_4.3H_2O$	247.2	
30	arsenite	NH_4AsO_2	125	prisms
31	benzoate	$NH_4C_7H_5O_2$	139.1	crystals
32	bromide	NH_4Br	98	regular
33	carbonate	$(NH_4)_2CO_3.H_2O$	114.1	plates
34	carbonate, acid	NH_4HCO_3	79.1	rhombic or monoclinic
35	carbonate, carbamate.	$NH_4HCO_3.NH_4CO_2.NH_2$	157.1	

INORGANIC COMPOUNDS

In all cases where temperatures are not stated ordinary room temperature may be understood (15–25° C.).

Boiling points are given at atmospheric pressure unless otherwise indicated.

Solubilities have been given in definite figures and temperatures stated, where possible, in the same form as for specific gravity.

The following abbreviations are employed: — a., acid; al., alcohol; alk., alkalies; appr., approximately; aq. rg., aqua regia; atm., atmospheres; conc., concentrated; decomp., decomposes; dil., dilute; i., insoluble; s., soluble; ∞, soluble in all proportions; sl. s., slightly soluble; subl., sublimes; v. s., very soluble; vol., volume.

	Sp. gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water.	Hot water.	Alcohol, acids, etc.
1	$1.0607^{15°}_{4}$	17	118	∞	∞	s. al.
2	2.71	658.	1800	i.	i.	s. alk.; s. HCl, H_2SO_4
3	....	decomp.	....	s.	decomp.	
4	....	....	....	i.	i.	sl. s. a.
5	....	....	....	v. s.	v. s.	s. al., CS_2
6	2.36	....	....	decomp.	....	s. a.
7	....	190, 2½ at.	180.7^{752} mm.	$69.87^{15°}$	....	s. $CHCl_3$, CCl_4, ether, CS_2
8	....	....	....	40	v. s.	s. ether, al.
9	3.1	....	....	i.	i.	i. a., al., alk.
10	2.3	....	....	i.	i.	s. a., alk.
11	2.63	180	360	....	....	....
12	....	....	....	v. s.	v. s.	s. al., CS_2
13	....	73	decomp. 134	v. s.	v. s.	s. al., alk.
14	3.75–4	....	....	i.	i.	s. conc. H_2SO_4; alk., HCl
15	....	....	....	i.	i.	s. a., alk.
16	2.59	decomp.	....	$36.1^{20°}$	$89.1^{100°}$	
17	1.62	decomp.	....	$86.8^{50°}$	$1132^{100°}$	sl. s. al.
18	$2.02^{13°}_{4}$	1100	....	decomp.	....	s. a.
19	$1.645^{20°}_{4}$	94.5	....	$3.9^{0°}$	$357^{100°}$	i. al.
20	1.719	....	....	$3.95^{0°}$	$15^{15°}$	s. al.
21	1.712	....	....	$40^{15°}$	400	i. al.
22	$1.757^{20°}_{4}$	84.5	....	$5.2^{0°}$	$422^{100°}$	
23	$1.812^{70°}$	89	....	20	50	i. al.
24	1.806	....	....	$20^{12.5°}$	v. s.	i. al.
25	....	....	....	decomp.	s.	
26	$1.675^{20°}_{4}$	61	....	$103.1^{10°}$	$146.3^{30°}$	i. al.
27	0.597 A; $0.6234^{0°}$ lq.	−77	−38.5	$89.9^{0°}$ g.; 104.960 c.c.	$7.4^{100°}$ g.; $58594^{25°}$ c.c.	
28	....	89	....	$148^{4°}$		
29	....	....	....	s.		
30	....	....	....	v. s.	....	s. alk.
31	....	decomp. 193.5	....	$952^{25°}$	$83.3^{100°}$	s. al.
32	$2.327^{15°}_{4}$	subl.	....	$66.2^{10°}$	$128.2^{100°}$	s. al., ether
33	....	decomp. 85°	....	$100^{15°}$	....	i. al.
34	1.586	decomp. 36–60	....	$11.9^{0°}$	$27^{30°}$	i. al.
35	....	subl.	....	$25^{15°}$	$67^{65°}$	. .

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Ammonium chloride...	NH_4Cl...............	53.5	regular or tetragonal.
2	chloroplatinate......	$(NH_4)_2.PtCl_6$.........	444	yellow, regular......
3	chromate...........	$(NH_4)_2CrO_4$..........	152.1	monoclinic, yellow..
4	citrate..............	$(NH_4)_3C_6H_5O_7$........	243.2	white powder.......
5	cyanate............	NH_4CNO............	60.1	....
6	cyanide............	NH_4CN..............	44.1	regular.............
7	dichromate..........	$(NH_4)_2Cr_2O_7$..........	152.1	monoclinic, yellow or red
8	fluoride............	NH_4F................	37	hexagonal..........
9	iodide..............	NH_4I................	145	regular.............
10	magnesium arsenate..	$MgNH_4AsO_4.6H_2O$....	289.4	tetragonal..........
11	magnesium phosphate	$MgNH_4PO_4.6H_2O$.....	245.6	tetragonal..........
12	molybdate..........	$(NH_4)_2MoO_4$..........	196.1	monoclinic..........
13	nitrate.............	NH_4NO_3............	80.1	tetragonal.........
14	nitrite.............	NH_4NO_2	64.1	....
15	oxalate.............	$(NH_4)_2C_2O_4.H_2O$......	142.1	prisms, trimetric....
16	perchlorate..........	NH_4ClO_4............	117.5	rhombic............
17	permanganate.......	NH_4MnO_4	137	rhombic............
18	persulphate.........	$(NH_4)_2S_2O_8$..........	228.2	monoclinic..........
19	phospate, di-........	$(NH_4)_2HPO_4$..........	132.2	monoclinic, colorless.
20	phosphate, mono-....	$NH_4H_2PO_4$..........	115.1	tetragonal..........
21	phosphomolybdate...	$(NH_4)_3PO_4.12MoO_3.3H_2O$	1931.2	yellow............
22	salicylate..........	$NH_4C_7H_5O_3$..........	155.1	monocl.............
23	sulphate...........	$(NH_4)_2SO_4$...........	132.2	rhombic, colorless ...
25	sulphide...........	$(NH_4)_2S$.............	68.2	....
24	sulphite...........	$(NH_4)_2SO_3.H_2O$.......	134.2	monoclinic.........
26	sulphydrate.........	NH_4HS..............	51.1	rhombic, colorless ...
27	sulphocyanate.......	NH_4CNS............	76.1	monoclinic, colorless.
28	tartrate............	$(NH_4)_2C_4H_4O_6$........	184.1	colorl. monocl.......
29	Antimonic acid......	H_3SbO_4.............	187.2	....
30	Antimonous acid.....	H_3SbO_3.............	171.2	....
31	Antimony..........	Sb..................	120.2	rhombohedric, white.
32	bromide...........	$SbBr_3$................	360	rhombic...........
33	chloride, tri-........	$SbCl_3$................	226.6	rhombic
34	chloride, penta-......	$SbCl_5$................	295.5	....
35	hydride............	SbH_3................	123.2	....
36	iodide, tri-..........	SbI_3.................	501	hexagonal or rhombic or monoclinic
37	oxide, tri-..........	Sb_2O_3...............	288.4	rhombic...........
38	oxide, tetr-.........	Sb_2O_4...............	304.2	white.............
39	oxide, penta-........	Sb_2O_5...............	320.4	yellow............
40	oxychloride (ous)....	$SbOCl$...............	171.7	regular, white.......
41	oxychloride (ic)......	$SbOCl_3$..............	242.6	yellow............
42	sulphate...........	$Sb_2(SO_4)_3$...........	528.4	....
43	sulphide, tri-	Sb_2S_3...............	336.6	hexagonal black.....
44	sulphide, penta-.....	Sb_2S_5...............	400.8	orange............

INORGANIC COMPOUNDS (Continued)

	Sp. gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water.	Hot water.	Alcohol, acids, etc.
1	1.52	....	....	$29.4^{0°}$	$77.3^{100°}$	sl. s. al., NH_3, methyl. al.
2	$3.034^{24°}_{4}$	decomp.	....	$0.67^{20°}$	$1.25^{100°}$	al. 0.005
3	1.866	decomp. 180°	....	$40^{30°}$	decomp.	
4	....	....	....	s., deliq.		
5	....	....	....	s.	decomp.	sl. s. al.
6	....	decomp. 36	....	s.	v. s.	s. al.
7	2.367	decomp.	....	$47.1^{30°}$	v. s.	
8	....	....	....	v. s.	decomp.	sl. s. al.
9	2.515	subl.	....	v. s.	v. s.	v. s. al.
10	....	....	....	$0.038^{20°}$	s.	i. al.; s. a.
11	1.65	....	....	0.0132	....	s. a.; i. al.
12	2.38–2.95	....	....	decomp.	decomp.	i. al.
13	$1.725^{15°}$	153–166	decomp. 210	$118^{0°}$	$871^{100°}$	$3.8^{20°}$ al.
14	1.69	decomp.	....	s.	decomp.	s. al.
15	1.502	....	....	$4.2^{15°}$	41.34	
16	1.95	decomp.	....	s.	v. s.	
17	2.207	decomp.	....	$8^{15°}$		
18	....	decomp.	....	$58.2^{0°}$		
19	1.619	....	....	25	s.	i. al.
20	$1.803^{19°}_{4}$	....	....	$171^{0°}$	$260^{21°}$	
21	....	....	....	$0.03^{15°}$	....	i.al., HNO_3; s. alk.
22	....	....	....	$111^{25°}$	s.	$43.5^{25°}$ al.
23	1.77	140	lecomp. 280	$71^{0°}$	$103.3^{100°}$	i. al.
24	....	decomp.	....	v. s.		
25	....	decomp.	....	$100^{12°}$	....	i. al.
26	....	decomp.	....	v. s.	....	s. al.
27	$1.3057^{18°}$	−159	lecomp. 170	$122^{0°}$	$162^{20°}$	s. al.
28	1.601	....	....	s.	s.	....
29	6.6	decomp.	....	sl. s.	sl. s.	s. a., KOH
30	....	decomp.	....	i.	i.	i. al.
31	$6.62^{20°}$	630	1440	i.	i.	s. hot conc. H_2SO_4, aq. rg.
32	$4.148^{23°}$	94.2	280	decomp.	decomp.	s. HCl, HBr, CS_2, al.
33	$3.064^{26°}$	73.2	223.5	$601.6^{0°}$	$4531^{60°}$	s. al., HCl, $H_2C_4H_4O_6$
34	$2.346^{20°}_{20}$	−6	92^{30mm}	decomp.	decomp.	s. HCl
35	(A)$4.344^{15°}$	−91.5	−18	s. 20 c.c.	4 c.c.	s. al. 1500 c.c., $CS_2$2500 c.c.
36	$4.848^{26°}$	170.8	401	decomp.	decomp.	s. al., HI, HCl, KI, CS_2
37	5.6	....	15.5	$0.00182^{15°}$	0.01	s. HCl, KOH, $H_2C_4H_4O_6$
38	4.07	O, 1060	....	i.	i.	s. alk.; sl. s. a.
39	3.78	O, 450	O_2, 1060	i.	i.	s. HCl, KOH, HI
40	....	....	....	i.	decomp.	i. al.; s. HCl, CS_2
41	....	decomp.	....	i.	decomp.	s. al.
42	4.89	decomp.	....	decomp.	decomp.	s. H_2SO_4
43	4.62	555	....	0.000175	decomp.	s. al., NH_4HS, K_2S, HCl
44	$4.120^{0°}$	....	....	i.	i.	s. al., NH_4HS, HCl

PHYSICAL CONSTANTS OF

	Name.	Formula.	Mol. wt.	Crystalline form and color.
1	Antimony potassium tartrate	$K(SbO)C_4H_4O_6.\frac{1}{2}H_2O$	332.33	octahedral
2	Arsenic cryst.	As_4	299.8	rhombohedric, gray
3	acid, ortho-	$H_3AsO_4.\frac{1}{2}H_2O$	151	
4	acid, pyro-	$H_4As_2O_7$	266	
5	acid, meta-	$HAsO_3$	124	
6	pentoxide	As_2O_5	229.9	amorphous
7	sulphide, di-	As_2S_2	114.1	monoclinic, red
8	sulphide, penta-	As_2S_5	310.3	yellow
9	Arsenous chloride	$AsCl_3$	181.3	needles
10	hydride	AsH_3	78	
11	oxide	As_2O_3	197.9	regular, amorphous, white
12	oxychloride	$AsOCl$	126.4	brown
13	sulphide	As_2S_3	246.1	monoclinic, yellow or red
14	Barium	Ba	137.4	white
15	acetate	$Ba(C_2H_3O_2)_2.H_2O$	273.4	prisms
16	arsenate	$Ba_3(AsO_4)_2$	690.1	black
17	bromate	$Ba(BrO_3)_2.H_2O$	411.2	monoclinic
18	bromide	$BaBr_2.2H_2O$	333.2	monoclinic
19	carbonate	$BaCO_3$	197.4	rhombic, white
20	chlorate	$Ba(ClO_3)_2.H_2O$	322.3	monoclinic
21	chloride	$BaCl_2.2H_2O$	244.3	rhombic
22	chloroplatinate	$BaPt\text{-}Cl_6.4H_2O$	617.4	monoclinic, red
23	chromate	$BaCrO_4$	253.5	rhombic plates, yellow
24	fluoride	BaF_2	175.4	amorphous, white
25	hydroxide	$Ba(OH)_2.8H_2O$	315.5	tetragonal, white
26	iodate	$Ba(IO_3)_2.H_2O$	505.2	
27	iodide	BaI_2	391.2	rhombic
28	nitrate	$Ba(NO_3)_2$	261.4	regular
29	nitrite	$Ba(NO_2)_2.H_2O$	247.4	hexagonal needles
30	oxalate	$BaC_2O_4.H_2O$	243.4	
31	oxide	BaO	153.4	regular or amorphous.
32	perchlorate	$Ba(ClO_4)_2$	336.3	hexagonal
33	permanganate	$Ba(MnO_4)_2$	375.3	
34	peroxide	BaO_2	169.4	gray
35	phosphate, tri-	$Ba_3(PO_4)_2$	602.2	
36	phosphate, mono-	$BaH_4(PO_4)_2$	331.5	triclinic
37	phosphate, di-	$BaHPO_4$	233.4	rhombic needles
38	phosphate, pyro-	$Ba_2P_2O_7$	448.8	rhombic, white
39	sulphate	$BaSO_4$	233.4	rhombic
40	sulphide	BaS	169.4	rhombic
41	sulphocyanate	$Ba(CNS)_2.2H_2O$	289.6	needles
42	Bismuth	Bi	208	rhombohedric, pinkish

INORGANIC COMPOUNDS (Continued)

	Sp. gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water.	Hot water.	Alcohol, acids, etc.
1	2.6	$\frac{1}{2}H_2O$, 100°	....	$5.26^{8.7°}$	$35.7^{100°}$	i. al.; s. glyc.
2	$5.727^{14°}$	subl.*	450	i.	i.	i.
3	2–2.5	35.5	H_2O, 160	16.7	50	s. alk.
4	....	206 decomp.				
5						
6	4.086	....	decomp.	150	v. s.	v. s.
7	3.55	307	565	i.	i.	s. K_2S, $NAHCO_3$
8	....	v. fusible	subl.	i.	i.	s. alk., HNO_3
9	$2.205^{0°}_{4}$	−18	130.2	s.	decomp.	s. HBr, HCl, al., ether
10	2.695 (A)	−113.5	−54.8	5.1 vol.	sl. s.	sl. s. alk.
11	3.65–4.15	218 subl.	....	$1.2006^{2°}$	$2.038^{25°}$	s. alk., alk. carbonates, HCl, al.
12	....	fusible	....	decomp.	decomp.	s. CS_2; i. al., ether
13	3.46	310	700	0.00005	sl. s.	s. alk., alk. carbonates
14	3.8	850	vol. 950	decomp.	decomp.	s. al., a.
15	2.02	decomp.	....	$62.9^{3°}$	$80.5^{99°}$	i. al.
16	....	....	....	0.055	....	s. a., NH_4Cl
17	3.82	decomp.	....	$0.3^{0°}$	$5.67^{100°}$	
18	$3.852^{24°}_{4}$	880; $2H_2O$, 100°	....	$125^{0°}$	$181.7^{100°}$	v. s. al.
19	4.275	795	decomp. 1450	$0.0022^{20°}$	$0.0065^{100°}$	i. al.; s. a., NH_4Cl
20	3.179	414	....	$19.2^{3°}$	$111.2^{100°}$	sl. s. al.
21	$3.097^{24°}_{4}$	960	....	$36.2^{0°}$	$72^{100°}$	i. al.; s. HNO_3
22	2.86	....	....	s.	....	decomp. by a.
23	$4.498^{15°}$	....	....	$0.00035^{18°}$	0.0043	s. HCl, HNO_3
24	4.828	1280	....	$0.163^{18°}$	sl. s.	s. a., NH_4Cl
25	1.656	78	103	$5.56^{15°}$	$182.7^{80°}$	sl. s. al.
26	5.28	H_2O, 130	....	$0.008^{0°}$	$0.21^{100°}$	i. al.; s. HCl, HNO_3
27	$5.150^{25°}_{4}$	537–740	....	$170^{0°}$	$272^{100°}$	v. s. al.
28	$3.244^{23°}$	575	decomp.	$5.2^{0°}$	$32.2^{100°}$	i. al.
29	$3.173^{29°}$	decomp. 115	....	$58^{0°}$	$97^{35°}$	v. s. HCl; s. alk.
30	2.6578	....	....	$0.0093^{18°}$	$0.0228^{100°}$	i. al.; s. a., NH_4Cl
31	4.73–5.74	....	....	v. s.	....	v. s. al.
32	....	505	....	s.	s.	s. alk., al.
33	....	....	....	$62.5^{11°}$	$75.4^{25°}$	
34	4.958	O, 450	....	i.	decomp.	s. dil. a.
35	4.1	....	....	....	....	s. a.
36	$2.9^{4°}$	....	....	decomp.	decomp.	s. a.
37	$4.165^{15°}$	....	....	0.01–0.02	....	s. a., NH_4 salts
38	3.9^{20}	....	....	0.01	....	s. a., NH_4 salts
39	4.25–4.5	1580 decomp.	....	$0.000173^{2°}$	$0.00031^{37.7°}$	0.006 3% HCl; s. conc. H_2SO_4
40	$4.25^{15°}$	infusible	....	decomp.	decomp.	i. al.
41	....	....	....	s.	s.	s. al.
42	$9.78^{20°}$	269.2	1436	i.	i.	s. HNO_3, aq. rg., conc. H_2SO_4

* Melts under pressure at 500°.

PHYSICAL CONSTANTS OF

	Name.	Formula.	Mol. wt.	Crystalline form and color.
1	Bismuth bromide	$BiBr_3$	447.8	yellow crystals
2	carbonate, sub-	$Bi_2O_3.CO_3.H_2O$	526	
3	chloride	$BiCl_3$	314.4	white crystals
4	hydroxide	$Bi(OH)_3$	259	white
5	nitrate	$Bi(NO_3)_3.5H_2O$	484.1	triclinic
6	nitrate, sub-	$BiONO_3.H_2O$	304	hexagonal plates
7	oxide (ous)	Bi_2O_3	464	yellow, tetragonal
8	oxide (ic)	Bi_2O_5	496	brown
9	oxychloride	$BiOCl$	259.5	white
10	phosphate	$BiPO_4$	303	
11	sulphate	$Bi_2(SO_4)_3$	704.2	white
12	sulphide	Bi_2S_3	512.2	rhombic, brown
13	Boric acid	H_3BO_3	62	triclinic, white
14	Boron	B	11	amorphous
15	chloride	BCl_3	117.4	
16	oxide	B_2O_3	70	
17	sulphide	B_2S_3	118.2	white crystals
18	Bromic acid	$HBrO_3$	129	colorless
19	Bromine	Br_2	159.8	brown
20	chloride	$BrCl.10H_2O$	295.6	yellow
21	iodide	BrI	206.8	
22	Cadmium	Cd	112.4	hexagonal
23	acetate	$Cd(C_2H_3O_2)_2.3H_2O$	284.5	monoclinic, colorless
24	borotungstate	$Cd_2B_2W_9O_{32}.18H_2O$	2739.1	yellow, crystalline
25	bromide	$CdBr_2$	272.2	
26	carbonate	$CdCO_3$	172.4	
27	chloride	$CdCl_2.2H_2O$	219.3	monoclinic
28	fluoride	CdF_2	150.4	crystalline
29	hydroxide	$Cd(OH)_2$	146.4	hexagonal, white
30	iodide	CdI_2	366.2	brownish
31	nitrate	$Cd(NO_3)_2.4H_2O$	308.5	prism. needles
32	oxide	CdO	128.4	brown, amorphous
33	sulphate	$3CdSO_4.8H_2O$	769.5	monoclinic
34	sulphate	$CdSO_4.4H_2O$	280.5	
35	sulphide	CdS	144.5	yellow, hexagonal
36	Cæsium	Cs	132.8	silvery yellow
37	bromide	$CsBr$	212.7	
38	carbonate	Cs_2CO_3	325.6	
39	chloride	$CsCl$	168.3	regular, colorless
40	hydroxide	$CsOH$	149.8	gray
41	iodide	CsI	259.7	
42	nitrate	$CsNO_3$	194.8	tetragonal
43	oxide	Cs_2O	281.6	crystalline, orange
44	sulphate	Cs_2SO_4	361.7	needles
45	Calcium	Ca	40.07	rhombohedric
46	acetate	$Ca(C_2H_3O_2)_2.H_2O$	176.1	needles
47	bromide	$CaBr_2.6H_2O$	308	

INORGANIC COMPOUNDS (Continued)

	Sp. gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water.	Hot water.	Alcohol, acids, etc.
1	5.604	219	453	decomp.	decomp.	s. ether, HBr
2	6.86	decomp.	....	i.	i.	s. a.
3	$4.56^{11°}$	232	447	decomp.	decomp.	s. al., a., acetone
4	....	H_2O, 100°	....	i.	i.	s. a.
5	2.78	74	decomp. 75–80	decomp.	decomp.	s. HNO_3, a.
6	$4.928^{15°}$	decomp. 260	....	i.	i.	s. a.
7	8.868	820–860	....	i.	i.	s. a.
8	....	O, 150	O_2, 357	i.	i.	s. a., conc. KOH
9	$7.717^{15°}$	red heat	....	i.	i.	s. a.
10	....	....	....	i.	i.	s. HCl
11	....	....	....	decomp.	decomp.	s. a.
12	7.39	decomp.	....	0.000018	....	s. HNO_3
13	$1.4347^{15°}$	185	....	$4.9^{21°}$	$28.7^{100°}$	s. al.
14	2.45	2000–2500	subl. at 3500	i.	i.	i. al.; s. conc. HNO_3, conc. H_2SO_4
15	1.434	....	18.23	decomp.	decomp.	decomp. al.
16	$1.83^{4°}$	577	....	$1.1^{0°}$	$16.4^{102°}$	s. al., conc. a.
17	1.55	310	....	decomp.		
18	....	decomp. 100	....	v. s.	decomp.	....
19	$3.1883^{0°}$	−7.3	58.7	$4.17^{0°}$	$3.49^{50°}$	s. alk., al., ether, CS_2, $CHCl_3$, KBr
20	....	7	decomp. above 10	v. s.	....	s. CS_2, ether
21	....	36	....	....	....	s. CS_2, $CHCl_3$
22	$8.65^{20°}$	320	778	i.	i.	s. a., NH_4NO_3
23	2.01	....	....	v. s.	v. s.	
24	....	....	....	$1250^{19°}$		
25	$5.192_{4}^{25°}$	568	806–812	$61.1^{0°}$	$161^{100°}$	s. al., ether
26	$4.258^{4°}$	decomp.	....	i.	i.	s. a., NH_4 salts
27	3.32	....	....	$168^{20°}$	$180^{100°}$	s. al.
28	6.64	520	1000	$4.36^{15°}$	....	s. a.
29	$4.79^{15°}$	H_2O, 300	....	$0.00026^{25°}$	....	s. a., NH_4 salts
30	5.644	404	708–719	$80.1^{0°}$	$128^{100°}$	s. al., ether, NH_4OH
31	2.455	59.5	132	$143.4^{0°}$	....	s. al.
32	6.95–8.11	....	....	i.	i.	s. a., NH_4 salts
33	$3.087_{4}^{25°}$	....	....	$114.2^{0°}$	$87^{100°}$	
34	3.05	....	....	$140^{0°}$	$135.5^{100°}$	i. al.
35	4.8	white heat	....	0.00013	....	s. a.
36	1.88	26.4	670	decomp.	decomp.	s. a., al.
37	$4.455^{21°}$	....	....	s.	....	decomp. al.
38	....	....	decomp. 610	$382.3^{20°}$	v. s.	s. al.
39	$3.972_{4}^{20°}$	646	subl.	$161.4^{0°}$	$270.5^{100°}$	s. al.
40	4.018	<272.3	....	$301.3^{30°}$	s.	s. al.
41	$4.51_{4}^{25°}$	621	....	$27.7^{0°}$	$51.5^{35.6°}$	
42	$3.687_{4}^{28°}$	414	decomp.	$9.33^{0°}$	$197^{100°}$	sl. s. al.
43	$4.78^{0°}$	....	....	v. s.	....	s. abs. al.
44	$4.2434_{4}^{20°}$	....	....	$167^{0°}$	$220.3^{100°}$	i. al.
45	$1.54^{29°}$	805	....	decomp.	decomp.	s. a.
46	....	decomp.	....	$43.6^{0°}$	$34.3^{100°}$	sl. s. al.
47	....	38	150	$50^{0°}$		

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Calcium bromide	$CaBr_2$	199.9	needles
2	carbide	CaC_2	64	crystalline, gray
3	carbonate	$CaCO_3$	100	rhombohedric or rhombic
4	chloride	$CaCl_2$	111	
5	chloride	$CaCl_2 \cdot 6H_2O$	219.1	hexagonal
6	chromate	$CaCrO_4.2H_2O$	192.2	yellow crystals
7	fluoride	CaF_2	78	regular
8	hydroxide	$Ca(OH)_2$	74.1	hexagonal
9	hypochlorite	$Ca(ClO)_2.4H_2O$	215	
10	hypophosphite	$Ca(H_2PO_2)_2$	170.2	monoclinic
11	iodide	CaI_2	293.9	plates
12	iodide	$CaI_2.6H_2O$	402	
13	nitrate	$Ca(NO_3)_2.4H_2O$	236.2	monoclinic
14	oxalate	$CaC_2O_4 \cdot H_2O$	146.1	colorl. oct.
15	oxide	CaO	56	amorphous, regular
16	permanganate	$Ca(MnO_4)_2 \cdot 4H_2O$	330	purple prisms
17	phosphate	$Ca_3(PO_4)_2$	310.3	amorphous
18	phosphate, di-	$CaHPO_4.2H_2O$	172.2	monoclinic, plates
19	phosphate, mono-	$CaH_4(PO_4)_2.H_2O$	252.2	rhombic
20	phosphate, pyro-	$Ca_2P_2O_7.4H_2O$	326.3	crystalline
21	sulphate	$CaSO_4$	136.1	rhombic
22	sulphate	$CaSO_4.2H_2O$	172.1	monoclinic
23	sulphide	CaS	72.1	regular, white
24	Carbon amorphous	C	12	amorphic, black
25	graphite	C	12	hexagonal, black
26	diamond	C	12	regular
27	chloride, tetra-	CCl_4	153.8	
28	dioxide	CO_2	44	
29	disulphide	CS_2	76.1	
30	monoxide	CO	28	
31	Ceric hydroxide	$2CeO_2.3H_2O$	398.6	
32	nitrate	$Ce(NO_3)_4$	388.3	reddish yellow
33	oxide	CeO_2	172.3	white powder
34	sulphate	$Ce(SO_4)_2.4H_2O$	404.5	yellow needles
35	Cerium	Ce	140.3	steel gray
36	Cerous carbonate	$Ce_2(CO_3)_3.5H_2O$	550.4	
37	chloride	$CeCl_3$	246.6	crystals
38	hydroxide	$Ce_2O_3.6H_2O$	436.6	
39	nitrate	$Ce(NO_3)_3.6H_2O$	435.2	red crystals
40	oxide	Ce_2O_3	328.5	gray powder
41	sulphate	$Ce_2(SO_4)_3$	568.7	monoclinic or rhombic
42	Chloric acid	$HClO_3.7H_2O$	210.6	
43	Chlorine	Cl_2	70.9	greenish yellow
44	oxide, mon-	Cl_2O	86.9	yellowish red
45	oxide, di-	ClO_2	67.5	red

INORGANIC COMPOUNDS (Continued)

	Sp. gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water.	Hot water.	Alcohol, acids, etc.
1	3.354$^{20°}_{4}$	760	806–812	125$^{0°}$	312$^{105°}$	v. s. al.
2	2.22$^{18°}$	....	....	dec. to C_2H_2		
3	2.7–2.949	dec. 825	....	0.0013$^{16°}$	0.002$^{100°}$	s. a., NH_4Cl, CO_2 aq.
4	2.152$^{20°}_{4}$	774	....	49.6$^{0°}$	154$^{99°}$	s. al.
5	1.654	29.48	129–130	37.3$^{0°}$	61.4$^{100°}$	s. al.
6	....	$2H_2O$, 200	....	22.2$^{0°}$	4.3$^{100°}$	s. al., a.
7	3.18	1378	....	0.0037$^{15.5°}$	0.0016$^{18°}$	sl. s. conc. a.
8	2.078	decomp.	....	0.17$^{0°}$	0.08$^{100°}$	s. NH_4Cl
9	....	decomp.	....	deliques.	decomp.	dec. by a.
10	....	decomp. at	red heat	17	s.	i. al.
11	3.956$^{25°}_{4}$	631	708–719	192$^{0°}$	435$^{92°}$	s. a., al.
12	....	42	160	v. s.	v. s.	
13	1.9$^{15°}$	42.31	132	134$^{0°}$	506$^{152°}$	s. al.
14	2.2$^{4°}$ (anh.)	decomp.	....	0.0006$^{18°}$	0.0014$^{95°}$	s. a.
15	3.306$^{5°}$	1995	....	0.131$^{0°}$	0.067$^{80°}$	s. a.
16	....	decomp.	....	331$^{14°}$	388$^{25°}$	
17	3.18	....	....	0.0023–0031	decomp.	s. a.; i. al.
18	2.306$^{16.5°}_{4}$	decomp.	....	0.02$^{24.5°}$	0.075$^{100°}$	i. al.; s. $H_4C_6H_7O_7$
19	2$^{4°}$	H_2O, 100°	dec. 200	1.8$^{30°}$	decomp.	
20	....	....	....	sl. s.	....	s. a.
21	2.96	1360	....	0.179$^{0°}$	0.178$^{100°}$	s.a., $Na_2S_2O_3$, NH_4 salts, HCl, NaCl; i. al.
22	2.32	$2H_2O$, below 300	....	0.241$^{0°}$	0.222$^{100°}$	
23	2.8$^{15°}$	....	....	decomp.	decomp.	s. a.
24	1.75–2.10	>3500	subl. 3500	i.	i.	i. a., alk.
25	2.3	....		i.	i.	
26	3.51	....		i.	i.	
27	1.5817$^{21°}_{4}$	−23.77	76.74	i.	i.	
28	1.53 (A) 22 (D)	−57	−79	179.67 c.c.$^{0°}$	90.14$^{20°}$	s. a., alk.
29	1.292$^{0°}_{4}$	−116	47	0.2$^{0°}$	0.014$^{50°}$	s. al., ether
30	0.9670 (A)	−207	−190	3.287c.c.$^{0°}$ 0.0044$^{0°}$	2.312c.c.$^{20°}$ 0.0018$^{50°}$	s. al., Cu_2Cl_2
31	....	....	....	....	....	s. al., a.; sl. s. alk.
32	....	....	....	deliques.	decomp.	s. al.
33	7.65	....	....	i.	i.	s. conc. H_2SO_4
34	....	....	....	s.		
35	6.92$^{25°}$	623	....	i.	i.	i. al., conc. HCl, HNO_3, H_2SO_4
36	....	....	....	i.	....	s. $(NH_4)_2CO_3$
37	3.88$^{15.5°}_{15.5}$	848	....	100	decomp.	s. al.
38	....	....	....	....	....	s. a. $(NH_4)_2CO_3$
39	....	$3H_2O$, 150	dec. 200	deliques.	v. s.	s. al.
40	6.9–7.0	....	....	i.	....	s. conc. H_2SO_4
41	3.912	....	....	16.56$^{0°}$	2.25$^{100°}$	
42	1.282$^{14°}$	decomp.	....	v. s.		
43	2.49 (A)	−102	−33.6	150$^{0°}$ c.c.	136$^{40°}$ c.c.	s. alk.
44	2.977 (A)	....	5	200 c.c.$^{0°}$	....	s. alk., conc. H_2SO_4
45	1.5 2.315 (A)	−76	9.9	2000 c.c.$^{4°}$	decomp.	

PHYSICAL CONSTANTS OF

	Name.	Formula.	Mol. wt.	Crystalline form and color.
1	Chromium	Cr	52	gray crystals
2	trioxide	CrO_3	100	red, triclinic
3	Chromic chloride	$CrCl_3$	158.4	pink crystals
4	fluoride	$CrF_3.4H_2O$	181.1	green crystals
5	hydroxide	$Cr(OH)_3.2H_2O$	139.1	green
6	nitrate	$Cr(NO_3)_3.9H_2O$	400.2	purple prisms
7	oxide	Cr_2O_3	152	hexagonal, dark green
8	phosphate	$Cr_2(PO_4)_2.6H_2O$	402.2	bluish green
9	sulphate	$Cr_2(SO_4)_3.18H_2O$	716.5	regular violet
10	sulphide	Cr_2S_3	200.2	dark powder
11	Chromous chloride	$CrCl_2$	122.9	crystalline
12	hydroxide	$Cr(OH)_2$	86	yellow brown
13	sulphate	$CrSO_4.7H_2O$	274.2	blue
14	Cobalt	Co	58.97	
15	carbonyl	$Co(CO)_4$	171	
16	Cobaltic chloride	$CoCl_3$	165.4	
17	hydroxide	$Co(OH)_3$	110	black
18	oxide	Co_2O_3	166	brown
19	potassium nitrite	$2Co(NO_2)_3.6KNO_2.3H_2O$	958.7	yellow prisms
20	sulphate	$Co_2(SO_4)_3$	406.2	blue crystalline powder
21	Cobalto cobaltic oxide	Co_3O_4	240.9	regular, black
22	Cobaltous acetate	$Co(C_2H_3O_2)_2.4H_2O$	249.1	reddish violet, crystalline
23	arsenate	$Co_3(AsO_4)_2.8H_2O$	599	reddish monoclinic
24	bromide	$CoBr_2.6H_2O$	326.9	red crystals
25	carbonate	$CoCO_3$	119	rhombohedric, rose colored
26	chloride	$CoCl_2.6H_2O$	238	monoclinic, ruby red.
27	hydroxide	$Co(OH)_2$	93	rose red, rhombic
28	nitrate	$Co(NO_3)_2.6H_2O$	291.1	monoclinic, red
29	oxide	CoO	75	brown
30	phosphate	$Co_3(PO_4)_2.3H_2O$	421	
31	sulphate	$CoSO_4.7H_2O$	281.2	red, rhombic
32	sulphide	CoS	91	brown
33	Copper	Cu	63.57	red crystalline
34	Cupric acetate	$Cu(C_2H_3O_2)_2.H_2O$	199.6	dark green
35	ammonium sulphate	$CuSO_4.4NH_3.H_2O$	245.8	rhombic, blue
36	arsenate	$Cu_3(AsO_4)_2.4H_2O$	540.7	bluish green
37	arsenite	$CuHAsO_3$	187.5	green
38	bromide	$CuBr_2$	223.4	black
39	carbonate	$2CuCO_3.Cu(OH)_2$	344.7	blue monoclinic
40	chloride	$CuCl_2.2H_2O$	170.5	rhombic blue
41	chloride	$CuCl_2$	134.5	brownish yellow
42	ferrocyanide	$Cu_2Fe(CN)_6.7H_2O$	465.2	red brown
43	hydroxide	$Cu(OH)_2$	97.6	blue crystals

INORGANIC COMPOUNDS (Continued)

	Sp. gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water.	Hot water.	Alcohol, acids, etc.
1	$6.92^{20°}$	1505	2200	i.	i.	s. HCl, dil. H_2SO_4
2	2.74	196	decomp.	$163.4^{0°}$	$2067^{100°}$	dec. al.; s. H_2SO_4
3	$2.757^{15°}$	....	1200–1500	i.	sl. s.	
4	....	....	....	v. s.	v. s.	s. a.
5	....	....	....	i.	i.	s. a., alk.
6	....	36.5	125.5	s.	s.	s. a., alk.
7	5.04	2059	....	i.	i.	s. a.
8	....	....	....	sl. s.	....	s. a., alk.; i. $HC_2H_3O_2$
9	$1.7^{22°}$	$12H_2O$, 100	....	$120^{20°}$	....	....
10	$3.77^{19°}$	....	....	i.	decomp.	s. HNO_3
11	$2.751^{14°}$	....	....	v. s.	v. s.	....
12	....	....	....	decomp.	....	s. a.
13	....	....	....	$12.35^{0°}$	....	sl. s. al.
14	$8.72^{21°}$	1478	....	i.	i.	s. a.
15	$1.827^{18°}$	42–46	dec. 135	i.	i.	s. al., ether, CS_2
16	2.94	decomp.	....	s.	s.	....
17	....	....	....	i.	i.	i. al.; s. a.
18	5.18	dec. red heat	....	i.	i.	s. conc. a.
19	....	....	....	sl. s.	sl. s.	i. al.
20	....	....	....	decomp.	....	s. conc. H_2SO_4
21	5.8–6.3	....	....	i.	i.	s. conc. a.
22	$1.7043^{18.7°}$	....	....	s.	s.	s. a.
23	2.948	....	....	i.	i.	s. a.
24	....	100	....	deliques.	$153.2^{97°}$	s. al., ether
25	4.13	decomp.	....	i.	i.	s. a.
26	1.84	86.75	$6H_2O$, 110	$76.7^{0°}$	$190.7^{100°}$	v. s. ether
27	$3.597^{15°}$	....	....	i.	i.	s. NH_4 salts
28	$1.83^{14°}$	56	dec. red heat	$133.8^{0°}$	....	s. al.
29	5.68	O, 2860	....	i.	i.	i. al.; s. a., NH_4OH
30	....	....	....	i.	i.	s. H_3PO_4
31	$1.918^{15°}$	96.8	$7H_2O$, 420	$24.6^{0°}$	$82.6^{100°}$	s. al.
32	$5.45^{18°}$	>1100	....	0.00038	....	s. a.
33	8.93–8.95	1083	2310	i.	i.	s. HNO_3, hot conc. H_2SO_4
34	1.9	dec. 240	....	7.2	20	s. al., ether
35	....	dec. 150	....	$18.5^{21.5°}$	decomp.	i. al.
36	....	....	....	i.	i.	s. a. NH_4OH
37	....	decomp.	....	i.	i.	s. a. NH_4OH
38	....	decomp.	....	v. s.	v. s.	
39	3.88	decomp.	....	i.	decomp.	s. a., NH_4OH
40	2.47–2.535	$2H_2O$, 100	dec. red heat	$110.4^{0°}$	$192.4^{100°}$	s. al., ether, NH_4Cl
41	3.054	498	decomp.	$70.6^{0°}$	$107.4^{100°}$	s. al.
42	....	....	....	i.	i.	s. conc. a., NH_4OH
43	3.368	decomp.	....	i.	decomp.	s. a., al., NH_4OH

PHYSICAL CONSTANTS OF

	Name.	Formula.	Mol. wt.	Crystalline form and color.
1	Cupric nitrate	$Cu(NO_3)_2.3H_2O$	241.6	blue prismatic
2	nitrate	$Cu(NO_3)_2.6H_2O$	295.7	blue crystals
3	oxide	CuO	79.6	regular, monoclinic, black
4	phosphate	$Cu_3(PO_4)_2.3H_2O$	434.8	rhombic blue
5	sulphate	$CuSO_4$	159.6	
6	sulphate	$CuSO_4.5H_2O$	249.7	triclinic, blue
7	sulphide	CuS	95.6	hexagonal, black
8	Cuprous bromide	$CuBr$	143.5	brown
9	carbonate	Cu_2CO_3	123.5	yellow
10	chloride	$CuCl$	99.1	white, tetrahedral
11	cyanide	$CuCN$	89.7	white, monoclinic
12	hydroxide	$CuOH$	80.6	yellow
13	iodide	CuI	190.5	
14	oxide	Cu_2O	143.1	regular, red
15	sulphide	Cu_2S	159.2	rhombic, black
16	sulphocyanate	$CuCNS$	121.7	white
17	Ferric acetate, basic	$FeOH(C_2H_3O_2)_2$	190.9	amorphous
18	arsenate	$FeAsO_4.2H_2O$	230.9	
19	bromide	$FeBr_3$	295.6	dark red crystals
20	chloride	$FeCl_3$	162.2	hexagonal, brown or black
21	chloride	$FeCl_3.6H_2O$	270.3	reddish yellow
22	ferrocyanide	$Fe_4[Fe(CN)_6]_3$	859.1	dark blue crystals
23	hydroxide	$Fe(OH)_3$	106.9	reddish brown
24	nitrate	$Fe(NO_3)_3.9H_2O$	404	rhombic
25	oxalate	$Fe_2(C_2O_4)_3$	375.7	amorphous
26	oxide	Fe_2O_3	159.7	red, hexagonal, rhombohedric or regular
27	phosphate	$FePO_4.4H_2O$	222.9	yellow, rhombic or monoclinic
28	sulphate	$Fe_2(SO_4)_3.9H_2O$	562	yellow, rhombic
29	sulphide	Fe_2S_3	207.9	yellowish green
30	sulphocyanate	$Fe(CNS)_3.3H_2O$	284.1	dark red, regular
31	Ferroso-ferric oxide	Fe_3O_4	231.5	regular, black
32	Ferrous ammonium sulphate	$FeSO_4(NH_4)_2SO_4.6H_2O$	392.2	monoclinic, bluish green
33	arsenate	$Fe_3(AsO_4)_2.6H_2O$	553.6	green, amorphous
34	bromide	$FeBr_2.6H_2O$	323.8	reddish, crystalline
35	carbonate	$FeCO_3$	115.8	rhombohedric, gray
36	chloride	$FeCl_2.4H_2O$	198.8	monoclinic, blue green
37	ferricyanide	$Fe_3[Fe(CN)_6]_2$	591.3	deep blue
38	hydroxide	$Fe(OH)_2$	89.8	crystalline, pale green
39	iodide	$FeI_2.4H_2O$	381.7	crystalline, green
40	nitrate	$Fe(NO_3)_2.6H_2O$	288	crystals
41	oxalate	$FeC_2O_4.2H_2O$	179.9	crystals, pale yellow
42	oxide	FeO	71.8	black
43	phosphate	$Fe_3(PO_4)_2.8H_2O$	501.7	monoclinic, blue

INORGANIC COMPOUNDS (Continued)

	Sp. gr, $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water.	Hot water.	Alcohol, acids, etc.
1	2.174	114.5	dec. 170	137.8	$1270^{100°}$	s. al.
2	2.047	26.4	decomp.	$243.7^{0°}$	∞	s. al.
3	6.4	1064	0.1110	i.	i.	s. a., NH_4Cl, KCN
4	....	....	....	sl. s.	....	s. a., NH_4OH
5	$3.516^{30°}$	dec. 621	....	$20^{0°}$	$194^{100°}$	i. al.
6	$2.286^{16°}$	$4H_2O$, 110	$5H_2O$, 230	$31.61^{0°}$	$203.3^{100°}$	i. al.
7	3.98	....	....	0.000033	....	s. HNO_3, KCN
8	4.72	484	861–954	i.	i.	s. HBr, HCl, NH_4OH
9	....	decomp.	....	i.	i.	s. a., NH_4OH
10	3.53	422	954–1032	sl. s.	....	s. HCl, NH_4OH
11	....	red heat	....	i.	i.	s. HCl, NH_4OH, KCN
12	....	$\frac{1}{2}H_2O$, 360	....	i.	i.	s. a., NH_4OH
13	$5.65^{15°}$	606	759–772	$0.0008^{18°}$	....	s. KI
14	5.88	red heat	O, 1800	i.	i.	s. NH_4OH, HCl, NH_4Cl
15	5.58	1100	....	0.00005	....	s. HNO_3
16	....	1084	....	$0.023^{18°}$	....	s. NH_4OH
17	....	....	....	i.	i.	s. hot a.
18	3.18	....	....	i.	i.	s. dil. HCl
19	....	subl. & dec.	....	s.	s.	s. al., ether
20	2.804	298	....	$74.39^{0°}$	$536.6^{100°}$	v. s. al. ether +HCl
21	....	37	280–285	$246^{0°}$	∞	s. al.
22	....	decomp.	....	i.	i.	s. conc. HCl, H_2SO_4
23	3.4–3.9	$1\frac{1}{2}H_2O$, 500	....	i.	i.	i. al.; s. a.
24	$1.6835^{20°}$	47.2	decomp.	v. s.	v. s.	s. al.
25	....	dec. 100	....	v. s.	v. s.	i. al.; s. a.
26	5.12–5.30	1541	....	i.	i.	s. a.
27	2.87	....	....	i.	0.067	s. mineral a.; i. $HC_2H_3O_2$
28	2–2.1	....	....	v. s.	decomp.	s. abs. al.
29	4.25–441	decomp.	....	decomp.	decomp.	dec. by a.
30	....	....	....	v. s.	v. s.	v. s. al., ether
31	5.16	1538	....	i.	i.	i. al.
32	1.865	....	....	$18^{0°}$	$78.2^{75°}$	i. al.
33	....	....	....	i.	i.	sl. s. NH_4OH; s. dil. HCl
34	....	27	....	$313.2^{0°}$	∞	s. al.
35	3.7–3.9	decomp.	....	i.	i.	s. CO_2 aq.
36	1.926	....	....	$160.1^{10°}$	$415.5^{100°}$	s. al.
37	....	decomp.	....	i.	....	i. al., dil. a.
38	....	....	....	0.00067	....	s. a., NH_4Cl
39	2.873	177 (anhyd.)	....	v. s.	decomp.	s. al.
40	....	60.5	....	$200^{0°}$	300^{25}	
41	....	dec. 160	....	0.022	0.026	s. a.
42	....	1419	....	i.	i.	s. a.
43	2.58–2.68	....	....	i.	i.	s. a. i. $HC_2H_3O_2$

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Ferrous sulphate	$FeSO_4.7H_2O$	278	monocl. blue green
2	sulphide	FeS	87.9	black
3	Fluorine	F_2	38	greenish yellow
4	Fluosilicic acid	H_2SiF_6	144.3	
5	Glucinum	Gl	9.1	hexagonal, gray
6	carbonate	$GlCO_3 \cdot 4H_2O$	141.2	
7	chloride	$GlCl_2$	80	crystals, needles
8	hydroxide	$Gl(OH)_2$	43.1	white
9	oxide	GlO	25.1	hexagonal
10	sulphate	$GlSO_4.4H_2O$	177.2	tetragonal
11	Gold	Au	197.2	regular, yellow
12	bromide, (ous)	AuBr	277.1	green
13	chloride, (ic)	$AuCl_3$	303.6	cryst. yellowish red
14	chloride (ous)	AuCl	232.7	crystals, yellow
15	cyanide (ic)	$Au(CN)_3.6H_2O$	383.3	
16	cyanide (ous)	AuCN	223.2	crystals, yellow
17	hydroxide (ic)	$Au(OH)_3$	248.2	yellow brown
18	hydroxide (ous)	AuOH	214.2	red brown
19	iodide (ic)	AuI_3	578	dark green
20	iodide (ous)	AuI	324.1	yellow
21	oxide (ic)	Au_2O_3	442.4	black
22	oxide (ous)	Au_2O	410.4	violet
23	sulphate (ic)	$Au_2O_3.2SO_3.H_2O$	620.5	
24	sulphide (ic)	Au_2S_3	490.6	brown
25	sulphide (ous)	Au_2S	426.5	black
26	Hydrazine	$NH_2.NH_2$	32.1	cryst.
27	dihydrochloride	$N_2H_4.H_2Cl_2$	105.0	regular
28	sulphate	$N_2H_4.H_2SO_4$	130.1	tablets
29	Hydrobromic acid	HBr	80.9	crystals, white
30	Hydrochloric acid	HCl	36.5	
31	Hydrocyanic acid	HCN	27	
32	Hydrofluoric acid	HF	20	
33	Hydriodic acid	HI	127.9	
34	Hydrogen	H_2	2.016	
35	peroxide	H_2O_2	34	colorless
36	Hydrosulphuric acid	H_2S	34.1	
37	Iodic acid	HIO_3	175.9	rhombic
38	Iodine	I_2	253.8	rhombic, black
39	chloride, mono-	ICl	162.4	rhombic, red brown
40	chloride, tri-	ICl_3	233.3	yellow crystals
41	Iron, pure	Fe	55.84	cubical or octahedral
42	wrought	Fe	55.84	
43	cast	Fe	55.84	gray
44	steel	Fe	55.84	gray
45	carbide	Fe_3C	179.5	regular, gray
46	carbide	FeC_4	103.8	crystals, gray
47	disulphide	FeS_2	120	reg.orrhombic,yellow
48	Lanthanum	La	139	lead gray
49	carbonate	$La_2(CO_3)_3 \cdot 8H_2O$	602.1	crystals white
50	chloride	$LaCl_3 \cdot 7H_2O$	371.4	triclinic
51	nitrate	$La(NO_3)_3 \cdot 6H_2O$	433.1	crystals, colorless
52	oxide	La_2O_3	326	amorphous

INORGANIC COMPOUNDS (Continued)

	Sp. gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water.	Hot water.	Alcohol, acids, etc.
1	1.875	64	decomp.	$32.8^{0°}$	$196.4^{76°}$	i. al.
2	4.84	1197	...	0.00089	...	s. a.
3	$1.31^{15°}$ (A)	−223	−187	decomp.	decomp.	
4	...	...	...	s.	s.	
5	$1.85^{20°}$	960	...	i.	i.	s. dil. a., alk.
6	...	...	...	$0.36^{0°}$		
7	...	400	500	deliques.	v. s.	v. s. al.
8	...	decomp.	...	i.	...	s. a., alk., $NaHCO_3$
9	$3.016^{0°}$ ...	infus.	...	i.	...	s. a., alk.
10	$1.7125^{10.5°}$	$2H_2O$, 100	decomp.	$100^{14°}$	∞	i. al.
11	$19.32^{17.5°}$	1065.6	2500	i.	i.	i. a.; s.aq.reg., KCN
12	...	decomp. 115	...	i.	i.	dec. a.
13	3.9	subl.	150	68	v. s.	s. al., ether
14	...	decomp.	...	decomp.	decomp.	
15	...	...	...	v. s.	v. s.	s. al.
16	...	decomp.	...	i.	i.	i. a.; s. KCN
17	...	decomp. 250	...	i.	i.	s. conc. HNO_3
18	...	decomp.	...	s.		
19	...	...	...	i.	decomp.	s. iodides
20	...	decomp. 120	...	i.	sl. s.	s. excess KI
21	...	{O, 160; O_3, 250}	...	i.	i.	s. HCl
22	...	decomp. 250	...	i.	i.	s. HI, alk.
23	...	...	...	deliques.	decomp.	s. HCl., conc. H_2SO_4
24	...	...	...	i.	...	s. Na_2S, K_2S; i. a.
25	...	...	...	i.	...	i. a.
26	$1.01^{15°}$	1.4	113	v. s.	...	s. al.
27	...	198	...	s.	v. s.	s. al.
28	...	254	...	sl. s.	v. s.	i. al.
29	$2.71^{0°}$ (A)	−87	−68.7	$221.2^{0°}$	$130^{100°}$	s. al.
30	$1.269^{0°}$ (A)	−112.5	−83.1	$82.5^{10°}$	$56.1^{60°}$	s. al., ether
31	$0.697^{18°}$ (A)	−13.8	26.54	∞	∞	∞ al., ether
32	$0.7126^{0°}$ (A)	−92.3	19.44	264	v. s.	
33	$4.38^{0°}$ (A)	−51.3	34.1	42,500 $c.c.^{10°}$	v. s.	s. al.
34	0.06948 (A)	−259	−253	$1.93^{0°}$	...	s. Pd, Pt, Fe;
35	$1.458^{0°}$ ...	−2	80.2	∞	...	s. al., ether
36	1.1895 (A)	−85.5	−61.8	437 $c.c.^{0°}$	186 $c.c.^{40°}$	s. al. charcoal
37	$4.629^{0°}$	decomp. 170	...	$286^{0°}$	$471^{80°}$	v.s.al.,HNO_3
38	$4.948^{17°}$	112–115	184.35	$0.0182^{11°}$	$0.092^{55°}$	s. al.,KI,ether
39	$3.1822^{0°}_{4}$	25	101	decomp.	...	s. al., ether
40	3.1107	33	...	s.	decomp.	s. al., ether HCl
41	7.85–7.88	1530	2450	i.	i.	s. a.
42	7.86	1505	...	i.	i.	s. a.
43	7.03	1275	...	i.	i.	s. a.
44	7.60–7.80	1375	...	i.	i.	s. a.
45	$7.07^{16°}$	...	...	i.	i.	s. a.
46	...	...	...	i.	i.	s. a.
47	4.86–5.18	1171	decomp.	0.00049	...	i. dil. a.
48	6.155	810	...	decomp.	decomp.	s. a.
49	...	...	...	i.	i.	sl. s. CO_2 aq.
50	...	...	...	v. s.	v. s.	s. al.
51	...	40	126	deliques.	v. s.	v. s. al.
52	$6.41^{15°}$	infusible	...	sl. s.	...	s. al., a., NH_4Cl

PHYSICAL CONSTANTS OF

	Name.	Formula.	Mol. wt.	Crystalline form and color.
1	Lanthanum sulphate	$La_2(SO_4)_3.9H_2O$	728.3	hexagonal, colorless
2	Lead	Pb	207.2	reg. or moclinic, gray
3	acetate	$Pb(C_2H_3O_2)_2.3H_2O$	379.3	monoclinic, white
4	borate	$Pb(BO_2)_2.H_2O$	311.2	crystals
5	bromide	$PbBr_2$	367	rhombic, colorless
6	carbonate	$PbCO_3$	267.2	rhombic
7	carbonate, basic	$2PbCO_3.Pb(OH)_2$	775.6	amorphous
8	chloride	$PbCl_2$	277.1	rhombic
9	chromate	$PbCrO_4$	323.2	monoclinic, yellow
10	chromate, basic	$PbCrO_4.PbO$	546.4	crystals, red
11	dichromate	$PbCr_2O_7$	423.2	crystals, brick red
12	hydroxide	$Pb(OH)_2$	241.2	white
13	iodate	$Pb(IO_3)_2$	557	white
14	iodide	PbI_2	461	hexagonal, yellow
15	nitrate	$Pb(NO_3)_2$	331.2	octahedral, white
16	oxalate	PbC_2O_4	295	white
17	oxide, mon-	PbO	223.2	rhombic, yellow
18	oxide, mon-	PbO	223.2	hexagonal, red
19	oxide, sub-	Pb_2O	430.4	amorphous, black
20	oxide, sesqui-	Pb_2O_3	462.4	amorp., reddish yellow
21	oxide, red	Pb_3O_4	685.6	amorphous, scarlet
22	oxide, per-	PbO_2	239.2	hexagonal, brown
23	oxychloride	$PbCl_2.PbO$	501.3	tetragonal, white
24	phosphate	$Pb_3(PO_4)_2$	811.7	white
25	phosphite	$PbHPO_3$	287.2	white
26	pyrophosphate	$Pb_2P_2O_7.H_2O$	606.5	rhombic
27	sulphate	$PbSO_4$	303.3	rhombic, white
28	sulphate, basic	$PbSO_4.PbO$	526.5	
29	sulphide	PbS	239.3	regular, black
30	sulphite	$PbSO_3$	287.3	white
31	sulphocyanate	$Pb(CNS)_2$	323.4	monocl., yellowish
32	Lithium	Li	6.94	silvery gray
33	acetate	$LiC_2H_3O_2.2H_2O$	102	rhombic, white
34	bicarbonate	$LiHCO_3$	68	white
35	bromide	$LiBr$	86.9	crystals, white
36	carbonate	Li_2CO_3	73.9	prismatic
37	chloride	$LiCl$	42.4	octahedral, white
38	hydroxide	$LiOH$	24	crystals, white
39	nitrate	$LiNO_3$	69	rhombohedric
40	oxide	Li_2O	29.9	crystals
41	phosphate	$Li_3PO_4.H_2O$	133.9	rhomboidal
42	sulphate	Li_2SO_4	110	monocl. rhomb. or reg.
43	sulphide	Li_2S	46	
44	Magnesium	Mg	24.32	silvery white
45	acetate	$Mg(C_2H_3O_2)_2.4H_2O$	214.4	monoclinic
46	ammonium arsenate	$MgNH_4AsO_4.6H_2O$	289.4	tetragonal
47	ammonium phosphate	$MgNH_4PO_4.6H_2O$	245.6	tetragonal
48	bromide	$MgBr_2.6H_2O$	184.2	hexagonal

INORGANIC COMPOUNDS (Continued)

	Sp. gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water.	Hot water.	Alcohol, acids, etc.
1	2.821	decomp.	....	$3.8^{0°}$	$1.06^{100°}$	
2	11.34	327	1525	i.	i.	s. HNO_3, hot conc. H_2SO_4, HCl
3	2.50	$3H_2O$, 75°	280	$45.64^{15°}$	$200^{100°}$	i. al.
4	5.598 (anhy.)	red heat	....	i.	i.	s. a.; i. al.
5	$6.572^{19.2°}$	380	861–950	$0.455^{0°}$	$4.75^{100°}$	s. a., KBr; i. al.
6	6.47	decomp.	....	0.00198	decomp.	i. al.; s. alk., a.
7	....	decomp.	....	i.	i.	s. CO_2 aq.
8	5.80	501	861–954	$0.673^{0°}$	$3.34^{100°}$	i. al.; s. dil. HCl
9	$6.123^{15°}$	fusible	....	$0.0002^{18°}$	....	s. a., alk.
10	....	....	....	i.	i.	s. a., alk.
11	....	....	....	decomp.	....	s. a., alk.
12	....	145	....	sl. s.	sl. s.	s. a., alk.
13	....	....	....	$0.0012^{2°}$	....	sl. s. HNO_3
14	6.16	3.58	861–954	$0.044^{0°}$	$0.436^{100°}$	i. al., s. KI
15	$4.531^{24°}$	decomp. 223	....	$39^{0°}$	$139^{100°}$	s. alk.
16	5.025	decomp. 300	....	$0.00016^{18°}$	....	i. al., s. HNO_3
17	9.375	888	white heat	$0.017^{20°}$	....	s. alk., NH_4Cl
18	$8.74^{14°}$	....	white heat	$0.0013^{22°}$	i.	
19	8.342	....	....	i.	i.	dec. a., alk.
20	....	decomp. 370	....	i.	decomp.	dec. a., alk.
21	9.07	decomp. 500	....	i.	i.	s. glacial $HC_2H_3O_2$
22	8.91	decomp.	....	i.	i.	i. al.; s. glacial $HC_2H_3O_2$
23	7.21	....	....	i.	i.	s. alk.
24	6.9–7.3	....	....	$0.000014^{20°}$	i.	s. HNO_3
25	....	decomp.	....	i.	i.	s. HNO_3
26	....	806 (anhy.)	....	i.	decomp.	s. alk., HNO_3
27	6.23	>1100	....	$0.0042^{20°}$	sl. s.	s. conc. a., NH_4 salts
28	....	....	....	0.0044	sl. s.	sl. s. H_2SO_4
29	7.48	1112	....	0.0001	i.	s. conc. a.
30	....	....	....	i.	i.	s. HNO_3
31	3.82	....	....	$0.5^{20°}$	decomp.	s. KCNS, HNO_3
32	$0.534^{20°}$	186	1400	decomp.	decomp.	s. a.
33	....	70	decomp.	300^{15}	v. s.	s. al.
34	....	....	....	$5.5^{13°}$	....	s. a.
35	$3.464^{25°}_{4}$	547	....	$143^{0°}$	$270^{103°}$	s. al.
36	2.111	695–710	decomp.	$1.539^{0°}$	$0.728^{100°}$	i. al.
37	2.068	600	....	$63.7^{0°}$	$129^{96°}$	v. s. al.
38	....	red heat	....	$12.7^{0°}$	$17.5^{100°}$	sl. s. al.
39	2.39	253–267	....	$48.3^{0°}$	$227.3^{100°}$	v. s. al.
40	$2.102^{15°}$	sublimes	....	$5.22^{0°}$	$6.26^{100°}$	s. a.
41	2.41	857	H_2O, 100	0.04	....	s. a., NH_4Cl
42	2.21	843–874	....	$35.34^{0°}$	$29.24^{100°}$	i. 80% al.
43	1.66	....	....	v. s.	v. s.	v. s. al.
44	$1.74^{5°}$	651	1120	i.	sl. decomp.	s. a., NH_4 salts
45	1.45	....	....	deliques.	v. s.	v. s. al.
46	....	decomp.	....	$0.038^{20°}$	s.	i. al.; s. a.
47	$1.71^{15°}$	decomp.	....	0.01322	s.	s. a.; i. al.
48	....	decomp.	....	$316^{0°}$	v. s.	s. al.

PHYSICAL CONSTANTS OF

	Name.	Formula.	Mol. wt.	Crystalline form and color.
1	Magnesium carbonate	$MgCO_3$	84.3	rhomboh. or rhombic
2	carbonate, basic	$4MgCO_3.Mg(OH)_2.5H_2O$	485.7	
3	chloride	$MgCl_2.6H_2O$	203.3	monoclinic
4	hydroxide	$Mg(OH)_2$	58.3	rhombohedric
5	iodide	MgI_2	278.2	
6	nitrate	$Mg(NO_3)_2.6H_2O$	256.5	monocl. or tricl.
7	oxalate	$MgC_2O_4.2H_2O$	148.4	white
8	oxide	MgO	40.32	reg. or hexagonal
9	phosphate	$Mg_3(PO_4)_2.4H_2O$	335.1	monoclinic
10	phosphate, acid	$MgHPO_4.7H_2O$	246.5	hexagonal
11	phosphate, pyro-	$Mg_2P_2O_7$	222.7	
12	sulphate	$MgSO_4$	120.4	
13	sulphate	$MgSO_4.7H_2O$	246.5	tetrag. or monocl.
14	sulphide	MgS	56.4	cubical, brown
15	Manganese	Mn	54.93	grayish pink
16	acetate	$Mn(C_2H_3O_2).4H_2O$	245	monocl., pale red
17	ammonium phosphate	$NH_4MnPO_4.H_2O$	186	crystals, white
18	bromide	$MnBr_2$	214.8	rose red
19	carbonate	$MnCO_3$	114.9	rhomboh. rose
20	chloride	$MnCl_2$	125.9	
21	chloride	$MnCl_2.4H_2O$	197.9	monocl., rose
22	hydroxide (ous)	$Mn(OH)_2$	89	hexagonal, white
23	hydroxide (ic)	$Mn_2O_3.H_2O$	175.9	tetragonal, brown
24	iodide	$MnI_2.4H_2O$	183.8	monoclinic, rose
25	nitrate	$Mn(NO_3)_2.6H_2O$	287.1	monoclinic, rose
26	oxalate	$MnC_2O_4.2\frac{1}{2}H_2O$	188	crystals, white
27	oxide (ous)	MnO	70.9	reg. grayish green
28	oxide (ic)	Mn_2O_3	157.9	regular, black
29	oxide, di-	MnO_2	86.9	tetrag.orrhomb.black
30	oxide, ous, ic	Mn_3O_4	228.8	tetrag. black
31	phosphate (ous)	$Mn_3(PO_4)_2.7H_2O$	481	amorphous, reddish
32	pyrophosphate	$Mn_2P_2O_7$	283.9	amorphous, white
33	silicate	$MnSiO_3$	131.2	crystals, red
34	sulphate (ic)	$Mn_2(SO_4)_3$	398.1	crystals, green
35	sulphate (ous)	$MnSO_4$	151	reddish
36	sulphate (ous)	$MnSO_4.4H_2O$	223.1	prisms, rose
37	sulphide (ous)	MnS	87	cryst., pale pink to brown
38	Mercury	Hg	200.6	silvery
39	Mercuric acetate	$Hg(C_2H_3O_2)_2$	318.7	scales, white
40	arsenate	$Hg_3(AsO_4)_2$	879.7	yellow
41	bromide	$HgBr_2$	360.4	rhombic
42	chloride	$HgCl_2$	271.5	rhombic, white
43	cyanide	$Hg(CN)_2$	252.6	tetragonal, white
44	hydroxide	$Hg(OH)_2$	234.6	
45	iodide red	HgI_2	454.4	tetragonal, red
46	iodide yellow	HgI_2	454.4	rhombic, yellow
47	nitrate	$Hg(NO_3)_2.H_2O$	342.6	crystals, white

INORGANIC COMPOUNDS (Continued)

	Sp. gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water.	Hot water.	Alcohol, acids, etc.
1	3.04	decomp. 450	....	0.0106	....	s. a., CO_2 water
2	2.18	....	....	0.04	0.011	s. a., NH_4 salts
3	1.569$^{17°}$	$2H_2O$, 100	....	167	367	s. al.
4	2.36$^{15°}$	decomp.	....	0.0009	....	s. NH_4 salts
5	....	decomp.	....	100$^{0°}$	164.9$^{110°}$	s. al., ether
6	1.464	90	$5H_2O$, 330	200	∞	s. al.
7	....	decomp.	....	0.07$^{16°}$	0.08$^{100°}$	s. a., oxalates
8	3.43	1890–1940	....	0.00062	....	s. a., NH_4 salts
9	....	....	....	0.0205	....	s. a.; i. NH_4 salts
10	....	....	....	0.3	0.2	s. a.; i. al.
11	2.40	....	....	i.	i.	s. a.; i. al.
12	2.66	decomp.	....	26.9$^{0°}$	73.8$^{100°}$	s. al.
13	1.678$^{16°}$	decomp.	....	76.9$^{0°}$	671.2$^{100°}$	s. al.
14	2.82$^{15°}$	decomp.	....	decomp.	....	s. a.
15	7.42	1207	1900	decomp.	decomp.	s. dil. a.
16	1.6	....	....	3	....	s. al.
17	....	....	....	0.0031	0.05	i. al., NH_4 salts
18	....	decomp.	....	127.3$^{0°}$	228$^{100°}$	....
19	3.125	decomp.	....	0.013	....	s. dil. a., CO_2 aq.
20	2.977$^{\frac{25}{4}°}$	650	....	62.16$^{10°}$	123.8$^{106.3°}$	s. al.; i. ether
21	1.913	87.5	106	151$^{8°}$	∞	s. al.; i. ether
22	3.258	decomp.	....	i.	i.	s. a., NH_4 salts; i. alk.
23	4.335	decomp.	....	i.	i.	s. hot conc. H_2SO_4
24	....	decomp.	....	deliques.	v. s.	
25	1.82	25.8	129.4	426.4$^{0°}$	∞	v. s. al.
26	2.453$^{20°}$	decomp. 150	....	0.05	0.08$^{100°}$	s. dil. a.
27	5.091	white heat	....	i.	i.	s. a., NH_4Cl
28	4.335	$\frac{1}{3}$ O, 1090	....	i.	i.	s. a.
29	5.026	$\frac{1}{2}$ O, 570	....	i.	i.	s. HCl
30	4.61	infusible	....	i.	i.	s. HCl
31	....	....	....	sl. s.	....	s. a.; i. al.
32	3.5847$^{20°}$	....	....	i.	i.	s. a.
33	3.35	1218	....	i.	i.	
34	....	decomp.	....	deliq.	decomp.	s. conc. HCl, dil. H_2SO_4
35	2.954	decomp.	....	53.2$^{0°}$	67$^{75°}$	s. al.; i. ether
36	2.107	decomp.	....	105.3$^{0°}$	111.2$^{54°}$	i. al.
37	3.63$^{\frac{17}{17}°}$	decomp.	....	0.00047	....	s. dil. a.
38	13.595$^{\frac{0}{4}°}$	−38.85	357.25	i.	i.	s. HNO_3, conc. H_2SO_4
39	3.2544$^{22°}$	....	....	25$^{10°}$	100$^{100°}$	s. al.
40	....	....	....	sl. s.	....	s. HCl, HNO_3
41	5.738	235–244	325	1.06$^{9°}$	20–25$^{100°}$	s. al., ether
42	5.424	277	303–307	5.73$^{0°}$	53.96$^{100°}$	s. al., ether
43	4.018	decomp.	....	12.5$^{15°}$	53$^{100°}$	s. al.
44	....	H_2O, 175	....	i.	i.	s. a.
45	6.257	253	349	0.004$^{17.5°}$	....	{s. al.
46	6	241	349	i.	i.	alk. salts}
47	....	decomp.	....	v. s.	decomp.	s. HNO_3; i. al.

PHYSICAL CONSTANTS OF

	Name.	Formula.	Mol. wt.	Crystalline form and color.
1	Mercuric oxide	HgO	216.6	tetrag. plates, yellow or monocl. prisms, red
2	phosphate	$Hg_3(PO_4)_2$	791.9	white to yellowish
3	sulphate	$HgSO_4$	296.7	white
4	sulphate, basic	$HgSO_4.2HgO$	729.9	yellow
5	sulphide	HgS	232.7	amorphous, black
6	sulphide	HgS	232.7	rhombohedric, red
7	Mercurous acetate	$HgC_2H_3O_2$	259.6	micaceous scales
8	bromide	$HgBr$	280.5	tetragonal, yellow
9	carbonate	Hg_2CO_3	461.2	yellow
10	chloride	$HgCl$	236.1	rhom. or tetrag., white
11	chromate	Hg_2CrO_4	517.2	crystals, red
12	iodide	HgI	327.5	tetragonal, yellow
13	nitrate	$HgNO_3.2H_2O$	298.6	monoclinic, white
14	oxide	Hg_2O	417.2	black
15	phosphate	Hg_3PO_4	681.2	
16	sulphate	Hg_2SO_4	497.3	monoclinic, white
17	sulphide	Hg_2S	433.3	black
18	Molybdenum	Mo	96	gray
19	chloride, di-	$MoCl_2$	166.9	amorphous, yellow
20	chloride, tri-	$MoCl_3$	202.4	needles, red
21	chloride, tetra-	$MoCl_4$	237.8	crystals, brown
22	chloride, penta-	$MoCl_5$	273.3	crystals, black
23	oxide, di-	MoO_2	128	prismatic, red
24	oxide, sesqui-	Mo_2O_3	240	yellow to black
25	oxide, tri-	MoO_3	144	rhombic
26	sulphide, di-	MoS_2	160.1	black
27	sulphide, tri-	MoS_3	192.2	red brown
28	sulphide, tetra-	MoS_4	224.3	brown
29	Molybdic acid	H_2MoO_4	162	needles
30	" "	$H_2MoO_4.H_2O$	180	monoclinic, yellow
31	Nickel	Ni	58.68	silvery
32	acetate	$Ni(C_2H_3O_2)_2$	176.7	prismatic, green
33	ammonium chloride	$NiCl_2.NH_4Cl.6H_2O$	291.2	rhombic, green
34	ammonium sulphate	$NiSO_4.(NH_4)_2SO_4.6H_2O$	395	crystals, green
35	bromide	$NiBr_2$	218.5	scales, yellow
36	carbonate	$NiCO_3$	118.7	rhombic, light green
37	carbonate, basic	$2NiCO_3.3Ni(OH)_2.4H_2O$	587.5	light green
38	carbonyl	$Ni(CO)_4$	170.7	needles
39	chloride	$NiCl_2$	129.6	scales, yellow
40	chloride	$NiCl_2.6H_2O$	237.7	hexagonal, green
41	cyanide	$Ni(CN)_2.4H_2O$	110.7	plates, apple green

INORGANIC COMPOUNDS (Continued)

	Sp. gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water.	Hot water.	Alcohol, acids, etc.
1	11.14	decomp.	....	0.00515$^{25°}$	0.0395$^{100°}$	s. a.; i. al.
2	....	....	....	i.	sl. s.	sl. s. a.; s. NH_4Cl
3	6.466	dec. red hot	....	decomp.	....	s. a.; i. al.
4	6.44	....	....	0.002	....	s. a.; i. al.
5	7.67	sublimes at 446	....	0.0025	....	s. Na_2S, K_2S, aq. reg.
6	8.09			i.	i.	
7	....	decomp.	....	0.75$^{13°}$	....	s. H_2SO_4, HNO_3
8	7.307	sublimes at 405	....	i.	i.	i. al.
9	....	decomp. 130	....	i.	decomp.	s. NH_4Cl
10	7.1	sublimes	383.2	0.00031	0.01	s. aq. reg.
11	....	decomp.	....	sl. s.	s.	s. HNO_3
12	7.7	290	310	0.0417	....	s. KI.; i. al.
13	4.78	decomp.	....	s.	decomp.	
14	9.8	decomp.	....	i.	i.	s. glac. $HC_2H_3O_2$
15	....	....	....	i.	decomp.	s. HNO_3
16	7.56	....	decomp.	0.055$^{16.5°}$	0.092$^{100°}$	s. H_2SO_4, HNO_3
17	....	decomp. 0°	....	i.	i.	i. a.
18	9.01	2535	....	i.	i.	s. HNO_3, conc. H_2SO_4, HCl
19	....	decomp.	....	i.	i.	s. a., al., ether
20	....	decomp.	....	i.	decomp.	s. HNO_3, H_2SO_4, al.
21	....	....	....	deliques.	decomp.	s. HNO_3, H_2SO_4, al.
22	9.5	194	268	deliques.	decomp.	s. HNO_3, H_2SO_4, al.
23	6.44$^{10°}$	....	....	i.	i.	i. a., alk.
24	....	....	....	i.	i.	i. a., alk.
25	4.39$^{21°}$	791	sublimes	0.107$^{18°}$	1.705$^{70°}$	s. a., NH_4OH
26	4.80$^{14°}$	....	....	i.	i.	s. conc. a.
27	....	decomp.	....	sl. s.	s.	s. alk., sulphides
28	....	....	....	i.	i.	s. alk., sulphides
29	....	....	....	sl. s.	....	s. NH_4OH
30	3.124$^{15°}$	H_2O, 70	....	0.133$^{18°}$	2.13$^{70°}$	s. a., NH_4OH, NH_4 salts
31	8.6–8.90	1452	....	i.	i.	s. a.
32	1.799	decomp.	....	16.6	....	i. al.
33	1.645	....	....	v. s.	v. s.	
34	1.929$^{20°}_{4}$	....	....	2.5$^{3.5°}$	39.2$^{85°}$	
35	4.64	decomp.	....	112.8$^{0°}$	155.1$^{100°}$	s. al., ether
36	....	decomp.	....	i.	i.	s. a.
37	....	decomp.	....	i.	decomp.	s. a., NH_4 salts
38	1.3185$^{17°}$	−25	43	0.018$^{9.8°}$	i.	s. al., CH_3Cl, conc. HNO_3
39	2.56	subl.	....	53.8$^{0°}$	87.6$^{100°}$	s. al., NH_4OH
40	....	....	....	179.3$^{0°}$	599$^{100°}$	v. s. al.
41	....	$4H_2O$, 200	decomp.	i.	i.	s. KCN

PHYSICAL CONSTANTS OF

	Name.	Formula.	Mol. wt.	Crystalline form and color.
1	Nickel hydroxide (ic)	$Ni(OH)_3$	109.7	jet black
2	hydroxide (ous)	$4Ni(OH)_2.H_2O$	388.8	light green
3	iodide	NiI_2	312.5	scales, black
4	nitrate	$Ni(NO_3)_2.6H_2O$	290.8	monoclinic, green
5	oxide, mon-	NiO	74.7	regular, green
6	oxide, sesqui-	Ni_2O_3	165.4	black
7	oxide (ous) (ic)	Ni_3O_4	240	gray
8	phosphate	$Ni_3(PO_4)_2.7H_2O$	492.2	green
9	sulphate	$NiSO_4$	154.8	regular, yellow
10	sulphate	$NiSO_4.7H_2O$	280.9	rhombic, green
11	sulphide	NiS	90.8	hexagonal, black
12	Nitric acid	HNO_3	63	
13	Nitrogen	N_2	28.02	
14	oxide, mon- (ous)	N_2O	44	
15	oxide, di- (ic)	$NO(N_2O_2)$	30	
16	oxide, tri-	N_2O_3	76	
17	oxide, tetr-	$NO_2\ (N_2O_4)$	46	
18	oxide, pent-	N_2O_5	108	
19	oxychloride	$NOCl$	65.5	cryst., yellow or red
20	Osmium	Os	190.9	amorphous, bluish
21	chloride, di-	$OsCl_2$	261.8	needles, dark green
22	chloride, tri-	$OsCl_3$	297.3	regular, brownish
23	chloride, tetra-	$OsCl_4$	332.7	needles, red to yellow
24	oxide, mon-	OsO	206.9	black
25	oxide, sesqui-	Os_2O_3	229.8	black
26	oxide, di-	OsO_2	222.9	coppery red
27	oxide, tetra-	OsO_4	254.9	monocl., colorless
28	sulphide, di-	OsS_2	255	brownish yellow
29	sulphide, tetra-	OsS_4	319.2	brownish black
30	Oxalic acid	$H_2C_2O_4.2H_2O$	126.1	crystals, colorless
31	Oxygen	O_2	32	
32	Ozone	O_3	48	
33	Palladium	Pd	106.7	regular, silvery
34	bromide	$PdBr_2$	266.5	brown
35	chloride	$PdCl_2.2H_2O$	213.7	prisms, brown
36	hydroxide	$Pd(OH)_2$	140.7	brown
37	iodide	PdI_2	360.5	black
38	nitrate	$Pd(NO_3)_2$	230.7	rhombic, yellow brown
39	oxide, mon-	PdO	122.7	black
40	oxide, di-	PdO_2	138.7	black
41	sulphate	$PdSO_4.2H_2O$	238.8	crystals, brown
42	sulphide, mono-	PdS	138.8	black
43	sulphide, di-	PdS_2	170.8	dark brown
44	Perchloric acid	$HClO_4$	100.5	
45	Periodic acid	$HIO_4.2H_2O$	228	monoclinic

INORGANIC COMPOUNDS (Continued)

	Sp. gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water.	Hot water.	Alcohol, acids, etc.
1	....	decomp.	....	i.	i.	s. a., NH_4OH
2	4.36	decomp.	....	i.	i.	s. a., NH_4OH
3	....	subl.	....	$124.2^{0°}$	$188.2^{100°}$	s. al.
4	2.05	56.7	136.7	$238.5^{0°}$	∞	s. al., NH_4OH
5	6.69	....	....	i.	i.	s. a., NH_4OH
6	4.83	reduced to	NiO at 600	i.	i.	s. HCl, NH_4OH
7	....	....	....	i.	i.	s. a.
8	....	....	....	i.	i.	s. a.
9	$3.418^{15°}$	SO_3, 840	....	$29.3^{0°}$	$83.7^{100°}$	i. al.
10	1.98	98–100	$6H_2O$, 103	$75.6^{15.5°}$	$475.8^{100°}$	sl. s. al.
11	4.60	797	....	0.00036	decomp.	s. HNO_3, aq. rg.
12	$1.530^{15°}_{6}$	−41.3	86	∞	∞	
13	0.967 (A)	−210.5	−195	2.348 c.c.$^{0°}$	1.542 c.c.$^{20°}$	sl. s. al.
14	1.5301 (A)	−102.4	−89.4	130.52 c.c.$^{0°}$	60.82 c.c.$^{24°}$	s. al., conc. H_2SO_4
15	1.0366 (A)	−160.6	−153	7.3 c.c.$^{0°}$	0.0 c.c.$^{100°}$	s. al., conc. H_2SO_4
16	$1.447^{-2°}$	−103	3.5	s.	....	s. a.
17	$1.4903^{0°}_{4}$	−9.6	21.6	s.	....	s. conc. a., CS_2, $CHCl_3$
18	$1.642^{18°}$	29–30	45–50	s.		
19	2.31 (A)	−60	−5.6	decomp.		
20	22.48	−2700	white heat	i.	i.	i. a.
21	....	....	....	sl. s.	....	s. al., ether, NaCl
22	....		....	sl. s.	....	s. alk., al. HCl
23	....	....	....	sl. s.	....	s. al., HCl
24	....	....	....	i.	i.	s. a.
25	....	....	....	i.	i.	i. a.
26	....	....	....	i.	i.	i. a.
27	8.89	20	100	s.	s.	s. al., ether
28	....	....	....	sl. s.	....	sl. s. alk.
29	....	decomp.	....	i.	....	s. HNO_3; i. alk.
30	$1.653^{18.5°}$	98	....	$4.9^{0°}$	$120^{70°}$	s. al.
31	1.1053 (A)	−227	−182.7	4.89 c.c.$^{0°}$	1.7 c.c.$^{100°}$	sl. s. al.; s. melted Ag
32	1.658 (A)	decomp. 270	−119	0.88		
33	12.16	1542	....	i.	i.	s. conc. a., aq. rg.
34	....	....	....	i.	i.	s. HBr
35	....	....	....	s.	s.	s. HCl
36	....	....	....	i.	i.	s. a., alk.
37	....	100	360	i.	i.	s. excess KI; i. al., ether
38	....	decomp.	....	s.	decomp.	s. HNO_3
39	....	O, 875	....	i.	i.	s. a.
40	....	O, 200	....	i.	i.	sl. s. a.
41	....	....	....	v. s.	decomp.	
42	....	decomp.	....	i.	i.	s. HCl
43	....	decomp.	....	i.	i.	s. aq. rg.
44	$1.764^{22°}_{4}$	....	39	s.		
45	....	130	734	v. s.	v. s.	s. al., ether

PHYSICAL CONSTANTS OF

	Name.	Formula.	Mol. wt.	Crystalline form and color.
1	Permanganic acid	$HMnO_4$	120	
2	Phosphoric acid, ortho-	H_3PO_4	98.1	rhomb.
3	acid, meta-	HPO_3	80.1	
4	acid, pyro-	$H_4P_2O_7$	178.1	needles
5	Phosphorous acid, ortho-	H_3PO_3	82.1	crystals, yellowish
6	acid, hypo-	H_3PO_2	66.1	
7	Phosphorus, yellow	P_4	124.16	regular, yellow
8	Phosphorus, red	P_4	124.16	amorphous, red
9	bromide, tri-	PBr_3	271	
10	bromide, penta	PBr_5	430.6	rhomboidal, yellow
11	chloride, tri-	PCl_3	137.4	colorless
12	chloride, penta-	PCl_5	208.3	rhombic, yellow
13	hydride (phosphine)	PH_3	34.1	
14	hydride, liquid	P_2H_4	66.1	
15	hydride, solid	$(P_4H_2)_3$	378.5	yellow
16	iodide, tri-	PI_3	411.8	prismatic, red
17	oxide, tri-	P_2O_3	110.1	monoclinic
18	oxide, tetra-	P_2O_4	126.1	orthorhombic
19	oxide, penta-	P_2O_5	142.1	amorphous, white
20	sulphide, tri-	P_2S_3	158.3	cryst., grayish yellow.
21	sulphide, penta-	P_2S_5	222.4	cryst., grayish yellow
22	Platinic acid, chlor-	$H_2PtCl_6.6H_2O$	518.1	cryst., red brown
23	Platinum	Pt	195.2	silvery gray
24	bromide (ous)	$PtBr_2$	355	brown
25	bromide (ic)	$PtBr_4$	514.9	dark brown
26	chloride (ous)	$PtCl_2$	266.1	brown
27	chloride (ic)	$PtCl_4$	337	cryst., reddish brown.
28	hydroxide (ous)	$Pt(OH)_2$	229.2	black
29	hydroxide (ic)	$Pt(OH)_4$	263.2	red brown
30	iodide (ous)	PtI_2	449	black
31	iodide (ic)	PtI_4	702.9	amorph., brown black
32	oxide (ous)	PtO	211.2	violet to black
33	oxide (ic)	PtO_2	227.2	black
34	sulphide (ous)	PtS	227.3	black
35	sulphide (ic)	PtS_2	259.3	needles, black or gray
36	sulphate	$Pt(SO_4)_2.4H_2O$	459.4	plates, yellow
37	Potassium	K	39.10	tetragonal, white
38	acetate	$KC_2H_3O_2$	98.1	
39	acetate, acid	$KH(C_2H_3O_2)_2$	158.2	needles, plates
40	aluminate	$K_2Al_2O_4.3H_2O$	250.5	crystals
41	antimonate	$KSbO_3$	207.3	crystals
42	antimonyl tartrate	$KSbOC_4H_4O_6.\frac{1}{2}H_2O$	332.3	octahedral

INORGANIC COMPOUNDS (Continued)

	Sp. gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water.	Hot water.	Alcohol, acids, etc.
1	....	....	....	v. s.	decomp.	
2	$1.884^{18.2°}$	38.6	decomp. 213	v. s.	v. s.	s. al.
3	2 2–2.5	subl. at white heat	....	s.	s.	
4	....	61	....	v. s.	decomp.	v. s. al., ether
5	$1.651^{21.2°}$	70.1	decomp. 200	∞	∞	
6	$1.493^{18.8°}$	26.1	decomp.	∞	∞	
7	1.83	44.2	290	0.00033	sl. s.	sl. s. al., ether
8	2.20	725	350	i.	i.	i. ether; s. alk.
9	2.8847	−41.5	170.8	decomp.	....	s. CS_2, ether, $CHCl_3$
10	....	100	106	decomp.		
11	1.6129	−111.8	75.95	decomp.	....	s. CS_2, ether, $CHCl_3$
12	$3.60^{296°}$ (D)	148 (pressure)	160–165	decomp.	....	s. CS_2
13	1.17 (D)	−133.5	−86.4	sl. s.	i.	s. al., ether
14	1.01	<−10	57-58	i.	i.	s. al.
15	$1.83^{19°}$	....	....	i.	i.	i. al.
16	....	61	decomp.	decomp.	....	s. CS_2
17	$2.135^{21°}_{4}$	22.5	173	s.	decomp.	s. CS_2, ether, $CHCl_3$
18	$2.537^{22.6°}_{4}$	>100	180	s.	....	....
19	2.387	....	....	v. s.	v. s.	s. conc. H_2SO_4
20	....	290	490	decomp.	....	s. al., alk., ether
21	$2.09^{17°}$	290	515	decomp.	....	s. CS_2, alk.
22	2.431	decomp.	....	v. s.	v. s.	s. al., ether
23	21.37	1755	....	i.	i.	s. aq. rg.; i. a.
24	....	decomp. 300	....	i.	i.	s. HBr, KBr
25	....	....	....	$0.41^{20°}$	sl. s.	s. al., ether, HBr
26	5.87	dec. red. ht.	....	i.	i.	s. HCl, NH_4OH
27	....	decomp.	....	v. s.	v. s.	s. al., ether
28	....	decomp.	....	i.	i.	s. HCl, HBr, alk.
29	....	decomp.	....	i.	i.	v. s. a., alk.
30	....	decomp. 325	....	i.	i.	i. a.; Na_2SO_3
31	....	decomp.	....	i.	i.	s. alk., HI, KI
32	....	555	....	i.	i.	s. H_2SO_3, conc. HCl
33	....	430	....	i.	i.	i. a.
34	8.897	decomp.	....	i.	i.	i. a.; s. $(NH_4)_2S$
35	5.27	decomp.	....	i.	i.	s. $(NH_4)_2S$, aq. rg.
36	....	....	....	s.	decomp.	s. a., al., ether
37	$0.870^{20°}$	62.5	712	decomp.	....	s. a., al.
38	....	....	....	$188^{2°}$	$492^{62°}$	s. al.; i. ether
39	....	148	decomp. 200	decomp.	....	s. glac. acetic
40	....	....	....	v. s.	v. s.	i. al.; s. alk.
41	....	....	....	i.	sl. s.	s. hot KOH
42	2.6	$\frac{1}{2}H_2O$, 100	....	$5^{8°}$	$52^{100°}$	i. al.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color.
1	Potassium arsenate	K_3AsO_4	256.3	crystals
2	arsenate, acid	KH_2AsO_4	180.1	crystals
3	arsenite	$KAsO_2$	146.1	
4	borate	$K_2B_4O_7.5H_2O$	324.3	hexagonal prisms
5	bromate	$KBrO_3$	167	rhombohedral
6	bromide	KBr	119	regular
7	carbonate	K_2CO_3	138.2	monoclinic
8	carbonate, acid	$KHCO_3$	100.1	monoclinic
9	chlorate	$KClO_3$	122.6	monoclinic
10	chloride	KCl	74.6	regular
11	chloroplatinate	K_2PtCl_6	486.2	regular, yellow
12	chromate	K_2CrO_4	194.2	rhombohedric, yellow
13	citrate	$K_3C_6H_5O_7.H_2O$	324.4	colorless crystals
14	cobaltinitrite	$2Co(NO_2)_3.6KNO_2.3H_2O$	958.7	tetragonal, yellow
15	cyanate	$KCNO$	81.1	needles
16	cyanide	KCN	65.1	regular, white
17	dichromate	$K_2Cr_2O_7$	294.2	tricl. or monocl., red
18	ferricyanide	$K_3Fe(CN)_6$	329.2	monoclinic, red
19	ferrocyanide	$K_4Fe(CN)_6.3H_2O$	422.4	monoclinic, yellow
20	fluoride	KF	58.1	
21	fluosilicate	K_2SiF_6	220.5	hexagonal
22	hydroxide	KOH	56.1	rhombohedric
23	hypochlorite	$KClO$	90.6	
24	iodate	KIO_3	214	regular
25	iodide	KI	166	regular
26	manganate	K_2MnO_4	197.1	rhomboh., dark green
27	nitrate	KNO_3	101.1	rhomboh. or prism
28	nitrite	KNO_2	85.1	prismatic
29	oxalate	$K_2C_2O_4.H_2O$	184.2	monoclinic
30	oxide	K_2O	94.2	octahedral, gray
31	oxide, per-	K_2O_4	142.2	yellow
32	perchlorate	$KClO_4$	138.6	rhombic
33	periodate	KIO_4	230	rhombic
34	permanganate	$KMnO_4$	158	rhombic, deep purple
35	persulphate	KSO_4	135.2	prismatic
36	phosphate, ortho-	K_3PO_4	212.3	rhombic
37	phosphate, hydrogen	K_2HPO_4	174.3	
38	phosphate, dihydrogen	KH_2PO_4	136.2	tetragonal
39	phosphate, pyro-	$K_4P_2O_7.3H_2O$	384.5	
40	phosphite	K_2HPO_3	158.3	
41	silicate	K_2SiO_3	154.5	
42	silver cyanide	$KAg(CN)_2$	199	regular
43	sulphate	K_2SO_4	174.3	rhomb. or hexag.
44	sulphate, acid	$KHSO_4$	136.2	monocl. or rhomb.
45	sulphate, pyro-	$K_2S_2O_7$	254.3	
46	sulphide, mono-	K_2S	110.3	crystals, brown
47	sulphide, penta-	K_2S_5	238.6	
48	sulphite	$K_2SO_3.2H_2O$	194.3	crystals, white
49	sulphite, acid	$KHSO_3$	120.2	needles
50	sulphocyanate	$KCNS$	97.2	prism
51	tartrate	$K_2C_4H_4O_6.\frac{1}{2}H_2O$	235.3	monocl.
52	Praeseodymium	Pr	140.9	yellow
53	chloride	$PrCl_3$	247.3	needles, green
54	oxide, tri-	Pr_2O_3	329.8	yellowish green

INORGANIC COMPOUNDS (Continued)

	Sp. gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water.	Hot water.	Alcohol, acids, etc.
1	....	....	....	18.87	v. s.	s. al.
2	2.851	288	....	$19^{6°}$	v. s.	i. al.
3	....	....	....	s.	s.	sl. s. al.
4	....	$5H_2O$, red heat	....	$26.7^{30°}$	v. s.	
5	3.24	434	decomp.	$3.11^{0°}$	$49.75^{100°}$	sl. s. al.
6	2.73	730	white heat	54 °	$105^{100°}$	sl. s. al., ether
7	2.29	900	....	$89.4^{0°}$	$156^{100°}$	i. al.
8	2.17	decomp. 100–200	....	$22.5^{0°}$	$60^{60°}$	i. al.; s. K_2CO_3 aq.
9	$2.344^{17°}$	357	decomp. 400	$3.3^{0°}$	$56^{100°}$	sl. s. al.; s. alk.
10	$1.984^{30°}_{4}$	776	white heat	$28.5^{0°}$	$56.6^{100°}$	s. al., alk.
11	$3.291^{21°}$	decomp.	....	$0.7^{0°}$	$5.22^{100°}$	i. al., ether
12	$2.732^{18°}$	971	....	$58.9^{0°}$	$79.1^{10°}$	i. al.
13	1.98	dec. 230	....	$167^{15°}$	v. s.	sl. s. al.
14	....	decomp. 200	....	$0.09^{0°}$	sl. s.	i. al., ether
15	2.048	....	....	s.	s.	i. al.
16	$1.52^{15°}$	red heat	....	v. s.	$122.2^{103.3°}$	s. al.
17	$2.692^{4°}$	396	dec. 1000	$5^{0°}$	$102^{100°}$	i. al.
18	$1.811^{17°}$	decomp.	....	$33^{4.5°}$	$77.5^{100°}$	sl. s. al.
19	$1.853^{17°}$	$3H_2O$, 70	....	$27.8^{12.2°}$	$90.6^{96.3°}$	i. al.
20	2.481	859.9	....	$92.3^{18°}$	v. s.	i. al.; s. HF
21	$2.665^{17.5°}_{4}$	dec. red ht.	....	$0.12^{17.5°}$	$0.955^{100°}$	i. al.; s. HCl
22	2.044	360.4	vol. wh. ht.	$97^{0°}$	$178^{100°}$	v. s. al., ether
23	....	decomp.	....	v. s.	v. s.	
24	$3.975^{18°}$	560	....	$4.74^{0°}$	$32.3^{100°}$	i. al.; s. KI
25	$3.115^{25°}_{4}$	680	....	$127.9^{0°}$	$209^{100°}$	s. al., ether
26	....	decomp. 190	....	s.	decomp.	s. KOH
27	$2.109^{16°}$	337	....	$13.3^{0°}$	$246^{100°}$	i. al., ether
28	$1.915^{25°}$	....	....	$300^{15.5°}$	v. s.	s. al.
29	2.08	decomp.	....	$33^{16°}$		
30	$2.32^{0°}_{0}$	red heat	....	v. s.	v. s.	s. al., ether
31	....	red heat	....	decomp.	....	s. al.
32	$2.524^{10.8°}_{4}$	610	....	$0.7^{0°}$	$19.8^{100°}$	i. al.
33	$3.618^{15°}_{4}$	582	O, 300	$0.66^{13°}$	s.	sl. s. KOH
34	$2.703^{9.9°}_{4}$	decomp. 240	....	$2.83^{0°}$	$32.75^{35°}$	dec. al., etc.
35	....	dec. <100	....	$1.77^{0°}$	$4.08^{40°}$	i. al.
36	....	....	....	sl. s.	s.	i. al.
37	....	decomp.	....	v. s.	v. s.	v. s. al.
38	$2.338^{20°}_{4}$	96	H_2O, 400	$25^{7°}$	s.	i. al.
39	2.33	$3H_2O$, 300	....	s.	v. s.	i. al.
40	....	decomp.	....	v. s.	v. s.	i. al.
41	....	....	....	s.	s.	i. al.
42	....	....	....	12.5	100	s. al.
43	$2.663^{20°}_{4}$	1076	....	$8.5^{0°}$	$26.2^{100°}$	i. al.
44	2.24–2.61	200	decomp.	$36.3^{0°}$	$121.6^{100°}$	
45	2.27	>300	....	s.	decomp.	
46	2.13.......	....	....	s.	v. s.	s. al.
47	....	....	....	v. s.	v. s.	v. s. al.
48	....	decomp.	....	100	v. s.	sl. s. al.
49	....	decomp.	....	s.	s.	i. al.
50	1.906	172.3	decomp. 500	$177.2^{0°}$	$217^{20°}$	s. al.
51	1.975	....	....	$50^{0°}$; $12.5^{175°}$	$278^{100°}$	sl. s. al.
52	6.48	940	....	decomp.		
53	$4.017^{18°}_{4}$	818	....	$69.5^{13°}$	v. s.	s. al.
54	$7.068^{20°}_{4}$					

PHYSICAL CONSTANTS OF

	Name.	Formula.	Mol. wt.	Crystalline form and color.
1	Praseodymium oxide, tetr-	Pr_2O_4	345.8	black
2	oxide, per-	Pr_2O_5	361.8	
3	sulphate	$Pr_2(SO_4)_3$	570	
4	sulphide	Pr_2S_3	378	brown
5	Radium	Ra	226	
6	bromide	$RaBr_2$	385.8	
7	chloride	$RaCl_2$	296.5	regular, yellow
8	Rhodium	Rh	102.9	grayish white
9	chloride	$RhCl_3$	209.3	red
10	hydroxide	$Rh(OH)_3$	153.9	black
11	nitrate	$Rh(NO_3)_3.2H_2O$	325	red
12	oxide, mon-	RhO	118.9	gray
13	oxide, sesqui-	Rh_2O_3	253.8	crystals, gray
14	oxide, di-	RhO_2	134.9	brown
15	sulphate	$Rh_2(SO_4)_3.12H_2O$	710.2	crystals, light yellow
16	sulphide	RhS	135	bluish
17	Rubidium	Rb	85.45	soft white
18	bromide	$RbBr$	165.4	regular
19	carbonate	Rb_2CO_3	230.9	
20	chloride	$RbCl$	120.9	regular
21	hydroxide	$RbOH$	102.5	gray
22	nitrate	$RbNO_3$	147.5	hexagonal or regular
23	oxide	Rb_2O	186.9	octahedral
24	peroxide	Rb_2O_2	202.9	needles, yellow
25	sulphate	Rb_2SO_4	267	hexagonal
26	sulphide	$Rb_2S.4H_2O$	275	crystals
27	Ruthenium	Ru	101.7	crystals, grayish
28	chloride	$RuCl_3$	208.1	crystals, brown
29	hydroxide	$Ru(OH)_3$	192.8	black
30	oxide, sesqui-	Ru_2O_3	131.6	blue black
31	oxide, di-	RuO_2	173.8	regular, violet
32	oxide, tetr-	RuO_4	165.7	rhombic, yellow
33	Scandium	Sc	44.1	
34	chloride	$ScCl_3$	150.5	plates
35	oxide	Sc_2O_3	136.2	powder, white
36	sulphate	$Sc_2(SO_4)_3$	376.4	
37	Selenium	Se_8	633.6	hexagonal, gray
38	oxide	SeO_2	111.2	tetragonal
39	Selenic acid	H_2SeO_4	145.2	hexagonal, prisms
40	Selenious acid	H_2SeO_3	129.2	crystals
41	Silicic acid, ortho-	H_4SiO_4	96.3	amorphous
42	acid, meta-	H_2SiO_3	78.3	amorphous
43	Silicon	Si	28.3	octahedral, gray
44	carbide	SiC	40.3	rhombic, plates
45	chloride	$SiCl_4$	170.1	yellow
46	fluoride	SiF_4	104.3	
47	oxide, amorphous	SiO_2	60.3	amorphous
48	oxide, crystal	SiO_2	60.3	hexagonal prisms
49	Silver	Ag	107.88	regular, white

INORGANIC COMPOUNDS (Continued)

	Sp. gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water.	Hot water.	Alcohol, acids, etc.
1	$5.978^{20°}_{4}$					
2						
3	$3.72^{16°}$	....	....	$23.64^{0°}$	$1.01^{100°}$	
4	$5.042^{11°}$	decomp.	....	i.	decomp.	s. dil. a.
5	....	700				
6	....	subl. 900	....	s.	s.	s. al.
7	....	1650				
8	12.44	1970	....	i.	i.	sl. s. a., aq. rg.
9	....	decomp. 475	....	i.	i.	i. a.
10	....	decomp.	....	i.	i.	s. a., KOH
11	....	....	....	s.	s.	i. al.
12	....	....	....	i.	i.	i. a.
13	....	....	....	i.	i.	i. a., KOH
14	....	....	....	i.	i.	i. a., KOH
15	....	....	....	v. s.	decomp.	i. al.
16	....	decomp.	....	i.	i.	i. a., aq. rg.
17	1.52	38.5	696	decomp.	....	s. a., al.
18	$3.21^{23°}$	683	....	$98^{5°}$	$205.2^{113.5}$	
19	....	837	....	$420^{20°}$	s.	s. al.
20	$2.706^{22.9°}$	726	....	$76.38^{1°}$	$138.9^{100°}$	s. al.
21	$3.203^{11°}$	301	....	$198^{30°}$	v. s.	s. al.
22	3.0955	....	....	$20.1^{0°}$	$452^{100°}$	v. s. HNO_3
23	$3.72^{0°}$	....	....	s.	s.	
24	$3.65^{0°}$	600				
25	$3.6113^{20°}_{4}$	1051	....	$36.4^{0°}$	$81.8^{100°}$	
26	....	....	....	v. s.	v. s.	
27	12.06	2000	....	i.	i.	sl. s. a.
28	....	....	....	s.	decomp.	sl. s. al.; i. a.
29	....	....	....	....	....	s. a., alk.
30	....	....	....	i.	i.	i. a.
31	7.2	....	....	i.	i.	i. a.
32	5.7	25	100.8 (183 mm.)	sl. s.	....	s. alk.
33	....	1350				
34	....	subl. 800–850	....	v. s.	v. s.	i. al.
35	3.864	....	....	i.	i.	s. hot conc. a.
36	2.579					
37	4.47–4.8	217	690	i.	i.	s. CS_2, conc. H_2SO_4
38	3.954	390	decomp. 100	$38.4^{14°}$	v. s.	v.s.a.l,acetica.
39	2.9505	58	260	v. s.	v. s.	s. conc. H_2SO_4
40	3.065	decomp.	....	v. s.	v. s.	v. s. al.
41	$1.576^{17°}$	....	....	sl. s.	sl. s.	s. alk.
42	$1.813^{17°}$	....	....	i.	i.	s. alk.
43	2.42	1420	3500	i.	i.	s. HNO_3
44	3.12	....	....	i.	i.	i. a.
45	$1.5241^{0°}_{4}$	−89	57.57	decomp.	....	dec. al.
46	3.57 (A)	−77	−65	decomp.	....	s. al., ether, HNO_3
47	2.20	1600	vol. 1750	i.	i.	i. a.; s. hot alk. HF
48	2.319–2.653	1750	....	i.	i.	i. alk.; s. HF
49	10.5	961	1955	i.	i.	s. HNO_3, hot conc. H_2SO_4

PHYSICAL CONSTANTS OF

	Name.	Formula.	Mol. wt.	Crystalline form and color.
1	Silver acetate	$AgC_2H_3O_2$	166.9	laminae
2	arsenate	Ag_3AsO_4	462.6	dark red
3	arsenite	Ag_3AsO_3	466.6	yellow
4	bromate	$AgBrO_3$	235.8	tetragonal
5	bromide	$AgBr$	187.8	regular, pale yellow
6	carbonate	Ag_2CO_3	275.8	
7	chlorate	$AgClO_3$	191.3	regular or tetragonal.
8	chloride	$AgCl$	143.3	regular
9	chromate	Ag_2CrO_4	331.8	crystals, dark red
10	cyanate	$AgCNO$	149.9	
11	cyanide	$AgCN$	133.9	curdy, white
12	dichromate	$Ag_2Cr_2O_7$	131.8	triclinic, red
13	ferricyanide	$Ag_3Fe(CN)_6$	535.5	orange
14	ferrocyanide	$Ag_4Fe(CN)_6.H_2O$	661.4	yellowish
15	fluoride	AgF	126.9	tetragonal, yellow
16	iodate	$AgIO_3$	282.8	monoclinic
17	iodide	AgI	234.8	hexag. or reg. yellow
18	nitrate	$AgNO_3$	169.9	hexag. or rhomb
19	nitrite	$AgNO_2$	153.9	crystals, white
20	oxalate	$Ag_2C_2O_4$	303.8	white
21	oxide	Ag_2O	231.8	brown
22	perchlorate	$AgClO_4$	207.3	white
23	permanganate	$AgMnO_4$	225.8	monoclinic
24	phosphate, ortho-	Ag_3PO_4	418.7	yellow
25	phosphate, pyro-	$Ag_4P_2O_7$	605.6	
26	potassium cyanide	$KAg(CN)_2$	199	regular, octahedra
27	sulphate	Ag_2SO_4	311.8	tricl. or rhomboh.
28	sulphide	Ag_2S	248.8	regular, gray or black
29	sulphite	Ag_2SO_3	295.8	crystals
30	sulphocyanate	$AgCNS$	166	white, curdy

INORGANIC COMPOUNDS (Continued)

	Sp. gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water.	Hot water.	Alcohol acids, etc.
1	3.259	decomp.	....	$1.02^{14°}$	$2.52^{80°}$	
2	$6.66^{25°}_{4}$	....	....	$0.00085^{20°}$	....	s. a., alk.
3	....	decomp.	....	$0.00115^{20°}$	....	s. a., alk.
4	5.206	decomp.	....	$0.158^{20°}$	....	sl. s. HNO_3; s. NH_4OH
5	6.473	427	decomp. 700	$0.000026^{25°}$	$0.00014^{100°}$	s. KCN, sl. s. NH_4OH
6	6.0	decomp. 200	....	$0.0031^{15°}$	$0.05^{100°}$	s. NH_4OH, HNO_3, H_2SO_4
7	4.21	230	decomp. 270	$10^{15°}$	$50^{80°}$	i. al.
8	5.553	455	....	$0.000152^{20°}$	$0.0022^{100°}$	s. NH_4OH, conc. HCl, KCN
9	5.523	....	....	$0.0028^{18°}$	$0.0284^{25°}$	s. NH_4OH, KCN
10	4.0	decomp.	....	sl. s.	s.	s. HNO_3, NH_4OH, KCN
11	3.95	decomp.	....	$0.000021^{25°}$	....	s. HNO_3, NH_4OH, KCN
12	....	decomp.	....	$0.0083^{15°}$	decomp.	v. s. HNO_3, NH_4OH, KCN
13	....	....	....	$0.000066^{20°}$	....	s. NH_4OH
14	....	....	....	i.	i.	s. KCN, NH_4OH
15	5.852	435	....	$182^{15.5°}$		
16	5.4–5.65	decomp.	....	$0.00385^{18°}$	sl. s.	s. HNO_3, NH_4OH
17	$5.674^{25°}_{4}$	526	....	$0.000035^{21°}$	....	s. KCN, $Na_2S_2O_3$, NaCl
18	$4.352^{19°}$	209	decomp.	$121.9^{0°}$	$940^{100°}$	s. al., ether
19	$4.453^{28°}$	....	....	0.33	s.	i. al.
20	$5.029^{4°}$	decomp.	....	$0.00339^{18°}$	....	s. NH_4OH, KCN
21	7.521	O, 300–340	....	$0.00215^{20°}$	....	s. NH_4OH, KCN, $Na_2S_2O_3$
22	....	486	....	s.	s.	
23	....	decomp.	....	$0.55^{0°}$	$1.69^{28.5°}$	
24	6.370	849	....	$0.00193^{20°}$	....	s. a., NH_4OH, KCN
25	5.306	585	....	i.	i.	s. NH_4OH, HNO_3, H_2SO_4, KCN
26	....	....	....	$25^{20°}$	v. s.	s. al.; i. a.
27	5.40	651	decomp. 925	$0.73^{14.5°}$	$1.393^{100°}$	s. HNO_3, H_2SO_4, NH_4OH
28	7.08	812	....	0.0002	....	s. conc. HNO_3; sl. s. KCN
29	....	decomp. 100	....	sl. s.	sl. s.	s. NH_4OH
30	....	....	....	$0.000021^{25°}$	$0.000023^{100°}$	s. NH_4OH, i. dil. a.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color.
1	Sodium	Na	23	tetragonal, silvery
2	acetate	$NaC_2H_3O_2$	82	monoclinic, prisms
3	aluminate	$Na_2Al_2O_4$	164.2	amorphous
4	antimonate	$2NaSbO_3.7H_2O$	508.5	octahedra
5	antimonate, pyro-	$Na_2H_2Sb_2O_7.H_2O$	418.4	
6	arsenate	$Na_3AsO_4.12H_2O$	424.2	
7	arsenate, acid	$Na_2HAsO_4.7H_2O$	312.1	crystalline
8	arsenate, acid	$Na_2HAsO_4.12H_2O$	402.2	monoclinic or rhomb.
9	arsenite	Na_2HAsO_3	170	
10	benzoate	$NaC_7H_5O_2$	144	crystalline
11	borate, meta-	$NaBO_2$	66	hexagonal prisms
12	borate, meta-	$Na_2B_2O_4.4H_2O$	204.1	monoclinic
13	borate, tetra-	$Na_2B_4O_7$	202	
14	borate, tetra-	$Na_2B_4O_7.5H_2O$	292.1	octahedral
15	borate, tetra- (borax)	$Na_2B_4O_7.10H_2O$	382.2	monoclinic
16	bromate	$NaBrO_3$	150.9	crystals
17	bromide	$NaBr$	102.9	regular
18	bromide	$NaBr.2H_2O$	139	monoclinic
19	carbonate	Na_2CO_3	106	
20	carbonate	$Na_2CO_3.H_2O$	124	crystals
21	carbonate	$Na_2CO_3.10H_2O$	286.2	monoclinic
22	carbonate, acid	$NaHCO_3$	84	monoclinic
23	chlorate	$NaClO_3$	106.5	regular, tetragonal
24	chloride	$NaCl$	58.5	regular
25	chromate	$Na_2CrO_4.10H_2O$	342.2	triclinic, yellow
26	citrate	$2Na_3C_6H_5O_7.11H_2O$	714.3	wh. cryst.
27	cyanide	$NaCN$	49	
28	dichromate	$Na_2Cr_2O_7.2H_2O$	298	triclinic, red
29	ferricyanide	$Na_3Fe(CN)_6.H_2O$	298.9	red
30	ferrite	$Na_2Fe_2O_4$	221.7	
31	ferrocyanide	$Na_4Fe(CN)_6.12H_2O$	520.1	monoclinic, yellow
32	fluoride	NaF	42	regular
33	fluosilicate	Na_2SiF_6	188.3	gelatinous or hexag.
34	formate	$NaCHO_2$	68.0	rhombic
35	hydroxide	$NaOH$	40	white
36	hypochlorite	$NaOCl$	74.5	
37	hypophosphite	$NaH_2PO_2.H_2O$	106.1	monoclinic, prisms
38	hyposulphite	$NaHSO_2$	88.1	
39	iodate	$NaIO_3$	197.9	
40	iodide	NaI	149.9	regular
41	iodide	$NaI.2H_2O$	185.9	
42	manganate	$Na_2MnO_4.10H_2O$	345.1	monoclinic, green
43	molybdate	$Na_2MoO_4.2H_2O$	242	tablets
44	nitrate	$NaNO_3$	85	rhombohedric
45	nitrite	$NaNO_2$	69	crystals
46	nitroprusside	$NaFe(CN)_5NO.2H_2O$	297.8	triclinic, red
47	oxalate	$Na_2C_2O_4$	134	
48	oxide	Na_2O	62	grayish
49	perchlorate	$NaClO_4$	122.5	rhombohedral
50	permanganate	$Na_2MnO_4.3H_2O$	196	crystals, purple
51	peroxide	Na_2O_2	78	yellow
52	phosphate, tribasic	$Na_3PO_4.12H_2O$	380.2	hexagonal
53	phosphate, dibasic	$Na_2HPO_4.12H_2O$	358.2	rhombic
54	phosphate, monobasic	$NaH_2PO_4.H_2O$	138.1	rhombic

INORGANIC COMPOUNDS (Continued)

	Sp. gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water.	Hot water.	Alcohol, acids, etc.
1	0.971	97	750	decomp.	....	i. benzol., kerosene
2	1.4	58	....	$26^{6°}$	200	s. al.
3	....	1800	....	s.	v. s.	i. al.
4	....	....	....	$0.031^{12.3°}$	....	sl. s. al., NH_4 salts
5	....	....	....	sl. s.	sl. s.	sl. s. al.
6	1.7593	85.5	....	$26.7^{17°}$		
7	....	57	$7H_2O$, 100	$61^{15°}$	v. s.	sl. s. al.
8	1.71	28	$12H_2O$, 100	$17.2^{0°}$	$140.7^{30°}$	sl. s. al.
9	1.87	....	....	v. s.	v. s.	
10	....	....	....	$62.5^{25°}$	$76.9^{100°}$	s. al.
11	....	966	....	s.	v. s.	
12	....	57	....	s.	v. s.	
13	2.367	741	....	$1.3^{5°}$	$52.5^{100°}$	i. al.
14	1.815	....	....	$1.9^{0°}$	$99.1^{100°}$	i. al.
15	$1.694^{17°}$	red heat	....	$2.83^{0°}$	$201.4^{100°}$	i. al.
16	3.339	381	....	$27.54^{0°}$	$90.9^{100°}$	i. al.
17	3.014	768	....	$79.5^{0°}$	$115^{100°}$	sl. s. al.
18	$2.176^{\frac{20}{4}°}$	....	....	$172.5^{0°}$	$259.5^{100°}$	s. al.
19	2.476	852	decomp.	$7.1^{0°}$	$45.4^{100°}$	i. al.
20	....	H_2O, 100	....	....	....	i. al.
21	1.458	34	106	$21.52^{0°}$	$420.68^{104°}$	i. al.
22	2.206	CO_2, 270	....	$6.90^{0°}$	$16.40^{60°}$	i. al.
23	$2.490^{15°}$	255	decomp.	$81.9^{0°}$	$232.6^{100°}$	s. al.
24	2.17	805	white heat	$35.7^{0°}$	$39.8^{100°}$	sl. s. al.; i. HCl
25	$2.71^{16°}$	19.92	....	v. s.	∞	sl. s. al.
26	....	150	decomp.	$91^{25°}$	$250^{100°}$	sl. s. al.
27	....	....	....	s.	v. s.	sl. s. al.
28	$2.52^{16°}$	320	$2H_2O$, 100	$163^{0°}$ (anhyd.)	$433^{100°}$ (anhyd.)	
29	....	....	....	$18.9^{0°}$	$80^{100°}$	i. al.
30	....	....	....	decomp.		
31	1.458	....	....	$22^{15.5°}$	....	i. al.
32	2.766	992	....	$4^{15°}$	....	sl. s. al.
33	2.679	dec. red ht.	....	$0.65^{17.5°}$	$2.46^{100°}$	i. al.
34	1.919	decomp.	....	$44^{0°}$	$160^{100°}$	sl. s. al.
35	2.13	318	white heat	$42^{0°}$	$313^{80°}$	v. s. al., ether
36	....	decomp.	....	s.	decomp.	
37	....	....	....	s.	s.	v. s. al.
38	....	....	....	v. s.	v. s.	s. al.
39	4.277	decomp.	....	$2.52^{0°}$	$33.9^{100°}$	i. al.; s. acetic
40	$3.665^{\frac{25}{4}°}$	664	....	$159^{0°}$	$302^{100°}$	v. s. al.
41	2.448	....	....	$317.9^{0°}$	$1550^{100°}$	
42	....	decomp.	....	s.	decomp.	
43	....	....	....	$56.2^{0°}$	$115.5^{100°}$	
44	$2.265^{15°}$	312	decomp.	$72.9^{0°}$	$180^{100°}$	sl. s. al.
45	$2.157^{26°}$	271	....	$83.3^{20°}$	v. s.	sl. s. ether, al.
46	$1.6803^{17°}$	....	....	$40^{15°}$		
47	....	....	....	$3.22^{6.5°}$	$6.33^{100°}$	
48	2.27	red heat	....	decomp.	....	decomp. al.
49	....	482	decomp.	s.	v. s.	s. al.
50	....	decomp.	....	v. s.	v. s.	
51	2.805	decomp.	....	s.	decomp.	
52	1.6445	77	$11H_2O$, 100	$28.3^{15°}$	∞	
53	$1.52^{17°}$	35	$12H_2O$,100	$6.5^{0°}$	∞	i. al.
54	2.04	$2H_2O$, 200	....	v. s.	v. s.	i. al

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color.
1	Sodium phosphate, meta-	$Na_4P_4O_{12}$	408.2	....
2	phosphate, pyro-	$Na_4P_2O_7.10H_2O$	446.2	monoclinic
3	phosphite	$Na_2HPO_3.5H_2O$	216.2	rhombohedric
4	potassium carbonate	$NaKCO_3.6H_2O$	230.2	monoclinic
5	salicylate	$NaC_7H_5O_3$	160.1	wh. scales
6	silicate	Na_2SiO_3	122.3	monoclinic
7	silicate (water glass)	$Na_2Si_4O_9$	303.2	amorphous
8	stannate	$Na_2SnO_3.3H_2O$	267.1	hexagonal
9	sulphate	Na_2SO_4	142.1	rhomb., monocl. or hexag.
10	sulphate	$Na_2SO_4.7H_2O$	268.2	rhomb. or tetrag.
11	sulphate	$Na_2SO_4.10H_2O$	322.2	monoclinic
12	sulphate, acid	$NaHSO_4$	120.1	triclinic
13	sulphide, mono-	Na_2S	78.1	amorph., pinkish
14	sulphide, penta-	Na_2S_5	206.4	....
15	sulphite	Na_2SO_3	126.1	hexagonal, prisms
16	sulphite, acid	$NaHSO_3$	104.1	monoclinic
17	sulphocyanate	NaCNS	81.1	rhombic
18	tartrate	$Na_2C_4H_4O_6.2H_2O$	230.1	trimetric
19	thiosulphate	$Na_2S_2O_3.5H_2O$	248.2	monoclinic
20	Strontium	Sr	87.63	crystals, silvery
21	bromide	$SrBr_2$	247.5	needles
22	bromide	$SrBr_2.6H_2O$	355.6	....
23	carbonate	$SrCO_3$	147.6	rhombic
24	chlorate	$Sr(ClO_3)_2$	254.6	rhomb. or monocl.
25	chloride	$SrCl_2$	158.6	....
26	chloride	$SrCl_2.6H_2O$	266.6	hexagonal
27	chromate	$SrCrO_4$	202.7	monoclinic
28	fluoride	SrF_2	125.6	regular, octahedra
29	hydroxide	$Sr(OH)_2$	121.7	....
30	hydroxide	$Sr(OH)_2.8H_2O$	265.8	tetragonal
31	iodide	SrI_2	341.5	plates
32	iodide	$SrI_2.6H_2O$	449.6	crystals
33	nitrate	$Sr(NO_3)_2$	211.7	regular, octahedra
34	nitrate	$Sr(NO_3)_2.4H_2O$	283.7	triclinic
35	oxalate	$SrC_2O_4.H_2O$	193.7	....
36	oxide	SrO	103.6	rhombic, gray white
37	phosphate	$SrHPO_4$	183.7	rhombic
38	sulphate	$SrSO_4$	183.7	rhombic
39	sulphide	SrS	119.7	regular
40	sulphite	$SrSO_3$	167.7	crystals
41	Sulphur, amorphous	S_8	256.48	amorph., pale yellow
42	monoclinic	S_8	256.48	monoclinic
43	rhombic	S_8	256.48	rhombic
44	chloride	S_2Cl_2	135	liquid, yellow sh red
45	oxide, di-	SO_2	64.1	....
46	oxide, tri-	SO_3	80.1	crystals, prismatic
47	Sulphuric acid	H_2SO_4	98.1	....
48	acid	$H_2SO_4.H_2O$	116.1	prisms
49	acid	$H_2SO_4.2H_2O$	134.1	....

INORGANIC COMPOUNDS (Continued)

	Sp. gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water.	Hot water.	Alcohol, acids, etc.
1	2.476	610	dec. red ht.	sl. s.	sl. s.	s. a., alk.
2	1.836	988 (anhyd.)	....	$5.4^{0°}$	$93.11^{100°}$	i. al.
3	....	53	....	s.	v. s.	i. al.
4	1.6334	$6H_2O$, 100	....	$185^{15°}$		
5	....	....	....	$111^{15°}$	$125^{25°}$	$17^{15°}$ al.
6	....	1056	....	s.	s.	{i. al., Na salts, K + salts
7	....	....	....	s.	s.	
8	....	....	....	$67.4^{0°}$	$61.3^{0°}$	i. al.
9	$2.673^{15°}$	884	....	$5.02^{0°}$	$42.5^{100°}$	i. al.
10	....	....	....	$19.6^{0°}$	$42.7^{100°}$	
11	1.462	32.383	....	$12.17^{0°}$	$312^{34°}$	i. al.
12	2.742	300	....	$50^{0°}$	$100^{100°}$	
13	2.471	....	....	$15.4^{10°}$	$59.2^{90°}$	sl. s. al.
14	....	....	....	s.	s.	sl. s. al.
15	$2.633^{15°}_{4}$	150	decomp.	$14.1^{0°}$	$33^{100°}$	i. al.
16	1.48	decomp.	....	sl. s.	s.	i. al.
17	....	287	....	v. s.	v. s.	v. s. al.
18	1.794	....	....	$29^{6°}$	$66^{43°}$	i. al.
19	$1.729^{17°}$	48	decomp. 220	$74.7^{0°}$	$301.5^{60°}$	i. al.
20	2.54	900	white heat	decomp.	....	s. a., al.
21	$4.216^{24°}_{6}$	630	....	$87.7^{0°}$	$250^{110°}$	s. al.
22	$2.358^{0°}$	....	....	$204.2^{0°}$	∞	
23	3.62	dec. 1155	....	$0.0011^{18°}$	....	s. a., NH_4 salts
24	3.152	decomp. 290	....	$174.9^{18°}$	v. s.	s. al.
25	3.054	872	....	$44.2^{0°}$	$101.9^{100°}$	s. abs. al.
26	$1.964^{16.7°}$	112°	$4H_2O$, 60	$106.2^{0°}$	$205.8^{40°}$	
27	$3.895^{15°}$	....	....	$0.12^{15°}$	....	s. acetic, NH_4 salts
28	2.44	902	dec. 1000	$0.012^{18°}$	sl. s.	s. HCl; i. HF
29	3.625	375	....	$0.41^{0°}$	$21.83^{100°}$	s. NH_4 salts
30	1.396	....	....	$0.9^{0°}$	$47.71^{100°}$	s. NH_4 salts
31	$4.549^{25°}_{4}$	507	....	$164^{0°}$	$370^{100°}$	
32	4.415	....	....	$448.9^{0°}$	∞	
33	2.93	645	....	$39.5^{0°}$	$101.1^{100°}$	0.012 abs. al.
34	$2.249^{15.5°}$	....	....	$60.43^{0°}$	$206.5^{100°}$	i. HNO_3
35	....	decomp.	....	$0.0051^{18°}$	$5^{100°}$	s. HCl, HNO_3
36	4.34	3000	....	decomp.	....	sl. s. al.
37	3.544	....	....	i.	i.	s.a., NH_4 salts
38	3.71	dec. wh. ht.	....	$0.0114^{18°}$	$0.0104^{100°}$	sl. s. a.; i. al., dil. H_2SO_4
39	$3.72^{15°}$	....	....	s.	decomp.	s. al.
40	....	decomp.	....	0.0033	....	v. s. H_2SO_3
41	2.046	120	444.7	i.	i.	sl. s. CS_2
42	1.957	119.3	444.7	i.	i.	s. CS_2, al.
43	2.07	114.5	444.7	i.	i.	{$24^{0°}$, $181.3^{55°}$} CS_2
44	$1.7094^{0°}_{4}$	−80	138	decomp.	....	s. CS_2, al.
45	{$1.43368^{0°}$, 2.2639(A.)}	−72.7	−10	7979 c.c.$^{0°}$	1560 c.c.$^{60°}$	s. al., H_2SO_4
46	{1.982^{15}_{4}, 2.75(A).}	14.8	46.2	decomp.	....	s. conc. H_2SO_4
47	$1.8342^{18°}_{4}$	10.46	decomp. 40	∞	∞	decomp. al.
44	$1.788^{17°}$	8.53	210–338	∞	∞	decomp. al.
49	$1.665^{0°}$	−38.9	170–190	∞	∞	decomp. al.

PHYSICAL CONSTANTS OF

	Name.	Formula.	Mol. wt.	Crystalline form and color.
1	Sulphuric acid, pyro-.	$H_2S_2O_7$	178.2	crystals
2	Tantalum	Ta	181.5	gray
3	bromide	$TaBr_5$	585.1	crystals, yellow
4	chloride	$TaCl_5$	358.8	prisms, yellow
5	oxide	Ta_2O_5	443	rhombic, white
6	Telluric acid	H_2TeO_4	193.5	
7	Tellurium	Te	127.5	amorphous, rhombic.
8	bromide	$TeBr_2$	187.3	needles, steel gray
9	chloride	$TeCl_2$	198.4	crystals, black
10	iodide	TeI_2	181.3	crystals, black
11	oxide	TeO_2	159.5	octahedral, yellow
12	Tellurous acid	H_2TeO_3	177.5	octahedral
13	Thallium	Tl	204	bluish white
14	bromide	TlBr	283.9	regular
15	carbonate	Tl_2CO_3	468	monoclinic
16	chloride	TlCl	239.5	regular, white
17	hydroxide	Tl(OH)	221	prisms, pale yellow
18	iodide	TlI	330.9	regular, yellow
19	nitrate	$TlNO_3$	266	rhombic, prisms
20	oxide (ous)	Tl_2O	424	yellow
21	oxide (ic)	Tl_2O_3	456	hexagonal, black
22	phosphate	Tl_3PO_4	707	needles
23	sulphate	Tl_2SO_4	504.1	rhombic, prisms
24	sulphide	Tl_2S	440.1	tetrag., blue black
25	Thorium	Th	232.4	amorph. or cryst.
26	chloride	$ThCl_4$	374.2	needles
27	hydroxide	$Th(OH)_4$	300.4	gelatinous
28	Tin	Sn	118.7	rhombic, tetragonal
29	stannic acid	H_2SnO_3	168.7	amorphous
30	stannic acid, meta-.	$H_{10}Sn_5O_{15}$	843.6	
31	stannic bromide	$SnBr_4$	438.4	
32	stannic chloride	$SnCl_4$	260.5	liquid
33	stannic iodide	SnI_4	626.4	
34	stannic oxide	SnO_2	150.7	amorph., hexag., tetrag, rhomb.
35	stannic sulphate	$Sn(SO_4)_2.2H_2O$	346.9	rhombic
36	stannic sulphide	SnS_2	183.8	hexagonal, yellow
37	stannous bromide	$SnBr_2$	278.5	crystals, yellow
38	stannous chloride	$SnCl_2$	189.6	
39	stannous chloride	$SnCl_2.2H_2O$	225.7	triclinic
40	stannous hydroxide.	$Sn(OH)_2$	152.7	amorphous
41	stannous iodide	SnI_2	372.5	crystals, red

INORGANIC COMPOUNDS (Continued)

	Sp. gr $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water.	Hot water.	Alcohol, acids, etc.
1	1.89	35	decomp.	decomp.	....	decomp.
2	16.6	2850	....	i.	i.	s. HF, fused alk.
3	....	240	320	decomp.	....	s. abs. al., ether
4	3.68	211.3	241.6	decomp.	....	s. H_2SO_4, abs. al.
5	7.53	....	....	i.	i.	i. a.; s. fused $KHSO_4$
6	3.441	decomp. 160	....	i.	sl. s.	i. cold a., alk.
7	6.25	451	1390	i.	i.	s.conc. H_2SO_4, KOH
8	....	280	339	decomp.		
9	6.89 (D).	175	324	decomp.	....	dec. HCl
10	....	....	....	i.	i.	
11	$5.89^{0°}$	dull red	>700	0.00067	....	s. a., alk.
12	3.053	dec. 40	....	sl. s.	decomp.	s. a., alk.
13	11.85	301.7	1280	i.	i.	s. HNO_3, H_2SO_4
14	7.54	450	....	$0.0466^{20°}$	$0.869^{68.5°}$	
15	7.11	272	....	$4.02^{15.5°}$	$27.21^{100°}$	i. al, ether
16	7.02	429	....	$0.2^{0°}$	$2^{90°}$	sl.s. HCl; i.al.
17	....	decomp. 100	....	v. s.	v. s.	s. al.
18	$7.072^{15.5°}$	422	806	$0.0064^{20°}$	$0.125^{100°}$	i. al, KI; s. aq. rg.
19	5.55	205	....	$3.9^{0°}$	$414^{100°}$	i. al.
20	....	>870	O, 1865	s.	s.	s. al.
21	$5.56^{0°}$	759	O_2, 875	i.	i.	s. a.; i. al.
22	6.89	....	....	$0.5^{15°}$	$0.67^{100°}$	i. al.; s. NH_4 salts
23	6.76	632	decomp.	$2.7^{0°}$	$16.5^{90°}$	
24	8.0	448	decomp.	$0.0379^{20°}$	sl. s.	s. a.; i. alk.
25	11.2	1700	....	i.	i.	s. HCl, H_2SO_4
26	4.59	820	....	v. s.	v. s.	s. al. ether, KCl
27	....	decomp.	....	i.	i.	s. a.; i. alk.
28	5.85-7.298	231.9	2270	i.	i.	s. dil. a., conc. alk., aq. rg.
29	....	....	....	i.	i.	i. a.; s. KOH, NaOH
30	....	....	....	i.	i.	
31	$3.349^{35°}$	29.9	203.3	s.	decomp.	
32	$2.2788^{0°}_{4}$	−33	114	s.	decomp.	s. al., ether
33	$4.696^{11°}$	144	295	v. s.	decomp.	s. al., ether
34	6.95	1127	....	i.	i.	s. conc. H_2SO_4
35	....	....	....	v. s.	decomp.	s. dil. H_2SO_4, HCl
36	4.51	dec. rd. ht.	....	0.00002	....	s. conc. HCl, alk., sulphides
37	$5.117^{17°}$	215	619	s.	decomp.	
38	....	247.2	603	$83.9^{0°}$	$269.8^{15°}$	s. alk., al.
39	2.7	37.7	decomp.	$118.7^{0°}$	∞	s. al., alk.
40	....	....	....	i.	decomp.	s. al., dil. a.
41	....	316	....	$0.98^{20°}$	$4.03^{100°}$	s. dil. HCl, KOH, CS_2

PHYSICAL CONSTANTS OF

	Name.	Formula.	Mol. wt.	Crystalline form and color.
1	Tin, stannous oxide...	SnO	134.7	regular
2	stannous sulphate..	$SnSO_4$	214.8	crystals.
3	stannous sulphide..	SnS	150.8	crystals, brown
4	Titanic acid	H_2TiO_3	98.1	....
5	Titanium	Ti	48.1	amorph., dark gray...
6	Titanium bromide...	$TiBr_4$	367.8	crystals, orange
7	chloride, di-	$TiCl_2$	119	black
8	chloride, tri-	$TiCl_3$	154.5	dark violet
9	chloride, tetra-	$TiCl_4$	189.9	....
10	iodide	TiI_4	555.8	octahedral, red
11	oxide, sesqui-	Ti_2O_3	144.2	amorphous, black
12	oxide, di-	TiO_2	80.1	tetrag., rhomb. white to black
13	sulphate	$Ti_2(SO_4)_3$	384.4	crystals, green
14	Tungsten	W	184	gray to black
15	chloride, di-	WCl_2	254.9	amorphous, gray
16	chloride, tetra-	WCl_4	325.8	crystals, gray
17	chloride, penta-	WCl_5	361.3	needles, black
18	chloride, hexa-	WCl_6	396.8	regular, dark blue
19	oxide, di-	WO_2	216	rhombic, brown
20	oxide, tri-	WO_3	232	rhombic, yellow
21	sulphide, di-	WS_2	248.1	crystals, dark gray...
22	sulphide, tri-	WS_3	280.2	black
23	Tungstic acid	H_2WO_4	250	yellow
24	Uranic acid	H_2UO_4	304.5	yellow
25	Uranium	U	238.2	crystals, white
26	bromide	UBr_4	557.9	leaflets, black
27	chloride	UCl_4	380	regular, green
28	iodide	UI_4	745.9	monoclinic, yellow
29	oxide	UO_2	270.2	octahedral, black
30	oxide (ous, ic)	U_3O_8	842.6	olive green
31	oxide, tri-	UO_3	286.2	yellow
32	sulphate	$U(SO_4)_2.4H_2O$	502.4	monoclinic, green
33	sulphide	US_2	302.3	gray
34	Uranyl acetate	$UO_2(C_2H_3O_2)_2.2H_2O$	424.3	monoclinic, yellow
35	nitrate	$UO_2(NO_3)_2.6H_2O$	502.3	rhombic, yellow
36	phosphate	$UO_2(HPO_4)_2.4H_2O$	534.4	rhombic, yellow
37	sulphate	$UO_2SO_4.3H_2O$	420.3	crystals, yellow
38	sulphide	UO_2S	302.3	brown
39	Vanadic acid, meta-..	HVO_3	100	scales, yellow
40	acid, pyro-	$H_4V_2O_7$	218	amorphous, brown...
41	Vanadium	V	51	crystals, light gray..
42	chloride, di-	VCl_2	121.9	hexagonal, green
43	chloride, tri-	VCl_3	157.4	pink

INORGANIC COMPOUNDS (Continued)

	Sp. gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water.	Hot water.	Alcohol, acids, etc.
1	6.3	dec. rd. ht.	....	i.	i.	s. a., NH_4Cl, i. alk.
2	....	....	....	$18.9^{19°}$	$18.2^{100°}$	s. H_2SO_4
3	$5.08^{0°}$	882	1230	0.000002	....	s. conc. HCl, $(NH_4)_2Sx$
4	....	....	....	i.	i.	s. a., alk.; i. al.
5	4.5	1800–1850	....	i.	decomp.	s. a.
6	2.6	39	230	decomp.		
7	....	....	....	decomp.	....	i. CS_2, $CHCl_3$
8	....	decomp. 440	....	s.	s.	s. al., HCl
9	1.76	−26	136	s.	decomp.	s. dil. HCl
10	....	150	>360	v. s.	v. s.	
11	....	....	....	i.	i.	s. H_2SO_4, HF
12	4.26	1560	....	i.	i.	s. alk., conc. H_2SO_4
13	....	....	....	i.	i.	s. dil. a.; i. al.
14	18.7	2974	....	i.	i.	s. HNO_3, aq. rg., hot KOH
15	....	....	....	decomp.		
16	....	decomp.	....	decomp.		
17	....	248	275.6	decomp.	....	sl. s. CS_2
18	$13.3^{350°}$ (D)	275	346.7	sl. s.	decomp.	v. s. CS_2
19	12.11	....	....	i.	i.	s. a., alk.
20	7.16	rd. ht.	....	i.	i.	i. a.; s. alk.
21	$7.5^{10°}$					
22	....	....	....	sl. s.	s.	s. alk. sulphides, alk.
23	....	$\frac{1}{2}H_2O$, 100°	....	i.	i.	s. HF, alk.
24	$5.93^{15°}$	H_2O, 250–300	....	i.	i.	s. a., alk. carbonates; i. alk.
25	18.68	....	....	i.	i.	s. a.; i. alk.
26	4.838	....	....	v. s.	v. s.	
27	....	....	....	s.	decomp.	s. NH_4Cl
28	$5.6^{15°}$	500	....	s.	s.	
29	10.95	2176	....	i.	i.	s. dil. a., alk. carbonates
30	7.31	decomp.	....	i.	i.	s. a.
31	5.14	decomp.	....	i.	i.	s. HNO_3
32	....	$4H_2O$, 300	....	decomp.	....	s. dil. a.
33	....	>1100	....	decomp.	....	s. conc. HCl
34	....	$2H_2O$, 275	....	s.	decomp.	s. al.
35	2.807	59.5	118	200	v. s.	v. s. al., ether, acetic
36	....	....	....	i.	i.	i. acetic
37	$3.28^{16.5°}$	....	....	$16.6^{13°}$	$22.2^{100°}$	s. al., H_2SO_4
38	....	decomp.	....	sl. s.	sl. s.	s. al., conc. HCl
39	....	....	....	sl. s.	s.	s. alk., NH_4OH
40	....	....	....	sl. s.	s.	s. a., alk.
41	5.69	1710	....	i.	i.	s. HNO_3, HF, H_2SO_4
42	3.28	....	....	s.	s.	s. al., ether
43	3.0	....	....	s.	s.	s. abs. al., ether

PHYSICAL CONSTANTS OF

	Name.	Formula.	Mol. wt.	Crystalline form and color.
1	Vanadium chloride, tetra-	VCl_4	192.8	liquid, red
2	oxide, di-	V_2O_2	134	crystals, light gray
3	oxide, tri-	V_2O_3	150	crystals, black
4	oxide, tetra-	V_2O_4	166	crystals, blue
5	oxide, penta-	V_2O_5	182	rhombic, yellow to red
6	sulphate	$(VO)_2(SO_4)_3$	422.2	blue
7	sulphide, tri-	V_2S_3	198.2	plates, dark
8	sulphide, penta-	V_2S_5	262.4	black
9	Xenon	Xe	130.2	
10	Ytterbium	Yb	173.5	
11	chloride	$YbCl_3.6H_2O$	388	rhombic, green
12	oxide	Yb_2O_3	395	
13	sulphate	$Yb_2(SO_4)_3$	635.2	
14	Yttrium	Yt	88.7	hexagonal, gray black
15	Yttrium chloride	$YtCl_3.6H_2O$	303.2	plates
16	hydroxide	$Yt(OH)_3$	139.7	gelatinous
17	nitrate	$Yt(NO_3)_3.6H_2O$	382.8	prisms
18	oxide	Yt_2O_3	225.4	crystals
19	sulphate	$Yt_2(SO_4)_3.8H_2O$	609.7	
20	Zinc	Zn	65.37	crystals
21	acetate	$Zn(C_2H_3O_2)_2.3H_2O$	237.5	
22	bromide	$ZnBr_2$	225.2	needles
23	carbonate	$ZnCO_3$	125.4	rhombic
24	chloride	$ZnCl_2$	136.3	octahedral
25	cyanide	$Zn(CN)_2$	117.4	ortho. prisms
26	ferrocyanide	$Zn_2Fe(CN)_6.3H_2O$	396.7	
27	hydroxide	$Zn(OH)_2$	99.4	rhombic, prisms
28	iodide	ZnI_2	319.2	octahedra
29	nitrate	$Zn(NO_3)_2.6H_2O$	297.5	tetragonal
30	oxalate	$ZnC_2O_4.2H_2O$	189	
31	oxide	ZnO	81.4	hexag. or amorph.
32	phosphate	$Zn_3(PO_4)_2$	386.2	prisms
33	phosphate, pyro-	$Zn_2P_2O_7$	304.8	
34	sulphate	$ZnSO_4$	161.4	
35	sulphate	$ZnSO_4.7H_2O$	287.6	rhombic prisms or mono.
36	sulphide	ZnS	97.4	reg., tetrag. or hexag.
37	sulphite	$2ZnSO_3.5H_2O$	381	
38	Zirconium	Zr	90.6	cryst. or amorph.

INORGANIC COMPOUNDS (Continued)

	Sp. gr. $H_2O = 1$ (A) air = 1 D (H_2) = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water.	Hot water.	Alcohol, acids, etc.
1	$1.8653^{20°}_{4}$	<−18	154	s.	s.	s. abs. al., ether
2	3.64	....	....	i.	i.	s. a., alk.
3	$4.87^{18°}_{4}$	....	....	sl. s.	s.	s. alk., HF
4	....	....	....	i.	i.	s. a., alk.
5	$3.357^{18°}_{4}$	658	....	$0.8^{20°}$	....	s. conc. a., alk
6	....	....	....	v. s.	decomp.	s. al.
7	3.85	....	....	....	....	s. HNO_3; sl. s. alk.
8	3.0	....	....	....	....	sl. s. alk.; s. HNO_3
9	4.422 (A.)	−140	−109	28.4 c.c.$^{17°}$		
10						
11	2.575	150–155	$6H_2O$, 180	v. s.	v. s.	sl. s. al.; i. ether
12	9.175(?)	....	....	i.	i.	s. hot a.
13	3.62	decomp. 900	....	$44.2^{0°}$	$4.67^{100°}$	
14	3.8	....	....	decomp.	....	v. s. dil. a.
15	$2.18^{18°}$	160	....	v. s.	v. s.	sl. s. al.; i. ether
16	....	decomp.	....	i.	i.	s. a, NH_4Cl; i. alk.
17	2.682	....	....	s.	s.	s. conc. HNO_3
18	$5.35^{18°}$	....	....	i.	i.	sl. s. a.
19	2.612	dec. 1000	....	1.52	sl. s.	s. sat. K_2SO_4 sol.
20	7–7.19	419.4	918	i.	i.	s. a., alk., acetic
21	1.72	242	....	$30^{25°}$	$44.6^{100°}$	s. al.
22	$4.219^{20°}_{4}$	394	650	$390^{0°}$	$670^{100°}$	v. s. al., ether, NH_4OH
23	4.44	CO_2, 300	....	$0.001^{15°}$	....	s. a., alk., NH_4 salts
24	$2.907^{25°}_{4}$	365	730	$209^{0°}$	$616^{100°}$	v. s. al., ether
25	....	decomp.	....	i.	i.	s. alk., KCN; i. al.
26	....	....	....	i.	i.	s. NH_3 aq.; i. HCl
27	3.053	decomp.	....	$0.00048^{18°}$	....	s. a., alk.
28	4.696	446	624	$430^{0°}$	$510^{100°}$	s. a. $(NH_4)_2CO_3$ aq.
29	2.065	36.4	130	$324.5^{0°}$	∞	v. s. al.
30	....	....	....	$0.00079^{18°}$	....	s. a., alk.
31	5.42–5.78	....	....	0.001	....	s. a., alk., NH_4 salts
32	$3.998^{15°}$	red ht.	....	i.	i.	s. a.
33	....	....	....	i.	i.	s. a., alk., NH_4OH
34	3.49	decomp. 720	....	$43.02^{0°}$	$95.03^{100°}$	sl. s. al.
35	2.015	50	$7H_2O$, 280	$115.2^{0°}$	$633.59^{100°}$	sl. s. al.
36	3.98	1049	vol. 1180	0.00069	....	i. acetic
37	....	....	....	0.16	decomp.	i. al.; s. H_2SO_3, NH_4OH
38	{4.15 / 6.40	1500 / 2350	.... / .... }	i.	i.	s. HF., sl. s. a.

PHYSICAL CONSTANTS OF

	Name.	Formula.	Mol. wt.	Crystalline form and color.
	Zirconium			
1	chloride	$ZrCl_4$	232.4	
2	hydroxide	$Zr(OH)_4$	158.6	gelatinous
3	nitrate	$Zr(NO_3)_4.5H_2O$	428.1	
4	oxide	ZrO_2	122.6	amorph. or hexag.
5	sulphate	$Zr(SO_4)_2.4H_2O$	354.8	crystals

INORGANIC COMPOUNDS (Concluded)

	Sp. gr. $H_2O = 1$ (A) Air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-Point, Deg. C.	Solubility in 100 parts of Cold water.	Hot water.	Alcohol, acids, etc.
1	....	....	400	s.	decomp.	s. al.
2	3.25	$2H_2O$, 550	....	0.02	....	s. a.; i. al., alk.
3	....	decomp. 100	....	s.	decomp.	
4	$5.4824^{\frac{18.5°}{4}}$	2500	....	i.	i.	s. conc. H_2SO_4, HF
5	....	....	....	$146^{39.5}$	....	s. H_2SO_4; i. al.

PHYSICAL CONSTANTS OF

The following table contains data for about two thousand compounds. The information has been collected from a large number of sources including not only the standard reference works but many modern texts on organic chemistry and on special branches of the subject.

Specific gravities are given at 15° C. where no other temperature is indicated, or at the definite temperature shown by the small figures at the right.

Boiling-points are given at normal atmospheric pressure unless otherwise indicated. Decomposition, occurring near or below the melting or boiling point is indicated by the letter d., preceding the temperature when decomposition occurs before the change of state and following the temperature when decomposition occurs with the change of state: d. 178 indicates that decomposition occurs at 178° C.; 178, d. indicates that the substance changes state with decomposition at 178° C.

Solubilities are indicated by figures giving the mass in grams soluble in 100 c.c. of the solvents. Unless otherwise indicated solubilities under alcohol are for 95% ethyl alcohol.

No.	Name	Synonyms	Formula	Mol. wt.
1	Abietic acid	....	$C_{20}H_{30}O_2$	302.34
2	Acenaphthene	....	$C_{10}H_6(CH_2)_2$	154.14
3	Acetal	....	$CH_3 \cdot CH(OC_2H_5)_2$	118.14
4	Acetaldehyde	aldehyde	CH_3CHO	44.04
5	Acetaldoxime	aldoxime	CH_3CHNOH	59.05
6	Acetamide	....	CH_3CONH_2	59.05
7	Acetamino-naphthol (1, 2)	....	$CH_3CO \cdot NH \cdot C_{10}H_6 \cdot OH$	201.16
8	Acetamino-naphthol (4, 1)	naphthacetol	$CH_3CO \cdot NH \cdot C_{10}H_6 \cdot OH$	201.16
9	Acetamino-phenol (2, 1)	....	$CH_3CO \cdot NH \cdot C_6H_4 \cdot OH$	151.12
10	" " (3, 1)	....	$CH_3CO \cdot NH \cdot C_6H_4 \cdot OH$	151.12
11	" " (4, 1)	....	$CH_3CO \cdot NH \cdot C_6H_4 \cdot OH$	151.12
12	Acetanilide	antifebrin	$C_6H_5 \cdot NH \cdot CO \cdot CH_3$	135.12
13	Acetaniside (o.)	....	$CH_3O \cdot C_6H_4 \cdot NH \cdot COCH_3$	165.14
14	Acetic acid	....	$CH_3 \cdot COOH$	60.04
15	anhydride	....	$(CH_3CO)_2O$	102.07
16	Acetnaphthalide(1)	acetalphanaphthyl-amine	$C_{10}H_7 \cdot NH \cdot COCH_3$	185.16
17	" (2)	acet-betanaphthyl-amine	$C_{10}H_7 \cdot NH \cdot COCH_3$	185.16
18	Aceto-acetic ether.	See *ethyl acetoacetate*		
19	Acetol	acetyl carbinol	$CH_3CO \cdot CH_2OH$	74.06
20	Acetone	dimethyl ketone	$CH_3 \cdot CO \cdot CH_3$	58.06
21	Acetonitrile.	See *methyl cyanide*		
22	Aceto-phenone	phenylmethyl ketone, hypnone	$CH_3CO \cdot C_6H_5$	120.10
23	Acetoxime	....	$(CH_3)_2C : NOH$	73.08
24	Acetphenetidide (p.)	phenacetin, oxy-ethyl acetanilide	$CH_3CO \cdot NH \cdot C_6H_4 \cdot OC_2H_5$	179.16
25	Acet-toluide (o.)	....	$CH_3 \cdot C_6H_4 \cdot NH \cdot COCH_3$	149.14
26	" (m.)	....	$CH_3 \cdot C_6H_4 \cdot NH \cdot COCH_3$	149.14
27	" (p.)	....	$CH_3 \cdot C_6H_4 \cdot NH \cdot COCH_3$	149.14

ORGANIC COMPOUNDS

The following abbreviations are used: — a., acid; abs., absolute; abt., about; acet., acetone; acet. a., acetic acid; al., alcohol; amor., amorphous; anh., anhydrous; br., brown; bz., benzene; c., cold; chl., chloroform; colorl., colorless; cryst., crystals; d., under melting-points, boiling-points or solubilities, decomposes; d., in connection with the names of compounds, dextrorotary; dec., decomposes; dk., dark; deliq., deliquescent; eth., ether; f., from; fluores., fluorescent; glac., glacial; grn., green; h., hot; hex., hexagonal; i., insoluble; ign., ignites; l., laevo-rotary; leaf., leaflets; liq., liquid; lgr., ligroin; lust., lustrous; m., meta-; meth., methyl; mic., microscopic; monocl., monoclinic; m.p., melting-point; n., normal; need., needles; o., ortho-; octahdr., octahedral; p., para-; pa., pale; pl., plates; powd., powder; pr., prisms; purp., purple; pyr., pyridine; rac., racemic; rhomb., rhombic; rhbdr., rhombohedral; s., soluble; sc., scales; sl., slightly; sm., small; subl., sublimes; sym., symmetrical; tab., tablets; tetr., tetragonal; tricl., triclinic; trim., trimetric; uns., unsymmetrical; v., very; visc., viscous; w., water; wh., white; yel., yellow.

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	leaf.	....	182	......	i.	v. s.	v. s.
2	need.	1.0687	95	277.5	......	s. h.	......
3	liq.	$0.8314^{20°}$	......	104	5.5 c.	∞	∞
4	liq.	$0.806^{0°}$	−120.7	20.8	∞	∞	∞
5	liq. or need	$0.965^{20°}$	13 or 47	115	∞	∞	∞
6	need. f. chl.	1.139	82	222	v. s.	v. s.	sl. s.
7	leaf.	....	235 d.	......	......	s.	......
8	need.	....	187	......	i.	s.	......
9	leaf.	....	201	......	s. h.	s.	......
10	need.	....	148–9	......	v. s.	s.	v. sl. s.
11	monocl.	$1.293^{21°}$	166	......	......	......	......
12	white leaf.	$1.211^{4°}$	114.2	303.8	0.5	40.	8.3
13	whte. cryst	....	78–84	303–5	v. s. h.	$55.^{21°}$	......
14	liq.	$1.051^{20°}_{20}$	16.7	118.1	∞	∞	∞
15	liq.	$1.080^{15°}$	......	137	dec.	∞	∞
16	colorl. cryst.	....	159	......	s. h.	v. s.	......
17	leaf.	....	132	......	s. h.	s.	......
18							
19	liq.	....	......	145-150d.	∞	∞	∞
20	liq.	$0.792^{20°}$	−94.6	56.5	∞	∞	∞
21							
22	plates	$1.033^{15°}_{15}$	20.5	202	i.	s.	s.
23	prisms	$0.887^{75°}_{4}$	59–60	135	v. s.	v. s.	v. s.
24	leaf.	....	134–5	......	0.11	6	1.3
25	colorl. cryst.	$1.168^{15°}$	107–110	296	0.86	s.	s.
26	cryst.	....	65.5	303	$0.44^{13°}$	......	......
27	need.	....	151–3	307	0.09	10.8	......

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Acetyl-acetone		$CH_3CO\cdot CH_2COCH_3$	100.09
2	Acetylamino-benzoic acid (o.)		$CH_3CO\cdot NH\cdot C_6H_4\cdot COOH$	179.13
3	Acetylamino-benzoic acid (m.)		$CH_3CO\cdot NH\cdot C_6H_4\cdot COOH$	179.13
4	Acetylamino-benzoic acid (p.)		$CH_3CO\cdot NH\cdot C_6H_4\cdot COOH$	179.13
5	Acetyl-biuret		$CH_3CO\cdot NH\cdot CO\cdot NH\cdot CO\cdot NH_2$	145.11
6	bromide		CH_3COBr	122.95
7	chloride		CH_3COCl	78.49
8	glycine		$CH_3CO\cdot NH\cdot CH_2 COOH$	117.09
9	peroxide		$(CH_3CO)_2O_2$	118.07
10	phenylene-diamine (p.)	amino-acetanalid	$NH_2\cdot C_6H_4\cdot NH\cdot COCH_3$	150.14
11	phenylhydra-zine (α)	hydracetin	$C_6H_5\cdot NH\cdot NH\cdot COCH_3$	150.14
12	salicylic acid	aspirin	$C_6H_4<{O\cdot COCH_3 \atop COOH}$	180.11
13	urea		$NH_2\cdot CO\cdot NH\cdot COCH_3$	102.08
14	Acetylene		$HC\vdots CH$	26.03
15	tetrabromide		$CHBr_2\cdot CHBr_2$	345.71
16	tetrachloride	tetrachlor-ethane	$CHCl_2\cdot CHCl_2$	167.87
17	Aconitic acid	equisetic acid	$C_3H_3(COOH)_3$	174.08
18	Aconitine	acetylbenzoyl-aconine	$C_{34}H_{47}O_{11}N$(?)	645.55
19	hydrobromide		$C_{34}H_{47}O_{11}N\cdot HBr + 2\frac{1}{2}H_2O$	771.52
20	Acridine		$C_6H_4<{CH \atop N}>C_6H_4$	179.15
21	Acrolein	acrylic aldehyde	$CH_2:CH\cdot CHO$	56.05
22	Acrylic acid	ethylenecarboxylic acid	$CH_2:CH\cdot COOH$	72.05
23	Adenine		$C_5H_5N_5$	135.12
24	Adipic acid		$COOH(CH_2)_4COOH$	146.11
25	Aesculin	esculin	$C_{15}H_{16}O_9$	340.20
26	Aldehyde.	See *acetaldehyde*		
27	ammonia		$CH_3\cdot CH(OH)NH_2$	61.08
28	benzoic acid (o.)		$COOH\cdot C_6H_4\cdot CHO$	150.09
29	" " (m.)		$COOH\cdot C_6H_4\cdot CHO$	150.09
30	" " (p.)		$COOH\cdot C_6H_4\cdot CHO$	150.09
31	Aldol		$CH_3\cdot CH(OH)CH_2\cdot CHO$	88.08
32	Alizarine	dihydroxyanthra-quinone α, β	$C_6H_4(CO)_2C_6H_2(OH)_2$	240.13
33	Allantoin		$C_4H_6N_4O_3$	158.11
34	Alloxan	mesoxalylurea	$C_4H_2N_2O_4+1$ or $4H_2O$	214.11 ($4H_2O$)
35	Allyl acetate		$CH_3\cdot COO\cdot C_3H_5$	100.09

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	liq.	$0.987^{15°}$	......	139.6	12.5	∞	∞
2	need.	....	185	......	sl. s.; s.h.	s. h.	s.
3	....	....	248 d.	......	sl. s. h.	sl. s. h.	sl. s.
4	need.	....	250 d.	......	sl. s.	s.	sl. s.
5	need.	....	193	......	v. s.	......	v. sl. s.
6	liq.	....	......	81	d.	d.	s.
7	liq.	$1.105^{20°}$	......	55(50.9)	d.	d.	s.
8	cryst.	....	206	......	2.7	s.	i.
9	leaf.	....	30	$63^{21mm.}$	sl. s.	......	∞
10	need.	....	159.5	......	sl. s.	v. s.	v. s.
11	colorl. cryst.	....	128–130	......	sl.s.; s.h.	s.	sl. s.
12	colorl. cryst.	....	135	......	sl. s.	s.	s.
13	....	....	218–9	......	v. s. h.	$1^{20°}$	....
14	gas	0.906(A)	–81	–85	v. sl. s.	s.	25 in 1 of acet.
15	yellowish liq.	2.97	......	136–7^{36mm}, 239-42 d.	i.	s.	∞
16	liq.	$1.58^{25°}$	......	147	i.	∞	∞
17	leaf.	....	191 d.	......	18	50^{12}	sl. s.
18	prisms	....	abt. 190	......	.03	4.5	2.25
19	hex. tab.	....	160–3	......	s.	s.	....
20	leaf.	....	107	abt. 360	v.sl.s.	v. s.	v. s.
21	liq.	0.84	......	52.4	40	s.	s.
22	liq.	$1.062^{16°}$	7–8	140	∞	......	....
23	need. f. c. H_2O	....	360 d.	......	.09 cold	sl. s.	i.
24	need.	....	153	$265^{100mm.}$	$1.5^{15°}$	v. s.	sl. s.
25	wh. need.	....	160	......	0.16 c., 8 h.	sl. s.	sl. s.
26							
27	rhomb.	....	70–80	100	v. s.	v. s.	sl. s.
28	leaf.	1.404	97.2	......	v. s.	v. s.	v. s.
29	need.	....	164–6	......	......	......	....
30	wh. need.	....	246,(285)	......	s. h.	v. s.	sl. s.
31	liq.	1.109	......	90–$105^{20mm.}$	∞	∞	s.
32	or. need.	....	289–90	430	i. c.	v. s.	v. s.
33	wh. cryst.	....	227–31 d.	......	0.6 c., v. s. h.	v. sl. s.	i.
34	prisms	....	dec. abt. 170	......	v. s.	s.	....
35	liq.	$0.938^{0°}$	......	$103–4^{734}$	sl. s.	∞	∞

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Allyl acetic acid		$C_3H_5 \cdot CH_2 \cdot COOH$	100.09
2	acetonitrile		$C_3H_5 \cdot CH_2CN$	81.09
3	alcohol		$CH_2 : CH \cdot CH_2OH$	58.06
4	amine		$CH_2 : CH \cdot CH_2 \cdot NH_2$	57.08
5	aniline		$C_6H_5 \cdot NH \cdot C_3H_5$	133.14
6	benzene		$C_6H_5 \cdot CH : CH \cdot CH_3$	118.13
7	benzoate		$C_6H_5 \cdot CO_2 \cdot C_3H_5$	162.13
8	bromide	monobromopropylene(γ)	$CH_2 : CH \cdot CH_2Br$	120.98
9	chloride	monochloropropylene (γ)	$CH_2 : CH \cdot CH_2Cl$	76.52
10	cinnamate		$C_6H_5.CH : CH \cdot COO \cdot C_3H_5$	188.16
11	cyanide		$CH_2 : CH \cdot CH_2CN$	67.07
12	ether		$(CH_2 : CH \cdot CH_2)_2O$	98.11
13	formate		$HCOO \cdot C_3H_5$	86.07
14	iodide		$CH_2 : CH \cdot CH_2I$	167.98
15	isoamyl ether		$C_3H_5 \cdot O \cdot C_5H_{11}$	128.17
16	isocyanide		$CH_2 : CHCH_2NC$	67.07
17	mercaptan		$CH_2 : CH \cdot CH_2SH$	74.12
18	mustard oil	allyl isosulphocyanicester, allyl isothiocyanate	$CH_2 : CH \cdot CH_2NCS$	99.13
19	oxalate		$C_2O_4(C_3H_5)_2$	170.12
20	phenyl ether		$C_6H_5 \cdot OC_3H_5$	134.13
21	pyridine (1)		$C_3H_5 \cdot C_5H_4 \cdot N$	119.12
22	sulphide	thioallyl ether	$(CH_2 : CH \cdot CH_2)_2S$	114.17
23	sulphocarbamide	thiosinamine	$C_3H_5 \cdot NH \cdot CS \cdot NH_2$	116.16
24	sulphocyanide		$C_3H_5 \cdot SCN$	99.13
25	Allylene	methyl acetylene, propine	$CH_3 \cdot C \vdots CH$	40.05
26	oxide		$CH_3 \cdot (C : CH)O$	56.05
27	Aluminum ethyl		$Al(C_2H_5)_3$	114.25
28	methyl		$Al(CH_3)_3$	72.19
29	Amidol.	See *diaminophenol*	*hydrochloride*	
30	Amino-acetanilid (p.)		$NH_2 \cdot C_6H_4 \cdot NH \cdot COCH_3$	150.14
31	acetic acid	glycin, glycocoll	$NH_2 \cdot CH_2 \cdot COOH$	75.06
32	acetophenone (p.)		$NH_2 \cdot C_6H_4COCH_3$	135.12
33	anthraquinone (1)		$NH_2 \cdot C_6H_3 : (CO)_2 : C_6H_4$	223.15
34	" (2)		$NH_2 \cdot C_6H_3 : (CO)_2 : C_6H_4$	223.15
35	azo-benzene (p.)	aniline yellow	$NH_2 \cdot C_6H_4 \cdot N_2 \cdot C_6H_5$	197.18
36	azo-naphthalene (4, α, α)		$C_{10}H_7 \cdot N_2 \cdot C_{10}H_6 \cdot NH_2$	297.25
37	benzaldehyde (o.)		$NH_2 \cdot C_6H_4 \cdot CHO$	121.10
38	" (m.)		$NH_2.C_6H_4 \cdot CHO$	121.10
39	" (p.)		$NH_2 \cdot C_6H_4 \cdot CHO$	121.10
40	benzamide (o.)		$NH_2 \cdot C_6H \cdot CONH_2$	136.12
41	" (m.)		$NH_2 \cdot C_6H \cdot CONH_2$	136.12
42	" (p.)		$NH_2 \cdot C_6H \cdot CONH_2$	136.12
43	benzene.	See *aniline*		
44	benzene-sulphonic acid (o.)		$NH_2 \cdot C_6H_4 \cdot SO_3H + \frac{1}{2}H_2O$	182.16
45	benzene-sulphonic acid (m.)	metanilic acid	$NH_2 \cdot C_6H_4 \cdot SO_3H + 1\frac{1}{2}H_2O$	200.18

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	liq.	$0.984^{18°}$	......	186–8	sl. s.	v. s.	v. s.
2	liq.	$1.18^{13°}$	......	140	i.	......	....
3	liq.	$0.854^{20°}$	......	96.6	∞	∞	∞
4	liq.	0.769	......	56.0–56.5	v. s.	s.	∞
5	yel. oil	$0.982^{25°}$	......	208–9	sl. s.	s.	....
6	liq.	0.914	......	176–7	......	s.	....
7	......	1.059	......	228	....	......	....
8	liq.	1.436	......	70–71	i.	∞	∞
9	liq.	$0.937^{20°}$	......	44.6–46	i.	s.	∞
10	wh. cryst.	$1.052^{25°}_{25}$	......	284–6 d.	i.	v. s.	∞
11	....	0.835	......	119	......	s.	....
12	....	$0.805^{18°}$	......	94.3	sl. s.	∞	∞
13	liq.	0.932	......	82–3	......	s.	....
14	yel. liq.	$1.89^{18°}$	......	101–2	i.	s.	....
15	liq.	....	......	120	v. sl. s.	∞	∞
16	liq.	$0.794^{17°}$	......	96–106	sl. s.	s.	∞
17	....	....	......	90	......	∞	∞
18	liq.......	$1.017^{10°}$	......	150.7	v. sl. s.	v. s.	v. s.
19	....	1.055	......	217	i.	s.	....
20	....	0.986	......	191.7	i.	......	....
21	liq.	$0.959^{0°}$	......	189–190	......	......	....
22	....	$0.888^{27°}$	......	140	sl. s.	∞	∞
23	....	....	74	......	v. s.	v. s.	v. s.
24	....	1.056	......	161	i.	......	....
25	gas	....	−110	−23.5	......	......	3000
26	....	....	......	62–3	sl. s.	......	....
27	liq.	....	......	194	decomp.	......	....
28	liq.	....	0	130	......	......	....
29							
30	need.	....	159.5	......	sl. s.	v. s.	v. s.
31	monocl.	1.161	233 d.	......	23	i.	i.
32	yel. pr..	....	105–6	......	v. sl. s.	s.	s.
33	red need.	....	242	......	i.	s.	s.
34	red need.	....	302	subl.	i.	s.	s.; s. 62
35	yel. need.	....	125–6	abt. 360	sl. s. h.	s. h.	s.
36	red need.	....	173–5	......	......	sl. s.	sl. s.
37	leaf.	....	39	decomp.	sl. s.	v. s.	v. s.
38	yel. amor.	....	......	......	......	......	....
39	flat plates	....	70	......	s.	......	....
40	leaf.	....	108	......	s. h.	v. s.	sl. s.
41	yellow	....	79	abt. 300	sl. s.	s.	s.
42	yellow	....	178–9	......	sl. s.	......	....
43			(182.9)				
44	prisms...	....	......	......	$1.5^{15°}$	sl. s.	sl. s.
45	need. or pr.	....	......	......	s.	sl. s.	sl. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Amino-benzene-sulphonic acid (p.)	See *suphanilic acid*		
2	benzidine (2)...	....	$(NH_2)_2C_6H_3\cdot C_6H_4NH_2$	199.19
3	benzoic (o.)....	anthranilic acid ..	$NH_2\cdot C_6H_4\cdot COOH$..	137.09
4	" (m.)....	....	$NH_2\cdot C_6H_4\cdot COOH$..	137.09
5	" (p.)....	....	$NH_2\cdot C_6H_4\cdot COOH$..	137.09
6	benzonitrile (m.)	....	$NH_2\cdot C_6H_4\cdot CN$.....	118.10
7	" (p.)	....	$NH_2\cdot C_6H_4\cdot CN$.....	118.10
8	cinnamic acid (o.)	....	$NH_2\cdot C_6H_4\cdot CH:CH\cdot COOH$	163.26
9	" " (m.)	....	$NH_2\cdot C_6H_4\cdot CH:CH\cdot COOH$	163.26
10	" " (p.)	....	$NH_2\cdot C_6H_4\cdot CH:CH\cdot COOH$	163.26
11	4 cresol (2)......	....	$NH_2\cdot C_6H_3\cdot CH_3(OH)$	123.12
12	5 " (2).......	....	$NH_2\cdot C_6H_3\cdot CH_3(OH)$	123.12
13	6 " (2).......	....	$NH_2\cdot C_6H_3\cdot CH_3(OH)$	123.12
14	6 " (3).......	....	$NH_2\cdot C_6H_3\cdot CH_3(OH)$	123.12
15	2 " (4).......	....	$NH_2\cdot C_6H_3\cdot CH_3(OH)$	123.12
16	3 " (4).......	....	$NH_2\cdot C_6H_3\cdot CH_3(OH)$	123.12
17	dimethyl aniline (o.)	....	$NH_2.C_6H_4\cdot N(CH_3)_2$	136.16
18	" " (m.)	....	$NH_2\cdot C_6H_4\cdot N(CH_3)_2$	136.16
19	" " (p.)	....	$NH_2\cdot C_6H_4\cdot N(CH_3)_2$	136.16
20	diphenyl (o.)...	....	$NH_2\cdot C_6H_4\cdot C_6H_5$....	169.16
21	" (m.)...	....	$NH_2\cdot C_6H_4\cdot C_6H_5$....	169.16
22	" (p.)...	xenylamine......	$NH_2\cdot C_6H_4\cdot C_6H_5$....	169.16
23	ethanol	....	$NH_2\cdot CH_2\cdot CH\ \cdot OH$	61.08
24	ethyl benzene (o).	....	$NH_2\cdot C_6H_5\cdot C_2H_5$	121.14
25	" " (m.)	....	$NH_2\cdot C_6H_5\cdot C_2H_5$....	121.14
26	" " (p.)	....	$NH_2\cdot C_6H_5\cdot C_2H_5$....	121.14
27	malonic acid....	....	$NH_2\cdot CH(COOH)_2$..	119.07
28	phenol (o.).....	....	$NH_2\cdot C_6H_4\cdot OH$.....	109.10
29	" (m.)....	....	$NH_2\cdot C_6H_4\cdot OH$.....	109.10
30	" (p.).....	para-amidophenol, rodinol	$NH_2\cdot C_6H_4\cdot OH$.....	109.10
31	propionic acid (*α*, d.)	d-alanine	$CH_3\cdot CH(NH_2)COOH$	89.08
32	propionic acid (*α*, *l.*)	l-alanine........	$CH_3\cdot CH(NH_2)COOH$	89.08
33	propionic acid (*α*, rac.)	d, l-alanine......	$CH_3\cdot CH(NH_2)COOH$	89.08
34	propionic acid (*β*)	*β*-alanine........	$CH_2(NH_2)CH_2COOH$	89.08
35	pyridine (2)....	....	$NH_2\cdot C_5H_4N$.......	94.09
36	" (3)....	....	$NH_2\cdot C_5H_4N$.......	94.09
37	" (4)....	....	$NH_2\cdot C_5H_4N$.......	94.09
38	quinoline (2)...	....	$C_9H_6N\cdot NH_2$.......	144.13
39	" (4)...	....	$C_9H_6N\cdot NH_2$.......	144.13
40	salicylic acid (3)	....	$NH_2\cdot C_6H_3(OH)(COOH)$	153.10
41	" " (5)	....	$NH_2\cdot C_6H_3(OH)(COOH)$	153.10

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms per 100 c.c. of Water	Alcohol	Ether
1							
2	need.	....	134	......	......	......	....
3	yel. leaf..	....	144–5	......	$0.35^{113.8°}$	$10.7^{9.6°}$	$16.05^{6.8}$
4	yel. cryst.	....	174	......	$0.56^{10°}$	$2.2^{10°}$	$1.7^{10°}$
5	yel. cryst.	....	186–7	......	$0.33^{10°}$	$11.3^{10°}$	$6.11^{10°}$
6	need.	....	53–4	288–90	sl. s.	v. sl. s.	v. sl. s.
7	colorl.	....	86	......	v. s. h.	v. s.	v. s.
8	need.	....	158–9 d.	......	sl. s. c.; s. h.	s. h.	s.
9	yel. need.	....	180–1	......	sl. s. c.; v. s. h.	v. s.	v. s.
10	yel. need.	....	175–6 d.	......	sl. s. c.; v. s. h.	v. s.	v. s.
11	colorl. leaf. or need.	....	159–61	......	s. c.; v. s. h.	v. s.	v. s.
12	leaf. f. bz.	....	abt. 174	......	s.	v. s.	v. s.
13	need.	....	124–8	......	sl. s.	......	sl. s.
14	warts f. bz.	....	174 d.	......	......	......	....
15	colorl.	....	144.5	......	......	......	....
16	sc. f. eth.	....	135	......	v. sl. s.	v. s.	v. s.
17	....	....	......	218	......	......	....
18	....	....	......	268–70	......	......	....
19	....	....	41	262	......	......	....
20	colorl. leaf.	....	45.5	299	i.	s.	....
21	....	....	30	254	......	......	....
22	colorl. leaf.	....	53	302	sl. s. h.	v. s.	v. s.
23	colorl. liq.	$1.022^{20°}$	....	171	∞	∞	1
24	liq.	$0.983^{22°}$	....	215–6	......	......	....
25	colorl. liq.	$0.990^{0°}$	....	214–15	......	......	....
26	leaf.	$0.975^{22°}$	5	216–65	......	......	....
27	colorl.	....	109 d.	....	sl. s.	sl. s.	....
28	rhomb.	....	170	subl.	$1.7^{0°}$	$4.4^{0°}$	v. s.
29	colorl.	....	123	......	2.6	v. s.	v. s.
30	leaf.	....	184 d.	......	$1.1^{0°}$	$4.5^{0°}$	sl. s.
31	colorl.	....	293	......	20	v. sl. s.	......
32	prisms	....	297 d.	......	......	......	......
33	colorl.	....	195	......	v. s.	$0.37^{25°}$	......
34	prisms f. al.	....	196	......	v. s.	v. sl. s. abs.	i.
35	leaf. f. lgr.	....	56	204	......	v. s.	....
36	leaf. f. bz.	....	64	250–2	v. s.	v. s.	v. s.
37	need. f. bz.	....	154.8	......	v. s.	v. s.	s.
38	leaf.	....	129	......	v. sl. s.; s. h.	v. s.	v. s.
39	need. f. w.	....	154 (+H_2O 69–70)	......	s.	s.	v. s. chl.
40	....	....	235 d.	......	......	v. sl. s.	....
41	need.	....	280 d.	......	i.	i.	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Amino-thiophene	....	$NH_2C_4H_3S$........	99.13
2	triphenyl-methane	....	$(C_6H_5)CH\cdot C_6H_4\cdot NH_2$	259.24
3	Amygdalin......	....	$C_{20}H_{27}NO_{11} + 3H_2O$	511.37
4	Amyl acetate....	amylacetic ester..	$CH_3COO\cdot C_5H_{11}$....	130.15
5	Amyl alcohol (n.).	....	$CH_3(CH_2)_3CH_2OH$	88.11
6	" " (act.)	....	$CH_3(C_2H_5)CH\cdot CH_2OH$	88.11
7	" " (sec. α)	methyl-n-propyl carbinol	$CH_3\cdot CH_2\cdot CH_2\cdot CH(OH)\cdot CH_3$	88.11
8	" " (tert.)	dimethyl ethyl carbinol	$(CH_3)_2\cdot C(OH)\cdot C_2H_5$	88.11
9	amine.........	....	$CH_3\cdot (CH_2)_4\cdot NH_2$...	87.14
10	benzene (n.)....	phenyl pentane...	$C_6H_5\cdot C_5H_{11}$........	148.18
11	bromide (n.....	α-brompentane...	$CH_3\cdot (CH_2)_4Br$.....	151.03
12	chloride (n.)....	α-chlorpentane...	$CH_3\cdot (CH_2)_4Cl$......	106.57
13	ether (n.)......	....	$(C_5H_{11})_2O$..........	158.23
14	formate (n.)....	....	$HCOO\cdot C_5H_{11}$......	116.13
15	iodide.........	....	$CH_3\cdot (CH_2)_4\cdot I$......	198.03
16	isobutyrate.....	....	$C_4H_7OO\cdot C_5H_{11}$.....	158.19
17	nitrite (n.).....	....	$C_5H_{11}\cdot NO_2$.........	117.12
18	salicylate.......	....	$HO\cdot C_6H_4\cdot COO\cdot C_5H_{11}$	168.19
19	Amylene (n.)....	propyl ethylene...	$CH_3\cdot (CH_2)_2\cdot CH{:}CH_2$	70.11
20	"	ethyl-methyl-ethylene	$C_2H_5\cdot CH : CH\cdot CH_3$	70.11
21	"	trimethyl-ethylene	$(CH_3)_2\cdot C : CH\cdot CH_3$	70.11
22	Anaesthesine.....	ethyl para-amino-benzoate	$NH_2\cdot C_6H_4\cdot COO\cdot C_2H_5$	165.14
23	Anethol (p.).....	....	$CH_3\cdot CH : CH\cdot C_6H_4\cdot O\cdot CH_3$	148.15
24	Angelic acid.....	....	$C_4H_7\cdot COOH$.......	100.09
25	Aniline..........	amino-benzene, phenyl-amine	$C_6H_5\cdot NH_2$.........	93.10
26	Anis alcohol (p.)..	anisyl alcohol....	$CH_3O\cdot C_6H_4\cdot CH_2\cdot OH$	138.12
27	Anisaldehyde (p.)	....	$CH_3O\cdot C_6H_4\cdot CHO$..	136.10
28	Anisic acid (p.)...	....	$CH_3O\cdot C_6H_4\cdot COOH$.	152.10
29	Anisidine (o.)....	....	$CH_3O\cdot C_6H_4\cdot NH_2$...	123.12
30	" (p.)....	....	$CH_3O\cdot C_6H_4\cdot NH_2$...	123.12
31	Anisol..........	methyl phenyl ether	$C_6H_5\cdot O\cdot CH_3$.......	108.10
32	Anthracene......	....	$C_6H_4 : (CH)_2 : C_6H_4$	178.15
33	Anthragallol (1, 2, 3)	trihydroxy-anthraquinone	$C_{14}H_5O_2(OH)_3$......	256.03
34	Anthramine (β)..	β-amino-anthra-cene	$C_6H_4 : (CH)_2 : C_6H_3\cdot NH_2$	193.17
35	Anthranil........	....	$C_6H_4 : NH\cdot CO$.....	119.09
36	Anthranilic acid.	See *o.-amino-benzoic acid*		
37	Anthranol.......	γ-hydroxy-anthra-cene	$C_{14}H_{10}O$...........	194.15
38	Anthrapurpurin..	trihydroxy anthra-quinone (1, 2, 7)	$C_{14}H_5O_2(OH)_3$......	256.13
39	Anthraquinoline..	....	$C_{17}H_{11}N$...........	229.18
40	Anthraquinone...	....	$C_6H_4 : (CO)_2 : C_6H_4$.	208.13

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	yel. oil	....	......	......	v. s.	v. s.	i.
2	prisms f. eth.	....	84	......	......	......	s.; s. bz. and lgr.
3	rhomb. f. w.	....	214–6	......	$8.3^{10°}$	$0.11^{10°}$	i.
4	liquid	$0.866^{25°}$	......	148^{0}	$0.18^{20°}$	∞	∞
5	colorl. liq.	$0.817^{20°}$	......	137.8	$2.7^{22°}$	∞	∞
6	colorl. liq.	$0.817^{18°}$	......	128.7	sl. s.	∞	∞
7	colorl. liq.	$0.824^{0°}$	......	119	16.7	∞	∞
8	colorl. liq.	0.814	−12	102.5	sl. s.	s.	s.
9	colorl. liq.	$0.766^{19°}$	......	104	s.	s.	∞
10	colorl. liq.	$0.860^{22°}$	......	201	......	s.	....
11	colorl. liq.	$1.223^{20°}$	......	128.7^{740}	......	s.	....
12	colorl. liq.	0.883^{20}	......	106.6^{740}	......	s.	....
13	yel. liq.	$0.775^{25°}$	......	169	i.	∞	∞
14	colorl. liq.	$0.902^{0°}$	......	130.4	sl. s.	∞	∞
15	....	$1.517^{20°}$	......	155.4^{739}	......	s.	....
16	....	0.859	......	153–5	sl. s.	......	....
17	pa. yel. liq.	....	......	96	......	......	....
18	colorl. liq.	1.052	......	276–7	......	33(90%)	....
19	colorl. liq.	....	......	39–40	i.	∞	∞
20	colorl. liq.	....	......	36.5	i.	∞	∞
21	colorl. liq.	0.666	......	37.1	v. sl. s.	s.	∞
22	rhomb. f. eth.	....	90–1	......	v. sl. s.	s.	14.3
23	leaf.	0.994	21.6	233.	v. sl. s.	∞	∞
24	monocl.	$0.954^{76°}$	45.5	185	sl. s.	v. s. h.	v. s.
25	liquid	$1.022^{20°}$	−6	184.4	$3.1^{16°}$	∞	∞
26	need.	1.113	45	258.8	i.	v. s.	v. s.
27	colorl. liq.	1.126	0	248	sl. s.	∞	∞
28	monocl.	$1.364^{4°}$	184.2	275–80	v. sl. s.; s. h.	v. s.	s.
29	colorl. liq.	1.098	5.2	224	sl. s.	......	....
30	need. f. h. w.	....	57.7	239.5	......	......	....
31	colorl. liq.	0.988^{21}	−37.8	155.	i.	s.	s.
32	colorl. leaf.	1.147	216.5	351	i.	$0.59^{15°}$	$1.17^{15°}$
33	or. red need.	....	310	......	s. alk., green	s.	s.
34	yel. need.	....	238	......	v. sl. s.	sl. s.	sl. s.
35	colorl.	1.189	18	210–5 d.	s. h. dil. NaOH	v. s.	....
36							
37	pale yel. need.	....	160–70 d.	......	......	......	v. s. h. bz.
38	or. need. f. al.	....	abt. 330	......	sl. s. h.	v. s.	sl. s.
39	leaf.	....	170	446	i.	v. s.	v. s.; s. bz.
40	pale yel. need.	....	284.5	380	i.	$0.05^{10°}$ $2.3^{70°}$	v. sl. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Anthrol (m.).....	....	$C_6H_4:(CH)_2:C_6H_3\cdot OH$	194.15
2	Antifebrin.	See *acetanilid*		
3	Antimony pentamethyl	....	$Sb(CH_3)_5$..........	195.35
4	trimethyl......	....	$Sb(CH_3)_3$..........	165.29
5	Antipyrene......	analgesine.......	$C_{11}H_{12}N_2O$.........	188.17
6	Arabinose (d. or l.)	....	$C_5H_{10}O_5$...........	150.11
7	Arabitol.........	arabite..........	$C_5H_{12}O_5$...........	152.13
8	Arachidic acid...	arachic acid......	$C_{20}H_{40}O_2$..........	312.42
9	Arbutin..........	....	$C_{12}H_{16}O_7+\frac{1}{2}H_2O$*	281.20
10	Asparagine (l.)...	....	$C_2H_3(NH_2)(COOH)\cdot CO\cdot NH_2$	132.10
11	Aspartic acid....	....	$CH(NH_2)\cdot(COOH)\cdot CH_2$	133.09
12	Aspirin..........	acetyl-salicylic acid	$C_6H_4<^{O\cdot COCH_3}_{COOH}$..	180.11
13	Atropic acid.....	....	$CH_2:C(C_6H_5)\cdot COOH$	148.11
14	Atropine........	dauterine, inactive tropine	$C_{17}H_{23}O_3N$.........	289.28
15	Atropine sulphate	....	$(C_{17}H_{23}O_3N)_2H_2SO_4$	387.36
16	Auramine.......	....	$HN:C[C_6H_4\cdot N(CH_3)_2]_2$	295.29
17	Aurine..........	coralline.........	$C_{19}H_{14}\cdot O_3$..........	290.22
18	Azelaic acid.....	....	$COOH\cdot(CH_2)_7\cdot COOH$	188.18
19	Azobenzene......	....	$C_6H_5\cdot N_2\cdot C_6H_5$.....	182.16
20	Azobenzoic acid (o.)	....	$COOH\cdot C_6H_4\cdot N_2\cdot C_6H_4\cdot COOH$	270.23
21	Azonaphthaline (α, α)	....	$C_{10}H_7\cdot N_2\cdot C_{10}H_7$....	282.30
22	Azophenol (o.)...	dihydroxy-azobenzene (2, 2′)	$HO\cdot C_6H_4\cdot N_2\cdot C_6H_4\cdot OH$	214.22
23	" (m.) ..	dihydroxy-azobenzene (3, 3′)	$HO\cdot C_6H_4\cdot N_2\cdot C_6H_4\cdot OH$	214.22
24	" (p.)...	dihydroxy-azobenzene (4, 4′)	$HO\cdot C_6H_4\cdot N_2\cdot C_6H_4\cdot OH$	214.22
25	Azotoluene (oo.)..	dimethyl-azobenzene (2, 2′)	$CH_3\cdot C_6H_4\cdot N_2\cdot C_6H_4\cdot CH_3$	210.27
26	" (mm.)	dimethyl-azobenzene (3, 3′)	$CH_3\cdot C_6H_4\cdot N_2\cdot C_6H_4\cdot CH_3$	210.27
27	" (pp.).	dimethyl-azobenzene (4, 4′)	$CH_3\cdot C_6H_4\cdot N_2\cdot C_6H_4\ CH_3$	210.27
28	Azoxybenzene....	....	$(C_6H_5)_2:N_2O$......	198.22
29	Azoxybenzoic acid (o.)	....	$(COOH\cdot C_6H_4)_2N_2O$	286.23
30	Azoxybenzoic acid (m.)	....	$(COOH\cdot C_6H_4)_2N_2O$	286.23
31	Azoxybenzoic acid (p.)	....	$(COOH\cdot C_6H_4)_2N_2O$	286.23
32	Azoxynaphthalene (α)	....	$(C_{10}H_7)_2N_2O$......	298.23

* Other authorities give $C_{25}H_{34}O_{14}$ and m.p. 144–166° C.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	need.	....	d. 200	......	s. acet.	v. s.	v. s.
2							
3	....	....	......	96–100	i.	......	....
4	....	1.523	......	80.6	sl. s.	i.	s.
5	leaf.	$1.19^{20°}$	111–13.	......	100+	100.	3.3
6	rhomb.	....	abt. 160	......	$59^{10°}$	v. sl. s.	i.
7	colorl. warts	....	102	......	v. s.	v. s. h.	....
8	leaf.	....	77	......	i.	$.45^{20°}$	v. s.
9	need....	....	165–70	......	v. s. h.	v. s.	i.
10	rhomb.	1.543	230–5 d.	......	$1.8^{10°}$ $53^{100°}$	i.	i.
11	leaf.	....	290.4 d.	......	$0.39^{10°}$ $5.4^{100°}$	i. abs.	....
12	colorl. cryst.	....	135	......	sl. s.	s.	s.
13	monocl. tab.	....	106–6.	267 d.	$0.14^{19°}$	s.	s. CS_2
14	need.	....	115–115.5	......	$0.22^{25°}$	68.5	6
15	wh. powd.	....	188	......	260	27	0.05
16	yel. leaf. f. al.	....	136	......	i.	s.	....
17	red need.	....	abt. 220	......	i.; s.alk.	s.	s.
18	leaf.	....	106	abt. 360 d.	$0.24^{20°}$ v. s. h.	v. s.	2.7
19	or. leaf.	1.203	68	295–7	i.	$8.5^{16°}$	s.
20	dk. yel. need.	....	237 d.	......	v. sl. s.	s.	v. s.
21	red need.	....	186–90	subl.	i.	sl. s.	s. bz.
22	yel. leaf.	....	171	subl.	i.; s. alk.	0.33	v. s.
23	br. leaf.	....	205	......	v. sl. s.	s.	sl. s.
24	br. triclin.	....	204 d.	......	sl. s.	v. s.	v. s.; s. bz.
25	red prisms	....	55	......	i.	$6^{14.5°}$	$147.7^{16.5}$
26	or. red. rhomb.	....	54–5	......	i.	v. s.	v. s.
27	or. yel. need.	....	144	......	i.; s. lgr.	s.	v. s.
28	yel. need. f. h. al.	$1.248^{20°}_{20}$	36.2	d.	i.	$17.5^{16°}$	v. s.
29	pa. yel. leaf.	....	248	dec.	v. sl. s. h.	sl. s.	sl. s.
30	pa. yel. need.	....	320 d.	......	i.	sl. s.	sl. s.
31	yel. amor.	....	dec.	......	i.	i.	s. pyr.
32	red rhomb.	....	126.5–7.0	......	s. conc. H_2SO_4	s.	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Barbituric acid...	malonyl urea.....	$CO:(NH\cdot CO)_2:CH_2+2H_2O$	164.07
2	Behenic acid.....	....	$C_{22}H_{44}O_2$..........	340.44
3	Benzal chloride...	....	$C_6H_5\cdot CHCl_2$.......	160.99
4	Benzaldehyde....	art. almond oil...	$C_6H_5\cdot CHO$.......	106.09
5	phenylhydrazone	....	$C_6H_5\cdot CH:N\cdot NH\cdot C_6H_5$	196.18
6	Benzaldoxime (α) (anti.)	....	$C_6H_5\cdot CH:NOH$...	121.14
7	Benzaldoxime (β) (syn.)	....	$C_6H_5\cdot CH:NOH$....	121.14
8	Benzamide......	....	$C_6H_5\cdot CONH_2$......	121.14
9	Benzanilid.......	phenyl benzamide	$C_6H_5\cdot CO\cdot NH\cdot C_6H_5$	197.20
10	Benzene.........	....	C_6H_6..............	78.08
11	azo-α-naphthylamine	....	$C_6H_5\cdot N_2\cdot C_{10}H_6\cdot NH_2$	247.21
12	hexabromide (α)	....	$C_6H_6Br_6$...........	457.84
13	hexachloride (α)	....	$C_6H_6Cl_6$...........	290.78
14	" (β)	....	$C_6H_6Cl_6$...........	290.78
15	sulphinic acid...	....	$C_6H_5\cdot SO_2H$........	142.13
16	sulphonic acid..	....	$C_6H_5\cdot SO_3H+1\frac{1}{2}H_2O$.	185.16
17	sulphonic amide.	....	$C_6H_5\cdot SO_2NH_2$......	157.18
18	sulphonic chloride	....	$C_6H_5\cdot SO_2Cl$........	176.57
19	Benzidine (p.)....	4, 4′-diamino-diphenyl (p.)	$NH_2\cdot C_6H_4\cdot C_6H_4\cdot NH_2$	184.20
20	Benzil...........	dibenzoyl........	$C_6H_5\cdot CO\cdot CO\cdot C_6H_5$.	210.15
21	Benzilic acid.....	....	$(C_6H_5)_2\cdot C(OH)\cdot COOH$	228.17
22	Benzoic acid.....	....	$C_6H_5\cdot COOH$.......	122.09
23	anhydride......	....	$(C_6H_5\cdot CO)_2O$......	226.14
24	Benzoin.........	....	$C_6H_5\cdot CH(OH)\cdot CO\cdot C_6H_5$	212.17
25	Benzonitrile.....	phenyl cyanide...	$C_6H_5\cdot CN$..........	103.08
26	Benzophenone...	diphenyl ketone..	$C_6H_5\cdot CO\cdot C_6H_5$.....	182.14
27	Benzoquinone.	See *quinone*		
28	Benzothiophene.	See *thio naphthene*		
29	Benzotrichloride..	toluene trichloride	$C_6H_5\cdot CCl_3$.........	195.43
30	Benzoyl-acetic acid	....	$C_6H_5\cdot CO\cdot CH_2\cdot COOH$	164.11
31	acetone........	....	$C_6H_5\cdot CO\cdot CH_2\cdot CO\cdot CH_3$	162.13
32	bromide........	....	$C_6H_5\cdot COBr$........	185.04
33	chloride........	....	$C_6H_5\cdot COCl$........	140.53
34	cyanide........	....	$C_6H_5\cdot COCN$	131.12

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	rhomb.	....	dec.	......	sl. s.	......	......
2	colorl. need.	....	84	......	i.	$0.10^{17°}$	$1.92^{16°}$
3	colorl. liq.	$1.295^{16°}$	−16	213	i.	∞	∞
4	colorl. liq.	1.05	−13.5	179.5	0.33	∞	∞
5	colorl.	....	154.5–155.5	......	......	......	......
6	colorl. leaf.	$1.11^{29°}$	33–5	118–9 10mm	sl. s.	v. s.	v. s.
7	colorl. tab. or need.	....	128–30	......	sl. s. bz.	......	v. s.
8	colorl. mono. tab.	$1.341^{4°}$	128	290	sl. s. h.	$27^{25°}$	v. s.
9	colorl. leaf.	$1.32^{4°}$	160–1	......	i.	1.7 c., 14.3 h.	sl. s.
10	colorl. rhomb. prisms	$0.879^{20°}$	5.4	80.36	$0.07^{22°}$	∞	∞
11	red need.	....	123	......	s. bz.	s.	s.
12	colorl. monocl.	....	212	......	......	sl. s.	sl. s.
13	colorl. monocl.	$1.87^{20°}$	157	218^{345mm}	$4.35^{15°}$ chl.	$6.5^{18°}$ bz.	v. s. aniline
14	colorl.	....	310	subl.	(Less	s. than	α in chl.)
15	prisms	....	83–4	d. 100	s. h.	v. s.	v. s.
16	colorl. leaf.	....	65–6	......	v. s.	v. s.	i.
17	lust. pl.	....	150	......	sl. s	v. s.	v. s.
18	oil	1.384	14.5	251.5	i.	v. s.	s.
19	lust scales f. h. w.	....	128.2 30.7	400–1 740mm	$0.94^{100°}$	s.	2.2
20	yel. need.	....	95	346–8 d	i.	v. s.	v. s.
21	co or.. monocl.	....	150	......	v. s. h.	v. s.	v. s.
22	colorl. leaf. or ne d.	1.266	121.2	249.2	$0.29^{20°}$ $5.9^{100°}$	$47.^{15°}$ abs.	31.4
23	colorl. rhomb.	1.199	42	360	.	s.	s.
24	hex. f. al.	....	133–7	343–4	i. c.; sl. s. h.	s. h.	......
25	liq.	$1.000^{25°}$	−13.1	191	$1^{100°}$	∞	∞
26	colorl. rhomb.	$1.098^{50°}_{50}$	48–8.5	306	i.	$13.5^{18°}$	$17.5^{13°}$
27							
28							
29	colorl. oil	1.38	−21.2	213–4	dec.	......	......
30	colorl. need.	....	103–4, d.	......	sl. s.	v. s.	v. s.
31	colorl.	....	60–1	......	v. sl. s.	v. s.	v. s.
32	colorl. liq.	1.570	abt. 0	218	dec.	s. wth. dec.	∞
33	colorl. liq.	1.219	−1	198	dec.	dec.	∞
34	colorl. tab.	....	32–3	206–8	i.	......	......

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Benzoyl-peroxide	....	$(C_6H_5 \cdot CO)_2O_2$	242.15
2	phenylhydrazine (α)	....	$C_6H_5 \cdot CO \cdot NH \cdot NH \cdot C_6H_5$	212.17
3	Benzyl acetate...	....	$CH_3 \cdot COO \cdot CH_2 C_6H_5$	150.13
4	aceto-acetic ether	....	$C_2H_3O \cdot CH\ (C_7H_7)$.. $COO \cdot C_2H_5$	220.20
5	alcohol.........	phenylcarbinol...	$C_6H_5 \cdot CH_2OH$......	108.10
6	amine.........	....	$C_6H_5 \cdot CH_2NH_2$.....	107.15
7	benzoate.......	....	$C_6H_5 \cdot COO \cdot CH_2 C_6H_5$	212.17
8	bromide........	....	$C_6H_5 \cdot CH_2Br$	171.06
9	carbinol	See *phenyl ethyl alc*	*ohol*	
10	chloride........	....	$C_6H_5 \cdot CH_2Cl$	126.55
11	cyanide........	....	$C_6H_5 \cdot CH_2CN$......	117.15
12	ether	....	$(C_6H_5 \cdot CH_2)_2O$	198.19
13	iodide..........	....	$C_6H_5 \cdot CH_2I$........	218.06
14	mustard oil.....	....	$C_6H_5 \cdot CH_2 \cdot NCS$....	149.19
15	sulphocyanide..	....	$C_6H_5 \cdot CH_2 \cdot SCN$....	149.19
16	urea...........	benzyl carbamide	$C_6H_5 \cdot CH_2 \cdot NH \cdot CO \cdot NH_2$	150.20
17	Berberine........	....	$C_{20}H_{17}O_4N + 6H_2O$.	443.34
18	Berberonic acid..	pyridine tricarbonic acid (2, 4, 5)	$C_5H_5N(COOH)_3$ (2,4,5) $+ 2H_2O$	247.15
19	Betaine.........	trimethyl glycocoll	$CO \cdot CH_2 \cdot N(CH_3)_3 \cdot O$	117.11
20	Bilirubin........	....	$C_{34}H_{36}N_4O_7$........	608.58
21	Biuret..........	....	$NH_2 \cdot CO \cdot NH \cdot CO \cdot NH_2 \cdot + H_2O$	121.19
22	Borneol (i.)......	....	$C_{10}H_{17}OH$.........	154.20
23	" (d.)......	Borneo camphor..	$C_{10}H_{17}OH$.........	154.20
24	" acetate (d.)	....	$CH_3 \cdot COOC_{10}H_{17}$...	184.22
25	Brassidic acid....	....	$C_{22}H_{42}\ O_2$..........	338.45
26	Brazilin.........	....	$C_{16}H_{14}O_5 + 1\frac{1}{2}H_2O$...	313.21
27	Brom-acetic acid.	....	$CH_2BrCOOH$......	139.00
28	acetone........	....	$CH_2Br \cdot CO \cdot CH_3$....	136.98
29	acetylene.......	....	C_2HBr..........	104.98
30	aniline (o.)	....	$BrC_6H_4NH_2$........	172.08
31	" " (m.)	....	$BrC_6H_4NH_2$........	172.08
32	" " (p.).	....	$BrC_6H_4NH_2$........	172.08
33	benzene.	See *phenyl bromide*		
34	benzoic acid (o.).	....	$BrC_6H_4 \cdot COOH$.....	201.04
35	" " (m.)	....	$BrC_6H_4 \cdot COOH$.....	201.04
36	" " (p.)	....	$BrC_6H_4 \cdot COOH$.....	201.04
37	ethylene.......	....	$CH_2{:}CHBr$........	107.00
38	naphthalene (α)	....	$C_{10}H_7Br$...........	207.07
39	" (β)	....	$C_{10}H_7Br$...........	207.07

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. rhomb.	....	103.5	......	i.; s. bz.	s.	v. s.
2	colorl.	....	168	......	v. sl. s. h.	s. h.	v. sl. s.
3	colorl. liq.	$1.057^{16°}$	......	206	v. sl. s.	∞	∞
4	colorl. liq.	$1.061^{\frac{25}{25}°}$	......	284–90. d.	i.	∞	∞
5	colorl. liq.	$1.043^{20°}$	......	204.7	$4^{17°}$	∞	∞
6	colorl. liq.	$0.980^{20°}$	......	184	∞	∞	∞
7	colorl. liq. or leaf.	$1.114^{19°}$	18.3	323–4.	i.	s.	∞
8	liq.	$1.438^{22°}$	−3.9	198.5	i.	∞	∞
9							
10	colorl. liq.	$1.103^{18°}$	−41.2	176–9.	i.	∞	∞
11	liq.	$1.021^{\frac{15}{15}°}$	−24.6	233.5	i.	∞	∞
12	colorl. oil	$1.036^{16°}$	......	295–8	......	v. s. h.	s.
13	....	$1.734^{25°}$	24.	dec.	s. CS_2	sl. s.	s.
14	....	....	......	243	i.	......	s.
15	prisms	....	41	230–5	i.	v. s.	v. s.
16	need.	....	147.	......	sl. s.	v. s.	sl. s.
17	yel. or or. need.	....	145 d.	......	$22^{21°}$	1 c.; v. s. h.	v. sl. s.
18	colorl. tricl.	....	d. 235	......	sl. s. c.; v. s. h.	v. sl. s. h;	i.
19	colorl. monocl.	....	270–6 d.	......	v. s.	s.	....
20	dk. red rhomb.	....	192–2.5	......	v. sl. s.; s. alk.	sl. s.	v. sl. s.
21	colorl. need.	....	190 d.	......	$1.54^{15°}$ $45.5^{106°}$	v. s.	v. sl. s.
22	colorl. hex. leaf.	1.011	210.5	subl.	v. sl. s.	v. s.	v. s.
23	colorl. hex. leaf.	1.011	203.4	212–2	v. sl. s.	v. s.	v. s.
24	colorl.	....	29	223	v. sl. s.	v. s.	s.
25	colorl. leaf.	0.859^{57}	60	......	0.74^{24}	v. sl. s. c.	s.
26	colorl. need.	....	abt. 250	......	sl. s.	s.	s.
27	colorl. hex.	....	50	208	∞	∞	∞
28	....	....	......	136.5 725mm	......	......	....
29	gas	....	......	−2	v. s.	s.	....
30	....	....	31–1.5	250–1	......	s.	....
31	....	$1.582^{21°}$	18–8.5	251	......	s.	....
32	rhomb.	....	66.4	dec.	i.	v. s.	v. s.
33							
34	colorl. need.	....	150	subl.	$0.18^{25°}$	v. s.	v. s.
35	colorl. need.	....	155	......	$0.04^{25°}$	v. s.	v. s.
36	colorl. monocl.	....	251	......	v. sl. s. c.	s.	v. s.
37	....	$1.517^{14°}$	......	16^{750mm}	i.	∞	∞
38	prisms	$1.487^{\frac{20}{18}°}$	5	279	∞ bz.	∞ abs.	∞
39	rhomb. leaf.	$1.605^{0°}$	59	282	s. bz.	6	v. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Brom-			
1	nitrobenzene (o.)	....	$BrC_6H_4NO_2$........	207.07
2	" (m.)	....	$BrC_6H_4NO_2$........	207.07
3	" (p.).	....	$BrC_6H_4NO_2$........	207.07
4	phenol (o.).....	....	BrC_6H_4OH........	173.03
5	" (m.)....	....	BrC_6H_4OH........	173.03
6	" (p.)....	....	BrC_6H_4OH........	173.03
7	toluene (o.)	....	$BrC_6H_4CH_3$........	171.06
8	" (m.)....	....	$BrC_6H_4CH_3$........	171.06
9	" (p.)....	....	$BrC_6H_4CH_3$........	171.06
10	Bromal.........	tribromaldehyde..	$CBr_3 \cdot CHO$........	280.90
11	Bromoform......	....	$CHBr_3$........	252.90
12	Brucine.........	....	$C_{23}H_{26}O_4N_2 + 4H_2O$	466.41
13	hydrochloride...	....	$C_{23}H_{26}O_4N_2 \cdot HCl$....	430.81
14	nitrate.........	....	$C_{23}H_{26}O_4N_2 \cdot HNO_3 + 2H_2O$	493.39
15	sulphate.......	....	$(C_{23}H_{26}O_4N_2)_2H_2SO_4 + 7H_2O$	1012.86
16	Butane (n.)......	....	$CH_3 \cdot CH_2 \cdot CH_2 \cdot CH_3$	58.10
17	Butyl acetate....	....	$CH_3 \cdot COO \cdot C_4H_9$....	116.13
18	alcohol (n.).....	....	$CH_3 \cdot (CH_2)_2 \cdot CH_2OH$	74.10
19	" (sec.)...	methyl ethyl carbinol	$CH_3 \cdot CH_2 \cdot CHOH \cdot CH_3$	74.10
20	" (iso) ...	....	$(CH_3)_2 \cdot CH \cdot CH_2OH$	74.10
21	" (tert.)...	trimethyl carbinol	$(CH_3)_3 \cdot COH$.......	74.10
22	amine (n.)......	....	$CH_3 \cdot (CH_2)_2 \cdot CH_2 NH_2$	73.15
23	benzoate (n.)...	....	$C_6H_5 \cdot COO \cdot C_4H_9$...	178.18
24	bromide (n.)....	....	$CH_3 \cdot (CH_2)_2 \cdot CH_2Br$	137.05
25	butyrate (n.)...	....	$C_3H_7 \cdot COO \cdot C_4H_9$...	144.17
26	carbinol........	....	$(CH_3)_3 \cdot C \cdot CH_2OH$..	88.13
27	chloride (n.)....	....	$CH_3(CH_2)_2 \cdot CH_2Cl$..	92.54
28	cyanide........	valero nitrile.....	$CH_3 \cdot (CH_2)_2 \cdot CH_2CN$	83.06
29	ether (n.)......	....	$(C_4H_9)_2 \cdot O$.........	130.19
30	formate........	....	$HCOO \cdot C_4H_9$.......	102.11
31	iodide..........	....	$CH_3 \cdot (CH_2)_2 \cdot CH_2I$..	184.06
32	mustard oil.....	....	$CH_3 \cdot (CH_2)_2 \cdot CH_2NCS$	115.19
33	phenyl ketone..	....	$C_4H_9 \cdot CO \cdot C_6H_5$.....	162.17
34	Butylene........	ethyl ethylene....	$CH_3 \cdot CH_2 \cdot CH : CH_2$	56.08
35	Butyramide (n.)..	....	$CH_3 \cdot CH_2 \cdot CH_2 \cdot CONH_2$	87.13
36	Butyric acid (n.) .	....	$CH_3 \cdot (CH_2)_2 \cdot COOH$	88.08
37	aldehyde (n.)...	....	$CH_3 \cdot (CH_2)_2 \cdot CHO$..	72.08
38	anhydride......	....	$(CH_3 \cdot (CH_2)_2CO)_2 \cdot O$	158.16
39	Butyrine........	tributyrine......	$(C_3H_7 \cdot COO)_3C_3H_5$..	302.28
40	Cacodyl.........	....	$(CH_3)_2As \cdot As(CH_3)_2$.	210.12
41	chloride........	....	$(CH_3)_2AsCl$........	140.51
42	oxide..........	....	$((CH_3)_2As)_2 \cdot O$.....	226.12
43	Cacodylic acid...	....	$(CH_3)_2AsO \cdot OH$....	138.06
44	Caffeic acid......	....	$C_9H_8O_4 + \frac{1}{2}H_2O$.....	189.12
45	Caffeine.........	theine..........	$C_8H_{10}O_2N_4 + H_2O$...	212.30
46	Camphene (i.)...	....	$C_{10}H_{16}$............	136.17
47	" (d. or l.)	....	$C_{10}H_{16}$............	136.17

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	....	....	38.5	264.4	i.	v. s.	s.
2	....	....	52.6	257.5	i.	s.	s.
3	monocl.	$1.934^{22°}$	125	259.2	i.	s.	....
4	oil	....	5.6	195	s. alk.	......	....
5	leaf.	....	32–3	236	s. alk.	......	....
6	tetr.	1.840	63–4	238	s. chl.	v. s.	v. s.
7	liq.	$1.431_{15}^{15°}$	–26	181	i.	s.	....
8	liq.	$1.410^{20°}$	–40	183	i.	s.	....
9	rhomb.	$1.354^{64°}$	28.5	184–5	i.	s.	s.
10	yel. liq.	2.65	......	174	dec.	......	....
11	colorl. liq.	$2.884^{25°}$	9	151.2	sl. s.	∞	∞
12	monocl.	....	105	......	0.31 c.; $0.67^{100°}$	v. s.	v. sl. s.
13	need.	....	......	......	v. s.	......	....
14	prisms	....	230 d.	......	s.	s.	....
15	long need.	....	......	......	s.	s.	....
16	gas	$0.60^{0°}$. 2.046 (A)	......	1	i.	5.6 c.	....
17	colorl. liq.	$0.882^{20°}$	......	125	sl. s.	∞	∞
18	colorl. liq.	$0.810^{20°}$	......	117	8.3	∞	∞
19	colorl. liq.	$0.819^{22°}$	......	99.8	$29^{20°}$	......	....
20	colorl. liq.	$0.806^{15°}$	–108	106.5	$9.5^{18°}$	∞	∞
21	colorl. liq. or rhomb.	$0.781^{25°}$	25	82.9	∞	s.	∞
22	colorl. liq.	$0.740^{20°}$	......	78	v. s.	s.	s.
23	oil	$1.000^{20°}$	......	247.3–9.0	i.	∞	∞
24	liq.	$1.279^{20°}$	......	101	i.	∞	∞
25	colorl. liq.	$0.888^{0°}$	......	165	sl. s.	∞	∞
26	....	$0.812^{20°}$	52–3	113–4	sl. s.	v. s.	v. s.
27	colorl. liq.	$0.887^{20°}$	......	77.5–8.0	i.	∞	∞
28	liq.	$1.000^{20°}$	......	141	i.	s.	s.
29	colorl. liq.	$0.769^{40°}$	......	141	s.	......	....
30	colorl. liq.	$0.911^{0°}$	......	106.9	sl. s.	∞	∞
31	liq.	$1.617^{20°}$	......	129.6	i.	∞	∞
32	liq.	....	......	167	i.	v. s.	v. s.
33	liq.	....	......	2.375–8.5	i.	v. s.	v. s.
34	gas	....	......	1.5–2.5	i.	v. s.	v. s.
35	wh. tab.	....	115–6	216	s.	s.	sl.s.
36	colorl. liq.	$0.960^{19°}$	–7.9	162.5	∞	∞	∞
37	colorl. liq.	$0.817^{20°}$	......	73–4.	3.7	∞	∞
38	colorl. liq.	0.978	......	191–3	dec.	dec.	∞
39	....	1.052	......	285	i.	v. s.	v. s.
40	colorl. liq.	....	–6	170	sl. s.	s.	s.
41	....	....	......	100	i.	......	......
42	....	1.462	–25	120	i.	......	......
43	rhombic.	....	200 d.	......	v. s.	s.	v. sl. s.
44	yel. prisms	....	195	dec.	s.	v. s.	....
45	wh. need.	$1.23^{19°}$	229.5–30.5	......	$1.35^{16°}$; $45.5^{65°}$	$2.3^{16°}$ (85%)	$0.044^{16°}$
46	feath. need.	....	47	157	i.	v. s.	v. s.
47	" " f. al.	....	51–2	159	i.	v. s.	v. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Camphor (d.)....	....	$C_{10}H_{16}O$...........	152.18
2	Camphoric acid (i.)	....	$C_8H_{14}(COOH)_2$.....	200.18
3	Camphoric acid(d.)	....	$C_8H_{14}(COOH)_2$.....	200.18
4	" anhydride	....	$C_{10}H_{14}O_3$...........	182.17
5	Cane sugar.	See *sucrose*		
6	Capric acid......	....	$CH_3\cdot(CH_2)_8\cdot COOH$	172.21
7	Caproic acid.....	....	$CH\cdot(CH_2)_4\cdot COOH$.	116.13
8	Caprylic acid....	....	$CH_3\cdot(CH_2)_6\cdot COOH$	144.17
9	Carbanilid.......	diphenyl urea....	$C_6H_5\cdot NH\cdot CO\cdot NH\cdot C_6H_5$	212.25
10	Carbazol........	....	$C_6H_4\cdot NH\cdot C_6H_4$....	167.17
11	Carbolic acid.....	See *phenol*		
12	Carbon dioxide...	....	CO_2...............	44.01
13	disulphide......	....	CS_2...............	76.13
14	hexachloride....	....	C_2Cl_6.............	236.77
15	monoxide......	....	CO..............	28.01
16	oxysulphide....	....	COS..............	60.07
17	suboxide.......	....	C_3O_2..............	68.02
18	tetrabromide...	....	CBr_4..............	331.85
19	tetrachloride....	tetrachlormethane	CCl_4..............	153.84
20	tetraiodide.....	....	CI_4...............	519.89
21	Carbonyl chloride	phosgene........	$COCl_2$.............	98.92
22	Carbostyril......	2 hydroxy-quinoline	$HO\cdot C_9H_6\cdot N$.......	145.15
23	Carvacrol.......	isopropylhydroxytoluene	$(CH_3)_2CH\cdot C_6H_3\cdot(CH_3)\cdot OH(4, 1, 2)$	150.16
24	Catechol........	pyrocatechin.....	$C_6H_4(OH)_2$ (o.).....	110.08
25	Cellulose........	....	$(C_6H_{10}O_5)x$.........	(162.11)x
26	acetate penta-..	....	$C_6H_5(COOCH_3)_5$....	372.24
27	" tetra-...	....	$C_6H_6O(COOCH_3)_4$..	330.21
28	" tri-.....	....	$C_6H_7O_2(COOCH_3)_3$.	288.19
29	nitrate hexa-....	principal constituent of gun cotton	$C_{12}H_{14}O_4(NO_3)_6$.....	594.23
30	" penta-...	....	$C_{12}H_{15}O_5(NO_3)_5$.....	549.23
31	" tetra-..	constituents of collodion	$C_{12}H_{16}O_6(NO_3)_4$.....	504.23
32	" tri-....	constituents of collodion	$C_{12}H_{17}O_7(NO_3)_3$.....	459.23

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. hex.	$0.992^{10°}$	176.4	205.3	v. sl. s.	$120^{12°}$	v. s.
2	....	1.228	208	......	$0.76^{25°}$; $10^{100°}$	s.	v. s.
3	colorl. monocl.	1.186	187	......	$0.62^{12°}$; $8.3^{100°}$	112.	....
4	rhomb. f. al.	....	220–1.	abt. 270. d.	v. sl. s.	v. s.	v. s.
5							
6	colorl. need.	$0.930^{37°}$	31.3	268.4	v. sl. s.	s.	s.
7	colorl. liq.	$0.929^{20°}$	-5.2	205.7	v. sl. s.	s.	s.
8	colorl. leaf.	$0.910^{20°}$	16.5	237.5	$0.25^{100°}$	∞	∞
9	need. f. al.	....	236–7	......	v. sl. s.	v. s.	v. s.
10	colorl. leaf.	....	238.5	351.5	i.	$0.92^{14°}$; $3.88^{78°}$	sl. s.
11							
12	gas	1.53 (A)	-65	-80	$179.7^{0°}$; $107.5^{15°}$ c.c.	$319.9^{15°}$ c.c.	....
13	colorl. liq.	$1.256^{22°}$	-112.8	46.2	$0.22^{22°}$	∞	∞
14	rhombic.	$1.99^{20°}$	182	187	i.	s.	v. s.
15	gas	0.967(A)	-205.7–7.0	-190	$2.5^{15°}$ c.c.	$20^{20°}$ c.c.	....
16	gas	2.104(A)	......	-47.5	100c.c.	......	....
17	gas	$1.11^{0°}$	-107	7	dec.	......	s.
18	tab.	3.42	92	189	i.	s.	s.
19	colorl. liq.	$1.584^{25°}$	-19.5	76.	$0.08^{20°}$	∞	∞
20	red	$4.32^{20°}$	......	dec.	i.	s.	s.
21	gas	....	<-75.	8.2	dec.	dec.	....
22	pr. f. al.	....	199–200.	subl.	v. sl. s. c.; s. h.	v. s.	v. s.
23	oil	$0.978^{20°}_{20}$	......	236–8	s. alk.	......	s.
24	colorl. leaf. f. bz.	1.344	104	240–5	v. s.	v. s.	v. s.
25	amor.	abt. 1.5	......	......	i.*	i.	i.
26	amor.	....	......	......	i.	s.	....
27	amor.	....	soft. abt. 150	......	i.; i. acet.	i.; i. meth.	i.; i amyl.‡ acet.
28	amor.	....	......	......	i.	i.; i. acet.	i.‡
29	wh. amor.	abt. 1.66	ign. 160–70	......	i.; i. bz.	i.; v. v. sl. s. eth.-al.	i ; s.† nitro-bz.
30	wh. amor.	abt. 1.66	......	......	i.; i. bz.	i.; s. eth.-al.	i.
31	wh. amor.	abt. 1.66	......	......	i.; i. bz.	i.; s. eth.-al.	i.; s. meth. al.
32	wh. amor.	abt. 1.66	......	......	i.; i. bz.	s. abs.; s. meth.	s. glac. acet. a.h.

* Soluble in conc. H_2SO_4· and ammoniacal CuO.
† All nitro celluloses are soluble in acetone, ethyl acetate, amylacetate.
‡ Soluble in chl., glac. acet. a. and nitrobenzene.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Cerotic acid.....	....	$C_{26}H_{52}O_2$...........	396.55
2	Ceryl alcohol....	....	$C_{26}H_{54}O$*	382.56
3	Cetyl alcohol....	ethal............	$C_{16}H_{33}OH$..........	242.35
4	Chlor-acetic acid.	....	$CH_2Cl \cdot COOH$.....	94.49
5	acetone	....	$CH_2Cl \cdot CO \cdot CH_3$....	92.51
6	acetyl chloride..	....	$CH_2Cl \cdot COCl$......	112.93
7	aniline (o.).....	....	$ClC_6H_4 \cdot NH_2$.......	127.57
8	" (m.).....	....	$ClC_6H_4 \cdot NH_2$.......	127.57
9	" (p.)......	....	$ClC_6H_4 \cdot NH_2$.......	127.57
10	benzamide (o.)..	....	$ClC_6H_4 \cdot CONH_2$....	155.58
11	" (m.).	....	$ClC_6H_4 \cdot CONH_2$....	155.58
12	" (p.)..	....	$ClC_6H_4 \cdot CONH_2$....	155.58
13	benzene........	phenylchloride...	C_6H_5Cl............	112.52
14	benzoic acid (o.)	....	ClC_6H_4COOH......	156.53
15	" " (m.)	....	ClC_6H_4COOH......	156.53
16	" " (p.)	....	ClC_6H_4COOH......	156.53
17	ethyl alcohol (2)	....	$CH_2Cl \cdot CH_2OH$.....	80.50
18	malonic acid....	....	$CHCl \cdot (COOH)_2$....	138.50
19	naphthalene (α).	....	$C_{10}H_7Cl$...........	162.56
20	" (β).	....	$C_{10}H_7Cl$...........	162.56
21	nitro-benzene (o.)	....	$ClC_6H_4 \cdot NO_2$.......	157.55
22	" " (m.)	....	$ClC_6H_4 \cdot NO_2$.......	157.55
23	" " (p.)	....	$ClC_6H_4 \cdot NO_2$.......	157.55
24	phenol (o.).....	....	$ClC_6H_4 \cdot OH$........	128.53
25	" (m.).....	....	$ClC_6H_4 \cdot OH$........	128.53
26	" (p.).....	....	$ClC_6H_4 \cdot OH$	128.53
27	picrin..........	nitro-chloroform, nitrotrichlor-methane	CCl_3NO_2..........	164.39
28	propionic acid (α)	....	$CH_3 \cdot CHCl \cdot COOH$..	108.51
29	" " (β)	....	$CH_2Cl \cdot CH_2 \cdot COOH$..	108.51
30	pyridine (2)....	....	ClC_5H_4N..........	113.55
31	" (3)....	....	ClC_5H_4N..........	113.55
32	" (4)....	....	ClC_5H_4N..........	113.55
33	quinoline(2)....	....	ClC_9H_6N..........	163.59
34	" (3)....	....	ClC_9H_6N..........	163.59
35	" (4)....	....	ClC_9H_6N..........	163.59
36	toluene (o.).....	....	$ClC_6H_4 \cdot CH_3$.......	126.55
37	" (m.)....	....	$ClC_6H_4 \cdot CH_3$.......	126.55
38	" (p.)....	....	$ClC_6H_4 \cdot CH_3$.......	126.55
39	Chloral..........	trichloracetic aldehyde	$CCl_3 \cdot CHO$.........	147.37
40	alcoholate......	....	$CCl_3 \cdot CH(OH) \cdot O \cdot C_2H_5$	193.46
41	hydrate........	....	$CCl_3 \cdot CH(OH)_2$.....	165.39
42	Chlorhydrine (α).	....	$CH_2Cl \cdot CHOH \cdot CH_2OH$	110.53

* Also given as $C_{27}H_{65}O$

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	need. f. al.	$0.836^{79°}$	78–82.5	dec.	i.; s. acet.	v. sl. s.c.; s. h.	$20.^{35°}$ s. bz.
2	colorl. cryst.	....	79	......	i.	s.	s.
3	leaf. f. al.	$0.818^{50°}$	50	344	i.	s.	s.
4	colorl. rhomb.	$1.398^{64°}$	62–3	186	v. s.	s.	s.
5	colorl. liq.	$1.162^{16°}$	......	119	sl. s.	∞	∞
6	colorl. liq.	$1.495^{0°}$	......	105–6	dec.	dec.	....
7	liq.	$1.213^{20°}$	......	207	s. a.	......	s.
8	liq.	$1.216^{20°}$	......	230	s. a.	......	....
9	rhomb.	$1.340^{18°}$	70	230–2	s. h.; s. a.	s.	s.
10	long. need.	....	142.4	......	sl. s.	v. s.	v. s.
11	need.	....	134.5	......	sl. s.	v. s.	....
12	need.	....	178.3	......	v. sl. s.	v. s.	v. s.
13	colorl. liq.	$1.106^{20°}$	–45	132	i.	∞	∞
14	colorl. rhomb.	1.540	137, (142)	......	$0.21^{25°}$	v. s.	v. s.
15	colorl. prisms	....	153, (158)	subl.	$0.04^{0°}$	s.	s.
16	colorl. monocl.	$1.541^{24°}$	236 (240–3)	......	v. sl. s.	v. s.	v. s.
17	colorl. liq.	$1.201^{19°}$	......	132	∞	∞	∞
18	prisms	....	133	......	v. s.	v. s.	v. s.
19	colorl.	$1.194^{20°}$	......	263	i.	s.	s.
20	colorl. leaf.	$1.266^{16°}$	56	265	i.	s.	s.
21	need.	$1.368^{22°}$	32.5	246	i.	s.	s.
22	rhomb.	1.534	44.2	235.6	s. bz.	v. s. h.	s.
23	monocl.	$1.520^{18°}$	83	239–42	i.	s.	....
24	colorl. liq.	$1.241^{\frac{18}{15}°}$	8.8	175–6	......	s.	....
25	colorl.	$1.245^{45°}$	32.8	214	......	s.	....
26	colorl.	$1.306^{20°}$	42.9	217	v. sl. s.	v. s.	v. s.
27	liq.	$1.692^{0°}$	–69.2	112	i.	∞	∞
28	colorl. liq.	$1.28^{0°}$	......	186	∞	∞	∞
29	colorl. leaf.	....	41.5	203–5	v. s.	v. s.	∞
30	liq.	1.205	......	166^{714mm}	v. sl. s.	......	....
31	liq.	....	......	148^{743mm}	......	......	....
32	liq.	....	......	147–8	s.	......	....
33	need.....	$1.275^{17°}$	37–8	275	v. sl. s.	v. s.	v. s.
34	....	....	......	255^{743mm}	......	......	....
35	....	$1.377^{17°}$	34	260–1 744mm	......	v. s.	v. s
36	colorl. liq.	$1.085^{18°}$	–34	157	sl. s.	s.	∞
37	colorl. liq.	$1.072^{20°}$	–47.8	162 (150)	sl. s.	s.	∞
38	colorl. liq.	$1.071^{18°}$	6.5–7.5	162	sl. s.	s.	∞
39	colorl. liq.	$1.512^{20°}$	–57.5	98	v. s.	∞	∞
40	colorl. cryst.	$1.143^{40°}$	56	115	v. s.	s.	s.
41	colorl. tab.	1.901	57	97–97.5, d.	66	v. s.	s.
42	liq.	$1.326^{\frac{18}{15}°}$	......	213	s.	s.	s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Chloroform......	trichlormethane..	$CHCl_3$	119.37
2	Cholesterol......	cholesterin.......	$C_{26}H_{43}OH+H_2O$....	390.50
3	Choline.........	bilineurine.......	$OH\cdot CH_2\cdot CH_2\cdot N(CH_3)_3\cdot OH$	121.16
4	Chrysene........	....	$C_{18}H_{12}$............	228.19
5	Cinchonine......	....	$C_{19}H_{22}ON_2$.........	294.29
6	bisulphate......	....	$C_{19}H_{22}ON_2\cdot H_2SO_4 +4H_2O$	464.43
7	hydrochloride...	....	$C_{19}H_{22}ON_2\cdot HCl +2H_2O$	366.79
8	sulphate.......	....	$(C_{19}H_{22}ON_2)_2H_2SO_4 +2H_2O$	722.69
9	Cinnamene......	styrene..........	$C_6H_5\cdot CH : CH_2$....	104.10
10	Cinnamic acid...	phenylacrylic acid (β)	$C_6H_5\cdot CH : CH\cdot COOH$	148.11
11	Cinnamic aldehyde	....	$C_6H_5\cdot CH : CH\cdot CHO$	132.11
12	Cinnamyl alcohol.	....	$C_6H_5\cdot CH : CH\cdot CH_2OH$	134.13
13	Citral...........	....	$C_9H_{15}\cdot CHO$.......	152.18
14	Citric acid.......	....	$COOH\cdot CH_2\cdot C(OH)(COOH)\cdot CH_2\cdot COOH$	210.11
15	Citronellal.......	....	$C_9H_{17}\cdot CHO$.......	154.19
16	Citronellol (d.)...	....	$C_{10}H_{20}O$...........	156.21
17	Cocaine.........	....	$C_{17}H_{21}O_4N$........	303.26
18	hydrochloride...	....	$C_{17}H_{21}O_4N\cdot HCl$....	339.73
19	Codeine.........	morphine methyl ether	$C_{18}H_{21}O_3N+H_2O$...	317.28
20	hydrochloride...	....	$C_{18}H_{21}O_3N\cdot HCl +2H_2O$	371.77
21	phosphate......	....	$C_{18}H_{21}O_3N\cdot H_3PO_4 +2H_2O$	433.37
22	sulphate.......	....	$(C_{18}H_{21}O_3N)_2\cdot H_2SO_4+5H_2O$	786.69
23	Collidine (α).....	2-methyl-4-ethyl pyridine	$CH_3\cdot C_5H_3N\cdot C_2H_5$	121.17
24	" (β).....	4-methyl-3-ethyl pyridine	$CH_3\cdot C_5H_3N\cdot C_2H_5$..	121.17
25	" (γ).....	2, 4, 6-trimethyl pyridine	$(CH_3)_3\cdot C_5H_2N$.....	121.17
26	Coniïne (d.).....	2-propyl piperidine	2, $C_5H_{10}N\cdot C_3H_7$....	127.19
27	hydrochloride...	....	$C_8H_{17}N\cdot HCl$.......	163.66
28	Coumaric acid (o.)	hydroxycinnamic acid (o.)	$HO\cdot C_6H_4\cdot CH : CH\cdot COOH$	164.11
29	" " (m.)	hydroxycinnamic acid (m.)	$HO\cdot C_6H_4\cdot CH : CH\cdot COOH$	164.11
30	" " (p.)	hydroxycinnamic acid (p.)	$HO\cdot C_6H_4\cdot CH : CH\cdot COOH$	164.11

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. liq.	$1.499^{15°}$	−70 (−63.2)	61.2	$0.62^{22°}$	∞	∞
2	monocl. tab.	1.067	148.5	......	i.	20 h.	18
3	visc. liq.	....	......	......	s.	s.	....
4	scales, red fluores	....	250	448	v. sl. s.	v. sl. s.	v. sl. s.
5	colorl. need.	....	240–50, d.	......	0.027^{20}	1	0.27
6	octahed.	....	......	......	$217^{14°}$	$111^{14°}$	....
7	colorl. monocl.	....	......	......	4.5 c.	100	0.18
8	rhombic	....	198.5	......	$1.55^{13°}$	$17^{11°}$	....
9	colorl. liq.	$0.925^{0°}$	......	146	i.	∞	∞
10	colorl. monocl.	$1.248^{4°}$	133	300	$0.1^{20°}$	$23^{20°}$	v. s.
11	colorl. liq.	$1.050^{24°}$	−7.5	$128–30^{20mm}$	v. sl. s.	∞	∞
12	need.	$1.040\frac{35}{35}°$	33	254	sl. s.	v. s.	v. s.
13	colorl. liq.	0.897	......	228–9	i.	∞	∞
14	colorl. rhomb.	$1.542^{18°}$	153	dec.	133 c.*	$116^{25°}$	2.26 c.
15	colorl. liq.	$0.854^{17.5°}$	......	205–8	v. sl. s.	∞	∞
16	colorl. liq.	$0.856^{8°}$	......	118^{17mm}	v. sl. s.	∞	∞
17	colorl. monocl.	....	98	......	$0.16^{25°}$; $0.38^{80°}$	$20^{25°}$	26.3
18	colorl. prisms	....	186†	......	$250^{25°}$	38.4^{25}	i.
19	colorl. orthorh.	....	155 anh.	......	$0.83^{25°}$; $1.7^{80°}$	$62.5^{25°}$	$8^{25°}$
20	colorl. need.	....	264 anh.	......	$3.84^{15°}$	......	....
21	colorl. need.	....	235	......	$44.5^{25°}$	$0.38^{25°}$	0.07
22	colorl. rhomb.	....	278, d.	......	3.3^{25}	0.1^{25}	i.
23	colorl. liq.	$0.927^{16°}$	......	179	s.	v. s.	v. s.
24	colorl. liq.	$0.966^{0°}$	......	abt. 195	i.	s.	....
25	colorl. liq.	0.917	......	171–2	v. sl. s.	......	....
26	colorl. liq.	$0.844^{20°}$	−2	166–7	1.1 c.	∞	v. s.
27	colorl. rhomb.	....	208–12	......	50	s.	i.
28	colorl. need.	....	208	dec.	sl. s.	v. s.	v. sl. s.
29	colorl. prisms	....	191	......	v. s. h.	......	v. s.
30	colorl. need.	....	206	......	sl. s. c.; v. s. h.	v. s.	v. s.

* Crystallizes from water with $1H_2O$.

† Crystallized from alcohol.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Coumarin.......	cumarin..........	$C_9H_6O_2$...........	146.10
2	Coumaron.......	....	C_8H_6O...........	118.09
3	Creatine.........	methylglycocy-amine	$NH{:}C(NH_2)N(CH_3)\cdot CH_2\cdot COOH+H_2O$	149.23
4	Creatinine.......	methylglycocyamidine	$C_4H_7ON_3$..........	113.20
5	Creosole.........	....	$CH_3\cdot O\cdot C_6H_3\cdot(CH_3)\cdot OH$, (1, 4, 2)	138.12
6	Cresol (o.).......	....	$CH_3\cdot C_6H_4\cdot OH$.....	108.10
7	" (m.)......	....	$CH_3\cdot C_6H_4\cdot OH$.....	108.10
8	" (p.)......	....	$CH_3\cdot C_6H_4\cdot OH$.....	108.10
9	Crotonic acid (α).	....	$C_3H_5\cdot COOH$.......	86.07
10	" " (β).	....	$C_3H_5\cdot COOH$.......	86.07
11	" aldehyde (α)	....	$C_3H_5\cdot CHO$........	70.07
12	Crotonyl a cohol..	....	$CH_3\cdot CH : CH\cdot CH_2OH$	72.08
13	Cumene.........	isopropyl benzene.	$C_6H_5\cdot CH(CH_3)_2$...	120.15
14	Cumidine........	paraisopropyl aminobenzene	$(CH_3)_2CH\cdot C_6H_4\cdot NH_2$	135.16
15	Cuminic acid (p.)	....	$(CH_3)_2CH\cdot C_6H_4\cdot COOH$	164.15
16	aldehyde (p.)...	paraisopropyl benzaldehyde	$(CH_3)_2CH\cdot C_6H_4\cdot CHO$	148.15
17	Cyan-acetic acid..	nitrilomalonic acid	$CH_2(CN)\cdot COOH$...	85.09
18	Cyanamide......	....	$CN\cdot NH_2$..........	42.11
19	Cyanogen.......	....	$N{:}C\cdot C{:}N$........	52.03
20	bromide........	....	CNBr.............	106.01
21	chloride........	....	CNCl.............	61.50
22	Cyanuric acid....	....	$H_3O_3N_3C_3+2H_2O$...	165.21
23	Cyclo-hexane....	hexanaphthene...	C_6H_{12}.............	82.13
24	hexanol.........	hexahydrophenol.	$(CH_2)_5{:}CHOH$.....	100.13
25	hexanone.......	....	$(CH_2)_5{:}CO$........	98.11
26	Cymene.........	p.-isopropyl toluene	$CH_3\cdot C_6H_4\cdot CH{:}(CH_3)_2$ (1, 4)	134.17.
27	Deca-hydro-naphthalene	....	$C_{10}H_{18}$.............	138.20
28	Decane (n.)......	....	$CH_3\cdot(CH_2)_8\cdot CH_3$...	142.23
29	Decyl alcohol....	....	$CH_3\cdot(CH_2)_8\cdot CH_2OH$	158.23
30	Decylene (n.)....	....	$CH_3\cdot(CH_2)_7\cdot CH{:}CH_2$	140.21
31	Dextrin.........	....	$(C_6H_{10}O_5)x$........	(162.11)x
32	Dextrose........	glucose, grape sugar	$C_6H_{12}O_6+H_2O$......	198.15
33	Diacetanilide....	....	$C_6H_5\cdot N(CO\cdot CH_3)_2$	177.15

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. rhomb.	....	67	290–0.5	v. sl. s.; s. h.	v. s.	v.s.
2	liq.......	$1.078^{15°}_{15}$	<–18	169–74	i.	s.	s.
3	colorl. monocl.	....	d. 295–300	......	1.35^{1}	$0.008^{70°}$	i.
4	colorl. prisms f.w.	....	d. abt. 270	......	8.7^{16}	0.16 c. abs.	....
5	oil	$1.096^{15°}_{15}$	......	220–2	sl. s.	∞	∞, ∞ bz.
6	colorl.	$1.051^{15°}_{15}$	30	190.8	$3.1^{35°}$	∞ abv. 30°	∞ abv. 30°
7	colorl. liq.	$1.039^{15°}_{15}$	4	202.8	$2.41^{25°}$	∞	∞
8	colorl. prisms	$1.039^{15°}_{15}$	36	201.8	$2.36^{40°}$	∞ abv. 36	∞ abv. 36
9	colorl. monocl.	$0.973^{72°}$	72	185	8.3	......	....
10	colorl. need.	1.031	15.5	169.72, d.	40	s.	....
11	colorl. liq.	$0.859^{14°}$	......	104–5	s.	......	....
12	colorl. liq.	$0.873^{0°}$	......	117	16.6	......	....
13	colorl. liq.	$0.862^{20°}$	......	152.5–3.0	i.	s.	s.
14	colorl. liq.	0.953	<–20	225	s. a.	......	....
15	colorl. tricl.	$1.163^{4°}$	116.5	subl.	v. sl. s. c.	s.	v. s.
16	colorl. liq.	$0.976^{25°}_{25}$	......	235	i.	s.	s.
17	colorl.	....	69–70	dec.	s.	s.	s.
18	colorl. need	....	46(41–2)	......	v. s.	v. s.	s.
19	gas	1.806 (A)	–34	–21	400 c.c.	v. s.	s.
20	colorl. need.	....	52	61.5	s.	s.	s.
21	gas	....	–5	15.5	2500 c.c.	10,000 c.c.	5,000 c.c.
22	colorl. monocl.	$1.768^{0°}$	......	......	$0.25^{17°}$	0.33 c.	v. sl. s
23	colorl. liq.	$0.779^{20°}$ (0.790^{20})	6.4 (4.7)	80.8	i.	∞	∞
24	colorl.	$0.962^{20°}$	16 (24)	160–1	3.6	s.	s.
25	colorl. liq.	$0.947^{20°}$	......	155–7	v. s.	s.	s.
26	colorl. liq.	$0.860^{16°}$	–73.5	175–6.5	i.	v. s.	s.
27	colorl. liq.	$0.877^{20°}$	......	189–91 (173–80)	i.	s.	s.
28	colorl. liq.	$0.730^{20°}$	–30–2	173	i.	∞	∞
29	colorl., visc. liq.	$0.830^{20°}$	7	231	......	s.	....
30	colorl. liq.	$0.763^{0°}$	......	172	i.	∞	∞
31	white amor.	1.038	......	......	v. s. h.	i.	i.
32	need. f. al.	$1.562^{18°}$	146 anh.	......	$83^{17.5°}$	sl. s.	i.
33	colorl. leaf.	....	37–8	142^{11mm}	......	......	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Diacetin.........	glyceryl diacetate	$C_3H_5(OH)(OOC\cdot CH_3)_2$	176.14
2	Diacetyl.........	....	$CH_3\cdot CO\cdot CO\cdot CH_3$	86.07
3	Diamino-azo-benzene (2, 4)	....	$(NH_2)_2\cdot C_6H_3\cdot N_2\cdot C_6H_5$	212.20
4	-azo-benzene.... hydrochloride	chrysoidine orange	$C_6H_5\cdot N_2\cdot C_6H_3\cdot (NH_2)_2HCl$	248.66
5	benzene (o.)....	....	$C_6H_4\cdot (NH_2)_2$......	108.11
6	" (m.)...	....	$C_6H_4\cdot (NH_2)_2$......	108.11
7	" (p.)...	....	$C_6H_4\cdot (NH_2)_2$......	108.11
8	Diamino-diphenyl methane (4, 4′).	....	$CH_2(C_6H_4\cdot NH_2)_2$	184.19
9	Diamino-naphthalene (1, 2)	naphthylene diamine	$C_{10}H_6\cdot (NH_2)_2$......	158.15
10	Diamino-naphthalene (1, 5)	naphthylene diamine	$C_{10}H_6\cdot (NH_2)_2$	158.15
11	Diamino-naphthalene (1, 8)	naphthylene diamine	$C_{10}H_6\cdot (NH_2)_2$......	158.15
12	Diaminophenol (2, 4)	....	$(NH_2)_2\cdot C_6H_3(OH)$	110.00
13	hydrochloride...	amidol..........	$HO\cdot C_6H_3\cdot (NH_2)_2\cdot 2HCl$	182.94
14	Diamino-triphenylmethane (4, 4′)	....	$C_6H_5\cdot CH\cdot (C_6H_4\cdot NH_2)_2$	274.26
15	Diazo-amino-benzene	....	$C_6H_5\cdot N_2\cdot NH\cdot C_6H_5$	197.27
16	benzene chloride	....	$C_6H_5\cdot N_2Cl$........	140.60
17	" nitrate.	....	$C_6H_5\cdot N_2NO_3$.......	167.19
18	Dibenzyl........	....	$C_6H_5\cdot CH_2\cdot CH_2\cdot C_6H_5$	182.19
19	Dibrom-acetic acid	....	$CHBr_2\cdot COOH$.....	217.95
20	anthracene.....	....	$C_{14}H_8Br_2$..........	320.97
21	benzene (o.)....	....	$C_6H_4Br_2$...........	235.98
22	" (m.)...	....	$C_6H_4Br_2$...........	235.98
23	" (p.)....	....	$C_6H_4Br_2$...........	235.98
24	Dichlor-acetamide	....	$CHCl_2\cdot CONH_2$....	127.98
25	acetic acid.....	....	$CHCl_2\cdot COOH$.....	128.93
26	acetone (α).....	....	$CHCl_2\cdot CO\cdot CH_3$....	126.95
27	" (β).....	....	$CH_2Cl\cdot CO\cdot CH_2Cl$..	126.95
28	acetyl chloride..	....	$CHCl_2\cdot COCl$......	147.37
29	aldehyde.......	....	$CHCl_2\cdot CHO$.......	112.93
30	anthracene (9,10)	....	$C_{14}H_8Cl_2$..........	247.05
31	aniline (2, 4)...	....	$NH_2\cdot C_6H_3Cl_2$......	162.01
32	" (2, 5)...	....	$NH_2\cdot C_6H_3Cl_2$......	162.01
33	" (3, 4)...	....	$NH_6\cdot C_6H_3Cl_2$......	162.01
34	" (3, 5)...	....	$NH_6\cdot C_6H_3Cl_2$......	162.01
35	benzene (o.)....	....	$C_6H_4Cl_2$...........	146.96

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	....	$1.179\frac{15}{15}$°	40	259–60	∞	v. s.	s.
2	yellow liq.	$0.973^{22°}$	......	87.5–8.0	$25^{15°}$	......	....
3	yel. need.	....	117.5	......	sl. s.	s.	s.
4	red brown	....	......	......	v. s.	s.	......
5	tab. f. chl.	....	101.2	256–8	sl. s. c.; s. h.	v. s.;	v. s.
6	rhombic	....	63	283–4	s.	s.	s.
7	colorl. sc. f. bz.	....	140	267	s.	s.	s.
8	colorl. leaf.	....	88	......	......	v. s.	s. bz.
9	colorl. rhomb. f. w.	....	95–6	......	s. h.	v. s.	v. s.
10	colorl. prisms f. eth.	....	189.5	subl.	v. sl. s. c.	v. s. chl.	v. s.
11	colorl. f. al.	....	66.5	......	sl. s.	v. s.	v. s.
12	colorl.	....	78–80 d.	......	s. alk.	......	....
13	gray-wh. cryst.	....	......	......	s.	sl. s.	....
14	colorl. warts	....	139	......	v. sl. s.	v. s.	v. s.
15	yel. leaf. f. al.	....	96	......	i.	s. h.	v. s.
16	colorl. need.	....	dec.	......	v. s.	s.	i.
17	colorl. need.	....	exp.	......	v. s.	s.	i.
18	colorl. monocl.	0.995	52	284	i.	s.	v. s.
19	....	....	48	232	v. s.	v. s.	v. s.
20	yel. need.	....	221	subl.	s. bz. h.	sl. s.	sl. s.
21	colorl.	$1.977^{18°}$	−1	224	i.	s.	....
22	colorl.	$1.955^{19°}$	1–2	219.5	i.	s.	s.
23	colorl. monocl.	2.220	89.3	219	i.	$14^{30°}$	....
24	monocl.	....	98	$233–4_{755mm}$	v. s. h.	v. s.	v. s.
25	colorl. liq.	$1.572^{13°}$	−4	190–1	s.	s.	s.
26	colorl. liq.	$1.236^{21°}$	......	120	s.	s.	∞
27	....	....	45	172–4	......	......	....
28	colorl. liq.	....	......	107–8	dec.	dec.	∞
29	colorl. liq.	....	......	88–90	i.	......	....
30	yel. need.	....	209	......	s. bz.	sl. s.	sl. s.
31	need.....	....	63	245	......	s.	....
32	need.....	....	50	251	......	s.	....
33	need.....	....	71.5	272	......	s.	....
34	need.....	....	505	259–60	i.	s.	....
35	colorl. liq.	$1.325^{0°}$	......	179	i.	s.	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Dichlor-			
1	benzene (m.)...	....	$C_6H_4Cl_2$...........	146.96
2	" (p.)....	....	$C_6H_4Cl_2$...........	146.96
3	benzoic acid (2, 5)	....	$Cl_2C_6H_3 \cdot COOH$....	190.97
4	" " (2, 6)	....	$Cl_2C_6H_3 \cdot COOH$....	190.97
5	" " (3, 4)	....	$Cl_2C_6H_3 \cdot COOH$....	190.97
6	hydrine (1, 3) (α)	....	$CH_2Cl \cdot CHOH \cdot CH_2Cl$	128.97
7	" (2, 3) (β)	....	$CH_2Cl \cdot CHCl \cdot CH_2OH$	128.97
8	methyl ether...	....	$CH_2Cl \cdot O \cdot CH_2Cl$...	114.96
9	naphthalene (1, 4)	....	$C_{10}H_6Cl_2$..........	197.08
10	" (1, 5)	....	$C_{10}H_6Cl_2$..........	197.08
11	nitro-hydrine...	....	$CH_2Cl \cdot CH(NO_3) \cdot CH_2Cl$	103.07
12	Diethyl-acetic acid	....	$(C_2H_5)_2 : CH \cdot COOH$	116.13
13	amine.........	....	$(C_2H_5)_2 : NH$......	73.12
14	aniline.........	....	$C_6H_5 \cdot N(C_2H_5)_2$....	149.21
15	benzene (o.)....	....	$C_6H_4(C_2H_5)_2$.......	134.17
16	" (m.)...	....	$C_6H_4(C_2H_5)_2$.......	134.17
17	" (p.)....	....	$C_6H_4(C_2H_5)_2$.......	134.17
18	carbinol........	....	$(C_2H_5)_2CHOH$.....	88.13
19	ketone.........	....	$C_2H_5 \cdot CO \cdot C_2H_5$.....	86.11
20	malonic acid....	....	$(C_2H_5)_2C \cdot (COOH)_2$	160.14
21	oxamide (s.)....	....	$(CO \cdot NHC_2H_5)_2$....	144.21
22	toluene (1, 3, 5,)	....	$(C_2H_5)_2 : C_6H_3 \cdot CH_3$..	148.19
23	urea (s.).......	....	$C_2H_5NH \cdot CO \cdot NHC_2H_5$	116.14
24	" (uns.).....	....	$NH_2 \cdot CO \cdot N(C_2H_5)_2$.	116.14
25	Dihydro-anthracene	....	$C_6H_4 : (CH_2)_2 : C_6H_4$	180.17
26	benzene (1, 2)..	....	C_6H_8..............	80.09
27	" (1, 4)..	....	C_6H_8..............	80.09
28	naphthalene (1, 4)	....	$C_{10}H_{10}$............	130.13
	Dihydroxy-			
29	benzene (o.)	See *catechol*		
30	" (m.)	See *resorcinol*		
31	" (p.)	See *quinol*		
32	benzoic acid (2, 3)	....	$(HO)_2 : C_6H_3 \cdot COOH + 2H_2O$	190.12
32	" " (2, 4)	....	$(HO)_2 : C_6H_3 \cdot COOH + 3H_2O$	208.14
34	" " (2, 5)	....	$(HO)_2 : C_6H_3 \cdot COOH$	154.09
35	" " (3, 5)	....	$(HO)_2 : C_6H_3 \cdot COOH + 1\frac{1}{2}H_2O$	181.12
36	" " (2, 6)	γ-resorcylic acid..	$(HO)_2 : C_6H_3 \cdot COOH$	154.09
37	naphthalene (1,6)	....	$C_{10}H_6(OH)_2$........	160.11
38	" (1, 7)	....	$C_{10}H_6(OH)_2$........	160.11
39	" (1, 8)	....	$C_{10}H_6(OH)_2$........	160.11
40	" (2, 3)	....	$C_{10}H_6(OH)_2$........	160.11
41	" (2, 7)	....	$C_{10}H_6(OH)_2$........	160.11
42	pyridine (2, 4)..	....	$(HO)_2C_5H_3N$........	111.11

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. liq.	$1.307^{0°}$	−18	172	i.	s.	s.
2	leaf. f. al.	$1.268^{15°}_{15}$	53	172–4	......	s.	v. s.
3	colorl. need.	....	156	301	sl. s.; s. alk.	s.	....
4	colorl. need.	....	126.5	......	s. alk.	......	....
5	colorl. need.	....	203	......	sl. s.; s. alk.	v. sl. s.	....
6	colorl. liq.	$1.367^{19°}$	......	174 (182)	$1.1^{19°}$	∞	∞
7	colorl. liq.	$1.355^{17.5°}$	......	182–3	......	......	....
8	....	1.315	......	105	......	......	....
9	need. f. al.	....	67–8	287	i.	s.	s.
10	sc. f. al.	....	107	subl.	i.	s.	s.
11	colorl.	1.459	......	......	i.	s.	s.
12	colorl. liq.	$0.920^{18°}$	......	190	sl. s.	......	....
13	colorl. liq.	$0.712^{15°}$	−40	55.5–6.0	v. s.	s.	s.
14	colorl. liq.	0.936	−38–9	216	v. sl. s.	s.	s.
15	colorl. liq.	$0.866^{18°}$	......	185	i.	s.	s.
16	colorl. liq.	$0.860^{20°}$	......	181–2	i.	s.	s.
17	colorl. liq.	$0.862^{18°}$	......	182–3	i.	s.	s.
18	colorl. liq.	$0.832^{20°}$	......	116.5	sl. s.	s.	s.
19	colorl. liq.	$0.814^{20°}$	......	102–7	s.	∞	∞
20	" prisms	....	121–5	......	$65^{16°}$	v. s.	v. s.
21	colorl. need.	....	175	......	sl. s.	s.	v. sl. s.
22	colorl. liq.	$0.879^{20°}$	......	199–200	i.	∞	∞
23	colorl. prisms	1.042	112	263	v. s.	v. s.	v. s.
24	colorl. prisms	....	70–4	......	v. s.	v. s.	s.
25	colorl. tricl.	....	108.5	313	i.	v. s.	v. s.
26	colorl. liq.	$0.848^{20°}$	......	82–5	i.	s.	v. s.
27	colorl. liq.	$0.847^{20°}$	......	85–6	i.	∞	∞
28	colorl. liq.	....	15–5.5	212	i.	v. s.	v. s.
29							
30							
31							
32	colorl. need.	....	204	dec.	s.	......	....
33	colorl. need.	....	204–6 d. (213)	dec.	$0.26^{17°}$	v. s.	v. s.
34	colorl. need.	....	199–200	dec.	v. s.	v. s.	v.s.
35	colorl. prisms	....	232	......	s.	v. s.	v. s.
36	colorl.	....	148–67 d.	......	s. alk.	......	....
37	colorl pr.	....	134–5	......	......	v. sl. s.	v. s.
38	colorl. need.	....	178	......	s.	v. s.	v. s.
39	need.	....	140	......	sl. s. h.	v. s. bz.	v. s.
40	rhomb. f. w.	....	159	......	s. h.	v. s.	v. s.
41	colorl. need.	....	190	subl., d.	s. h.	s.	s.
42	rhombic	....	260–5	......	sl. s.	sl. s.	i.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Dihydroxy-			
1	pyridine (2, 6)		$(HO)_2C_5H_3N+\frac{1}{2}H_2O$	120.12
2	quinone (2, 5)		$C_6H_2O_2(OH)_2$	140.06
3	toluene (2, 4)		$CH_3C_6H_3(OH)_2$	124.10
4	" (2, 5)		$CH_3C_6H_3(OH)_2$	124.10
5	" (2, 6)		$CH_3C_6H_3(OH)_2$	124.10
6	Diiodo-acetic acid		$CHI_2\cdot COOH$	311.97
7	benzene (o.)		$C_6H_4I_2$	330.00
8	" (m.)		$C_6H_4I_2$	330.00
9	" (p.)		$C_6H_4I_2$	330.00
10	Diiso-amylamine		$[(CH_3)_2CH\cdot CH_2\cdot CH_2]_2NH$	157.27
11	amyl ketone		$(C_5H_{11})_2CO$	170.24
13	butyl amine		$[(CH_3)_2\cdot CH\cdot CH_2]_2NH$	129.24
13	" oxalate		$C_2O_4(C_4H_9)_2$	202.20
14	propyl carbinol		$(C_3H_7)_2CHOH$	116.17
15	" ketone		$(C_3H_7)_2CO$	114.16
16	Dimethyl acetic acid	See *isobutyric acid*		
17	amine		$(CH_3)_2NH$	45.11
18	anilin		$C_6H_5N(CH_3)_2$	122.17
19	anthracene (2, 3)		$C_{14}H_8(CH_3)$	206.20
20	" (2, 4)		$C_{14}H_8(CH_3)$	206.20
21	arsine		$(CH_3)_2AsH$	106.07
22	benzene	See *xlyenes*		
23	benzoic acid (2, 3)		$(CH_3)_2C_6H_3\cdot COOH$	150.13
24	" " (2, 4)	xylic acid	$(CH_3)_2C_6H_3\cdot COOH$	150.13
25	" " (2, 5)		$(CH_3)_2C_6H_3\cdot COOH$	150.13
26	" " (2, 6)		$(CH_3)_2C_6H_3\cdot COOH$	150.13
27	" " (3, 4)		$(CH_3)_2C_6H_3\cdot COOH$	150.13
28	" " (3, 5)	mesitylinic acid (1, 3, 5)	$(CH_3)_2C_6H_3\cdot COOH$	150.13
29	ether	methyl ether	$CH_3\cdot O\cdot CH_3$	46.06
30	ethyl acetic acid		$(CH_3)_2(C_2H_5)\cdot C\cdot COOH$	116.13
31	" benzene (2, 3, 5)		$C_2H_5\cdot C_6H_3\cdot (CH_3)_2$	134.17
32	" benzene		$C_2H_5\cdot C_6H_3\cdot (CH_3)_2$ (1, 3, 4)	134.17
33	glyoxime	diacetyldioxime	$(CH_3)_2C_2(NOH)_2$	116.10
34	isophthalate (1, 3)		$C_6H_4(COOCH_3)_2$	194.13
35	isopropyl carbinol		$(CH_3)_2(C_3H_7)COH$	102.15
36	naphthylamine(α)		$C_{10}H_7\cdot N(CH_3)_2$	171.21
37	" (β)		$C_{10}H_7\cdot N(CH_3)_2$	171.21
38	nitros amine		$(CH_3)_2N\cdot NO$	74.11
39	oxalate		$(COOCH_3)_2$	118.07
40	oxamide (s.)		$(CO\cdot NHCH_3)_2$	116.16
41	" (uns.)		$(CH_3)_2N\cdot CO\cdot CO\cdot NH_2$	116.16

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	yel. need.	....	195	......	sl. s.	sl. s.	v. sl. s.
2	yel. need.	....	215–20	......	i.	v. s.	v. sl. s.
3	colorl.	....	103–4	267–70	v. s.	v. s.	v. s.
4	colorl. leaf.	....	124	subl.	v. s.	v. s.	v. s.
5	colorl. need.	....	63–6	......	v. s.	v. s.	....
6	yellow	....	110	......	sl. s.	......	....
7	prisms	....	27	286.5	i.	s.	....
8	rhomb.	....	40.4	284.7	i.	s.	....
9	leaf.	....	129.4	285	i.	s.	....
10	colorl.	0.778	......	190	sl. s.	s.	∞
11	yel liq.	....	......	226	i.	s.	s.
12	colorl. liq.	0.749	......	139–40	v. sl. s.	s.	s.
13	colorl. liq.	$1.002^{14°}$	......	229	i.	s.	s.
14	colorl. liq.	$0.829^{20°}$	......	140	v. sl. s.	s.	s.
15	colorl.	$0.806^{20°}$	......	123.7	......	s. bz.	....
16							
17	gas	$0.687^{-5.8°}$	......	7.2	v. s.	s.	s.
18	yel. liq.	$0.958^{20°}$	2.5	194	v. sl. s.	s.	s.
19	colorl. leaf.	....	246	......	......	......	v. s. bz.
20	need. f. al.	....	71	......	......	s.	v. s. bz.
21	colorl. liq.	$1.213^{29°}$	......	36	∞ chl.	∞	∞
22							
23	colorl. prisms	....	144	......	v. sl. s. h.	s.	....
24	colorl. monocl.	....	126	268	v. sl. s. h.	v. s. h.	s.
25	colorl. need.	....	132	268	v. sl. s. h.	v. s.	....
26	need. f. al.	....	97–9 (116)	274.5	sl. s.	......	v. s.
27	colorl. prisms	....	163	......	v. sl. s. h.	v. sl. s.	....
28	monocl. f. al.	....	166	sub.	v. sl. s.	v. s.	....
29	gas	1.617 (A)	−138.5	−24	3700 c.c.	s.	s.
30	colorl. liq.	....	−14	187	v. sl. s.	s.	s.
31	colorl. liq.	$0.861^{20°}$	......	185	i.	......	....
32	colorl. liq.	$0.878^{20°}$	......	183.4	i.	......	....
33	colorl.	....	234.5	......	i.	v. s.	v. s.
34	colorl.	....	64.5 (67–8)	......	i.	......	....
35	colorl. liq.	$0.823^{19°}$	−14	117.6	s.	s.	....
36	colorl.	$1.045\frac{15}{5}°$	......	276	i.	s.	s.
37	colorl.	$1.046\frac{20}{40}°$	46	305	i.	......	....
38	yel. liq.	....	......	153	i.	......	....
39	colorl. monocl.	....	54	166.3	......	......	....
40	colorl. need.	....	209–10	......	sl. s.	sl. s.	v. sl. s.
41	colorl. tab.	....	104	......	v. s.	v. s.	v. sl. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Dimethyl-			
1	phosphine......	....	$(CH_3)_2PH$.........	62.07
2	phthalate (o.)...	....	$C_6H_4(COOCH_3)_2$...	194.13
3	propyl carbinol.	....	$(CH_3)_2(C_3H_7)COH$..	102.15
4	pyridine.	See *lutidine*		
5	quinone (2, 3)..	....	$(CH_3)_2C_6H_2O_2$.....	136.10
6	" (2, 5)..	....	$(CH_3)_2C_6H_2O_2$.....	136.10
7	" (2, 6)..	....	$(CH_3)_2C_6H_2O_2$.....	136.10
8	racemate.......	....	$C_4H_4O_6(CH_3)_2$.....	178.11
9	succinate.......	....	$C_2H_4\cdot(COO\cdot CH_3)_2$.	146.11
10	sulphate.......	....	$(CH_3)_2SO_4$.........	126.12
11	tartrate (d. and l.)	....	$C_4H_4O_6(CH_3)_2$.....	178.11
12	terephthalate (p.)	....	$C_6H_4(COOCH_3)_2$...	194.13
13	thiophene (2, 4)	....	$(CH_3)_2C_4H_2S$......	112.14
14	" (2, 5)	....	$(CH_3)_2C_4H_2S$......	112.14
15	urea (sym.).....	....	$CH_3NH\cdot CO\cdot NHCH_3$	88.16
16	" (uns.).....	....	$NH_2\cdot CO\cdot N(CH_3)_2$.	88.16
17	Dinaphthol (α)...	....	$HO\cdot C_{10}H_6\cdot C_{10}H_6\cdot OH$	286.22
18	" (β)...	....	$HO\cdot C_{10}H_6\cdot C_{10}H_6\cdot OH$	286.22
19	Dinaphthyl (α α) .	....	$C_{10}H_7\cdot C_{10}H_7$.......	254.22
20	" (β β).	....	$C_{10}H_7\cdot C_{10}H_7$.......	254.22
21	Dinitraniline (2, 4)	....	$(NO_2)_2C_6H_3NH_2$ ...	183.19
22	Dinitro benzene (o.)	....	$C_6H_4(NO_2)_2$........	168.14
23	" (m.)	....	$C_6H_4(NO_2)_2$........	168.14
24	" (p.)	....	$C_6H_4(NO_2)_2$........	168.14
25	benzoic acid (2, 4)	....	$(NO_2)_2\cdot C_6H_3\cdot COOH$	212.15
26	" " (2, 5)	....	$(NO_2)_2\cdot C_6H_3\cdot COOH$	212.15
27	" " (2, 6)	....	$(NO_2)_2\cdot C_6H_3\cdot COOH$	212.15
28	" " (3, 4)	....	$(NO_2)_2\cdot C_6H_3\cdot COOH$	212.15
29	" " (3, 5)	....	$(NO_2)_2\cdot C_6H_3\cdot COOH$	212.15
30	diphenyl (p., p.).	....	$NO_2C_6H_4\cdot C_6H_4NO_2$.	244.20
31	methane.......	....	$CH_2(NO_2)_2$........	106.11
32	phenol (2, 3)...	....	$(NO_2)_2\cdot C_6H_3\cdot OH$..	184.14
33	" (2, 4)...	....	$(NO_2)_2\cdot C_6H_3\cdot OH$..	184.14
34	" (2, 6)...	....	$(NO_2)_2\cdot C_6H_3\cdot OH$..	184.14
35	" (3, 4)...	....	$(NO_2)_2\cdot C_6H_3\cdot OH$..	184.14
36	" (3, 5)...	....	$(NO_2)_2\cdot C_6H_3\cdot OH$..	184.14
37	toluene (2, 4)...	....	$(NO_2)_2\cdot C_6H_3\cdot CH_3$..	182.17
38	" (2, 5)...	....	$(NO_2)_2\cdot C_6H_3\cdot CH_3$..	182.17
39	" (2, 6)...	....	$(NO_2)_2\cdot C_6H_3\cdot CH_3$.	182.17
40	" (3, 4)...	....	$(NO_2)_2\cdot C_6H_3\cdot CH_3$.	182.17
41	" (3, 5)...	....	$(NO_2)_2\cdot C_6H_3\cdot CH_3$.	182.17
42	Diphenyl.......	....	$C_6H_5\cdot C_6H_5$.......	154.14

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point C°	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	....	....	......	25	i.	......	....
2	colorl. liq.	....	......	282	i.	......	....
3	colorl. liq.	....	......	123	v. sl. s.	s.	....
4							
5	yel. need.	....	55	subl.	v. sl. s.	s.	s.
6	prisms	....	125	subl.	sl. s. h.	sl. s.	v. s.
7	yel. need.	....	72–3	......	......	......	....
8	monocl. f. al.	....	85	282	......	s.	....
9	colorl.	1.126	18.5	195.2	i.	......	....
10	....	....	......	188.5	......	......	....
11	colorl.	1.340	48	280	s.	v. s.	s. chl.
12	need...	....	140	......	0.33	......	....
13	....	$0.996^{20°}$	......	138	i.	s.	s.
14	....	0.986	......	135	i.	s.	s.
15	colorl. prisms	....	100	268–73	v. s.	s.	i.
16	colorl. prisms	....	180	......	v. s.	v. sl. s.	v. sl. s.
17	rhombic	....	300	......	i.	s.	v. s.
18	need.	....	218	subl.	i.	s.	v. s.
19	colorl. tab.	....	154 (160.5)	abt. 360	v. s. bz.	s.	s.
20	colorl.	....	187	......	......	sl. s.	....
21	yel.monocl.	1.615	187.5–8.0	......	i.	$0.7^{21°}$	....
22	tab. f. al.	$1.565^{17°}$	117	319	$0.38^{100°}$	$3.8^{25°}$	v. s. bz.
23	need f. al.	$1.546^{17°}$	90	297	0.01 c.	$3.5^{20°}$	v. s.; v. s. bz.
24	need.	$1.587^{17°}$	171–2	298.4	$0.18^{100°}$	$0.4^{20°}$	s. bz.
25	colorl. pr. f. w.	....	179	......	$1.85^{25°}$	v. s.	$0.71^{30°}$ bz.
26	colorl. need.	....	177	......	sl. s. h.	......	......
27	" "	....	202	dec.	v. s. h.	......	......
28	colorl.	....	163–4	......	$0.67^{25°}$	v. s.	v. s.
29	tab. f. w.	....	203–4	......	$1.9^{100°}$	v. s.	sl. s.
30	need.	....	233–5	......	......	s. h.	v. s.
31	liq.	....	......	exp. 100°	s.	......	....
32	yel. need. f. w.	....	144	......	sl. s.	v. s. h.	v. s.
33	yel. pl. f. w.	$1.683^{24°}$	114	......	v.sl.s.c.; v.s.h.	$3.9^{19°}$	v. s.
34	yel. need. f. w.	....	61.8	......	v.sl.s.c.; v.s.h.	v. s. h.	v. s.
35	need.	....	134	......	......	......	....
36	leaf.	....	122	......	......	......	....
37	need. f. al.	$1.321^{0°}$	70.7	......	v.sl.s.c.	sl. s.	v. s.
38	need. f. al.	....	52	......	v.s.CS_2	v. s.	v. s. bz.
39	need.	....	66	......	......	s.	....
40	need. f. CS_2	1.32	61	......	i.	s.	2.19 c. CS_2
41	need. f. w.	....	92–3	......	v. sl. s.	s.	v. s.
42	colorl. tab.	1.165	70.5	254.6	i.	10.c	s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Diphenyl-acetic acid.....	....	$(C_6H_5)_2\cdot CH\cdot COOH$	212.17
2	amine.........	....	$(C_6H_5)_2\cdot NH$.......	169.19
3	benzene (p.)....	....	$C_6H_5\cdot C_6H_4\cdot C_6H_5$...	230.21
4	carbinol........	benzhydrol......	$(C_6H_5)_2CHOH$.....	184.16
5	hydrazine (α, α)	....	$(C_6H_5)_2N\cdot NH_2$.....	184.24
6	ketone.	See *benzophenone*		
7	methane.......	....	$(C_6H_5)_2CH_2$........	168.17
8	urea (uns.).....	carbanilide......	$NH_2\cdot CO\cdot N\cdot (C_6H_5)_2$	212.25
9	Dipicolinic acid (2, 6)	....	$C_5H_3N(COOH)_2+1\frac{1}{2}H_2O$	194.11
10	Dipropargyl.....	....	$CH\vdots C\cdot CH_2\cdot CH_2\cdot C\vdots CH$	78.08
11	Dipropyl amine..	....	$(C_3H_7)_2NH$........	101.19
12	carbinol........	....	$(C_3H_7)_2\cdot CHOH$....	116.17
13	ether..........	propyl ether.....	$C_3H_7\cdot O\cdot C_3H_7$......	102.15
14	ketone.........	butyrone........	$C_3H_7\cdot CO\cdot C_3H_7$....	114.16
15	Dipyridyl (p. p)..	....	$C_5H_4N\cdot C_5H_4N+2H_2O$...	156.21
16	Diquinoline......	....	$C_9H_7N\cdot C_9H_7N$.....	258.29
17	Ditolyl (o. o.)....	....	$CH_3\cdot C_6H_4\cdot C_6H_4\cdot CH_3$	182.19
18	" (o. m.)...	....	$CH_3\cdot C_6H_4\cdot C_6H_4\cdot CH_3$	182.19
19	" (m. m.) ..	....	$CH_3\cdot C_6H_4\cdot C_6H_4\cdot CH_3$	182.19
20	" (p. p.)....	....	$CH_3\cdot C_6H_4\cdot C_6H_4\cdot CH_3$	182.19
21	Ditolyl amine (o.).	....	$(CH_3C_6H_4)_2NH$....	197.23
22	" " (m.)	....	$(CH_3C_6H_4)_2NH$....	197.23
23	" " (p.)	....	$(CH_3C_6H_4)_2NH$....	197.23
24	Dodecane (n.)....	....	$CH_3(CH_2)_{10}\cdot CH_3$...	170.28
25	Dodecylene......	....	$C_{12}H_{24}$..........	168.26
26	Dulcite..........	....	$C_6H_8(OH)_6$........	182.15
27	Ecgonine (l.).....	....	$C_9H_{15}O_3N+H_2O$....	203.19
28	hydrochloride...	....	$C_9H_{15}O_3N\cdot HCl$....	239.66
29	Elaïdic acid......	....	$C_{17}H_{33}COOH$......	282.37
30	Eosine..........	tetrabromfluorescein	$C_{20}H_8O_5Br_4$........	648.84
31	Eosine (dye).....	alkali salt of above	$C_{20}H_6O_5Br_4Na_2$.....	691.83
32	Epichlorhydrine (α)	chloropropylene oxide	C_3H_5ClO..........	92.51
33	Epidichlorhydrine (α)	....	$C_3H_4Cl_2$...........	110.95
34	Erucic acid......	....	$C_{21}H_{41}COOH$......	338.45
35	Erythrosine......	tetraiodofluorescein	$C_{20}H_8O_5I_4$.........	835.84
36	Erythrosine (dye)	alkali salt of above	$C_{20}H_6O_5I_4Na_2$......	879.82

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. need.	....	148	......	v. s. h.	v. s.	v. s.
2	colorl. scales	1.159	54	302 (310)	v. sl. s.	v. s.	v. s.
3	colorl. leaf.	....	205	383	s. h. bz.	v. sl. s.	sl. s.
4	need.	....	67.5–8.0	297–8	0.05 c.	v. s.	v. s.
5	tricl. f. lgr.	1.190	34.5(44)	220^{40mm}	v. sl. s.	v. s.	v. s.
6							
7	colorl. rhomb.	$1.001^{26°}$	26–7	261–2	v. sl. s.	v. s.	v. s.
8	colorl. need.	....	189	......	v. sl. s.	s.	s.
9	colorl. need.	....	226 d.	......	v. sl. s.	v. sl. s.	....
10	liq.	0.805	–6	85	i.	s.	v. s.
11	colorl. liq.	$0.736^{25°}$	......	110	s.	s.	....
12	colorl. liq.	$0.820^{20°}$	......	154	......	s.	s.
13	colorl. liq.	$0.744^{21°}$	......	90.7	s.	∞	∞
14	colorl. liq.	0.821	......	144	i.	∞	∞
15	need.	....	73*	305	v. sl. s.	v. s.	v. s.
16	yel. need.	....	114	......	i.	v. s.	v. s.
17	colorl. liq.	....	......	272	i.	......	....
18	colorl. liq.	....	......	288	i.	v. s.	v. s.
19	colorl. liq.	....	......	280–1	i.	......	....
20	colorl. pr. f. eth.	....	121	......	......	s.	s.
21	liq.	....	......	313–4	v. sl. s.	......	....
22	liq.	....	......	319–20	i.	v. s.	v. s.
23	colorl. need.	....	79	330.5	v. sl. s.	......	....
24	colorl. liq.	0.768^{20}	−12	214.5	i.	v. s.	v. s.
25	colorl. liq.	0.785^{20}	−31.5	213–5	i.	v. s.	v. s.
26	colorl. pr.	1.466	188.5	......	4 c.; v. s. h.	v. sl. s.	v. sl. s.
27	colorl. pr.	....	198 d.	......	$21.7^{17°}$	1.5	v. sl. s.
28	tricl. pl.	....	246	......	s.	sl. s.	....
29	colorl. leaf.	0.851^{79}	51.5	234^{15mm}	i.	s.	s.
30	red need.	....	......	......	i.	s.	s. acet. a.
31	red to br. powd.	....	......	......	s.	s.	....
32	colorl. liq.	$1.203^{0°}$	......	117	i.	∞	∞
33	colorl. liq.	$1.209^{\frac{25}{25}°}$	......	96	i.	∞	∞
34	colorl. need.	$0.860^{55°}$	33.4	264^{15mm}	......	v. s.	....
35	yel. cryst.	....	......	......	i.	s.	v. sl. s.
36	red-br. powd.	....	......	......	s.	s.	....

* Anhydrous melts at 114° C.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Ethane	....	$CH_3 \cdot CH_3$	30.06
2	Ether	diethyl ether	$C_2H_5 \cdot O \cdot C_2H_5$	74.10
3	Ethoxy-benzoic acid (o.)	....	$C_2H_5 \cdot O \cdot C_6H_4 \cdot COOH$	166.13
4	Ethoxy-benzoic acid (m.)	....	$C_2H_5 \cdot O \cdot C_6H_4 \cdot COOH$	166.13
5	Ethoxy-benzoic acid (p.)	....	$C_2H_5 \cdot O \cdot C_6H_4 \cdot COOH$	166.13
6	Ethyl acetate	....	$CH_3 \cdot COO \cdot C_2H_5$	88.06
7	acetoacetate	acetoacetic ether	$CH_3 \cdot CO \cdot CH_2 \cdot CO_2 \cdot C_2H_5$	130.11
8	acetylene	....	$C_2H_5 \cdot C : CH$	54.02
9	acrylate	....	$C_3H_3OO \cdot C_2H_5$	100.09
10	alcohol	....	$C_2H_5 \cdot OH$	46.06
11	allyl ether	....	$C_2H_5 \cdot O \cdot CH_2 \cdot CH : CH_2$	86.11
12	amine	....	$C_2H_5 \cdot NH_2$	45.11
13	amyl ketone	....	$C_2H_5 \cdot CO \cdot C_5H_{11}$	128.17
14	aniline	....	$C_6H_5 \cdot NH \cdot C_2H_5$	121.17
15	benzene	phenylethane	$C_6H_5 \cdot C_2H_5$	106.12
16	benzoate	....	$C_6H_5 \cdot COO \cdot C_2H_5$	150.13
17	benzoic acid (o.)	....	$C_2H_5 \cdot C_6H_4 \cdot COOH$	150.13
18	" " (m.)	....	$C_2H_5 \cdot C_6H_4 \cdot COOH$	150.13
19	" " (p.)	....	$C_2H_5 \cdot C_6H_4 \cdot COOH$	150.13
20	benzoyl-acetate	benzoyl acetic ester	$C_6H_5 \cdot CO \cdot CH_2 \cdot COO \cdot C_2H_5$	192.16
21	benzyl ether	....	$C_2H_5 \cdot O \cdot CH_2 \cdot C_6H_5$	136.15
22	" ketone	....	$C_2H_5 \cdot CO \cdot CH_2 \cdot C_6H_5$	148.15
23	brom-acetate	....	$CH_2Br \cdot COO \cdot C_2H_5$	167.04
24	bromide	monobromethane	C_2H_5Br	109.01
25	butyl ether (n.)	....	$C_2H_5 \cdot O \cdot C_4H_9$	102.15
26	" ketone (n.)	....	$C_2H_5 \cdot CO \cdot C_4H_9$	114.16
27	butyrate	....	$C_3H_7 \cdot COO \cdot C_2H_5$	116.13
28	carbamate.	See *urethane*		
29	carbonate	....	$(C_2H_5)_2CO_3$	118.11
30	chloracetate	....	$CH_2Cl \cdot COO \cdot C_2H_5$	122.53
31	chloraceto-acetate	....	$CH_3 \cdot CO \cdot CH_2 \cdot COO \cdot C_2H_5$	164.55
32	chlorformate	ethyl chlorcarbonate	$ClCOO \cdot C_2H_5$	108.52
33	chloride	....	C_2H_5Cl	64.50
34	chlorpropionate (α)	....	$CH_3 \cdot CHCl \cdot COO \cdot C_2H_5$	136.55
35	cinnamate	....	$C_6H_5 \cdot CH : CH \cdot COO \cdot C_2H_5$	176.16
36	cyanacetate	....	$CH_2CN \cdot COO \cdot C_2H_5$	113.13
37	cyanide	propionitrile	C_2H_5CN	50.10
38	diaceto-acetate	....	$(CH_3 \cdot CO)_2CH \cdot COO \cdot C_2H_5$	172.14
39	dichloracetate	....	$CHCl_2 \cdot COO \cdot C_2H_5$	156.97
40	diethyl-aceto-acetate	....	$CH_3CO \cdot C(C_2H_5)_2CO_2C_2H_5$	186.19
41	diethyl-malonate	....	$(C_2H_5)_2 \cdot C \cdot (COO \cdot C_2H_5)_2$	216.22
42	dimethyl-malonate	....	$(CH_3)_2 \cdot C \cdot (COO \cdot C_2H_5)_2$	188.18

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	gas	1.049(A)	−172	−86	sl. s.	46 c.c.$^{4°}$	....
2	colorl. liq.	0.719	−116.2	35	$8.3^{17.5}$	∞	....
3	colorl.	....	19.4	......	sl. s.	......	....
4	colorl. need.	....	137	sub.	sl. s. h.	s.	s.
5	colorl. need.	....	195	......	v. sl. s. h.	......	....
6	colorl. liq.	$0.900^{20°}$	−82.4	77.	$8.6^{20°}$	∞	∞
7	liq.	$1.030^{15°}$	......	181	sl. s.	s.	s.
8	colorl.	....	−130	18	i.	s.	s.
9	colorl. liq.	$0.939^{0°}$	......	98.5	......	......	....
10	colorl. liq.	$0.789^{20°}$	−114	78.4	∞	......	∞
11	colorl. liq.	$0.799^{25°}$	......	66	i.	∞	∞
12	colorl. liq.	0.689	−84	abt. 19	∞	∞	∞
13	colorl. liq.	$0.850^{0°}$	......	170	i.	∞	∞
14	liq.	$0.963^{20°}$	−80	205	v. sl. s.	∞	∞
15	colorl. liq.	$0.874^{14°}$	−94	136.5	i.	∞	∞
16	colorl. liq.	1.051	......	212	sl. s. h.	s.	∞
17	colorl. need.	....	68	259	v. sl. s.	v. s.	v. s.
18	colorl. need.	....	47	......	v. sl. s.	......	....
19	colorl. leaf.	....	112–3	......	s. h.	v. s.	v. s.
20	colorl. liq.	1.121	......	265–70 d.	i.	∞	∞
21	colorl. liq.	$0.950\frac{18}{15}°$	......	185(189)	i.	∞	∞
22	colorl. liq.	$0.998^{17.5°}$	......	223–6 (230)	i.	∞	∞
23	colorl. liq.	$1.507\frac{25}{25}°$	......	158–60	i.	∞	∞
24	colorl. liq.	1.450	......	39	$0.09^{20°}$	∞	∞
25	colorl. liq.	$0.752^{20°}$	......	92	i.	∞	∞
26	colorl. liq.	....	......	147–8	i.	∞	∞
27	colorl. liq.	0.886	−93.3	119.9	$0.68^{25°}$	s.	s.
28							
29	colorl. liq.	0.978	......	126	i.	s.	....
30	colorl. liq.	$1.159^{20°}$	......	145.5	i.	......	....
31	colorl. liq.	$1.179\frac{25}{25}°$	......	196–200	v. sl. s.	∞	∞
32	colorl. liq.	1.139	......	93	dec.	∞	∞
33	colorl. liq.	$0.921^{0°}$ $(0.925^{0°})$	−141	12.2–.5	2	∞	∞
34	colorl. liq.	1.087	......	146	v. sl. s.	∞	∞
35	colorl. liq.	1.050	12	271	i.	s.	v. s.
36	colorl. liq.	1.066	......	207	i.	∞	∞
37	colorl. liq.	$0.780^{20°}$	......	97.1	s.	∞	....
38	colorl. liq.	1.101	......	200–5	sl. s.	......	....
39	colorl. liq.	1.283	......	156–8	v. sl. s.	∞	∞
40	colorl. liq.	$0.974^{20°}$	......	218	i.	∞	∞
41	colorl. liq.	0.992	......	223	i.	∞	∞
42	colorl. liq.	1.002	......	196.5	i.	∞	∞

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Ethyl			
1	diphenylamine..	....	$(C_6H_5)_2NC_2H_5$.....	197.23
2	fluoride........	....	C_2H_5F..........	48.05
3	formate........	....	$HCOO \cdot C_2H_5$.......	74.07
4	glycerate.......	....	$C_2H_3(OH)_2 \cdot COO \cdot C_2H_5$	134.11
5	glycol ether....	....	$CH_2OH \cdot CH_2 \cdot O \cdot C_2H_5$	90.10
6	glycollate......	....	$CH_2OH \cdot COO \cdot C_2H_5$	104.08
7	hydrazine......	....	$C_2H_5NH \cdot NH_2$.....	60.15
8	hydrocinnamate.	....	$C_6H_5 \cdot CH_2 \cdot CH_2 \cdot CO_2 \cdot C_2H_5$	178.18
9	hydrogen sulphate	ethyl sulphuric acid	$C_2H_5 \cdot HSO_4$........	126.11
10	hydrosulphide..	See *ethyl mercaptan*		
11	hydroxylamine(α)	....	$NH_2 \cdot O \cdot C_2H_5$......	61.11
12	" (β)	....	C_2H_5NHOH.......	61.11
13	iodide.........	....	C_2H_5I...........	156.02
14	isoamyl ether...	....	$C_2H_5 \cdot O \cdot C_5H_{11}$.....	116.17
15	isobutyl ether...	....	$C_2H_5 \cdot O \cdot C_4H_9$......	102.15
16	isobutyl ketone.	....	$C_2H_5 \cdot CO \cdot C_4H_9$....	114.16
17	isobutyrate.....	....	$(CH_3)_2CH \cdot COO \cdot C_2H_5$	116.13
18	isocyanate......	....	C_2H_5NCO.........	71.10
19	isocyanide......	ethyl carbylamine	C_2H_5NC...........	55.10
20	isopropyl-aceto-acetate	....	$C_2H_3O \cdot CH(C_3H_7) \cdot CO_2 \cdot C_2H_5$	172.18
21	isopropyl ether..	....	$C_2H_5 \cdot O \cdot CH(CH_3)_2$.	88.13
22	" ketone.	....	$C_2H_5 \cdot CO \cdot CH(CH_3)_2$	100.13
23	isosuccinate....	....	$CH_3 \cdot CH(COO \cdot C_2H_5)_2$	174.15
24	isothiocyanate..	ethyl mustard oil.	$C_2H_5 \cdot N : CS$.......	87.15
25	isovaleriate.....	....	$(CH_3)_2CH \cdot CH_2 \cdot COO \cdot C_2H_5$	130.16
26	lactate.........	....	$C_3H_5O_3 \cdot C_2H_5$......	118.11
27	malate.........	....	$C_2H_3(OH) \cdot (COO \cdot C_2H_5)_2$	190.15
28	malonate.......	....	$CH_2(COO \cdot C_2H_5)_2$..	160.14
29	mercaptan.....	....	C_2H_5SH..........	62.11
30	monotartrate...	....	$COOH \cdot (CHOH)_2 \cdot COO \cdot C_2H_5$	178.11
31	mustard oil. See	*ethyl isothiocyanate*		
32	naphthalene (α).	....	$C_{10}H_7 \cdot C_2H_5$.......	156.16
33	" (β).	....	$C_{10}H_7 \cdot C_2H_5$.......	156.16
34	naphthyl ether(α)	....	$C_{10}H_7 \cdot O \cdot C_2H_5$.....	172.16
35	" " (β)	....	$C_{10}H_7 \cdot O \cdot C_2H_5$.....	172.16
36	nitrate.........	....	$C_2H_5NO_3$..........	91.09
37	nitrite.........	....	$C_2H_5NO_2$..........	75.09
38	nitro-benzoate(o.)	....	$NO_2 \cdot C_6H_4 \cdot COO \cdot C_2H_5$	195.16
39	" " (m.)	....	$NO_2 \cdot C_6H_4 \cdot COO \cdot C_2H_5$	195.16
40	" " (p.)	....	$NO_2 \cdot C_6H_4 \cdot COO \cdot C_2H_5$	195.16
41	nitrolic acid....	....	$CH_3 \cdot C \cdot (NOH) \cdot NO_2$	104.12
42	oxalate........	....	$(\cdot COO \cdot C_2H_5)_2$.....	146.10
43	palmitate......	....	$C_{15}H_{31} \cdot COO \cdot C_2H_5$.	284.39

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	liq.	....	......	295	i.	s.	....
2	gas	1.7	......	−32	198c.c.$^{14°}$	v. s.	....
3	colorl. liq.	0.917	−80	54.4	11	∞	∞
4	liq.	1.091	......	230–40	s.	v. s.	v. s.
5	colorl. liq.	$0.926^{13°}$	......	135	s.	∞	∞
6	colorl. liq.	$1.083^{23°}$	......	160	......	v. s.	v. s.
7	colorl. liq.	....	......	101	v. s.	v. s.	v. s.
8	colorl. liq.	$1.012\frac{25}{25}°$	......	247–9	i.	......	....
9	liq.	1.316	......	dec.	v. s.	s.	s.
10							
11	colorl. liq.	$0.883^{7.5°}$	......	68	∞	∞	∞
12	colorl. leaf.	$0.908^{64°}$	59–60 d.	......	v. s.	v. s.	sl. s.
13	liq.	$1.94\frac{15}{15}°$	−112	72.3	$0.4^{20°}$	s.	s.
14	colorl. liq.	0.761	......	112	i.	∞	∞
15	colorl. liq.	0.751	......	78–80	i.	∞	∞
16	colorl. liq.	$0.815\frac{17}{0}°$	......	136	i.	∞	∞
17	colorl. liq.	$0.869^{20°}$	......	110.1	sl. s.	∞	∞
18	liq.	0.898	......	60	i.	......	s.
19	colorl. liq.	$0.759^{4°}$	......	78–9	v. s.	......	s.
20	colorl. liq.	$0.947\frac{22}{18}°$	......	200.5 d.	v. sl. s.	∞	∞
21	colorl. liq.	$0.745^{0°}$	......	54	s.	∞	∞
22	colorl. liq.	$0.830^{0°}$	......	114.5	v. sl. s.	v. s.	∞
23	colorl. liq.	1.021	......	198	v. sl. s.	∞	∞
24	colorl. liq.	$0.995^{23°}$	−5.9	131–2	i.	s.	s.
25	colorl. liq.	0.872	......	134.3	i.	∞	∞
26	colorl. liq.	$1.031^{19°}$	......	154.5	∞	v. s.	v. s.
27	colorl. liq.	$1.124\frac{25}{25}°$	......	248–52 d.	s.	∞	∞
28	colorl. liq.	1.061	−50	198	v. sl. s.	∞	∞
29	liq.	0.838^{21}	−144	36–7	1.5	s.	s.
30	colorl. rhomb.	....	90	......	s.	......	....
31							
32	colorl. liq.	$1.064\frac{15}{15}°$	......	258 sl. d.	i.	∞	∞
33	colorl. liq.	$1.008^{0°}$	−19	251	i.	∞	∞
34	liq.	....	5.5	280	i.	v. s.	v. s.
35	....	....	37	282	i.	sl. s.	s.
36	colorl. liq.	1.116	−112	87.6	i.	∞	∞
37	liq.	0.900	......	17	v. sl. s.	∞	s.
38	colorl. tricl.	....	30	......	......	......	....
39	prisms	....	47 (54)	......	i.	v. s.	v. s.
40	colorl.	....	57	......	......	......	....
41	yel. rhomb.	....	86–8 d.	......	s.	......	s.
42	colorl. liq.	1.085	......	186.1	sl. s.	∞	∞
43	colorl. need.	....	24.2	......	i.	s.	s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Ethyl			
1	phenate	See *phenetol*		
2	phenol (o.)	....	$C_2H_5 \cdot C_6H_4 \cdot OH$	122.12
3	" (p.)	....	$C_2H_5 \cdot C_6H_4 \cdot OH$	122.12
4	phenyl-acetate	....	$C_6H_5 \cdot CH_2 \cdot COO \cdot C_2H_5$	164.15
5	phenyl ketone	....	$C_6H_5 \cdot CO \cdot C_2H_5$	134.13
6	phosphate	....	$(C_2H_5)_3PO_4$	182.15
7	phthalate (o.)	....	$C_6H_4 \cdot (COO \cdot C_2H_5)_2$	222.17
8	" (m.)	ethyl isophthalate	$C_6H_4 \cdot (COO \cdot C_2H_5)_2$	222.17
9	" (p.)	ethyl terephthalate	$C_6H_4 \cdot (COO \cdot C_2H_5)_2$	222.17
10	propiolate	....	$CH \vdots C \cdot COO \cdot C_2H_5$	98.07
11	propionate	....	$C_2H_5 \cdot COO \cdot C_2H_5$	102.11
12	propyl carbinol (n.)	....	$C_3H_7 \cdot CHOH \cdot C_2H_5$	102.15
13	" ether	....	$C_3H_7 \cdot O \cdot C_2H_5$	88.13
14	" ketone	....	$C_2H_5 \cdot CO \cdot C_3H_5$	100.13
15	" malonate	....	$C_3H_7 \cdot CH \cdot (COO \cdot C_2H_5)_2$	202.19
16	pyridine (2)	....	$C_2H_5 \cdot C_5H_4N$	107.11
17	" (3)	....	$C_2H_5 \cdot C_5H_4N$	107.11
18	" (4)	....	$C_2H_5 \cdot C_5H_4N$	107.11
19	salicylate	....	$HO \cdot C_6H_4 \cdot COO \cdot C_2H_5$	166.13
20	succinate (n.)	....	$(\cdot CH_2 \cdot COO \cdot C_2H_5)_2$	174.16
21	succinic acid	....	$C_2H_3(C_2H_5)(COOH)_2$	146.11
22	sulphate	....	$(C_2H_5)_2SO_4$	154.15
23	sulphide	....	$(C_2H_5)_2S$	90.15
24	sulphite	....	$(C_2H_5)_2SO_3$	138.15
25	sulphocyanate	See *ethyl thiocyanate*		
26	sulphone	....	$(C_2H_5)_2SO_2$	122.15
27	sulphonic acid	....	$C_2H_5SO_2 \cdot OH$	110.11
28	sulphonic chloride	....	$C_2H_5 \cdot SO_2Cl$	128.55
29	tartrate (d. or l.)	....	$(\cdot CH(OH) \cdot COO \cdot C_2H_5)_2$	206.16
30	thiocyanate	....	$C_2H_5 \cdot SCN$	87.16
31	toluate (o.)	....	$CH_3 \cdot C_6H_4 \cdot COO \cdot C_2H_5$	164.15
32	" (m.)	....	$CH_3 \cdot C_6H_4 \cdot COO \cdot C_2H_5$	164.15
33	" (p.)	....	$CH_3 \cdot C_6H_4 \cdot COO \cdot C_2H_5$	164.15
34	toluene (o.)	methylethyl benzene (o.)	$C_2H_5 \cdot C_6H_4 \cdot CH_3$	120.15
35	" (m.)	methylethyl benzene (m.)	$C_2H_5 \cdot C_6H_4 \cdot CH_3$	120.15
36	" (p.)	methylethyl benzene (p.)	$C_2H_5 \cdot C_6H_4 \cdot CH_3$	120.15
37	trichloracetate	....	$CCl_3 \cdot COO \cdot C_2H_5$	191.41
38	urea	....	$NH_2 \cdot CO \cdot NHC_2H_5$	88.16
39	valeriate	....	$C_4H_9 \cdot COO \cdot C_2H_5$	130.16
40	vanillate	....	$C_{10}H_{12}O_4$	196.15
41	Ethylene	....	$CH_2 : CH_2$	28.04

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1							
2	colorl. liq.	$1.037^{0°}$	......	206.5–7.5	......	......	....
3	colorl.	....	46	218.5	......	v. s.	v. s.
4	colorl. liq.	1.086	......	229 (226)	i.	∞	∞
5	colorl. leaf.	1.015	21	218	i.	s.	s.
6	....	....	......	215	dec.	s.	s.
7	colorl. liq.	$1.118^{20°}$	......	295	i.	∞	∞
8	colorl. liq.	....	......	285	......	......	....
9	colorl.	....	44	......	......	......	....
10	colorl. liq.	....	......	119	i.	v. s.	v. s.
11	colorl. liq.	0.896	......	98.3	$2.4^{20°}$	∞	∞
12	colorl. liq.	$0.819^{20°}$	......	135	......	s.	....
13	colorl. liq.	$0.755^{0°}$	......	63.6	s.	∞	∞
14	colorl. liq.	$0.818^{18°}$	......	122–4	v. sl. s.	∞	∞
15	colorl. liq.	0.993	......	221	......	......	....
16	liq.	$0.937^{17°}$	......	148.6	sl. s.	∞	v. s.
17	colorl. liq.	$0.959^{0°}$	......	165	v. sl. s.	......	....
18	colorl. liq.	$0.952^{0°}$	......	164–6	s. dil. a.	......	....
19	colorl. liq.	1.135	1.3	231	......	∞	∞
20	colorl. liq.	1.044	−20.8	216.5	i.	∞	∞
21	colorl. prisms	....	98	......	v. s.	v. s.	v. s.
22	colorl. liq.	1.184	−24.5	208	i.; sl. dec.	dec. h.	....
23	colorl. liq.	$0.837^{20°}$	−99.5	91–3	i.	s.	s.
24	colorl. liq.	$1.106^{0°}$	......	161	s. dec.	s.	....
25							
26	rhombic crystals	$1.357^{20°}$	70	248	$15.6^{16°}$	......	....
27		....	......	......	s.	s.	s. alk.
28	liq.	....	......	177	dec.	dec.	v. s.
29	colorl. liq.	1.209	......	280	sl. s.	∞	∞
30	colorl. liq.	$1.007^{23°}$	......	146(142)	i.	∞	∞
31	colorl. liq.	1.039	......	221 (227)	i.	∞	∞
32	colorl. liq.	....	......	226–8	i.	∞	∞
33	colorl. liq.	....	......	228	......	......	....
34	colorl. liq.	0.873	......	158–9	i.	∞	∞
35	colorl. liq.	$0.869^{20°}$	......	158–9	i.	s.	s.
36	colorl. liq.	$0.865^{21°}$	......	162	i.	s.	s.
37	colorl. liq.	1.369	......	164–7	i.	∞	∞
38	colorl. prisms	$1.213^{18°}$	92	......	v. s.	v. s.	....
39	colorl. liq.	$0.877^{20°}$	......	144.5	i.	∞	∞
40	colorl.	....	44	292	i.	v. s.	v. s.
41	gas	0.978(A)	−169	−102.7	$25.6^{0°}$ c.c.	360 c.c.	s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Ethylene			
1	acetate........	....	$(CH_3 \cdot COO)_2C_2H_4$..	146.11
2	alcohol.	See *ethylene glycol*		
3	bromide........	glycol dibromide.	$CH_2Br \cdot CH_2Br$.....	187.96
4	chloride........	glycol dichloride..	$CH_2Cl \cdot CH_2Cl$.....	98.94
5	cyanhydrine....	glycol cyanhydrine	$HO \cdot CH_2 \cdot CH_2 \cdot CN$.	71.07
6	cyanide........	succinonitrile....	$CN \cdot CH_2 \cdot CH_2 \cdot CN$.	60.07
7	diamine........	....	$NH_2 \cdot CH_2 \cdot CH_2NH_2$.	60.10
8	diphenyl ether..	....	$C_2H_4(OC_6H_5)_2$......	214.19
9	glycol	glycol...........	$HOCH_2 \cdot CH_2OH$...	62.06
10	" monoacetate	glycol monoacetate	$HOCH_2 \cdot CH_2$ $OOCCH_3$	102.07
11	iodide.........	glycol diiodide...	$CH_2I \cdot CH_2I$.......	281.98
12	nitrate.........	glycol dinitrate...	$NO_3 \cdot CH_2 \cdot CH_2 \cdot NO_3$	152.12
13	nitrite.........	glycol dinitrite...	$NO_2 \cdot CH_2 \cdot CH_2 \cdot NO_2$	120.12
14	oxide..........	....	C_2H_4O...........	44.04
15	Ethylidene dibromide	....	$CH_3 \cdot CHBr_2$.......	187.96
16	dichloride......	....	$CH_3 \cdot CHCl_2$.......	98.94
17	diiodide.......	....	$CH_3 \cdot CHI_2$........	281.98
18	urea...........	....	$C_3H_6ON_2$..........	86.15
19	Eucalyptol......	cineol...........	$C_{10}H_{18}O$..........	154.20
20	Eugenol (1, 4, 3).	eugenic acid.....	$C_3H_5 \cdot C_6H_3 \cdot$ $(OH)(OCH_3)$	164.15
21	methyl ether (1, 2, 4)	....	$C_3H_5 \cdot C_6H_3 : (OCH_3)_2$	178.17
22	Flavaniline......	....	$NH_2 \cdot C_6H_4 \cdot C_9H_5N \cdot$ CH_3	234.28
23	Flavopurpurin...	trihydroxy-anthraquinone (1, 2, 6)	$C_{14}H_5O_2 \cdot (OH)_3$....	256.13
24	Fluoran.........	....	$C_{20}H_{12}O_3$..........	300.20
25	Fluoranthene....	....	$C_{15}H_{10}$............	190.16
26	Fluorene........	....	$(C_6H_4)_2 : CH_2$......	166.15
27	Fluoresceïn......	....	$C_{20}H_{12}O_5$..........	332.20
28	Fluoroform......	....	CHF_3.............	70
29	Formaldehyde...	....	$HCHO$.............	30.03
30	Formamide......	....	$HCONH_2$..........	45.08
31	Formanilid......	....	C_6H_5NHOCH......	121.14
32	Formic acid......	....	$H \cdot COOH$.........	46.03
33	Fructose........	laevulose, fruit sugar	$C_6H_{12}O_6$..........	180.13
34	Fuchsin.	See *rosaniline*		
35	Fulminuric acid..	....	$C_3H_3O_3N_3$.........	129.14
36	Fumaric acid....	....	$HOOC \cdot CH : CH \cdot$ $COOH$	116.05
37	Furfural.........	furfuraldehyde...	$C_4H_3O \cdot CHO$.......	96.06
38	Furfuran........	....	C_4H_4O............	68.05
39	Furfuryl alcohol..	....	$C_4H_3O \cdot CH_2OH$....	98.08

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. liq.	$1.128^{0°}$	......	186–7	14.3	s.	s.
2							
3	colorl. liq.	2.189	9–10	131	v. sl. s.	s.	∞
4	colorl. liq.	1.265	......	84	sl. s.	s.	∞
5	colorl. liq.	$1.059^{0°}$	......	221–3	∞	∞	s.
6	colorl.	....	51–2 (54.5)	265–7 d.	v. s.	v. s.	s.
7	colorl.	0.902	10 ($1H_2O$)	117	s.	......	v. sl. s.
8	colorl.	....	98.5	......	v. sl. s. c.; s. h.	sl. s.	v. s.
9	colorl. liq.	1.115	......	197–7.5	∞	∞	sl. s.
10	colorl. liq.	1.108	......	182	∞	s.	....
11	yel. prisms	2.07	81–2	......	sl. s.	s.	s.
12	yel. liq.	$1.483^{8°}$	......	*	i.	s.	....
13	liq.	$1.216^{0°}$	......	96–8	i.	s.	s.
14	colorl. liq.	$0.897^{0°}$	......	14	∞	∞	∞
15	liq.	2.100	......	110–12.5	i.	v. s.	v. s.
16	colorl. liq.	1.178	......	58–60	$0.55^{20°}$	v. s.	v. s.
17	liq.	$2.84^{0°}$	......	178	i.	v. s.	v. s.
18	colorl. need.	....	154	dec.	v. sl. s.	sl. s.	v. sl. s.
19	colorl. liq.	$0.927^{20°}$	–1–3	176	i.	∞	∞
20	colorl. liq.	$1.063^{18°}$	......	247.5 (253)	v. sl. s.	∞	∞
21	colorl. liq.	$1.035_{25}^{25°}$	......	250–3 (244)	i.	∞	∞
22	colorl. prisms	....	97	......	v. sl. s.	v. s.	s. bz.
23	yel. need.	....	459	......	v. sl. s. h.	s. h.	sl. s.
24	need.	....	180 (175)	......	......	s.	....
25	colorl. monocl.	....	109–10	......	......	sl. s. c.	v. s.
26	colorl. leaf.	....	113–6	295	......	sl. s.	v. s.
27	or. powd.	....	dec. 290	......	i.; s. alk.	s.	s.
28	gas	....	......	$20^{40\,atm.}$	sl. s.	500 c.c.	s. l. s. chl.
29	colorl. gas	....	......	–21	s.	s.	s.
30	colorl. liq.	1.337	......	192–5 d.	∞	∞	sl. s.
31	colorl. prisms	1.144	46	......	s.	v. s.	s.
32	colorl. liq.	$1.218^{20°}$	8.6	100.8	∞	∞	....
33	need. f. w.	$1.555^{0°}$	94–5	......	v. s.	20	s.
34							
35	colorl. prisms	....	exp. 145	......	s.	s.	s.
36	colorl. prisms	1.625	286–7	sub. 200	$0.65^{16°}$	s.	s.
37	colorl–yel.	$1.159^{20°}$	–36.5	161	$9^{13°}$	s.	s.
38	colorl. need.	0.944	......	31.5	i.	v. s.	v. s.
39	colorl. liq.	$1.136^{20°}$	......	168–70	s.	v. s.	v. s.

Explodes by percussion or on heating to 114–16° C.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Galactose (d.)....	....	$C_6H_{12}O_6$..........	180.03
2	Gallic acid (3, 4, 5)	....	$(HO)_3C_6H_2COOH + H_2O$	188.11
3	Geraniol.........	....	$C_9H_{15}\cdot CH_2OH$.....	154.20
4	acetate........	....	$CH_3\cdot COOC_{10}H_{17}$...	196.22
5	Glucose (d.).	See *dextrose*		
6	pentacetate.....	....	$C_6H_7O_5(OCCH_3)_5$...	390.26
7	phenyl hydrazone (α)	....	$C_6H_{12}O_5N_2HC_6H_5$..	270.29
8	phenyl hydrazone (β)	....	$C_6H_{12}O_5N_2HC_6H_5$..	270.29
9	Glutamic acid (r.)	glutaminic acid...	$C_3H_5(NH_2)(COOH)_2$	147.14
10	Glutaric acid.....	....	$HOOC\cdot(CH_2)_3\cdot COOH$	132.09
11	Glyceric acid.....	....	$HOCH_2\cdot CHOH\cdot COOH$	106.07
12	aldehyde.......	....	$HOCH_2\cdot CHOH\cdot CHO$	90.07
13	Glycerine.........	....	$HOCH_2\cdot CHOH\cdot CH_2OH$	92.08
14	Glyceryl			
15	chlorhydrine (α).	See *chlorhydrine α*		
16	diacetate.	See *diacetin*		
17	dichlorhydrine (α, α).	See *dichlorhydrine* (1, 3)		
18	" (α, β).	See *dichlorhydrine* (2, 3)		
19	dinitrate.......	....	$C_3H_5(OH)(NO_3)_2 + \frac{1}{2}H_2O$	202.30
20	ether..........	....	$C_3H_5O_3C_3H_5$.......	130.11
21	monoacetate.	See *monacetin*		
22	mononitrate (α)	....	$CH_2OH\cdot CHOH\cdot CH_2NO_3$	137.12
23	triacetate.	See *triacetin*		
24	tribromhydrine.	See *tribromhydrine*		
25	trichlorhydrine.	See *trichlorhydrine*		
26	trinitrate.	See *nitroglycerine*		
27	trinitrite	....	$CH_2NO_2\cdot CHNO_2\cdot CH_2NO_2$	179.18
28	Glycid..........	....	$C_2H_3O\cdot CH_2OH$....	74.07
29	Glycin..........	glycocoll........	$CH_2(NH_2)\cdot COOH$..	75.09
30	Glycocoholic acid.	....	$C_{24}H_{39}O_4\cdot NH\cdot CH_2\cdot COOH$	465.52
31	Glycogen........	....	$(C_6H_{10}O_5)_x$........	162.11_x
32	Glycol..........	ethylene glycol...	$HOCH_2\cdot CH_2OH$...	62.06
33	aldehyde.......	....	$CH_2OH\cdot CHO$......	60.04
34	amide..........	....	$CH_2(OH)\cdot CONH_2$..	75.09
35	bromhydrine...	ethylene bromhydrine	$CH_2OH\cdot CH_2Br$....	124.97
36	chlorhydrine....	ethylene chlorhydrine	$CH_2OH\cdot CH_2Cl$....	80.51
37	cyanhydride....	ethylene cyanhydride	$CH_2OH\cdot CH_2CN$...	71.07
38	diacetate.	See *ethylene acetate*		
39	dibromide.	See *ethylene bromide*		

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	hex. tab.	....	168–70	......	v. s.	sl. s.	....
2	triclinic	$1.694^{4°}$	222–40	dec.	$1.16^{25°}$	$27.2^{25°}$	$2.5^{15°}$
3	colorl. liq.	0.881	......	229–30	i.	∞	∞
4	colorl. liq.	0.915	......	242–5 d.	v. sl. s.	v. s.	∞
5							
6	need.	....	130	subl.	v. sl. s.	$1.32^{15°}$	$2.1^{15°}$
7	....	....	144–5	......	v. s.	v. s. h.	v. sl. s.
8	need.	....	115–6	......	......	s.	....
9	colorl.	....	208 d.	......	1	v. sl. s.	....
10	colorl. monocl.	....	97.5	302–4 d.	$64^{20°}$	v. s.	v. s.
11	syrup...	....	......	......	∞	∞	i.; v. s. acet.
12	....	....	abt. 132	......	sl. s.	v. sl. s.	v. sl. s.
13	colorl. liq.	$1.260^{20°}$	17 *	290	∞	∞	i.
14							
15							
16							
17							
18							
19	....	1.47anh.	26	......	7.7	v. s.	s.
20	colorl. liq.	1.091	......	171–2	∞	∞	∞
21							
22	....	1.40	5.8	......	$70^{15°}$	v. s.	sl. s.
23							
24							
25							
26							
27	yel. liq.	....	......	150	i.	dec.	s.
28	colorl.	$1.165^{0°}$	......	161–2 d.	∞	∞	∞
29	colorl. monocl.	1.161	231–5 d.	......	23 c.	v. sl. s.	i.
30	colorl. need.	....	132–4 (152)	......	0.33 c.	v. s.	v. sl. s.
31	wh. amor.	....	abt. 240	......	v. s.	i.	i.
32	colorl. liq.	1.115	......	197–7.5	∞	∞	sl. s.
33	plates	....	95–7	......	v. s.	v. s. h.	sl. s.
34	colorl.	....	120	......	v. s.	sl. s.	sl. s.
35	liq.	....	......	147	s.	......	....
36	colorl. liq.	$1.223^{0°}$	......	128	∞	......	....
37	colorl. liq.	$1.059^{0°}$	......	221–3	∞	∞	s.
38							
39							

* Solidifies at a much lower temperature.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Glycol			
1	dichloride.	See *ethylene chloride*		
2	dicyanide.	See *ethylene cyanide*		
3	diiodide.	See *ethylene iodide*		
4	dinitrate.	See *ethylene nitrate*		
5	dinitrite.	See *ethylene nitrite*		
6	monoacetate.	See *ethylene glycol*	*monoacetate*	
7	urea	hydantoin	$C_3H_4O_2N_2$	100.13
8	Glycolid		$C_4H_4O_4$	116.06
9	Glycollic acid	hydroxyacetic acid	$CH_2(OH)\cdot COOH$	76.04
10	anhydride		$C_4H_6O_5$	134.07
11	Glyoxal	oxalaldehyde	$CHO\cdot CHO$	58.03
12	Glyoxalic acid	glyoxylic acid	$CHO\cdot COOH+H_2O$	92.04
13	Glyoxalin		$C_3H_4N_2$	68.13
14	Glyoxime		$HON:CH\cdot CH:NOH$	88.12
15	Guaiacol		$HO\cdot C_6H_4\cdot OCH_3(o)$	124.10
16	Guanidine		$NH:C(NH_2)_2$	59.17
17	Guanine		$C_5H_5ON_5$	151.27
18	Gun cotton. See	*cellulose hexanitrate*		
19	Haematein		$C_{16}H_{12}O_6$	300.18
20	Haematin		$C_{32}H_{32}N_4Fe_4$	695.82
21	Haematoxylin		$C_{16}H_{14}O_6+3H_2O$	356.24
22	Hemimelitic acid	benzene tricarboxylic acid (1, 2, 3)	$C_6H_3(COOH)_3$	212.10
23	Heptane (n.)		$CH_3\cdot(CH_2)_5\cdot CH_3$	100.17
24	Heptoic acid (n.)		$CH_3\cdot(CH_2)_5\cdot COOH$	130.16
25	Heptyl acetate (n.)		$CH_3\cdot COOC_7H_{15}$	158.20
26	alcohol		$CH_3\cdot(CH_2)_5\cdot CH_2OH$	116.17
27	aldehyde	oenanthal	$CH_3\cdot(CH_2)_5\cdot CHO$	114.15
28	amine		$CH_3\cdot(CH_2)_5\cdot CH_2NH_2$	115.22
29	ether		$(C_7H_{15})_2O$	214.31
30	formate		$HCOO\cdot C_7H_{15}$	144.17
31	Heptylene	heptene	$CH_3\cdot(CH_2)_4\cdot CH:CH_2$	98.16
32	Hesperidine		$C_{22}H_{26}O_{12}$; $(C_{50}H_{60}O_{22})$	482.32
33	Hexabrom ethane		$CBr_3\cdot CBr_3$	403.77
34	Hexachlor benzene		C_6Cl_6	284.73
35	ethane		$CCl_3\cdot CCl_3$	236.17
36	Hexadecane		$C_{16}H_{34}$	226.35
37	Hexaethyl benzene		$C_6(C_2H_5)_6$	246.33

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1							
2							
3							
4							
5							
6							
7	colorl. need.	....	215	......	s.; v. s. h.	......	....
8	colorl. leaf.	....	86–7	......	i.; v. s. acet.	sl. s.	sl. s.
9	leaf. f. eth.	....	78–9	dec.	s.	s.	s.
10	powd.	....	128–30	......	i.; c. s. h.	i.	i.
11	....	1.14	15	50.5	v. s.	s.	s.
12	colorl. rhomb.	....	......	......	v. s.	......	....
13	colorl. prisms	....	88–9	255	v. s.	v. s.	s.
14	rhomb. tab. f. w.	....	178	......	v. s. h.	s.	s.
15	colorl. prisms	$1.140\frac{15}{15}°$	31–2	205	$1.6^{15°}$	s.	s.
16	cryst.	....	......	......	v. s.	v. s.	....
17	colorl. need.	....	dec. abv. 360	......	i.; s. alk.	v. sl. s.	v. sl. s.
18							
19	brown plates	....	......	......	$0.6^{20°}$	sl. s.	sl. s. sl. s.
20	brown powd.	....	......	......	s. alk.	s. h.	....
21	tetrag.	....	140	......	v. sl. s.	s.	s.
22	colorl. need.	....	185 d. (195)	......	sl. s.	......	s.
23	colorl. liq.	0.689	......	98.4	i.	100	∞
24	colorl.	0.921	–10	224	$0.24^{15°}$	s.	s.
25	liq.	0.874	......	190	i.	s.	s.
26	colorl. liq.	0.830	......	175.8	s.	∞	∞
27	colorl. liq.	0.822	......	153–5	sl. s.	s.	∞
28	colorl. liq.	$0.78^{20°}$	......	155–7	v. sl. s.	∞	∞
29	colorl. liq.	$0.815^{0°}$	......	261	i.	s.	s.
30	colorl. liq.	$0.894^{0°}$	......	176–7	i.	......	s.
31	colorl. liq.	$0.703^{19°}$	......	98–9	i.	s.	s.
32	sm. need.	....	251 d.	......	sl. s.	sl. s.	i.
33	rhombic	....	d. 210	......	i.	sl. s.	sl. s.
34	monocl.	$2.044^{23°}$	229	326	i.	i. c.	v. sl. s.
35	rhomb. tabl.	....	184–7	subl.	i.	v. s.	v. s.
36	colorl. leaf.	$0.775^{18°}$	18	287.5–91.0	i.	∞	∞
37	colorl. monocl.	$0.831^{20°}$	129	298	i.	s.	v. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Hexahydro-anthracene	....	$C_{14}H_{16}$	184.20
2	benzene	....	C_6H_{12}	84.12
3	benzoic acid	....	$C_6H_{11}\cdot COOH$	128.14
4	cumene	....	$C_6H_{11}\cdot C_3H_7$	126.20
5	cymene (p.)	....	$CH_3\cdot C_6H_{10}\cdot C_3H_7$	140.26
6	mellitic acid	....	$C_6H_6(COOH)_6$	348.16
7	mesitylene	....	$C_6H_9(CH_3)_3$ (1, 3, 5)	226.19
8	naphthalene	....	$C_{10}H_{14}$	134.16
9	pyridene.	See *piperidine*		
10	salicylic acid	....	$HO\cdot C_6H_{10}\cdot COOH$	144.14
11	toluene	....	$C_6H_{11}\cdot CH_3$	98.16
12	xylene (m.)	....	$C_6H_{10}(CH_3)_2$	112.17
13	" (p.)	....	$C_6H_{10}(CH_3)_2$	112.17
14	Hexahydroxy benzene	....	$C_6(OH)_6$	174.13
15	Hexaiodobenzene	....	C_6I_6	833.55
16	Hexamethyl benzene	....	$C_6(CH_3)_6$	162.21
17	Hexamethylenetetramine	urotropine	$C_6H_{12}N_4$	140.17
18	Hexane (n.)	....	$CH_3(CH_2)_4CH_3$	86.15
19	Hexenyl alcohol	....	$C_6H_{11}OH$	100.13
20	Hexoic aldehyde	....	$CH_3(CH_2)_4CHO$	110.13
21	Hexyl acetate (n.)	....	$CH_3\cdot COOC_6H_{13}$	144.17
22	alcohol	....	$CH_3\cdot(CH_2)_4\cdot CH_2OH$	102.15
23	formate	....	$HCOOC_6H_{13}$	130.16
24	Hexylene (n.)	....	$CH_3(CH_2)_3CH : CH_2$	84.13
25	Hippuric acid	benzoyl glycine	$C_6H_5CO\cdot NHCH_2COOH$	179.16
26	Homopyrocatechin	....	$CH_3\cdot C_6H_3\cdot(OH)_2$ (1, 3, 4)	124.10
27	Homotropine	....	$C_{16}H_{21}O_3N$	275.26
28	hydrobromide	....	$C_{16}H_{21}O_3N\cdot HBr$	356.19
29	Hydrastin	....	$C_{21}H_{21}O_6N$	383.32
30	hydrochloride	....	$C_{21}H_{21}O_6N\cdot HCl$	407.81
31	Hydrazo-benzene	....	$C_6H_5\cdot NH\cdot NH\cdot C_6H_5$	184.24
32	benzoic acid (o.)	....	$(HOOC\cdot C_6H_4\cdot NH\cdot)_2$	272.25
33	naphthalene (1, 1′)	....	$C_{10}H_7\cdot NH\cdot NH\cdot C_{10}H_7$	284.25
34	naphthalene (2, 2′)	....	$C_{10}H_7\cdot NH\cdot NH\cdot C_{10}H_7$	284.25
35	toluene (o.)	....	$(CH_3\cdot C_6H_4\cdot NH)_2$	212.28
36	" (p.)	....	$(CH_3\cdot C_6H_4\cdot NH)_2$	212.28
37	Hydrindene (1, 2)	....	$C_6H_4 : C_2H_4 : CH_2$	118.13
38	Hydrindone (α)	....	C_9H_8O	132.11
39	Hydro-anthracene.	See *dihydro-anthracene*		
40	atropic acid	phenyl propionic acid (α)	$CH_3\cdot CH(C_6H_5)\cdot COOH$	150.13

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. leaf.	....	63	290	i.; v. s. bz.	v. s.	v. s.
2	colorl. liq.	$0.747^{0°}$	......	79	i.	......	....
3	colorl. monocl.	1.048	30	233	sl. s.	v. s.	v. s.
4	colorl. liq.	$0.787^{20°}$	......	147–50	i.	v. s.	v. s.
5	colorl. liq.	0.796	......	171–3	i.	v. s.	v. s.
6	cryst.	....	dec.	......	v. s.	v. s.	v. s.
7	colorl. liq.	....	......	135–8	......	......	....
8	colorl. liq.	$0.934^{20°}_{0}$	......	abt. 205	......	......	....
9							
10	tab.	....	111	......	v. s.	v. s.	v. s.
11	colorl. liq.	$0.769^{20°}$	......	101–2	i.	∞	∞
12	colorl. liq.	$0.771^{21°}$	......	118–9	i.	∞	∞
13	colorl. liq.	$0.769^{20°}$	......	120.5–1.0	......	......	....
14	need.	....	dec. 200	......	sl. s.	sl. s.	sl. s.
15	red.-br. need.	....	140–50 d.	......	......	......	....
16	colorl. rhomb.	....	164	264	......	sl. s.	....
17	rhomb. f. al.	....	280–1	......	$83^{12°}$	3	v. sl.
18	colorl. liq.	$0.660^{20°}$	–94	69	i.	$50^{33°}$	∞
19	colorl. liq.	$0.891^{10°}$	......	137	v. s.	∞	∞
20	liq.	$0.834^{20°}$	......	116–8	i.	v. s.	v. s.
21	colorl. liq.	$0.890^{0°}$	......	169.2	i.	v. s.	v. s.
22	colorl. liq.	$0.820^{20°}$	......	157	sl. s.	∞	∞
23	colorl. liq.	$0.898^{0°}$	......	153.6	......	∞	∞
24	colorl. liq.	$0.683^{20°}$	–98.5	68–70	i.	∞	∞
25	colorl. rhomb.	$1.371^{21°}$	187–90	......	$33^{20°}$	sl. s.	sl. s.
26	colorl.	....	51	251–2	v. s.	v. s.	v. s.
27	colorl. prisms	....	96.5–7.5	......	sl. s.	s.	s.
28	colorl. prisms	....	213.8	......	17.5^{25}	3.3	i.
29	colorl. prisms	....	132	......	$0.025^{80°}$	$0.74^{25°}$	$0.8^{25°}$
30	powd.	....	......	......	s.	......	s.
31	colorl. tab.	1.158	131 (126)	dec.	v. sl. s.	$5^{16°}$	s.
32	colorl. leaf.	....	205	......	i.	s.	....
33	colorl. leaf.	....	275	......	i.	v. s.	v. s.
34	colorl. flocks	....	162–4	......	i.	sl. s.	v. s.
35	colorl. leaf.	....	165	dec.	v. sl. s.	s.	s.
36	colorl. monocl.	0.957	133–4 (128)	dec.	i.	v. s.	v. s.
37	colorl. liq.	0.957	......	176	i.	∞	∞
38	rhomb. tab.	$1.101^{45°}$	41	244	v. sl. s.	v. s.	s.
39							
40	colorl. liq.	....	......	264–5	sl. s.	......	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Hydro-			
1	benzamide	tribenzaldiamine	$(C_6H_5\cdot CH)_3N_2$	298.17
2	benzoïn		$[C_6H_5\cdot CH(OH)\cdot]_2$	214.19
3	carbostyril		C_9H_9ON	147.16
4	cinnamic acid	phenyl propionic acid (β)	$C_6H_5\cdot CH_2\cdot CH_2\cdot COOH$	150.13
5	" aldehyde		$C_6H_5\cdot CH_2\cdot CH_2\cdot CHO$	134.13
6	coumaric acid (p.)	phenol propionic acid (β)	$HO\cdot C_6H_4\cdot (CH_2)_2\cdot COOH$	166.13
7	cyanic acid	prussic acid	HNC	27.06
8	naphthoquinone (1, 2)		$C_{10}H_6(OH)_2$	160.11
9	naphthoquinone (1, 4)		$C_{10}H_6(OH)_2$	160.11
10	quinone (p.).	See *quinol*		
11	quinone dimethyl ether		$C_6H_4(OCH_3)_2$	138.12
12	quinone ethyl ether		$HO\cdot C_6H_4\cdot OC_2H_5$	138.12
13	Hydroxy-acetic acid	See *glycollic acid*		
14	anthraquinone (2)		$C_6H_4:(CO)_2:C_6H_3\cdot OH$	224.07
15	azo benzene (o.)		$HO\cdot C_6H_4\cdot N:N\cdot C_6H_5$	198.16
16	" " (p.)		$HO\cdot C_6H_4\cdot N:N\cdot C_6H_5$	198.16
17	benzaldehyde (o.)		$HO\cdot C_6H_4\cdot CHO$	122.08
18	" (m.)		$HO\cdot C_6H_4\cdot CHO$	122.08
19	" (p.)		$HO\cdot C_6H_4\cdot CHO$	122.08
20	benzamide (o.)		$HO\cdot C_6H_4\cdot CONH_2$	137.10
21	" (m.)		$HO\cdot C_6H_4\cdot CONH_2$	137.10
22	" (p.)		$HO\cdot C_6H_4\cdot CONH_2$	137.10
23	benzoic acid (o.)		$HO\cdot C_6H_4\cdot COOH$	138.08
24	" " (m.)		$HO\cdot C_6H_4\cdot COOH$	138.08
25	" " (p.)		$HO\cdot C_6H_4\cdot COOH$	138.08
26	benzyl alcohol (o.)	saligenin	$HO\cdot C_6H_4\cdot CH_2OH$	124.10
27	" " (m.)		$HO\cdot C_6H_4\cdot CH_2OH$	124.10
28	" " (p.)		$HO\cdot C_6H_4\cdot CH_2OH$	124.10
29	butyric acid (α)		$CH_3\cdot CH_2CH(OH)\cdot COOH$	104.08
30	caproic acid	oxycaproic acid	$CH_3\cdot (CH_2)_3\cdot CH(OH)\cdot COOH$	133.13
31	cinnamic acid.	See *coumaric acid*		
32	citric acid		$C_3H_3(OH)_2\cdot (COOH)_3$	208.14
33	isobutyric acid (α)	acetonic acid	$(CH_3)_2\cdot C(OH)\cdot COOH$	104.08

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. prisms	....	101	......	i.	v. s.	v. s.
2	leaf. f. al.	....	138	abt. 300	0.25; c. 1.3 h.	v. s.	......
3	colorl. prisms f. al.	....	163	......	v. sl. s.	v. s.	v. s.
4	colorl. need.	$1.071^{49°}$	48.7	279.8	$0.59^{20°}$	v. s.	s.
5	colorl. liq.	....	......	208 (223)	i.	17	......
6	colorl. monocl.	....	128–9	......	v. s. h.	v. s.	v. s.
7	colorl. liq.	$0.697^{18°}$	–10–12 *	25.2	∞	∞	v.s. (∞)
8	colorl. leaf.	....	60	......	s. alk.	......	......
9	colorl. need.	....	175	......	s. h.	v. s. h.	v. s.
10							
11	colorl. leaf.	....	55–6	216.6	i.	s. bz.	......
12	leaf.	....	66	246–7	sl.	v. s.	v. s.
13							
14	yel. leaf.	....	302	sub.	v. sl. s.	s.	s.
15	need.	....	82.5–3.0	......	sl. s.; s. alk.	s.	s.
16	prisms. f. al.	....	152	......	v. sl. h.	v. s.	v. s.
17	liq.	$1.159^{21°}$	–20	196.7	v. sl. s.	∞	∞
18	colorl. need.	....	104	240	s. h.	v. s.	s.
19	colorl. need.	....	115–6	sub.	sl. s.	v. s.	v. s.
20	yel. leaf.	....	140	270 d.	s.	......	......
21	colorl. leaf.	....	167 (170.5)	......	sl. s. c.; s. h.	v. s.	v. s.
22	need.	....	162	......	sl. s.	v. s.	sl. s.
23	need. f. w.	....	158	sub.	$0.18^{20°}$	$50^{15°}$	$23.4^{17°}$
24	colorl. rhomb.	....	200	......	$0.92^{18°}$	......	9.7^{17}
25	colorl. monocl.	$1.404^{22°}$	210 (214)	dec.	$0.79^{15°}$	v. s.	9.4^{17}
26	rhombic	$1.161^{25°}$	86 (82)	sub.	$6.7^{22°}$	v. s.	v. s.
27	need.	....	67	300 d.	v. s. h.	v. s.	v. s.
28	colorl. need.	....	110 (125)	......	s.	v. s.	v. s.
29	colorl.	....	43	255–60 d.	s.	s.	s.
30	colorl.	....	60–2	sub. 100	......	......	......
31							
32	liq.	....	......	......	v. s.	v. s.	v. s.
33	colorl. prisms	....	79	212	v. s.	v. s.	v. s.

* Solidifies at –15° C.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Hydroxy-			
1	isophthalic acid (2) (1, 3)	....	$HO\cdot C_6H_3\cdot(COOH)_2 + H_2O$	200.10
2	isophthalic acid (4) (1, 3)	....	$HO\cdot C_6H_3\cdot(COOH)_2$	182.09
3	isophthalic acid (5) (1, 3)	....	$HO\cdot C_6H_3\cdot(COOH)_2 + 2H_2O$	218.12
4	phthalic acid (3) (1 ,2)	....	$HO\cdot C_6H_3\cdot(COOH)_2$	182.09
5	phthalic acid (4) (1, 2)	....	$HO\cdot C_6H_3\cdot(COOH)_2$	182.09
6	propionic acid (α).	See *lactic acid*		
7	pyridine (2)....	α pyridone......	$HO\cdot C_5H_4N$........	95.08
8	" (3)....	β pyridone......	$HO\cdot C_5H_4N$........	95.08
9	" (4)....	γ pyridone......	$HO\cdot C_5H_4N + H_2O$..	113.09
10	quinol.........	....	$C_6H_3(OH)_3$ (1, 2, 4)	126.08
11	quinoline (2)...	carbostyril.......	$HO\cdot C_9H_6N$........	145.11
12	" (4)...	kyanuran........	$HO\cdot C_9H_6N + 3H_2O$.	199.16
13	succinic acid.	See *malic acid*		
14	terephthalic acid (2) (1, 4)	....	$HO\cdot C_6H_3\cdot(COOH)_2$	182.09
15	toluic acid (1,2,3)	....	$CH_3\cdot C_6H_3\cdot(COOH)(OH)$	152.10
16	" " (1,2,4)	....	$CH_3\cdot C_6H_3\cdot(COOH)(OH)$	152.10
17	" " (1,2,5)	....	$CH_3\cdot C_6H_3\cdot(COOH)(OH) + \frac{1}{2}H_2O$	161.11
18	" " (1,2,6)	....	$CH_3\cdot C_6H_3\cdot(COOH)(OH)$	152.10
19	" " (1,3,2)	....	$CH_3\cdot C_6H_3\cdot(COOH)(OH)$	152.10
20	" " (1,3,4)	....	$CH_3\cdot C_6H_3\cdot(COOH)(OH)$	152.10
21	" " (1,3,5)	....	$CH_3\cdot C_6H_3\cdot(COOH)(OH)$	152.10
22	" " (1,3,6)	....	$CH_3\cdot C_6H_3\cdot(COOH)(OH) + \frac{1}{2}H_2O$	161.11
23	" " (1,4,2)	....	$CH_3\cdot C_6H_3\cdot(COOH)(OH)$	152.10
24	" " (1,4,3)	....	$CH_3\cdot C_6H_3\cdot(COOH)(OH)$	152.10
25	urea...........	....	$NH_2\cdot CO\cdot NH(OH)$.	76.06
26	valeric acid (α).	....	$CH_3\cdot(CH_2)_2\cdot CH(OH)\cdot COOH$	118.11
27	Hyoscine........	scopolamine.....	$C_{17}H_{21}O_4N$........	303.26
28	hydrobromide..	....	$C_{17}H_{21}O_4N\cdot HBr + 3H_2O$	438.24
29	Hyoscyamine....	....	$C_{17}H_{23}O_3N$........	289.28
30	hydrobromide..	....	$C_{17}H_{23}O_3NHBr$.....	370.21
31	Hypnoacetin.....	....	$C_{16}H_{15}O_3N$........	269.21

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. need.	....	243	......	v. sl. s. c.; s. h.	v. s.	v. s.
2	colorl. need.	....	305	......	sl. s. h.	v. s.	v. s.
3	colorl. need.	....	288	sub.	$18^{100°}$; sl. s. c.	v. s.	v. s.
4	colorl. prisms	....	dec.	......	$20^{17°}$	s.	s.
5	colorl rosettes	....	181 d.	......	$3^{10°}$	v. s.	s.
6							
7	colorl. need. f. bz.	....	106–7	280–1	v. s.	v. s.	s.
8	need.	....	129	......	v. s.	v. s.	....
9	colorl. monocl.	....	148.5 anh.	......	100	v. s.	v. sl. s.
10	colorl.	....	140.5	......	v. s.	v. s.	v. s.
11	colorl. pr. f. al.	....	199–200	subl.	v. sl. s. c.; v. s. h.	v. s.	v. s.
12	colorl.	....	201	......	$0.47^{15°}$	s.	sl. s.
13							
14	powd.	....	subl.	......	sl. s.	v. s.	s.
15	need. f. w.	....	168	......	$0.14^{25°}$	v. s.	v. s.
16	need f. w.	....	172 (183)	......	sl. s.	v. s.	v. s.
17	sm. need. f. w.	....	177 anh.	......	sl. s.	v. s.	v. s.
18	glit. need. f. w.	....	145–6 (183)	......	s.	v. s.	v. s.
19	long need. f. w.	....	163–4	......	v. s. h.	s. chl.	....
20	long. need. f. w.	....	151	......	v. sl. s.	v. s.	v. s.
21	tabl. f. w.	....	208 (210)	subl.	s.	......	....
22	need. f. w.	....	172–3 anh.	......	s. h.	v. s.	v. s.
23	long. need.	....	206–7	subl.	v. sl. s.	v. s.	s.
24	monocl. f. al.	....	177	......	v. sl. s.	s.	....
25	colorl. need.	....	128–30	......	v. s.	s.	....
26	colorl. need.	....	31	......	v. s.	v. s.	v. s.
27	colorl. prisms	....	56–7	......	$10.5^{15°}$	v. s.	v. s.
28	colorl. rhomb.	....	193–4	......	$66.6^{25°}$	$6.3^{25°}$	i.
29	need.	....	108.5	......	5.	v. s.	s.
30	prisms	....	151.8	......	v. s.	50	0.06
31	colorl. leaf. f. al.	....	160	......	v. sl. s.	$0.28^{35°}$	v. sl. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Hypogaeic acid...	....	$C_{15}H_{29}\cdot COOH$.....	254.32
2	Hypoxanthine....	....	$C_5H_4ON_4$..........	136.10
3	Imino-acetic acid.	....	$NH\cdot(CH_2COOH)_2$	133.09
4	aceto-nitrile....	....	$NH\cdot(CH_2\cdot CN)_2$....	95.09
5	ethyl alcohol...	....	$NH\cdot(CH\cdot CH_2\cdot OH)_2$	103.10
6	Indican.........	....	$C_{14}H_{17}O_6N+3H_2O$..	349.26
7	Indigo..........	indigotine.......	$C_{16}H_{10}O_2N_2$........	262.17
8	carmine........	soluble indigo....	$C_{16}H_8O_2N_2(SO_3Na)_2$	466.28
9	dicarboxylic acid	....	$C_{18}H_{10}O_6N_2$........	350.19
10	white..........	....	$C_{16}H_{12}O_2N_2$........	264.19
11	Indol...........	....	C_8H_7N............	117.11
12	Inosite (i.)	....	$C_6H_{12}O_6+2H_2O$....	216.16
13	Iodeosine.	See *erythrosine*		
14	Iodo-acetic acid..	....	$CH_2I\cdot COOH$......	185.95
15	aniline (o.).....	....	$IC_6H_4\cdot NH_2$........	219.01
16	" (m.)....	....	$IC_6H_4\cdot NH_2$........	219.01
17	" (p.)....	....	$IC_6H_4\cdot NH_2$........	219.01
18	benzene........	....	C_6H_5I............	203.99
19	ethylene.......	....	$CH_2:CHI$.........	153.95
20	propionic acid (α)	....	$CH_3\cdot CHI\cdot COOH$..	199.97
21	" " (β)	....	$CH_2I\cdot CH_2\cdot COOH$..	199.97
22	toluene (o.).....	....	$IC_6H_4\cdot CH_3$........	218.01
23	" (m.)....	....	$IC_6H_4\cdot CH_3$........	218.01
24	" (p.)....	....	$IC_6H_4\cdot CH_3$........	218.01
25	Iodoform........	....	CHI_3.............	393.77
26	Iodosobenzene...	....	C_6H_5IO...........	219.99
27	Iodoxybenzene...	....	$C_6H_5IO_2$...........	235.99
28	Ionone (α).......	....	$C_{13}H_{20}O$...........	192.23
29	" (β).......	....	$C_{13}H_{20}O$...........	192.23
30	Irone...........	....	$C_{13}H_{20}O$...........	192.23
31	Isatine..........	....	$C_8H_5O_2N$..........	147.09
32	chloride........	....	C_8H_4ONCl........	165.54
33	Isatinic acid.....	....	$NH_2\cdot C_6H_4\cdot CO\cdot COOH$	165.14
34	Isatoxime........	....	$C_8H_6O_2N_2$.........	162.11
35	Isoamyl-acetate..	....	$CH_3\cdot COOC_5H_{11}$....	130.15
36	acetic acid.....	....	$(CH_3)_2\cdot CH(CH_2)_3\cdot COOH$	130.15
37	alcohol.........	isobutyl carbinol.	$(CH_3)_2\cdot CH\cdot(CH_2)_2 OH$	88.12
38	" (sec.)...	methyl isopropyl carbinol	$(CH_3)_2\cdot CH\cdot CH(OH) CH_3$	88.12
39	amine.........	....	$(CH_3)\cdot CH\cdot CH_2\cdot CH_2\cdot NH_2$	72.11
40	benzene........	....	$C_6H_5\cdot C_5H_{11}$.......	148.18

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. need.	....	33	......	i.	v. s.	s.
2	need.	....	d. 150	......	$0.07^{19°}$; $1.4^{100°}$	......	....
3	colorl. rhomb.	....	abt. 225	......	$2.43^{5°}$	i.	i.
4	colorl. lf. f. eth.	....	75	......	s.	s.	sl. s.
5	colorl.	....	28	270	∞	∞	∞
6	br. liq.	....	176–7 anh.	dec.	v. s.	v. s.	s.
7	rhomb.	....	390–2 d.	......	i.; s. h. anil.	i.	i.; s. h. chl.
8	blue powd.	....	......	......	s.	sl. s.	....
9	blue powd.	....	......	......	i.; s. H_2SO_4	i.	i.
10	white powd.	....	......	......	i.; s. alk.	s.	s.
11	colorl. leaf.	....	52	253–4	s. h.	v. s.	v. s.
12	colorl. monocl.	....	225	......	$17.5^{24°}$	i. (abs.)	i.
13							
14	yel.	....	82	dec.	i.	s.	v. sl. s.
15	need.	....	57 (60–1)	......	v. sl. s.	v. s.	....
16	leaf.	....	25–7	......	i.	s.	....
17	need. or pr.	....	63 (67–8)	......	i.	s.	....
18	liq.	....	−28.5	188.2	i.	s.	∞
19	"	$2.08^{0°}$	......	56	i.	∞	∞
20	prisms	....	44.5–5.5	......	sl. s.	v. s.	v. s.
21	leaf.	....	82	......	$8^{25°}$	v. s.	v. s.
22	liq.	$1.697^{20°}$	......	211 (204)	i.	∞	∞
23	"	$1.698^{20°}$	......	204	i.	∞	∞
24	leaf.	....	35	211.5	i.	v. s.	v. s.
25	yel. hex.	....	119 subl.	......	$0.01^{25°}$	$1.3^{18°}$; $7.8^{78°}$	$13.6^{25°}$
26	amor.	....	expl. abt. 210	......	s.	s.	i.
27	need.	....	expl. 230–8	......	v. sl. s.	v. s. bz.	v. s. chl.
28	colorl. liq.	0.934	......	120.6^{12mm}	v. sl. s.	∞	∞
29	colorl. liq.	0.949	......	134.6^{12mm}	v. sl. s.	∞	∞
30	colorl. liq.	0.939	......	144^{16mm}	v. sl. s.	v. s.	v. s.
31	red need. f. al.	....	198–9	subl.	v. sl. s. c. s. h.	s.	sl. s.
32	br. need.	....	180. d.	......	i.	s.	v s.
33	wh. powd.	....	dec.	......	sl. s.	......	....
34	yel. need.	....	202 d.	......	v. sl. s.	s.	s. alk.
35	colorl. liq.	0.876	......	139	$0.16^{25°}$	∞	∞
36	colorl. liq.	$0.912^{19°}$	......	209	sl. s. h.	∞	∞
37	colorl. liq.	$0.810^{20°}$	......	130	$3.3^{22°}$	∞	∞
38	colorl. liq.	$0.819^{19°}$	......	112.5	sl. s.	∞	∞
39	colorl. liq.	0.747	......	95	v. sl. s.	∞	∞
40	colorl. liq.	$0.885^{18°}$	......	193 (201)	i.	∞	∞

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Isoamyl-			
1	benzoate		$C_6H_5\cdot COOC_5H_{11}$	192.19
2	bromide		$(CH_3)_2\cdot CH\cdot (CH_2)_2 Br$	151.03
3	butyrate		$C_3H_7\cdot COOC_5H_{11}$	158.19
4	chlorcarbonate		$Cl\cdot COOC_5H_{11}$	150.58
5	chloride		$(CH_3)_2\cdot CH\cdot (CH_2)_2 Cl$	106.57
6	cyanide	capronitrile	$(CH_3)_2\cdot CH\cdot (CH_2)_2\cdot CN$	97.13
7	ether		$C_5H_{11}\cdot O\cdot C_5H_{11}$	158.23
8	formate		$H\cdot COOC_5H_{11}$	116.13
9	iodide		$(CH_3)_2\cdot CH\cdot (CH_2)_2I$	198.03
10	isobutyrate		$(CH_3)_2\cdot CH\cdot COOC_5 H_{11}$	158.19
11	isocyanide		$(CH_3)_2\cdot CH\cdot (CH_2)_2\cdot NC$	97.13
12	isovaleriate		$C_4H_9\cdot COOC_5H_{11}$	172.21
13	mustard oil		$C_5H_{11}\cdot NCS$	129.21
14	nitrate		$(CH_3)_2\cdot CH\cdot (CH_2)_2\cdot NO_3$	133.16
15	nitrite		$(CH_3)_2\cdot CH\cdot (CH_2)_2\cdot NO_2$	117.16
16	phenol (p.)		$C_5H_{11}\cdot C_6H_4\cdot OH$	164.18
17	phenyl ketone		$C_5H_{11}\cdot CO\cdot C_6H_5$	176.19
18	propionate		$CH_3\cdot CH_2\cdot COOC_5 H_{11}$	144.17
19	salicylate		$HO\cdot C_6H_{.}\cdot COOC_5 H_{11}$	208.19
20	sulphide		$(C_5H_{11})_2S$	174.28
21	urea		$NH_2\cdot CO\cdot NH (C_5H_{11})$	130.16
22	Isobutane	trimethyl methane	$(CH_3)_2\cdot CH\cdot CH_3$	58.10
23	Isobutyl-acetate		$CH_3\cdot COOC_4H_9$	116.13
24	alcohol	isopropyl carbinol	$(CH_3)_2\cdot CH\cdot CH_2OH$	74.10
25	aldehyde		$(CH_3)_2\cdot CH\cdot CHO$	72.08
26	amine		$(CH_3)_2\cdot CH\cdot CH_2\cdot NH_2$	73.12
27	benzene		$C_6H_5\cdot C_4H_9$	134.16
28	benzoate		$C_6H_5\cdot COOC_4H_9$	178.17
29	bromide		$(CH_3)_2\cdot CH\cdot CH_2Br$	137.01
30	butyrate		$C_3H_7\cdot COOC_4H_9$	144.17
31	chlorcarbonate		$Cl\cdot COOC_4H_9$	136.55
32	chloride		$(CH_3)_2\cdot CH\cdot CH_2Cl$	92.55
33	cyanide	isovaleronitrile	$(CH_3)_2\cdot CH\cdot CH_2\cdot CN$	83.14
34	ether		$C_4H_9\cdot O\cdot C_4H_9$	146.19
35	formate		$H\cdot COOC_4H_9$	102.11
36	iodide		$(CH_3)_2\cdot CH\cdot CH_2I$	184.06
37	isocyanide		$(CH_3)_2\cdot CH\cdot CH_2\cdot NC$	83.11
38	isovaleirate		$C_4H_9\cdot COO\cdot C_4H_9$	158.19
39	ketone		$C_4H_9\cdot CO\cdot C_4H_9$	142.20
40	mustard oil		$C_4H_9\cdot NCS$	115.19

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. liq.	$0.993^{19°}$	......	261	i.	s.	....
2	colorl. liq.	1.219	......	120–0.6	i.	s.	....
3	colorl. liq.	$0.882^{20°}$	......	178.6	v. sl. s.	v. s.	v. s.
4	colorl. liq.	$1.024\frac{25}{25}°$	......	151–6	dec.	∞	∞
5	colorl. liq.	0.880	......	100–1	i.	s.	∞
6	liq.	0.807	......	155.5	i.	s.	∞
7	colorl. liq.	0.781	......	173	i.	......	∞
8	colorl. liq.	$0.894^{0°}$	......	123.3	v. sl. s.	s.	∞
9	liq.	$1.473^{20°}$	......	148.2	i.	s.	∞
10	colorl. liq.	$0.876^{0°}$	......	168.8	......	s.	s.
11	liq.	....	......	137	i.	s.	s.
12	colorl. liq.	$0.858^{19°}$	......	194	v. sl. s.	s.	s.
13	liq.	0.942	......	183–4	v. sl. s.	v. s.	v. s.
14	liq.	$1.000^{7.5°}$	......	147	v. sl. s.	s.	v. s.
15	liq.	0.880	......	94–5	v. sl. s.	∞	∞
16	need f. h. w.	....	92–3	255	v. sl. s. h.	v. s.	v. s.
17	colorl. liq.	....	......	241.5–2.5	i.	v. s.	v. s.
18	colorl. liq.	$0.888^{0°}$	......	160.2	$0.09^{25°}$	s.	s.
19	colorl. liq.	$1.045\frac{25}{25}°$	......	270	i.	v. s.	∞
20	colorl. liq.	$0.843^{20°}$	......	213–16	i.	v. s.	v. s.
21	colorl.	....	89–91	......	sl. s.	......	....
22	gas.	* $0.603^{0°}$	......	–11	i.	s.	s.
23	colorl. liq.	$0.871^{20°}$	......	116.3	$0.63^{25°}$	∞	∞
24	colorl. liq.	0.806	–108	106.5	$9.5^{18°}$	∞	∞
25	colorl. liq.	$0.794^{20°}$	......	63–4	11	∞	∞
26	colorl. liq.	0.735	......	68	∞	∞	∞
27	colorl. liq.	0.873	......	171–1.5	i.	∞	∞
28	colorl. liq.	1.002	......	237 (241.5)	i.	∞	∞
29	liq.	1.260	......	90–1	i.	∞	∞
30	colorl. liq.	0.866	......	156.9	v. sl. s.	∞	∞
31	liq.	$1.040\frac{25}{25}°$	......	127–30	dec.	∞	∞
32	colorl. liq.	0.880	......	69	i.	∞	∞
33	liq.	$0.807^{20°}$	......	129–9.5	sl. s.	∞	∞
34	colorl. liq.	....	......	122–2.5	sl. s.	∞	∞
35	colorl. liq.	$0.885^{20°}$	......	98.5	1	∞	∞
36	colorl. liq.	1.614	–90.7	120	i.	∞	∞
37	colorl. liq.	$0.787^{4°}$	......	114–7	sl. s.	s.	s.
38	colorl. liq.	$0.848\frac{25}{25}°$	......	167–70	i.	∞	∞
39	colorl. liq.	$0.833^{20°}$	......	181–2	i.	v. s.	v. s.
40	liq.	$0.943^{20°}$	......	162	i.	v. s.	v. s.

* Specific gravity of the liquid.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Isobutyl-			
1	nitrate.........	....	$(CH_3)_2 \cdot CH \cdot CH_2 \cdot NO_3$	119.13
2	nitrite.........	....	$(CH_3)_2 \cdot CH \cdot CH_2 \cdot NO_2$	103.10
3	phenyl ketone..	....	$C_4H_9 \cdot CO \cdot C_6H_5$....	162.17
4	Isobutyric acid...	....	$(CH_3)_2 \cdot CH \cdot COOH$.	88.08
5	amide.........	....	$(CH_3)_2 \cdot CH \cdot CONH_2$	87.13
6	anhydride......	....	$[(CH)_2 \cdot CH \cdot CO]_2O$.	158.16
7	Isocarbostyril....	1 hydroxy-isoquinoline	C_9H_7ON..........	145.11
8	Isocinchomeronic acid	....	$C_5H_3N \cdot (COOH)_2 + H_2O$	185.14
9	Isocitric acid.....	....	$C_6H_8O_7 + H_2O$......	210.11
10	Isocrotonic acid..	....	$CH_3 \cdot CH : HC \cdot COOH$	86.07
11	Isodurene.......	....	$C_6H_2(CH_3)_4$ (1, 2, 3, 5)	134.16
12	Isoeugenol (1, 3, 4)	....	$C_3H_5 \cdot C_6H_3(OCH_3)OH$	164.15
13	Isohydrobenzoin .	....	$C_{14}H_{12}(OH)_2$.......	214.18
14	Isomalic acid....	....	$CH_3 \cdot C(OH)(COOH)_2$	134.07
15	Isomannid.......	....	$C_6H_{10}O_4$...........	146.11
16	Isonicotinic acid..	....	$C_5H_4N \cdot COOH(4)$..	123.08
17	Isopentane......	....	$(CH_3)_2CHCH_2CH_3$.	72.12
18	Isophthalic acid (m.)	....	$C_6H_4(COOH)_2$.....	166.09
19	aldehyde (m.)..	....	$C_6H_4(CHO)_2$.......	118.09
20	nitrile.........	....	$C_6H_4(CN)_2$........	128.09
21	Isoprene.........	....	$CH_2 : CH \cdot C(CH_3) : CH_2$	68.09
22	Isopropyl-acetate.	....	$CH_3 \cdot COO \cdot CH(CH_3)_2$	102.11
23	acetylene.......	....	$(CH_3)_2CH \cdot C : CH$..	68.09
24	alcohol.........	....	$CH_3 \cdot CH(OH) \cdot CH_3$	60.08
25	amine.........	....	$(CH_3)_2CHNH_2$.....	59.11
26	benzene.	See *cumene*		
27	benzoic acid (o.)	....	$(CH_3)_2 \cdot CH \cdot C_6H_4 \cdot COOH$	164.15
28	bromide........	....	$(CH_3)_2CH \cdot Br$......	122.99
29	chloride........	....	$(CH_3)_2CH \cdot Cl$......	78.53
30	cyanide........	....	$(CH_3)_2CH \cdot CN$.....	69.12
31	ether..........	....	$(CH_3)_2CH \cdot O \cdot CH(CH_3)_2$	102.15
32	ethylene.......	....	$(CH_3)_2CH \cdot CH : CH_2$	70.11
33	iodide.........	....	$(CH_3)_2CH \cdot I$.......	169.93
34	isocyanide......	....	$(CH_3)_2CH \cdot NC$.....	69.11
35	ketone.........	....	$(CH_3)_2CH \cdot CO \cdot CH(CH_3)_2$	114.15
36	mercaptan.....	....	....	......
37	methyl benzene (p.).	See *cymene* (p.)		
38	phenyl ketone..	....	$(CH_3)_2CH \cdot CO \cdot C_6H_5$	148.15
39	pyridine (1)....	....	$(CH_3)_2CH \cdot C_5H_4N$..	121.17

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. liq.	1.021	......	123	i.	∞	∞
2	liq.	$0.908^{0°}$	......	67	......	s.	....
3	colorl. liq.	0.993	......	225–6	i.	∞	∞
4	colorl. liq.	$0.945^{25°}$	......	155	$20^{20°}$	∞	∞
5	colorl. leaf.	....	128–9	216–20	v. s.	v. s.	sl. s.
6	colorl. liq.	0.957	......	182.5	dec.	dec.	....
7	colorl.	....	208–9	......	sl. s.	v.s.	sl. s.
8	colorl. leaf.	....	236	subl.	v. sl. s.	v. sl. s.	v. sl. s.
9	prisms	....	......	......	v. sl. s.	v. sl. s.	v. sl. s.
10	need.	1.031	15.5	169–9.3	40	......	....
11	liq.	$0.896^{0°}$	......	195–7	i.	s.	....
12	liq.	$1.091\frac{15}{15}°$	......	267.5	sl. s.	s.	s.
13	colorl. monocl.	....	119.5	......	$0.21^{15°}$	v. s.	v. s.
14	monocl.	....	dec.	......	v. s.	v. s.	v. s.
15	colorl. monocl.	....	87	274 d.	v. s.	sl. s.	i.
16	colorl. need.	....	315	......	sl. s. c.; v. s. h.	v. sl. s.	v. sl. s.
17	colorl. liq.	0.628	......	31	i.	∞	∞
18	colorl. need.	....	abt. 300	subl.	$0.013^{25°}$; 0.22 h.	s.	....
19	need.	....	89	......	sl. s.	v. s.	....
20	colorl. need.	....	158–9	......	sl. s.	s. h.	....
21	colorl. liq.	$0.691^{0°}$	......	35.8	i.	∞	∞
22	colorl. liq.	$0.917^{0°}$	......	90–3	sl. s.	∞	∞
23	colorl. liq.	$0.685^{0°}$	......	28–9	i.	∞	∞
24	colorl. liq.	$0.789^{20°}$	......	82.8	∞	∞	∞
25	colorl. liq.	$0.690^{18°}$	......	32.2	∞	∞	∞
26							
27	colorl. pr.	....	51	......	s. h.	....	....
28	colorl. liq.	$1.310\frac{25}{25}°$	......	59–60	i.	∞	∞
29	colorl. liq.	$0.857\frac{25}{25}°$	......	35–6	v. sl. s.	∞	∞
30	colorl. liq.	....	......	107–8	sl. s.	∞	∞
31	colorl. liq.	$0.725^{21°}$	......	69	sl. s.	∞	∞
32	colorl. liq.	....	......	21.2	i.	∞	∞
34	liq.	$1.705\frac{25}{25}°$	......	89.5	i.	∞	∞
34	colorl. liq.	$0.760^{0°}$	......	87	i.	∞	∞
35	colorl. liq.	$0.806^{20°}$	......	123.7	i.	∞	∞
36							
37							
38	colorl. liq.	....	......	217	i.	s.	s.
39	liq.	$0.934^{0°}$	......	158–9	sl. s.	∞	∞

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Isopropyl-			
1	pyridine (3)	....	$(CH_3)_2CH \cdot C_5H_4N$	121.17
2	sulphide	....	$(CH_3)_2CH \cdot S \cdot CH(CH_3)_2$	118.20
3	Isopurpurin.	See *anthrapurpurin*		
4	Isoquinoline	....	C_9H_7N	129.15
5	Isosaccharic acid	....	$[CH(OH) \cdot CH(COOH)]_2O$	192.09
6	Isosuccinic acid	....	$CH_3 \cdot CH(COOH)_2$	118.07
7	Isovaleric acid	....	$(CH_3)_2 \cdot CH \cdot CH_2 \cdot COOH$	102.11
8	aldehyde	....	$(CH_3)_2 \cdot CH \cdot CH_2 \cdot CHO$	86.11
9	Ketene	....	$CH_2 : CO$	42.03
10	Lactamide	....	$CH_3 \cdot CH(OH) \cdot CO \cdot NH_2$	89.10
11	Lactic acid (i.)	....	$CH_3 \cdot CH(OH) \cdot COOH$	90.08
12	anhydride	....	$C_6H_{10}O_5$	162.11
13	Lactide	....	$C_6H_8O_4$	144.09
14	Lactose	milk sugar	$C_{12}H_{22}O_{11}+H_2O$	360.25
15	Lactyl urea	....	$C_4H_6O_2N_2+H_2O$	131.16
16	Laevulinic acid	....	$CH_3 \cdot CO \cdot (CH_2)_2 \cdot COOH$	116.09
17	aldehyde	....	$CH_3 \cdot CO \cdot (CH_2)_2 \cdot CHO$	100.09
18	Laevulose.	See *fructose*		
19	Lauric acid	....	$C_{11}H_{23} \cdot COOH$	200.26
20	aldehyde	....	$C_{11}H_{23} \cdot CHO$	172.26
21	Lepidine	....	$CH_3 \cdot C_9H_6N$(py. 4)	143.16
22	Leucine (l.)	....	$CH_3 \cdot (CH_2)_3 \cdot CH(NH_2) \cdot COOH$	131.14
23	Leuco-aniline	....	$(NH_2 \cdot C_6H_4)_2 \cdot CH \cdot C_6H_3 \cdot CH_3(NH_2)$	303.39
24	" " (p.)	....	$CH(C_6H_4 \cdot NH_2)_3$	289.28
25	Leuco-malachite-green	....	$C_6H_5 \cdot CH \cdot [C_6H_4 \cdot N(CH_3)_2]_2$	330.34
26	Limonene (d. or l.)	....	$C_{10}H_{16}$	136.18
27	Linalool (d. or l.)	....	$C_{10}H_{18}O$	154.19
28	Linalyl acetate	....	$CH_3 \cdot COOC_{10}H_{17}$	196.22
29	Linoleic acid	....	$C_{18}H_{32}O_2$	280.35
30	Lutidine (α)	dimethyl pyridine	$(CH_3)_2 \cdot C_5H_3N$	107.12
31	" (2, 4)	" "	$(CH_3)_2 \cdot C_5H_3N$	107.12
32	" (2, 6)	" "	$(CH_3)_2 \cdot C_5H_3N$	107.12
33	" (3, 4)	" "	$(CH_3)_2 \cdot C_5H_3N$	107.12
34	Lutidinic acid	....	$C_5H_3N \cdot (COOH)_2 + H_2O$	185.14
35	Maleic acid	....	$COOH \cdot CH : CH \cdot COOH$	116.05
36	anhydride	....	$C_4H_2O_3$	98.04

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	liq.	0.944$^{0°}$	......	177–8	......	∞	∞
2	liq.	....	......	120.5	i.	s.	s.
3							
4	colorl.	1.099$^{20°}$	24.6	240.8	v. sl. s.	......	....
5	rhomb.	....	185	dec.	v. s.	v. s.	v. s.
6	colorl. pr.	1.455	135 d.	......	44.3$^{0°}$	v. s.	v. s.
7	colorl. liq.	0.956$^{22°}$	......	176	4.2$^{20°}$	∞	∞
8	colorl. liq.	0.820$^{0°}$	......	92.5	sl. s.	s.	s.
9	gas	....	......	–56	dec.	s.	s.
10	colorl.	1.138$^{80°}$	74	......	v. s.	v. s.	....
11	colorl. syrup.	1.249	......	119^{12mm}	∞	∞	∞
12	amor.	....	250–60 d.	......	v. sl. s.	v. s.	v. s.
13	colorl. monocl.	0.862$^{10°}$	128	255	v. sl. s. c.	v. sl. s.	....
14	colorl. rhomb.	1.525$^{20°}$	abt. 200 d.	......	17c.; 40 h.	i.	i. sl.
15	rhomb.	....	anh. 145	......	v. s.	v. s.	v. s.
16	colorl. leaf.	1.137$^{25°}$	33	245–6	v. s.	v. s.	v. s.
17	colorl. liq.	1.016	......	186–8 d.	∞	∞	∞
18							
19	colorl. need.	0.864$^{60°}$	43.6 (48)	dec.	i.	s.	s.
20	colorl. leaf.	....	44.5	184–5$_{100mm}$	i.	s.	s.
21	colorl. liq.	1.086^{20}	......	266 (261–3)	v. sl. s.	∞	∞
22	colorl. leaf.	1.293$^{18°}$	283–5 d.	......	2.4$^{22°}$	0.07$^{17°}$; 0.12 h.	10.9 gl. ac. a.
23	colorl.	....	abt. 100	......	v. sl. s. h.	v. s.	v. sl. s.
24	colorl. leaf.	....	148	......	i.	s.	....
25	colorl.	....	93–4	......	i.	v. s.	v. s.
26	colorl. liq.	0.853$^{10°}$	......	176.5	i.	∞	∞
27	colorl. liq.	0.873	......	195–9	v. sl. s.	∞	∞
28	colorl. liq.	0.91	......	abt. 220 d.	v. sl. s.	∞	∞
29	yel. oil.	0.921	<–18	......	i.	∞	∞
30	colorl. liq.	0.947$^{0°}$	......	154–6.5	25	......	....
31	colorl. liq.	0.938	......	157–9	20	......	....
32	colorl. liq.	0.942$^{0°}$	......	142–3	∞ c.	......	....
33	colorl. liq.	....	......	163.5–4.5	......	......	....
34	leaf.	....	235	......	s.	s.	i.
35	colorl. prisms	1.590	130	......	50$^{10°}$	s.	s.
36	colorl. trimet.	0.934$^{19°}$	56–7	202	......	......	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Malic acid (d. or l.)	....	$COOH\cdot CH_2\cdot CH(OH)\cdot COOH$	134.07
2	" " (i.)....	....	$COOH\cdot CH_2\cdot CH(OH)COOH$	134.07
3	Malonic acid.....	....	$CH_2\cdot (COOH)_2$.....	104.05
4	amide.........	....	$CH_2\cdot (CO\cdot NH_2)_2$...	168.07
5	Malononitrile....	....	$CH_2\cdot (CN)_2$........	66.05
6	Maltose.........	malt sugar.......	$C_{12}H_{22}O_{11}+H_2O$....	360.25
7	Mandelic acid (i.).	....	$C_6H_5\cdot CH(OH)\cdot COOH$	152.10
8	Manitol (d.).....	mannite.........	$C_6H_8(OH)_6$........	182.15
9	Mannose (d.)....	....	$C_6H_{12}O_6$...........	180.13
10	Margaric acid....	....	$C_{16}H_{33}\cdot COOH$.....	270.36
11	Meconine........	....	$C_{10}H_{10}O_4$..........	194.13
12	Melene..........	....	$C_{30}H_{60}$.............	420.63
13	Melissic acid.....	....	$C_{29}H_{59}\cdot COOH$.....	452.63
14	Mellitic acid.....	....	$C_6(COOH)_6$........	342.11
15	Menthol (l.).....	....	$C_{10}H_{19}OH$.........	156.21
16	Menthone (l.)....	....	$C_{10}H_{18}O$..........	154.20
17	Mercuric fulminate	....	$Hg(ONC)_2+\frac{1}{2}H_2O$..	293.10
18	Mercury ethyl...	....	$Hg(C_2H_5)_2$........	258.10
19	methyl.........	....	$Hg(CH_3)_2$.........	230.06
20	Mesaconic acid...	....	$CH_3(COOH)C:CH\cdot COOH$	130.08
21	Mesitylene (1, 3, 5)	....	$C_6H_3(CH_3)_3$.......	120.15
22	Mesitylinic acid..	....	$(CH_3)_2\cdot C_6H_3\cdot COOH$	150.13
23	Mesotartaric acid	....	$(HO)_2\cdot C_2H_2\cdot (COOH)_2+H_2O$	168.08
24	Mesoxalic acid...	....	$(HO)_2\cdot C\cdot (COOH)_2$.	136.05
25	Metaldehyde.....	....	$(C_2H_4O)_4$..........	176.19
26	Methacetine.....	p. methoxy-acetaminophenol	$CH_3O\cdot C_6H_4\cdot NH\cdot COCH_3$	165.14
27	Methane........	....	CH_4..............	16.03
28	Methoxy-benzoic acid (o.)	....	$CH_3O\cdot C_6H_4\cdot COOH$	152.10
29	Methoxy-benzoic acid (m.)	....	$CH_3O\cdot C_6H_4\cdot COOH$	152.10
30	Methyl acetanilide	....	$CH_3CO\cdot N(CH_3)\cdot C_6H_5$	149.18
31	acetate.........	....	$CH_3\cdot COO\cdot CH_3$....	74.07
32	aceto-acetate...	....	$CH_3CO\cdot CH_2\cdot COO\cdot CH_3$	116.09
33	aceto-acetic ether	....	$CH_3CO\cdot CH(CH_3)\cdot COO\cdot C_2H_5$	144.14
34	acridine (2).....	....	$CH_3\cdot C_{13}H_8N$......	193.17
35	acrylate........	....	$CH_3O_2\cdot CH_3$.......	86.07
36	acrylic acid.....	....	$CH_2:C(CH_3)\cdot COOH$	86.07

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. need.	1.595	100	dec.	v. s.	sl. s.	sl. s.
2	colorl.	$1.601^{20\circ}$	133	dec.	v. s.	v. s.	v. s.
3	colorl. tricl.	....	132	dec.	>100	s.	s.
4	colorl. need.	....	170	......	$8.3^{8\circ}$	i. abs.	....
5	colorl.	....	29–30	218–9	13.3	40	20
6	fine need.	$1.540^{17\circ}$	......	......	v. s.	v. sl. s. c.	....
7	colorl. rhomb.	$1.361^{4\circ}$	118	dec.	$16^{20\circ}$	s.	s.
8	colorl. need.	1.521	166	......	$15.6^{18\circ}$	v. sl. abs.	i.
8	colorl. prisms	....	132–3	......	250	v. sl. s.	i.
10	colorl.	$0.853^{60\circ}$	59.9	227^{100mm}	i.	sl. s.	v. s.
11	colorl. need.	....	102–2.5	......	0.14 c.; 4.5 h.	......	....
12	colorl.	0.89	62	370–80	i.	s. h.	....
13	colorl. scales	....	90	......	i.	sl. s. c.; v. s. h.	v. sl. s.
14	colorl. need.	....	286–8	dec.	v. s.	s.	....
15	colorl. trim.	0.890	42	210	sl. s.	v. s.	v. s.
16	colorl. liq.	$0.896^{20\circ}$	......	207	sl. s.	∞	∞
17	rhomb.	....	expl. 180	......	$0.07^{12\circ}$	sl. s. h.	....
18	liq.	2.444	......	159	i.	sl. s.	s.
19	liq.	3.069	......	96	i.	......	....
20	colorl. need.	....	202	subl.	$2.7^{18\circ}$; v. s. h.	39	s.
21	colorl. liq.	$0.863^{20\circ}$	......	164.5	i.	s.	s.
22	monocl.	....	166	subl.	v. sl. s.	v. s.	....
23	colorl. tab.	1.666	140–3	......	$120^{15\circ}$	......	....
24	colorl. del. need.	....	119–20	......	v. s.	s.	s.
25	colorl. tetrag.	....	subl. 112–5	......	i.	$1.8^{70\circ}$	$0.5^{35\circ}$
26	colorl. need.	....	127	......	$2^{15\circ}$	$12.7^{21\circ}$	v. s. chl.
27	gas	0.558 (A)	–184	–153	5.45 c.c.$^{0\circ}$	52.2 c.c.	s.
28	monocl. tab.	1.180	98.5	......	$0.5^{30\circ}$	......	....
29	colorl. need.	....	167	subl.	sl. s.; v. s. h.	v. s.	v. s.
30	colorl. prisms	....	102	245	s.	s.	....
31	colorl. liq.	0.964	......	57.5 (54)	$31.9^{20\circ}$	∞	∞
32	colorl. liq.	$1.037^{9\circ}$	......	170	v. sl. s.	∞	∞
33	colorl. liq.	$1.009^{6\circ}$	......	186.8	......	s.	s.
34	yel'sh	....	131.5–4.0	......	v. s. bz.	v. s.	v. s.
35	colorl. liq.	$0.973^{0\circ}$	......	80.3	......	s.	s.
36	colorl. prisms	$0.015^{20\circ}$	14	162–3	s.	∞	∞

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Methyl			
1	alcohol		CH_3OH	32.04
2	allene		$CH_2:C:CH\cdot CH_3$	54.07
3	allyl amine		$CH_3\cdot NH\cdot C_3H_5$	71.10
4	" carbinol		$CH_2:CH\cdot CH_2\cdot CH(OH)\cdot CH_3$	86.11
5	" ether		$CH_3\cdot O\cdot C_3H_5$	72.08
6	amine		CH_3NH_2	31.09
7	amine hydrochloride		$CH_3NH_2\cdot HCl$	67.52
8	amino-acetate		$NH_2\cdot CH_2\cdot COO\cdot CH_3$	89.08
9	" -benzoate (o.)		$NH_2\cdot C_6H_4\cdot COO\cdot CH_3$	151.12
10	" " (p.)		$NH_2\cdot C_6H_4\cdot COO\cdot CH_3$	151.12
11	" -propionic acid (α)		$CH_3\cdot CH(NHCH_3)\cdot COOH$	103.10
12	amyl ketone		$CH_3\cdot CO\cdot C_5H_{11}$	114.15
13	aniline		$C_6H_5\cdot NHCH_3$	107.12
14	anthracene (α)		$C_{14}H_9\cdot CH_3$	192.17
15	" (β)		$C_{14}H_9\cdot CH_3$	192.17
16	anthranilate		$H_2N\cdot C_6H_4\cdot COO\cdot CH_3$	151.12
17	anthraquinone (2)		$C_{14}H_7O_2\cdot CH_3$	222.16
18	arsine		$CH_3\cdot AsH_2$	91.99
19	auramine		$CH_3N\cdot C\cdot[C_6H_4\cdot N(CH_3)_2]_2$	281.30
20	benzoate		$C_6H_5\cdot COO\cdot CH_3$	136.10
21	benzoyl-acetate		$C_6H_5CO\cdot CH_2\cdot COO\cdot CH_3$	178.13
22	benzyl-ketone		$CH_3\cdot CO\cdot CH_2C_6H_5$	134.13
23	bromide		CH_3Br	94.95
24	butyl amine		$CH_3\cdot NH\cdot C_4H_9$	87.14
25	" carbinol		$CH_3\cdot CH(OH)\cdot C_4H_9$	102.14
26	" ether		$CH_3\cdot O\cdot C_4H_9$	88.12
27	" ketone		$CH_3\cdot CO\cdot C_4H_9$	100.13
28	butyrate		$C_3H_7\cdot COO\cdot CH_3$	102.11
29	butyrone		$C_8H_{16}O$	128.17
30	caprate		$C_9H_{19}\cdot COO\cdot CH_3$	186.23
31	caproate		$C_5H_{11}\cdot COO\cdot CH_3$	130.15
32	caprylate		$C_7H_{15}\cdot COO\cdot CH_3$	158.19
33	carbamate		$NH_2\cdot COO\cdot CH_3$	75.06
34	carbanilide		$CH_3\cdot C_6H_5N\cdot CO\cdot NH\cdot C_6H_5$	226.20
35	carbostyril (γ)	lepidone	$C_9H_6(CH_3)ON$	159.13
36	chloracetate		$CH_2Cl\cdot COO\cdot CH_3$	108.52
37	chlorcarbonate		$Cl\cdot COO\cdot CH_3$	94.49
38	chloride	chloromethane	CH_3Cl	50.49
39	cinnamate		$C_6H_5\cdot CH:CH\cdot COO\cdot CH_3$	162.13
40	crotonate (α)		$C_3H_5\cdot COO\cdot CH_3$	100.09
41	cyan-acetate		$CH_2(CN)\cdot COO\cdot CH_3$	99.07

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. liq.	$0.798^{15}_{15}{}^{\circ}$	−97.1	66	∞	∞	∞
2	colorl. liq.	....	......	118–9	i.	∞	∞
3	colorl. liq.	....	......	65	∞	......	....
4	colorl. liq.	$0.834^{20^{\circ}}$	......	115–6	12.5	∞	∞
5	colorl. liq.	0.77	......	46	v. sl. s.	∞	∞
6	gas.....	$0.699^{-10.8}$	......	−6.7	$1150^{12^{\circ}}$ c.c.	s.	....
7	leaf.	....	226–7	......	v. s.	s.	i.
8	colorl. liq.	....	......	abt. 130 d.	......	......	....
9	colorl.	1.168	24.5	......	s.	v. s.	v.s.
10	colorl. leaf.	....	112 (102)	......	......	......	....
11	colorl. rhomb.	....	260 d.	......	s.	v. sl. s. c. abs.	....
12	colorl. liq.	$0.835^{0^{\circ}}$	......	151	v. sl. s.	s.	s.
13	yellow liq.	$0.987^{20^{\circ}}$	......	195.5	v. sl. s.	s.	∞
14	colorl. leaf.	....	199–200	......	s. bz.	......	....
15	colorl. scales	....	199–200 (207)	......	s. bz.	sl. s.	sl. s.
16	....	1.168	24.5	......	sl. s.	v. s.	v. s.
17	yel'sh need.	....	177	subl.	v. s. bz.	v. sl. s.	s.
18	gas	....	......	2	......	v. s.	v. s.
19	gr'n'sh yel.	....	130–3	......	v. sl. s.	v. s.	....
20	colorl. liq.	1.094	−12.3	199	v. sl. s.	∞	∞
21	colorl. liq.	....	......	260–5 d.	i.	∞	∞
22	colorl.	$1.019^{0^{\circ}}$	27	215	i.	v. s.	v. s.
23	gas	$1.732^{0^{\circ}}$	<−84	4.5	sl. s.	v. s.	v. s.
24	colorl. liq.	0.737	......	91	......	......	....
25	colorl. liq.	$0.833^{0^{\circ}}$	......	136	v. sl. s.	s.	....
26	colorl. liq.	$0.763^{0^{\circ}}$	......	70.3	v. sl. s.	∞	∞
27	colorl. liq.	$0.830^{0^{\circ}}$	......	127	v. sl. s.	∞	∞
28	colorl. liq.	$0.919^{0^{\circ}}$	......	102.3	s.	∞	∞
29	colorl. liq.	0.827	......	180	i.	v. s.	v. s.
30	colorl. liq.	....	......	223.5	i.	v. s.	v. s.
31	colorl. liq.	$0.904^{0^{\circ}}$	......	150	i.	v. s.	v. s.
32	colorl. liq.	$0.894^{0^{\circ}}$	......	193	i.	v. s.	v. s.
33	colorl. tab.	....	52	177	$217^{11^{\circ}}$	$73^{15^{\circ}}$	s.
34	colorl. need.	....	104	......	i.	sl. s.	v. s.
35	colorl. need.	....	217.4	......	v. sl. s. c.	v. s. h.	v. sl. s.
36	colorl. liq.	....	......	130–2	v. sl. s.	∞	∞
37	colorl. liq.	....	......	72–5	dec.	∞	∞
38	colorl. gas	0.920	−91.5	−23.7	400 c.c.	3500 c.c.	....
39	colorl.	$1.042^{36^{\circ}}$	36	260	i.	v. s.	s.
40	colorl. liq.	$0.981^{4^{\circ}}$	......	120.7	i.	v. s.	v. s.
41	colorl. liq.	....	−22.5	204	i.	∞	∞

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Methyl			
1	cyanide........	acetonitrile......	$CH_3 \cdot CN$..........	41.04
2	diazoamino-benzene (4)	....	$CH_3 \cdot C_6H_4 \cdot N_2 \cdot NH \cdot C_6H_5$	211.20
3	diethyl amine...	....	$CH_3N(C_2H_5)_2$......	87.14
4	diethyl amino-benzene (o.)	....	$CH_3 \cdot C_6H_4 \cdot N(C_2H_5)_2$	163.20
5	diethyl amino-benzene (p.)...	....	$CH_3 \cdot C_6H_4 \cdot N(C_2H_5)_2$	163.20
6	diethyl carbinol.	....	$(C_2H_5)_2 \cdot C(OH) \cdot CH_3$	102.14
7	diphenylamine..	....	$(C_6H_5)_2NCH_3$......	183.18
8	ether..........	....	$CH_3 \cdot O \cdot CH_3$.......	46.06
9	ethyl acetic acid	....	$CH_3 \cdot CH(C_2H_5) \cdot COOH$	102.10
10	" acetone...	....	$CH_3 \cdot CO \cdot CH(C_2H_5) \cdot CH_3$	100.13
11	" aniline....	....	$C_6H_5 \cdot N(CH_3)C_2H_5$.	135.16
12	ethyl benzene (o.)	....	$CH_3 \cdot C_6H_4 \cdot C_2H_5$...	120.14
13	" " (m.)	....	$CH_3 \cdot C_6H_4 \cdot C_2H_5$...	120.14
14	" " (p.)	....	$CH_3 \cdot C_6H_4 \cdot C_2H_5$...	120.14
15	" carbonate.	....	$CH_3 \cdot CO_3 \cdot C_2H_5$....	104.08
16	" ether.....	....	$CH_3 \cdot O \cdot C_2H_5$......	60.08
17	" ketone....	....	$CH_3 \cdot CO \cdot C_2H_5$.....	72.08
18	" ketoxime..	....	$CH_3 \cdot C(NOH) \cdot C_2H_5$	87.10
19	" oxalate...	....	$CH_3 \cdot OOC \cdot COO \cdot C_2H_5$	132.09
20	" succinate..	....	$C_7H_{12}O_4$..........	160.13
21	" sulphide..	....	$CH_3 \cdot S \cdot C_2H_5$.......	76.14
22	formate........	....	$H \cdot COO \cdot CH_3$......	60.04
23	furfurol........	....	$CH_3 \cdot C_4H_2O \cdot CHO$..	110.08
24	glycerate.......	....	$CH_2OH \cdot CHOH \cdot COO \cdot CH_3$	120.08
25	glycolate.......	....	$CH_2(OH) \cdot COO \cdot CH_3$	90.06
26	heptenone......	....	$(CH_3)_2C : CH(CH_2)_2 COCH_3$	126.15
27	hyptyl ether....	....	$CH_3 \cdot O \cdot C_7H_{15}$......	130.18
28	hexyl ketone....	....	$CH_3 \cdot CO \cdot C_6H_{13}$....	128.17
29	hydrazine......	....	$NH_2 \cdot NH \cdot CH_3$.....	46.07
30	hydrazo-benzene (o.)	....	$CH_3 \cdot C_6H_4 \cdot NH \cdot NH \cdot C_6H_5$	198.20
31	hydrazo benzene (m.)	....	$CH_3 \cdot C_6H_4 \cdot NH \cdot NH \cdot C_6H_5$	198.20
32	hydrazo benzene (p.)	....	$CH_3 \cdot C_6H_4 \cdot NH \cdot NH \cdot C_6H_5$	198.20
33	hydrogen sulphate	methyl sulphuric acid	$CH_3 \cdot HSO_4$.........	112.10
34	iodide.........	iodomethane.....	CH_3I............	141.95
35	isoamyl ketone..	....	$CH_3 \cdot CO \cdot C_5H_{11}$....	114.15
36	" ketoxime	....	$CH_3 \cdot C(NOH) \cdot C_5H_{11}$	129.17
37	isobutyl amine..	....	$CH_3 \cdot NH \cdot C_4H_9$....	87.14
38	" ketone.	....	$CH_3 \cdot CO \cdot C_4H_9$.....	100.13
39	isobutyrate.....	....	$(CH_3)_2 \cdot CH \cdot COO \cdot CH_3$	102.11
40	isocyanide......	methyl carbyl-amine	$CH_3 \cdot NC$..........	41.04

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. liq.	0.791	–41	81.5	∞	∞	....
2	yel'sh leaf.	....	90–1	......	......	......	....
3	colorl. liq.	....	......	63–5	v. s.	......	....
4	colorl. liq.	....	......	227–8	......	......	....
5	colorl. liq.	0.924	......	229	......	......	....
6	colorl. liq.	$0.824^{20°}$	......	123	sl. s.	s.	....
7	colorl. liq.	$1.052^{\frac{15}{15}°}$	......	296	i.	......	....
8	colorl. gas.	....	–138.5	–34	3700 c.c.	v. s.	v. s.
9	colorl. liq.	$0.938^{\frac{20}{20}°}$	<–80	177	sl. s.	∞	∞
10	colorl. liq.	0.818	......	118	sl. s.	∞	∞
11	colorl. liq.	....	......	201	......	......	....
12	colorl. liq.	0.873	......	158–9	i.	s.	s.
13	colorl. liq.	$0.869^{20°}$	......	158–9	i.	s.	s.
14	colorl. liq.	0.865	......	162	i.	s.	s.
15	colorl. liq.	$1.002^{27°}$	–14.5	109.2	i.	∞	∞
16	colorl. liq.	$0.725^{0°}$	......	10.8	s.	∞	∞
17	colorl. liq.	$0.805^{20°}$	......	80.6	s.	∞	s.
18	colorl. liq.	$0.919^{24°}$	......	152–3	10	∞	∞
19	colorl. liq.	$1.156^{0°}$	......	173.8	i.	v. s.	v. s.
20	colorl. liq.	$1.093^{0°}$	......	208.2	i.	v. s.	v. s.
21	liq.	....	–105	70	i.	∞	∞
22	colorl. liq.	0.980	......	32.3	$30.4^{20°}$	∞	....
23	colorl. liq.	1.109	......	187	3.3	v. s.	....
24	liq.	....	......	239–44	∞	∞	v. sl. s.
25	colorl. liq.	$1.168^{18°}$	......	151.2	......	......	....
26	colorl. liq.	0.855	......	173–4 (170)	i.	∞	∞
27	colorl. liq.	$0.795^{0°}$	......	149.8	i.	∞	∞
28	colorl. liq.	0.820	–16	172.5	i.	∞	∞
29	colorl. liq.	....	......	87.5	v. s.	∞	∞
30	colorl. leaf.	....	101–2	......	i.	......	....
31	colorl. prisms f. lgr.	....	59–61	......	......	v. s.	....
32	colorl. scales	....	86–7	......	......	v. s.	v. s. bz.
33	oil	....	<–30	......	v. s.	s.	s.
34	colorl.-br. liq.	2.285	......	42.5 (45)	$1.4^{20°}$	∞	∞
35	colorl. liq.	$0.818^{17°}$	......	144	v. sl. s.	∞	∞
36	colorl.-yel.	$0.888^{20°}$	......	195–6 d.	......	......	....
37	colorl. liq.	$0.722^{18°}$	......	76–8	......	......	....
38	colorl. liq.	$0.803^{19°}$	......	116 (119)	i.	∞	∞
39	colorl. liq.	$0.912^{0°}$	......	92.3	sl. s.	∞	∞
40	colorl. liq.	$0.756^{4°}$	......	59.6	$10^{15°}$	s.	∞

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Methyl			
1	isopropyl benzene (m.)	....	$CH_3\cdot C_6H_4CH(CH_3)_2$	134.16
2	" ketone	....	$CH_3\cdot CO\cdot CH(CH_3)_2$	86.10
3	" ketoxime	....	$CH_3\cdot C(NOH)\cdot CH(CH_3)_2$	101.12
4	isosuccinate....	....	$CH_3\cdot CH\cdot (COO\cdot CH_3)_2$	146.11
5	isovaleriate.....	....	$C_4H_9\cdot COO\cdot CH_3$...	116.13
6	lactate.........	....	$CH_3\cdot CH(OH)\cdot COO\cdot CH_3$	104.08
7	malate.........	....	$C_2H_4O\cdot (COO\cdot CH_3)_2$	162.11
8	malonate.......	....	$CH_2\cdot (COO\cdot CH_3)_2$..	132.09
9	mercaptan.....	....	$CH_3\cdot SH$..........	48.10
10	mustard oil.....	methyl isothiocyanate	$CH_3\cdot NCS$.........	73.10
11	naphthalene (α).	....	$C_{10}H_7\cdot CH_3$........	142.14
12	" (β).	....	$C_{10}H_7\cdot CH_3$........	142.14
13	naphthylamine (α)	....	$C_{10}H_7\cdot NHCH_3$.....	157.15
14	" (β)	....	$C_{10}H_7\cdot NHCH_3$.....	157.15
15	naphthyl ether(α)	....	$C_{10}H_7\cdot O\cdot CH_3$......	158.14
16	" " (β)	nerolin..........	$C_{10}H_7\cdot O\cdot CH_3$......	158.14
17	nitrate.........	....	$CH_3\cdot NO_3$.........	77.04
18	nitrite.........	....	$CH_3\cdot NO_2$.........	61.04
19	nitrobenzoate (o.)	....	$NO_2\cdot C_6H_4\cdot COO\cdot CH_3$	181.11
20	" (m.)	....	$NO_2\cdot C_6H_4\cdot COO\cdot CH_3$	181.11
21	" (p.)	....	$NO_2\cdot C_6H_4\cdot COO\cdot CH_3$	181.11
22	nitrolic acid....	....	$HC(NOH)NO_2$.....	58.04
23	nonyl ketone...	....	$CH_3\cdot CO\cdot C_9H_{19}$....	170.23
24	orange.........	Na salt of helianthine	$(CH_3)_2N\cdot C_6H_4\cdot N_2\cdot C_6H_4\cdot SO_3Na$	327.27
25	palmitate......	....	$C_{15}H_{31}\cdot COO\cdot CH_3$..	270.36
26	phenyl acetate..	....	$C_6H_5\cdot CH_2\cdot COO\cdot CH_3$	150.13
27	" carbinol	....	$CH_3\cdot CH(OH)\cdot C_6H_5$	122.12
28	" ether.	See *anisol*		
29	phosphine......	....	$CH_3\cdot PH_2$..........	48.08
30	phthalate. See	*dimethyl phthalate*		
31	propargyl ether.	....	$CH_3\cdot O\cdot C_3H_3$......	70.07
32	propionate.....	....	$C_2H_5\cdot COO\cdot CH_3$...	88.08
33	propyl acetic acid	....	$CH_3\cdot CH(C_3H_7)\cdot COOH$	116.13
34	" amine....	....	$CH_3\cdot NH\cdot C_3H_7$....	73.12
35	" ether.....	....	$CH_3\cdot O\cdot C_3H_7$......	74.10
36	" ketone....	....	$CH_3\cdot CO\cdot C_3H_7$.....	86.11
37	" ketoxime..	....	$CH_3\cdot C(NOH)\cdot C_3H_7$	101.12
38	pyridine.	See *picoline*		
39	pyrrol (1)......	....	$C_4H_4N\cdot CH_3$.......	81.09

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O=1 (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. liq.	$0.862^{20°}$	......	175–6	......	......	....
2	colorl. liq.	0.805	......	95	v. sl. s.	∞	∞
3	colorl. liq.	....	......	157–8	......	......	....
4	colorl. liq.	1.107	......	179	v. sl. s.	∞	∞
5	colorl. liq.	$0.901^{0°}$	......	116.7	v. sl. s.	∞	∞
6	colorl. liq.	1.094	......	144.8	s., d.	s.	s.
7	colorl. liq.	....	......	242–6	v. s.	∞	∞
8	colorl. liq.	1.160	–62	181.5	v. sl. s.	∞	∞
9	gas	....	–130.5	5.8	i.	v. s.	v. s.
10	....	$1.069^{37°}$	35	119	v. sl. s.	∞	v. s.
11	colorl. liq.	$1.001^{19°}$	–22	240–2	i.	v. s.	v. s.
12	colorl. monocl.	....	32.5	242	i.	v. s.	v. s.
13	red oil	....	......	293	i.	v. s.	v. s.
14	darkens in air	....	......	298	......	......	....
15	colorl. liq.	1.096	......	269	i.	v. s.	v. s.
16	colorl. leaf.	....	72	274	sl. s.	sl. s.	v. s.
17	liq.	$1.182^{22°}$	......	65–6, exp.	sl. s.	s.	s.
18	gas	0.991	......	–12	......	s.	s.
19	yel. oil	$1.286^{20°}$	–13	275 (286–9)	i.	∞	∞
20	....	....	78.5 (70)	279	......	sl. s. methyl	....
21	yel. leaf.	....	96	......	i.	s.	s.
22	need.	....	64	......	v. s.	......	v. s.
23	colorl.	$0.829^{18°}$	15 *	224 (230)	i.	s.	s.
24	yel. powd.	....	......	......	v. s.	s.	i.
25	colorl.	....	28	......	i.	s.	s.
26	colorl. liq.	1.044	......	220	i.	∞	∞
27	colorl. liq.	....	......	202–4	i.	∞	∞
28							
29	gas	....	......	–14	sl. s.	sl. s.	v. s.
30							
31	colorl. liq.	0.83	......	61–2	sl. s.	∞	∞
32	colorl. liq.	$0.915^{20°}$	<–75	79.9	$6.5^{20°}$	∞	∞
33	colorl. liq.	$0.941^{0°}$	......	193	$0.57^{17°}$	s.	s.
34	colorl. liq.	$0.720^{17°}$	......	62–4	s.	......	....
35	colorl. liq.	$0.746^{0°}$	......	38.9	s.	∞	∞
36	colorl. liq.	0.812	......	102	v. sl. s.	∞	∞
37	colorl. liq.	$0.907^{20°}$	......	168	s.	∞	∞
38							
39	colorl. liq.	0.915	......	114–5	i.	∞	∞

* Solidifies at 6° C.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Methyl			
1	pyruvate		$C_3H_3O_3 \cdot CH_3$	102.07
2	quinoline (2)	quinaldine	$CH_3 \cdot C_9H_6N$	143.13
3	salicylate	artificial oil of wintergreen	$HO \cdot C_6H_4 \cdot COO \cdot CH_3$	152.10
4	stearate		$C_{17}H_{35} \cdot COO \cdot CH_3$	298.40
5	sulphate		$(CH_3)_2 \cdot SO_4$	126.12
6	sulphide		$(CH_3)_2 \cdot S$	62.12
7	sulphite		$(CH_3)_2 \cdot SO_3$	110.12
8	sulphocyanate	methyl thiocyanate	$CH_3 \cdot SCN$	73.10
9	sulphonic acid		$CH_3 \cdot HSO_3$	96.10
10	" chloride		CH_3SO_2Cl	114.55
11	tartrate.	See *dimethyl tartrate*		
12	tetramethylene		C_5H_{10}	70.11
13	trichlor-acetate		$CCl_3 \cdot COO \cdot CH_3$	177.42
14	trimethyl acetate		$(CH_3)_3C \cdot COO \cdot CH_3$	116.13
15	trimethylene		C_4H_8	56.08
16	urea		$NH_2 \cdot CO \cdot NHCH_3$	74.09
17	uric acid (1)		$C_6H_6O_3N_4$	182.12
18	" " (3)		$C_6H_6O_3N_4 + \frac{1}{2}H_2O$	191.13
19	" " (7)		$C_6H_6O_3N_4 + H_2O$	200.13
20	valeriate		$C_4H_9 \cdot COO \cdot CH_3$	116.13
21	Methylal		$CH_2 \cdot (OCH_3)_2$	76.08
22	Methylene acetate		$(CH_3 \cdot COO)_2CH_2$	132.09
23	bromide	dibrom-methane	CH_2Br_2	173.86
24	chloride	dichlor-methane	CH_2Cl_2	84.93
25	iodide	diiodo methane	CH_2I_2	267.86
26	Michler's ketone.	See *tetramethyldiaminobenzophenone* (4, 4')		
27	Milk sugar.	See *lactose*		
28	Monacetin (α)	glyceryl monacetate	$CH_2(OH) \cdot CH(OH) \cdot CH_2 \cdot OOC \cdot CH_3$	134.11
29	Morphine		$C_{17}H_{19}O_3N + H_2O$	303.26
30	hydrochloride		$C_{17}H_{19}O_3N \cdot HCl + 3H_2O$	375.76
31	sulphate		$(C_{17}H_{19}O_3N)_2H_2SO_4 + 5H_2O$	758.64
32	Mucic acid		$COOH \cdot (CHOH)_4 \cdot COOH$	210.11
33	Murexide	NH_4 salt of purpuric acid	$C_8H_4O_6N_5 \cdot NH_4 + H_2O$	302.18
34	Myricyl alcohol		$C_{30}H_{61} \cdot OH$	438.65
35	Myristic acid		$C_{13}H_{27} \cdot COOH$	228.29
36	Myristine	trimyristine	$(C_{14}H_{27}O_2)_3C_3H_5$	722.91
37	Naphthalene		$C_{10}H_8$	128.11
38	disulphonic acid (2, 6)		$C_{10}H_6 \cdot (SO_3H)_2$	288.23

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. liq.	$1.154^{0°}$	......	134–7	......	∞	∞
2	colorl. liq.	....	......	246–7	v. sl. s.	......	....
3	colorl. liq.	1.186	–8.3	224	sl. s.	∞	∞
4	colorl.	....	38	......	i.	s.	s.
5	colorl. liq.	$1.352^{0°}$	–10	188.3–.6	v. sl. s.	......	s.
6	colorl. liq.	$0.846^{21°}$	–83	38	i.	s.	s.
7	colorl. liq.	1.046	......	121.5	dec.	s.	s.
8	colorl. liq.	$1.069^{24°}$	–51	133	i.	∞	∞
9	colorl. liq.	....	......	d. 130	v. s.	......	....
10	....	1.51	......	160	i.	s.	s.
11							
12	colorl. liq.	....	......	39–40	i.	∞	∞
13	colorl.	$1.673^{35°}$	34	191–2	dec.	dec.	s.
14	colorl. liq.	$1.044^{0°}$	......	101	......	∞	∞
15	gas	....	......	4–5	sl. s.	v. s.	v. s.
16	colorl. prisms	....	102	dec.	v. s.	v. s.	sl. s.
17	colorl. need.	....	d. 400	......	$0.05^{100°}$	......	....
18	colorl. pr. f. w.	....	d. 360	......	$0.38^{100°}$	v. sl. s.	s. alk.
19	colorl. leaf. f. w.	....	d. 370–80	......	$1.25^{100°}$	s. alk.	....
20	colorl. liq.	$0.910^{0°}$	......	127.3	v. sl. s.	∞	∞
21	colorl. liq.	0.872	......	45.5	v. s.	∞	∞
22	colorl. liq.	....	......	170	......	∞	∞
23	liq.	2.498	......	97	$1.15^{20°}$	∞	∞
24	colorl. liq.	1.377	......	42	$2^{20°}$	∞	∞
25	yel. liq.	3.333	4	180 d.	i.	∞	s.
26							
27							
28	colorl. liq.	1.221	......	dec.	v. s.	v. s.	sl. s.
29	colorl. need.	1.32	230 d.	......	0.03	0.6	0.02
30	need.	....	......	......	5.72	2.38	i.
31	need.	....	d. 250	......	6.66	0.22	i.
32	colorl. cryst. powd.	....	206 d.	......	$0.33^{14°}$	i.	....
33	purp. powd.	....	......	......	s.	i.	i.
34	colorl. need. f. eth.	....	85	......	i.	s.	s.
35	colorl. leaf.	....	53.8	250.5_{100mm}	i.	v. sl. s.	v. sl. s.
36	glit. need. f. eth.	....	55	......	......	......	s.
37	colorl. monocl.	1.152	80	218	i.	5.3 abs.	v. s.
38	need.	....	......	......	v. s.	s.	i.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Naphthalene disulphonic acid (2, 7)	....	$C_{10}H_6\cdot(SO_3H)_2$.....	288.23
2	sulphonic acid (α)	....	$C_{10}H_7\cdot SO_3H+H_2O$.	226.19
3	" " (β)	....	$C_{10}H_7\cdot SO_3H$.......	208.17
4	sulphonic chloride (α)	....	$C_{10}H_7\cdot SO_2\cdot Cl$......	194.57
5	" " (β)	....	$C_{10}H_7\cdot SO_2\cdot Cl$......	194.57
6	Naphthalic acid (1, 8)	....	$C_{10}H_6\cdot(COOH)_2$....	216.12
7	Naphthamide (α).	....	$C_{10}H_7\cdot CO\cdot NH_2$....	171.14
8	" (β).	....	$C_{10}H_7\cdot CO\cdot NH_2$....	171.14
9	Naphthoic acid (α)	....	$C_{10}H_7\cdot COOH$......	172.12
10	" " (β)	....	$C_{10}H_7\cdot COOH$......	172.12
11	aldehyde (α)....	....	$C_{10}H_7\cdot CHO$.......	156.12
12	" (β)....	....	$C_{10}H_7\cdot CHO$.......	156.12
13	Naphthol (α)....	....	$C_{10}H_7\cdot OH$.........	144.11
14	" (β)....	....	$C_{10}H_7\cdot OH$.........	144.11
15	Naphthol sulphonic acid (1, 2)	....	$HO\cdot C_{10}H_6\cdot SO_3H$...	224.17
16	Naphthol sulphonic acid (2, 6)	....	$HO\cdot C_{10}H_6\cdot SO_3H$...	224.17
17	Naphthonitrile (α)	naphthyl cyanide	$C_{10}H_7\cdot CN$.........	153.12
18	" (β)	" "	$C_{10}H_7\cdot CN$.........	153.12
19	Naphthoquinone (α)	....	$C_{10}H_6O_2$...........	158.10
20	" (β)	....	$C_{10}H_6O_2$...........	158.10
21	Naphthyl acetate (α)	....	$CH_3\cdot COO\cdot C_{10}H_7$...	186.14
22	" " (β)	....	$CH_3\cdot COO\cdot C_{10}H_7$...	186.14
23	amine (α)......	....	$C_{10}H_7\cdot NH_2$........	143.13
24	" hydrochloride (α)	....	$C_{10}H_7\cdot NH_2\cdot HCl$...	179.60
25	" (β)......	....	$C_{10}H_7\cdot NH_2$........	143.13
26	" hydrochlo-	....	$C_{10}H_7\cdot NH_2\cdot HCl$...	179.60
27	" ride (β)			
28	" sulphonic acid (1, 4)	naphthionic acid .	$NH_2\cdot C_{10}H_6\cdot SO_3H + \frac{1}{2}H_2O$	200.14
29	cyanide.	See *naphtho-nitrile*		
30	ether (α).......	....	$C_{10}H_7\cdot O\cdot C_{10}H_7$....	270.21
31	" (β).......	....	$C_{10}H_7\cdot O\cdot C_{10}H_7$....	270.21
32	hydrazine (α)...	....	$C_{10}H_7\cdot NH\cdot NH_2$....	158.15
33	" (β)...	....	$C_{10}H_7\cdot NH\cdot NH_2$....	158.15
34	ketone (α, β)...	....	$C_{10}H_7\cdot CO\cdot C_{10}H_7$...	282.12
35	Naphthylene diamine. See *diamino-naphthalene*			

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	leaf.	....	......	......	v. s.	s.	i.
2	....	....	90	......	s.	s.	sl. s.
3	leaf.	....	161	......	s.	......	....
4	tab.	....	67	......	i.	s.	v. s.
5	"	....	77	......	i.	s.	v. s.
6	colorl. need. f. al.	....	*	......	v. sl. s.	sl. s.	sl. s.
7	colorl. f. al.	....	202	......	v. sl. s.	v. sl. s.	....
8	colorl. tab.	....	192	......	sl. s.	sl. s.	....
9	colorl. need.	....	160	300	v. sl. s. h.	v. s. h.	s.
10	colorl. need.	....	184	>300	v. sl. s. h.	v. s.	v. s.
11	liq.	....	....	292	i.	s.	s.
12	colorl. leaf. f. w.	....	61	......	s. h.	v. s.	v. s.
13	colorl. monocl.	$1.224^{4°}$	94	278–80	sl. s. h.; i. c.	v. s.	v. s.
14	colorl. leaf.	$1.217^{4°}$	122	285–6	sl. s. h.	v. s.	v. s.
15	colorl. tab.	....	>250	......	s.	......	....
16	colorl. leaf.	....	122	......	v. s.	v. s.	....
17	colorl. need.	$1.117\frac{15}{15}°$	37.5	299	i.	v. s.	v. s.
18	colorl. leaf.	$1.094\frac{80}{80}°$	66	304–5	i.	s.	s.
19	yel need.	....	125	......	sl. s.	s.	v. s.
20	red need. f. eth.	....	d. 115–20	......	s.	s.	....
21	need. f. al.	....	44.8	......	s. h.	s.	v. s.
22	need.	....	68.5	......	i.	v. s.	v. s.
23	colorl. need.	$1.123\frac{25}{25}°$	50	300	0.17	v. s.	v. s.
24	need.	....	......	......	$3.77^{20°}$	v. s.	s.
25	leaf. f. w.	....	111–2	306	s.	s.	....
26	leaf.	....	......	......	v. s.	v. s.	s.
27							
28	need. f. w.	....	......	......	† $0.02^{15°}$	v. sl. s.	v. sl. s.
29							
30	colorl. leaf.	....	110	>360	i.	s. h.	s.
31	colorl.	....	105	abt. 360	......	s. h.	v. s.
32	colorl. leaf.	....	116	......	v. sl. s. c.	v. s. h.	v. s. chl.
33	colorl. leaf.	....	124–5	......	s. chl.	v. s. h.	s. bz.
34	colorl. need. f. al.	....	135	......	......	$1.3^{14°}$	v. s.
35							

* The anhydride forms at 150° C.; this melts at about 270° C.
† All other naphthylamine sulphonic acids have similar solubilities.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Narceïne........	....	$C_{23}H_{27}O_8N+3H_2O$..	499.39
2	hydrochloride...	....	$C_{23}H_{27}O_8N \cdot HCl +3H_2O$	535.86
3	Narcotine.......	....	$C_{22}H_{23}O_7N$........	413.30
4	Nicotine.........	....	$C_{10}H_{14}N_2$........	162.18
5	salicylate.......	....	$C_{10}H_{14}N_2 \cdot C_7H_6O_3$..	300.26
6	Nicotinic acid....	....	$C_5H_4N \cdot COOH$.....	123.08
7	Nitraniline (o.)...	....	$NO_2 \cdot C_6H_4 \cdot NH_2$....	138.10
8	" (m.)..	....	$NO_2 \cdot C_6H_4 \cdot NH_2$....	138.10
9	" (p.)...	....	$NO_2 \cdot C_6H_4 \cdot NH_2$....	138.10
10	Nitro-alizarine (α)	....	$(HO)_2 \cdot C_{14}H_5O_2 \cdot NO_2$	285.14
11	" " (β)	alizarine orange..	$(HO)_2 \cdot C_{14}H_5O_2 \cdot NO_2$	285.14
12	anisol (o.)......	....	$NO_2 \cdot C_6H_4 \cdot OCH_3$...	153.10
13	" (p.)......	....	$NO_2 \cdot C_6H_4 \cdot OCH_3$...	153.10
14	anthracene (9)..	nitrosoanthron...	$C_{14}H_9 \cdot NO_2$........	223.15
15	anthraquinone (α)	....	$C_6H_4 : (CO)_2 : C_6H_3 \cdot NO_2$	253.14
16	benzaldehyde (o.)	....	$NO_2 \cdot C_6H_4 \cdot CHO$...	151.09
17	" (m.)	....	$NO_2 \cdot C_6H_4 \cdot CHO$...	151.09
18	" (p.)	....	$NO_2 \cdot C_6H_4 \cdot CHO$...	151.09
19	benzamide (o.)..	....	$NO_2 \cdot C_6H_4 \cdot CO \cdot NH_2$	166.10
20	" (m.).	....	$NO_2 \cdot C_6H_4 \cdot CO \cdot NH_2$	166.10
21	" (p.)..	....	$NO_2 \cdot C_6H_4 \cdot CO \cdot NH_2$	166.10
22	benzanilide (m.)	....	$NO_2 \cdot C_6H_4 \cdot CO \cdot NH \cdot C_6H_5$	242.16
23	benzene........	....	$C_6H_5 \cdot NO_2$.........	123.08
24	benzoic acid (o.)	....	$NO_2 \cdot C_6H_4 \cdot COOH$..	167.08
25	" " (m.)	....	$NO_2 \cdot C_6H_4 \cdot COOH$..	167.08
26	" " (p.)	....	$NO_2 \cdot C_6H_4 \cdot COOH$..	167.08
27	benzonitrile (o.).	....	$NO_2 \cdot C_6H_4 \cdot CN$.....	148.09
28	" (m.)	....	$NO_2 \cdot C_6H_4 \cdot CN$.....	148.09
29	" (p.).	....	$NO_2 \cdot C_6H_4 \cdot CN$.....	148.09
30	benzophenone (o.)	....	$NO_2 \cdot C_6H_4 \cdot CO \cdot C_6H_5$	227.15
31	" (m.)	....	$NO_2 \cdot C_6H_4 \cdot CO \cdot C_6H_5$	227.15
32	" (p.)	....	$NO_2 \cdot C_6H_4 \cdot CO \cdot C_6H_5$	227.15
33	benzoquinone...	....	$NO_2 \cdot C_6H_3O_2$.......	153.06
34	benzyl alcohol (o.)	....	$NO_2 \cdot C_6H_4 \cdot CH_2OH$.	153.10

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. prisms f. w.	....	170	......	$0.078^{13°}$	0.1	....
2	yel. cryst.	....	190–2 anh.	......	sl. s.	s.	......
3	colorl. need. f. al.	....	176	......	i.	$1^{20°}$	0.8
4	liq.	$1.010^{20°}$	......	247.3	∞	∞	∞
5	plates	....	117.5	......	s.	s.	....
6	colorl. need.	....	228–9	subl.	sl. s. c.; s. h.	s. h.	v. sl. s.
7	need. f. al.	1.443	71.4	......	v. sl. s.	s.	s.
8	yel. need. f. al.	$1.398^{18°}$	114 (111.8)	285	sl. s.	s.	s.
9	yel. need. f. al.	1.437	146.5	......	$0.08^{19°}$; $2.2^{100°}$	s.	s.
10	yel. need. f. al.	....	289 d.	......	sl. s.	s.	s. alk.
11	or. need. f. bz.	....	244 d.	......	sl. s.	s.	s. chl.
12	yel. oil	$1.268^{20°}$	9	265	i.	∞	∞
13	colorl. plates	$1.233^{20°}$	54	258–60	v. sl. s. c.	s.	v. s.
14	yel. need. f. al.	....	146	......	v. s. bz.	v. s. CS_2	....
15	yel. need.	....	228–30	subl.	i.	sl. s.	sl. s.
16	yel. need. f. w.	....	44.5	153^{23mm}	v. sl. s.	v. s.	v. s.
17	need.	....	58	164^{23mm}	v. sl. s.	s.	v. s.
18	colorl. prisms	....	106	......	sl. s. h.	v. s.	s.
19	need.	....	174–6	317	s. h.	s.	s.
20	yel need. f. w.	....	140–2	310–5	s. h.	s.	s.
21	need.	....	197–8 (201.4)	......	v. sl. s.	s.	s.
22	leaf. fr. w.	....	153–4	subl.	v. sl. s. c.	s.	s.
23	yel. liq.	....	5.4	210	v. sl. s.	v. s. c.	v. s.
24	need. f. w.	$1.575^{4°}$	148	......	$0.68^{20°}$	$28^{10°}$	$21.6^{11°}$
25	leaf. f. w.	$1.494^{4°}$	140	......	$0.31^{20°}$	$33^{10°}$	$25.1^{11°}$
26	leaf. f. w.	$1.550^{32°}$	238	......	$0.04^{20°}$	$0.09^{10°}$	$2.2^{11°}$
27	silky need.	....	109	......	s. h.	s.	s.
28	need.	....	117–8 (115)	......	sl. s.	s.	s.
29	leaf. f. al.	....	147	......	sl. s. c.	sl. s. c.; s. h.	s. chl.
30	colorl.	....	105	......	......	sl. s. abs.	....
31	colorl. need. f. al.	....	94–5	......	......	s.	....
32	colorl. leaf. f. al.	....	138	......	......	s.	....
33	yel.	....	d.abt.206	......	v. s. h.	s.	sl. s.
34	need.	....	74	......	sl. s. c.	s.	s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Nitro-			
1	benzyl alcohol (m.)	....	$NO_2 \cdot C_6H_4 \cdot CH_2OH$.	153.10
2	" " (p.)	....	$NO_2 \cdot C_6H_4 \cdot CH_2OH$.	153.10
3	" cyanide (o)	....	$NO_2 \cdot C_6H_4 \cdot CH_2CN$.	162.11
4	" " (p.)	....	$NO_2 \cdot C_6H_4 \cdot CH_2CN$.	162.11
5	bromoform.....	....	CBr_3NO_2..........	297.78
6	chloroform.	See *chlor-picrin*		
7	cinnamic acid (o.)	....	$NO_2 \cdot C_6H_4 \cdot CH : CH \cdot COOH$	193.11
8	" " (m.)	....	$NO_2 \cdot C_6H_4 \cdot CH : CH \cdot COOH$	193.11
9	" " (p.)	....	$NO_2 \cdot C_6H_4 \cdot CH :_6 CH \cdot COOH$	193.11
10	diethyl aniline (m.)	....	$NO_2 \cdot C_6H_4 \cdot N(C_2H_5)_2$	194.18
11	" " (p.)	....	$NO_2 \cdot C_6H_4 \cdot N(C_2H_5)_2$	194.18
12	dimethyl amine.	....	$(CH_3)_2N \cdot NO_2$......	114.09
13	" aniline (m.)	....	$NO_2 \cdot C_6H_4 \cdot N(CH_3)_2$	166.14
14	" " (p.)	....	$NO_2 \cdot C_6H_4 \cdot N(CH_3)_2$	166.14
15	diphenyl (o.)...	....	$C_6H_5 \cdot C_6H_4 \cdot NO_2$...	199.14
16	" (p.)...	....	$C_6H_5 \cdot C_6H_4 \cdot NO_2$...	199.14
17	ethane.........	....	$C_2H_5 \cdot NO_2$.........	75.06
18	glycerine.......	glyceryl trinitrate	$C_3H_5(NO_3)_3$........	227.09
19	guanidine......	....	$NH_2 \cdot CNH \cdot NHNO_2$	104.08
20	methane.......	....	$CH_3 \cdot NO_2$.........	27.04
19	naphthalene (α).	....	$C_{10}H_7 \cdot NO_2$........	173.11
22	" (β).	....	$C_{10}H_7 \cdot NO_2$........	173.11
23	naphthoic acid (8, 1)	....	$C_{10}H_6(NO_2) \cdot COOH$	217.12
24	naphthol (2, 1)..	....	$NO_2 \cdot C_{10}H_6 \cdot OH$....	189.12
25	" (4, 1).	....	$NO_2 \cdot C_{10}H_6 \cdot OH$....	189.12
26	" (1, 2).	....	$NO_2 \cdot C_{10}H_6 \cdot OH$....	189.12
27	" (5, 2).	....	$NO_2 \cdot C_{10}H_6 \cdot OH$....	189.12
28	" (8, 2).	....	$NO_2 \cdot C_{10}H_6 \cdot OH$....	189.12
29	naphthylamine (2, 1)	....	$NO_2 \cdot C_{10}H_6 \cdot NH_2$...	188.13
30	" (1, 2)	....	$NO_2 \cdot C_{10}H_6 \cdot NH_2$...	188.13
31	" (5, 2)	....	$NO_2 \cdot C_{10}H_6 \cdot NH_2$...	188.13
32	" (8, 2)	....	$NO_2 \cdot C_{10}H_6 \cdot NH_2$...	188.13
33	phenol (o.).....	....	$NO_2 \cdot C_6H_4 \cdot OH$.....	139.08
34	" (m.)....	....	$NO_2 \cdot C_6H_4 \cdot OH$.....	139.08
35	" (p.).....	....	$NO_2 \cdot C_6H_4 \cdot OH$.....	139.08
36	phthalic acid (3)	....	$NO_2 \cdot C_6H_3 \cdot (COOH)_2$	211.09

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	rhomb.	....	27	......	......	......	....
2	need. f. w.	....	93	179.3	sl. s. c.; s. h.	v. s.	v. s.
3	need. f. w.	....	82.5–4.0	......	s. h.	......	....
4	prisms f. al.	....	114–6	......	i.	s.	s.
5	....	2.811^12°	10	127^118mm	i.	s.	s.
6							
7	sc. or need. f. al.	....	240	......	i. c.	sl. s. c.	....
8	yel. need.	....	196–7	......	v. sl. s.	......	....
9	prisms f. al.	....	284–6	......	v. sl. s.	sl. s. h.	v. sl. s.
10	yel. oil	....	......	288–90	......	......	....
11	need.	....	77–8	......	......	v. s. h.	sl. s. lgr.
12	....	....	57–8	187	s.	s.	s.
13	red. pr. f. eth.	1.313^17°	60–1	280–5 d.	i.	s.	s.
14	need. f. al.	....	163–4	......	i.	s.	s. conc. HCl
15	leaf. f. al.	....	37	320	i.	v. s.	v. s.
16	need. f. al.	....	114	340	i.	sl. s. c.	s.
17	liq.	1.056	......	114–5	sl. s.	∞	∞
18	colorl.–yel. liq.	1.601	13	expl. 260	0.12	25	∞
19	need.	....	230 (240)	......	v. sl. s. c.; sl. s. h.	sl. s.	i.
20	liq.	1.144	–26	101	sl. s.	s. alk.	s.
21	yel. need.	....	61	304	i.	s.	2.8^15°
22	rhomb. need.	....	79	......	i.	v. s.	v. s.
23	prisms f. al.	....	215	......	0.04 c.	4.6	sl. s.
24	leaf.	....	128	......	v. sl. s.	sl. s.	....
25	yel. need. f. w.	....	164	......	s. h.	v. s.	....
26	yel.	....	103	......	......	v. sl. s. c.	v. s.
27	yel. need.	....	147	......	......	v. s.	....
28	yel. need. f. w.	....	144–5	......	s.	v. s.	....
29	yel. pr. f. al.	....	144	......	......	s.	....
30	or. yel. need.	....	abt. 125	......	s. h.	v. s.	....
31	red. need. f. al.	....	143.5	......	......	v. s. h.	s. bz.
32	red need.	....	103.5	......	......	v. s.	....
33	prisms	....	45.2	214	v. sl. s. c.	v. s.	v. s.
34	tab.	....	96	......	sl. s. c.; s. h.	v. s.;	v. s.
35	monocl.	....	114	279 d.	sl. s. c.; s. h.	v. s.	v. s.
36	yel. monocl. f. eth.	....	219–20	......	sl. s.	v. s.	v. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Nitro- phthalic acid (4)	....	$NO_2 \cdot C_6H_3 \cdot (COOH)_2 + H_2O$	229.11
2	phthalide (5)...	....	$NO_2 \cdot C_8H_5O$.......	163.09
3	propane........	....	$CH_3 \cdot CH_2 \cdot CH_2 \cdot NO_2$	89.08
4	quinoline (5)...	....	$NO_2 \cdot C_9H_6N$.......	174.11
5	" (6)...	....	$NO_2 \cdot C_9H_6N$.......	174.11
6	" (7)...	....	$NO_2 \cdot C_9H_6N$.......	174.11
7	" (8)...	....	$NO_2 \cdot C_9H_6N$.......	174.11
8	salicylic acid (3).	....	$NO_2 \cdot C_6H_3(OH) \cdot COOH + H_2O$ (3,2,1)	201.10
9	" " (5).	....	$NO_2 \cdot C_6H_3(OH) \cdot COOH$ (5, 2, 1)	183.09
10	styrene (o.).....	....	$NO_2 \cdot C_6H_4 \cdot CH : CH_2$	149.11
11	" (m.)....	....	$NO_2 \cdot C_6H_4 \cdot CH : CH_2$	149.11
12	" (p.)....	....	$NO_2 \cdot C_6H_4 \cdot CH : CH_2$	149.11
13	thiophene (2)...	....	$NO_2 \cdot C_4H_3S$........	129.11
14	toluene (o.).....	....	$NO_2 \cdot C_6H_4 \cdot CH_3$....	137.10
15	" (m.)....	....	$NO_2 \cdot C_6H_4 \cdot CH_3$....	137.10
16	" (p.)....	....	$NO_2 \cdot C_6H_4 \cdot CH_3$....	137.10
17	o-toluidine (3)..	....	$NO_2 \cdot C_6H_3 \cdot CH_3 (NH_2)$ (3, 1, 2)	152.12
18	" " (4)..	....	$NO_2 \cdot C_6H_3 \cdot CH_3 (NH_2)$ (4, 1, 2)	152.12
19	" " (5)..	....	$NO_2 \cdot C_6H_3 \cdot CH_3 (NH_2)$ (5, 1, 2)	152.12
20	" " (6)..	....	$NO_2 \cdot C_6H_3 \cdot CH_3 (NH_2)$ (6, 1, 2)	152.12
21	m- " (2)..	....	$NO_2 \cdot C_6H_3 \cdot CH_3 (NH_2)$ (2, 1, 3)	152.12
22	" " (4)..	....	$NO_2 \cdot C_6H_3 \cdot CH_3 (NH_2)$ (4, 1, 3)	152.12
23	" " (5)..	....	$NO_2 \cdot C_6H_3 \cdot CH_3 (NH_2)$ (5, 1, 3)	152.12
24	" " (6)..	....	$NO_2 \cdot C_6H_3 \cdot CH_3 (NH_2)$ (6, 1, 3)	152.12
25	p- " (2)..	....	$NO_2 \cdot C_6H_3 \cdot CH_3 (NH_2)$ (2, 1, 4)	152.12
26	" " (3)..	....	$NO_2 \cdot C_6H_3 \cdot CH_3 (NH_2)$ (3, 1, 4)	152.12
27	urethane.......	....	$NO_2 \cdot NH \cdot COO \cdot C_2H_5$	134.08
28	urea...........	....	$NH_2 \cdot CO \cdot NHNO_2$..	105.06
29	Nitroform.......	trinitro-methane..	$CH(NO_2)_3$.........	151.04
30	Nitroso- aniline (p.)	....	$NO \cdot C_6H_4 \cdot NH_2$....	122.10
31	benzene........	....	C_6H_5NO..........	107.08
32	benzoic acid (o.)	....	$NO_2 \cdot C_6H_4 \cdot COOH$..	167.09
33	diethylamine...	....	$(C_2H_5)_2N \cdot NO$......	102.12
34	diethylaniline (p.)	....	$NO \cdot C_6H_4 \cdot N(C_2H_5)_2$	178.18

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	need.	....	161	......	s.	s.	s.
2	need. f. al.	....	141	......	i. c.	s.	s.
3	liq.	1.011	......	131	v. sl. s.	∞	∞
4	need. f. w.	....	72	subl.	sl. s. h.	s. bz.	....
5	need.	....	149–50	subl.	v. sl. s. c. s. h.	v. sl. s.	v. sl. s.
6	need. f. al.	....	132–3	......	......	v. sl. s.	v. s.
7	need. f. al.	....	88–9	......	v. sl. s. c.	s.	s.
8	long need.	....	144 anh.	......	0.13 c.	v. s.	v. s.
9	need.	....	228–30	......	0.07 c.; s. h.	v. s.	v. s.
10	colorl. liq.	....	12–13.5	......	s. conc. H_2SO_4	......	....
11	....	....	−5	......	......	s. abs.	s.; s. lgr.
12	pr. f. lgr.	....	29	......	s. lgr.	v. s. h.	v. s.
13	monocl.	....	44	224–5	i.	v. s.	v. s.
14	yel. liq.	1.168	−10.5	220.4	v. sl. s. c.	∞	∞
15	....	$1.168^{22°}$	15.9	232	v. sl. s. c.	∞	∞
16	colorl. need.	$1.286^{20°}$	52	237.7	v. sl. s.	s.	v. s.
17	or. prisms	....	96	......	v. s. bz.	v. s.	v. s.
18	monocl.	1.365	179	......	......	s.	s.
19	yel. need.	1.366	127–8	......	v. sl. s. h.	v. s.	....
20	yel. leaf.	1.378	91.5	......	1.3 h.	v. s.	v. s.
21	yel. need.	....	53	......	sl. s.	v. s.	....
22	yel. leaf. f. w.	....	109	......	s. h.	v. s.	v. s.
23	or. need.	....	98	......	v. sl. s.	v. s.	v. s.
24	yel. need.	....	138	......	s. a.	s.	....
25	yel. monocl.	....	77.5	......	s.	sl. s. CS_2	....
26	red. pr. f. al.	1.312	114 (116–7)	......	v. sl. s. h.	v. s.	....
27	colorl. leaf. fr. lgr.	....	64	......	v. s.	s. lgr.	....
28	cryst. powd.	....	dec.	......	sl. s.	v. s.	v. s.
29	colorl. oil	....	15	exp.	s.	......	....
30	steel blue need.	....	173–4	......	s. bz.	s.	....
31	colorl. monocl. f. eth.	....	67.5–8.0	......	......	s.	s.
32	colorl. f. abs. al.	....	210 d.	......	v. sl. s. bz.	s.	v. sl. s.
33	yel. liq.	$0.951^{18°}$	......	175.4	s.	∞	∞
34	need.	....	84	......	sl. s.	v. s.	v. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Nitroso-			
1	diisopropylamine	....	$[(CH_3)_2 \cdot CH]_2N \cdot NO$	130.16
2	dimethylamine..	....	$(CH_3)_2N \cdot NO$......	74.08
3	dimethylaniline (p.)	....	$NO \cdot C_6H_4 \cdot N(CH_3)_2$.	150.14
4	diphenylamine..	....	$(C_6H_5)_2 \cdot N \cdot NO$.....	198.16
5	dipropylamine..	....	$(CH_3 \cdot CH_2 \cdot CH_2)_2N \cdot NO$	130.16
6	naphthol (2, 1).	....	$NO \cdot C_{10}H_6 \cdot OH$.....	173.12
7	" (4, 1).	....	$NO \cdot C_{10}H_6 \cdot OH$.....	173.12
8	" (1, 2).	....	$NO \cdot C_{10}H_6 \cdot OH$.....	173.12
9	naphthylamine (1, 2).	....	$NO \cdot C_{10}H_6NH_2$.....	188.13
10	phenol (p.).....	quinone monoxime	$NO \cdot C_6H_4 \cdot OH$.....	123.08
11	toluene (o.).....	....	$NO \cdot C_6H_4 \cdot CH_3$.....	121.10
12	Nonane (n.).....	....	C_9H_{20}............	128.21
13	Nondecylic acid..	....	$C_{18}H_{37} \cdot COOH$.....	298.40
14	Nonyl alcohol....	....	$C_9H_{19}OH$..........	144.21
15	Nonylic acid.....	....	$C_8H_{17} \cdot COOH$.....	158.18
16	Octane (n.).....	....	C_8H_{18}............	114.18
17	Octyl alcohol (n.).	....	$C_8H_{17}OH$..........	130.18
18	aldehyde.......	....	$CH_3 \cdot (CH_2)_6 \cdot CHO$..	128.17
19	amine.........	....	$CH_3 \cdot (CH_2)_7 \cdot NH_2$..	129.20
20	formate........	....	$H \cdot COO \cdot C_8H_{17}$.....	158.19
21	Oenanthol.......	heptylic aldehyde	$C_6H_{13} \cdot CHO$.......	114.15
22	Oenanthylic acid.	heptylic acid.....	$C_6H_{13} \cdot COOH$......	130.15
23	Oleïc acid.......	....	$C_{17}H_{33} \cdot COOH$.....	282.36
24	Olein...........	triolein..........	$(C_{18}H_{33}O_2)_3C_3H_5$...	885.12
25	Oxalic acid......	....	$COOH \cdot COOH + 2H_2O$	126.06
26	Oxalyl chlorid....	....	$COCl \cdot COCl$.......	126.93
27	Oxamic acid.....	....	$COOH \cdot CONH_2$....	89.04
28	Oxamide........	....	$CONH_2 \cdot CONH_2$...	88.06
29	Oxanilic acid.....	....	$COOH \cdot CONHC_6H_5$	165.11
30	Oxanilide........	....	$C_6H_5 \cdot NH \cdot CO \cdot CO \cdot NH \cdot C_6H_5$	240.19
31	Oxindol.........	....	C_8H_7ON..........	133.11
32	Palmitic acid....	....	$CH_3 \cdot (CH_2)_{14} \cdot COOH$	256.34
33	Palmitin........	tripalmitin.......	$(C_{15}H_{31} \cdot COO)_3C_3H_5$	807.04
34	Palmitolic acid...	....	$C_{15}H_{27} \cdot COOH$.....	252.30
35	Palmito-nitrile...	....	$C_{15}H_{31} \cdot CN$........	237.34
36	Papaverine......	....	$C_{20}H_{21}O_4N$........	339.28
37	Parabanic acid...	oxalyl urea......	$C_3H_2O_3N_2$.........	114.05
38	Paraformaldehyde	....	$(CH_2O)_x$.........	$(30.02)_x$
39	Paraldehyde.....	....	$(C_2H_4O)_3$..........	132.13

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	....	....	46	194.5	v. sl. s.	v. s.	....
2	yel.	....	......	148	v. s.	∞	∞
3	green scales	....	87.8	......	v. sl. s.	s.	s.
4	yel. tab.	....	66.5	......	......	v. sl. s. c.; s. h.	s. bz.
5	yel. liq.	0.924	......	296 (200–5)	v. sl. s.	∞	∞
6	yel. need. f. bz.	....	147–8 (152)	......	v. sl. s. c.	v. s.	s.
7	yel.	....	abt. 193 d.	......	i.	v. s.	v. s.
8	brown pr. f. al.	....	109.5 (106)	......	v. sl. s.	$2.4^{13°}$; v. s. h.	v. s.
9	gr'n. need. f. al.	....	150–2	......	sl. s. h.	v. s.	v. s.
10	yel. need.	....	120–30 d.	......	s.	v. s.	v. s.
11	cryst.	....	72–2.5	......	v. s. chl.	v. s.	v. s.
12	colorl. liq.	$0.718^{20°}$	–51	149.7	i.	v. s.	v. s.
13	leaf. f. al.	....	66.5	......	i.	......	....
14	colorl. liq.	$0.842^{0°}$	–5	213.5	......	∞	∞
15	liq.	0.689	12	253–4	v. sl. s.	s.	s.
16	colorl. liq.	0.706	–56.6	125.5	i.	......	....
17	colorl. liq.	$0.838^{0°}$	–17.9	195.5	s.	∞	∞
18	colorl. liq.	$0.821^{20°}$	......	......	v. sl. s.	∞	∞
19	....	....	......	176	v. sl. s.	v. s.	v. s.
20	colorl. liq.	$0.893^{0°}$	......	198	i.	......	....
21	colorl. liq.	$0.850^{20°}$	......	155	......	s.	∞
22	colorl. liq.	0.921	......	223	sl. s.	s.	s.
23	need.	$0.891^{12°}$	14	286^{100mm}	i.	∞	∞
24	oil	....	–5–6	......	i.	sl. s.	v. s.
35	colorl. monocl.	1.653	99 *	......	$9.5^{15°}$	v. s. c.	$1.2^{15°}$
26	colorl. liq.	....	–12	64	dec.	dec.	s.
27	colorl.	....	210 d.	......	$1.4^{14°}$	v. sl. s.	....
28	wh. powd.	$1.476^{30°}$	417–9 d.	......	i.	i.	i.
29	rhombic	....	149	......	s. h.	v. s.	v. s.
30	scales	....	245 (252.5)	......	i.	v. sl. s. h	i.
31	need. f. w.	....	120	......	v. s. h.	s.	s.
32	colorl. need.	$0.853^{62°}$	62.6	dec.	i.	$9.3^{20°}$	s.
33	colorl.	$0.866^{80°}$	65.5	......	i.	v. sl. s.	v. s.
34	colorl. need.	....	47	......	i.	v. s.	v. s.
35	colorl. tab.	$0.822^{31°}$	29(31)	251.5 100mm	i.	s.	s.
36	colorl. need. f. al.	....	146–7	......	v.sl. s. h.	v. s.; v. s. chl.	$0.39^{10°}$
37	colorl. pl. f. w.	....	227–35 d.	......	$4.7^{8°}$	v. s.	sl. s.
38	wh. amor. powd.	....	sub. abt. 120	......	v. s.	i.	i.
39	colorl.	0.999	10.5	124	10	......	....

* Anhydrous form melts at 187° C.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Pararosaniline . . .	. . . .	$C(OH)\cdot(C_6H_4\cdot NH_2)_3$	305.28
2	Pelargonic acid. . .	. . . .	$CH_3\cdot(CH_2)_7\cdot COOH$	158.19
3	Penta-brombenzene	. . . .	C_6HBr_5.	472.64
4	chloraniline.	. . . .	$Cl_5C_6\cdot NH_2$.	265.36
5	chlorbenzene. . .	. . . .	C_6HCl_5.	250.34
6	chlorethane.	. . . .	$CCl_3\cdot CHCl_2$.	202.32
7	decane (n.).	. . . .	$CH_3\cdot(CH_2)_{13}\cdot CH_3$. .	212.33
8	ethyl benzene. . .	. . . .	$C_6H\cdot(C_2H_5)_5$.	218.21
9	methyl benzene.	. . . .	$C_6H\cdot(CH_3)_5$.	208.21
10	" benzoic acid	. . . .	$(CH_3)_5\cdot C_6\cdot COOH$. .	192.19
11	" phenol. .	. . . .	$(CH_3)_5\cdot C_6\cdot OH$.	164.10
12	methylene	cyclo pentane. . . .	C_5H_{10}.	70.08
13	" diamine	cadaverine.	$NH_2\cdot(CH_2)_5\cdot NH_2$. .	102.16
14	Pentaminobenzene	. . . .	$C_6H\cdot(NH_2)_5$.	153.17
15	Pentane (n.).	. . . .	C_5H_{12}.	72.12
16	Perchlorethane.	See *hexachlorethane*		
17	Perchlorether. . . .	. . . .	$C_2Cl_5\cdot O\cdot C_2Cl_5$.	418.62
18	Perseïte (d. or l.).	. . . .	$C_7H_{16}O_7$.	212.16
19	Phenacetin.	See *acetphenetidide*		
20	Phenanthrene. . . .	. . . .	$C_{14}H_{10}$.	178.15
21	Phenanthrene-	. . . .	$C_{14}H_8O_2$.	208.13
22	quinone			
23	Phenanthrol.	. . . .	$C_{14}H_9\cdot OH$.	194.15
24	Phenazine.	. . . .	$C_{12}H_8N_2$.	180.14
25	Phenetol.	phenyl ethyl ether	$C_6H_5\cdot O\cdot C_2H_5$.	122.12
26	Phenocoll.	aminoacetyl-para-phenetidine	$C_2H_5O\cdot C_6H_4\cdot NH\cdot CO\cdot CH_2(NH) + H_2O$	211.19
27	Phenol.	carbolic acid.	$C_6H_5\cdot OH$.	94.08
28	-phthalein.	. . . .	$C_{20}H_{14}O_4$.	318.21
29	Phenyl-acetanilide	. . . .	$C_6H_5\cdot NH\cdot OC\cdot CH_2\cdot C_6H_5$	211.18
30	acetaldehyde. . .	. . . .	$C_6H_5\cdot CH_2\cdot CHO$. . .	120.10
31	acetate.	. . . .	$CH_3\cdot COO\cdot C_6H_5$. . .	136.10
32	acetic acid.	. . . .	$C_6H_5\cdot CH_2\cdot COOH$. .	136.10
33	acetylene.	. . . .	$C_6H_5\cdot C\vdots CH$.	102.09
34	acridine (9).	. . . .	$C_6H_5\cdot C_{13}H_8N$.	255.21
35	amino-propionic acid (β, α)	phenyl alanine. . .	$C_6H_5\cdot CH_2\cdot CH(NH_2)COOH$	165.14
36	amino-propionic acid (β, β)	. . . .	$C_6H_5\cdot CH(NH_2)\cdot CH_2\cdot COOH$	165.14
37	benzoate.	. . . .	$C_6H_5\cdot COO\cdot C_6H_5$. . .	198.15
38	benzoic acid (o.).	. . . .	$C_6H_5\cdot C_6H_4\cdot COOH$.	198.15
39	" " (m.)	. . . .	$C_6H_5\cdot C_6H_4\cdot COOH$.	198.15
40	" " (p.)	. . . .	$C_6H_5\cdot C_6H_4\cdot COOH$.	198.15
41	benzylamine. . . .	. . . .	$C_6H_5\cdot NH\cdot CH_2\cdot C_6H_5$	183.18
42	carbamate.	. . . .	$C_6H_5\cdot COONH_2$. . . .	137.10

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	leaf.	....	188–9	......	i.	s.	s.
2	colorl. leaf.	0.910	12.5	253–4	sl. s.	s.	s.
3	need. f. al.	....	159–60	subl.	s. bz.	sl. s.	sl. s.
4	need.	....	232	......	......	v. s.	v. s.
5	need. f. al.	$0.769^{20°}$	85–6	275–6	i.	v. sl. s.	v. s.
6	liq.	1.834	–22	161.7	i.	∞	∞
7	colorl.	$0.769^{20°}$	10	270.5	i.	v. s.	v. s.
8	colorl. liq.	$0.899^{19°}$	<–20	277	i.	......	....
9	colorl.	....	53	230	i.	......	....
10	need. f. w.	....	210.5	subl.	v. sl. s.	s.	....
11	need. f. al.	....	125	267	i.	s.	....
12	colorl. liq.	$0.751^{20°}$	......	50–1	i.	......	....
13	syrup	0.885	abt. 9	178–9	v. s.	sl. s.	sl. s.
14	need.	....	......	......	v. s.	i.	i.
15	colorl. liq.	0.634	......	37	i.	∞	∞
16							
17	scales	1.900	69	dec.	......	......	....
18	colorl. need.	....	188	......	$5.5^{18°}$	sl. s.	....
19							
20	colorl. leaf.	$1.063^{100°}$	100	340	i.	10 h.	v. s.
21	or. need.	....	202	360	sl. s. h.	sl. s.	sl. s.
22							
23	need.	....	112 (152)	......	sl. s.	v. s.	v. s.
24	yel. need.	....	170–1	abt. 360	v. sl. s.	2	sl. s.
25	colorl. liq.	$0.982^{0°}$	......	172	i.	s.	∞
26	wh. need.	....	abt. 95; anh. 100.5	......	sl. s.	s.	....
27	colorl. need.	$1.072^{20°}$	42.5–3.0	183	$6.7^{16°}$; ∞ $^{68°}$	∞	v. s.
28	triclinic	....	250–3	......	sl. s.	s.	sl. s.
29	prisms f. al.	....	117	......	i.	3.3	s.
30	colorl. liq.	1.032	......	193–4	v. sl. s.	∞	∞
31	colorl. liq.	$1.093^{0°}$	......	196	v. sl. s.	∞	∞
32	colorl. leaf.	....	76.5	265.5	v. s. h. sl. s. c.	v. s.	v. s.
33	colorl. liq.	$0.937^{12°}$	......	139–42	i.	∞	∞
34	yel. need. f. al.	....	181.5–2.5	403–4	i.	sl. s.	s.; v. s. bz.
35	prisms	....	263–5 d.	......	s.	v. sl.	i.
36	monocl.	....	120–1	......	s.	v. s.	v. sl. s.
37	colorl. monocl.	....	68–9	314	v. sl. s.	s.	s.
38	colorl. need.	....	110–1	343	sl. s. h.	v. s.	....
39	colorl. leaf.	....	160–1 (166)	......	sl. s.	v. s.	v. s.
40	colorl. need.	....	218–9 (224)	subl.	v. sl. s. h.	v. s.	v. s.
41	pr. f. al.	....	32	298–300	......	s.	....
42	leaf.	....	141	......	sl. s.; s. h.	v. s.	v. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Phenyl-carbylamine chloride	isocyanphenyl chloride	$C_6H_5 \cdot NCCl_2$	174.01
2	cyanide.	See *benzonitrile*		
3	disulphide		$(C_6H_5)_2S_2$	218.26
4	ditolylmethane		$C_6H_5 \cdot CH \cdot (C_6H_4 \cdot CH_3)_2$	272.27
5	ether		$C_6H_5 \cdot O \cdot C_6H_5$	170.14
6	ethyl alcohol	benzyl carbinol	$C_6H_5 \cdot CH_2 \cdot CH_2OH$	121.12
7	" amine		$C_6H_5 \cdot CH_2 \cdot CH_2 \cdot NH_2$	122.14
8	glucosazone (d.)		$C_{18}H_{22}O_4N_4$	358.31
9	glycine	anilino acetic acid	$C_6H_5 \cdot NH \cdot CH_2 \cdot COOH$	151.12
10	glyoxylic acid	benzoy formic acid	$C_6H_5 \cdot CO \cdot COOH$	150.09
11	hydrazine		$C_6H_5 \cdot NH \cdot NH_2$	108.11
12	hydroxylamine(β)		$C_6H_5 \cdot NH \cdot OH$	109.10
13	isocyanide	phenyl carbylamine	$C_6H_5 \cdot NC$	103.09
14	methyl ketone.	See *aceto-phenone*		
15	mustard oil	phenyl isothiocyanate	$C_6H_5 \cdot NCS$	135.15
16	naphthalene (α)		$C_{10}H_7 \cdot C_6H_5$	204.18
17	" (β)		$C_{10}H_7 \cdot C_6H_5$	204.18
18	naphthylamine(α)		$C_{10}H_7 \cdot NH \cdot C_6H_5$	219.19
19	" (β)		$C_{10}H_7 \cdot NH \cdot C_6$	219.19
20	naphthyl ketone (α)		$C_{10}H_7 \cdot CO \cdot C_6H_5$	232.18
21	" " (β)		$C_{10}H_7 \cdot CO \cdot C_6H_5$	232.18
22	nitramine		$C_6H_5 \cdot NH(NO_2)$	138.10
23	prop olic acid		$C_6H_5 \cdot C \vdots C \cdot COOH$	146.09
24	pyridine (α)		$C_6H_5 \cdot C_5H_4N$	155.14
25	" (β)		$C_6H_5 \cdot C_5H_4N$	155.14
26	" (γ)		$C_6H_5 \cdot C_5H_4N$	155.14
27	quinoline (α)		$C_6H_5 \cdot C_9H_6N$	205.16
28	sal cylate	salol	$HO \cdot C_6H_4 \cdot COO \cdot C_6H_5$	214.14
29	semi carbazide (1)		$C_6H_5 \cdot NH \cdot NH \cdot CO \cdot NH_2$	151.14
30	sulphide		$(C_6H_5)_2S$	186.20
31	toluene (o.)		$C_6H_5 \cdot C_6H_4 \cdot CH_3$	168.16
32	" (m.)		$C_6H_5 \cdot C_6H_4 \cdot CH_3$	168.16
33	" (p.)		$C_6H \cdot C_6H_4 \cdot CH_3$	168.16
34	tolyl ketone (o.)		$C_6H_5 \cdot CO \cdot C_6H_4 \cdot CH_3$	196.17
35	" " (m.)		$C_6H_5 \cdot CO \cdot C_6H_4 \cdot CH_3$	196.17
36	" " (p.)		$C_6H_5 \cdot CO \cdot C_6H_4 \cdot CH_3$	196.17
37	urea		$C_6H_5 \cdot NH \cdot CO \cdot NH_2$	136.12
38	urethane	ethylphenyl carbamate	$C_6H_5 \cdot NH \cdot COO \cdot C_2H_5$	165.14
39	Phenylene diamine.	See *diamino-benzene*		

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. oil	....	......	209	......	......	....
2							
3	need.	....	60–1	310 d.	i.	s.	s.
4	need.	....	55–6	......	v. s. bz.	s.	v. s.
5	colorl. monocl.	$1.073^{20°}$	28	252–3 (259)	v. sl. s.	5	s.
6	colorl. liq.	1.024	......	212	$1.6^{20°}$	∞	∞
7	wh.-yel. liq.	$0.958^{24°}$	......	197–8	4	v. s.	v. s.
8	yel. need.	....	217	......	v. sl. s.	s. h.	....
9	colorl.	....	125–7	......	s.	......	sl. s.
10	colorl.	....	65–6	......	v. s.	v. s.	....
11	yellow.	$1.097^{23°}$	17.5	243.5 sl. d.	sl. s.	∞	∞
12	need.	....	......	81–2	2 c.; 10 h.	v. s.	v. s.
13	colorl.-grn. liq.	0.978	......	165–6	dec.	dec.	s.
14							
15	liq.	1.138	–21	221	i.	s.	s.
16	colorl. liq.	....	......	324–5	......	v. s.	v. s.
17	colorl. leaf.	....	102–2.5	345	......	v. s.	v. s.
18	colorl. leaf.	....	60–2	......	v. s. bz.	v. s.	v. s.
19	need.	....	107.5–8.0	395	s. chl.	s.	s.
20	rhombic	....	75.5	385	i.	$2.4^{12°}$	....
21	need.	....	82	......	i.	2 c.	....
22	leaf. f. lgr.	....	46–6.5	exp.	s.	v. s.	....
23	long need.	....	136–7	subl.	v. sl. s.	v. s.	v. s.
24	liq.	....	......	269–71	i.	v. s.	v. s.
25	oil	....	......	269.5–70.5	i.	v. s.	v. s.
26	leaf. f. w.	....	77	274–5	v. sl. s. h.	s.	s.
27	need. f. al.	....	84–6	300	sl. s.	v. s. h.	v. s.
28	colorl. rhomb.	$1.261^{30°}$	42.5	......	v. sl. s.	$21.5^{25°}$	v. s.
29	leaf. f. al.	....	172	......	sl. s. c.; s. h.	v. s.	....
30	liq.	$1.119^{15°}_{15}$	......	296	i.	s.	∞; ∞ bz.
31	colorl. liq.	....	......	258–60	i.	s.	s.
32	colorl. liq.	$1.031^{0°}$	......	272–7	i.	s.	s.
33	colorl. liq.	$1.015^{27°}$	–2–3	263–7	i.	s.	s.
34	colorl. liq.	....	<–18	315–6	......	......	....
35	colorl. liq.	$1.088^{18°}$	......	314–6	∞ bz.	v. s.	v. s.
36	monocl.	....	59–60*	326	v. s. bz.	s.	v. s.
37	monocl.	....	146.5–7.0	......	sl. s. c.; v. s. h.	v. s.	v. s.
38	need. f. w.	....	51.5–2.0	......	v. sl. s.	v. s.	v. s.
39							

* A hexagonal form melts at 55° C.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Phloridzin	....	$C_{21}H_{24}O_{10}+2H_2O$	472.33
2	Phloroglucinol	trihydroxybenzene (3, 1, 5)	$C_6H_3\cdot(OH)_3+2H_2O$	162.11
3	triethyl ether	....	$C_6H_3\cdot(OC_2H_5)_3$	210.02
4	trimethyl ether	....	$C_6H_3\cdot(OCH_3)_3$	168.14
5	Phoron	....	$C_9H_{14}O$	138.16
6	Phosgene.	See *carbonyl chloride*		
7	Phthalamide	....	$C_6H_4\cdot(CO\cdot NH_2)_2$ (o.)	164.12
8	Phthalic acid	....	$C_6H_4\cdot(COOH)_2$ (o.)	166.09
9	aldehyde	....	$C_6H_4\cdot(CHO)_2$ (o.)	134.09
10	anhydride	....	$C_6H_4\cdot(CO)_2O$ (o.)	148.06
11	Phthalide	....	$C_8H_6O_2$	134.08
12	Phthalimide	....	$C_6H_4:(CO)_2:NH$	147.06
13	Phthalyl chloride (o.)	....	$C_6H_4\cdot(CO\cdot Cl)_2$	202.99
14	Picene	....	$C_{22}H_{14}$	278.22
15	Picoline (α)	methyl pyridine (2)	$CH_3\cdot C_5H_4N$	93.10
16	" (β)	" " (3)	$CH_3\cdot C_5H_4N$	93.10
17	" (γ)	" " (4)	$CH_3\cdot C_5H_4N$	93.10
18	Picolinic acid (2)	pyridine carbonic acid (2)	$C_5H_4N_5COOH$	123.08
19	Picramic acid (4, 6, 2)	dinitroaminophenol (4, 6, 2, 1)	$(NO_2)_2(NH_2)\cdot C_6H_2\cdot OH$	199.10
20	Picramide	trinitroaniline	$NH_2\cdot C_6H_2\cdot(NO_2)_3$ (1, 2, 4, 6)	228.10
21	Picric acid	trinitrophenol (1, 2, 4, 6)	$HO\cdot C_6H_2\cdot(NO_2)_3$ (1, 2, 4, 6)	229.08
22	Picryl chloride	....	$Cl\cdot C_6H_2\cdot(NO_3)_3$	295.45
23	Pilocarpine	....	$C_{11}H_{16}O_2N_2$	208.20
24	hydrochloride	....	$C_{11}H_{16}O_2N_2\cdot HCl$	244.67
25	nitrate	....	$C_{11}H_{16}O_2N_2\cdot HNO_3$	271.22
26	Pinacoline	....	$CH_3\cdot CO\cdot C(CH_3)_3$	100.13
27	Pinacone	....	$(CH_3)_2\cdot C(OH)\cdot C(OH)\cdot(CH_3)_2$	118.14
28	Pinene (α)	....	$C_{10}H_{16}$	136.18
29	hydrochloride	....	$C_{10}H_{16}\cdot HCl$	172.65
30	Piperic acid	....	$C_{12}H_{10}O_4$	218.14
31	Piperidine	hexahydropyridine	$C_5H_{11}N$	85.12
32	Piperine	....	$C_5H_{10}N\cdot CO\cdot C_4H_4\cdot C_6H_3:O_2:CH_2$	285.25
33	Piperonal	heliotropin	$CH_2\cdot O_2\cdot C_6H_3\cdot CHO$	150.09
34	Populin	benzoyl salicin	$C_{20}H_{22}O_8+2H_2O$	426.31
35	Propane	....	$CH_3\cdot CH_2\cdot CH_3$	44.08
36	Propargyl acetate	....	$CH_3\cdot COO\cdot C_3H_3$	98.07
37	alcohol	....	$CH\vdots C\cdot CH_2OH$	56.05
38	Propiolic acid	....	$CH\vdots C\cdot COOH$	70.03
39	Propionaldoxime	....	$C_2H_5\cdot CH:NOH$	73.08
40	Propionamide	....	$C_2H_5\cdot CO\cdot NH_2$	73.08

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	need.	$1.430^{19°}$	108–9*	......	0.1 c.; v. s. h.	v. s.	v. sl. s.
2	rhombic	....	anh. 217–9	subl. d.	v. s.	v. s.	v. s.
3	colorl.	....	43	......	i.	v. s.	v. s.
4	colorl. pr.	....	52	255.5	......	v. s.	v. s.
5	pale yel.	$0.885^{20°}$	28	198.5	......	s.	s.
6							
7	colorl. rh'bd'r.	....	219–20	......	i.	i.	i.
8	colorl. rhomb.	1.585	184 d.	......	$0.54^{14°}$; $18^{99°}$	v. s.	$0.69^{15°}$
9	....	....	56	......	s.	s.	s.
10	colorl. pr.	$1.527^{4°}$	128	284.5	v. sl. s.	s.	sl. s.
11	need. f. w.	....	73	290	v. sl. s.	v. s.	....
12	need.	....	228.5	subl.	v. sl. s.	v. sl. s. bz.	sl. s.
13	colorl. liq.	....	0	281.5	dec.	dec.	s.
14	colorl. leaf.	....	364	518–20	sl. s. h. bz.	sl. s. chl.	....
15	colorl. liq.	0.950	......	129	v. s.	∞	∞
16	colorl. liq.	0.961	......	143.5	∞	∞	∞
17	colorl. liq.	0.957	......	143.1	∞	∞	∞
18	need. f. w.	....	136	subl.	v. s.	v. s.	v. sl. s.
19	monocl. f. chl.	....	168–9	......	$0.14^{22°}$	s.	sl. s.; v. s. bz.
20	yel. tab.	....	188	......	i.	i.	s. acet. a.
21	yel. leaf. f. w.	$1.767^{19°}$	122	exp.	$1.22^{20°}$ $6.33^{100°}$	$5.92^{14.8°}$	$1.08^{13°}$
22	yel. pr.	....	81–2	......	i.	s.	s.
23	colorl. need.	....	34	......	v. s.	v. s.	sl. s.
24	deliq. cryst.	....	200–4	......	333	43; 10 abs.	i.; sl. s. chl.
25	prisms	....	178	......	$16^{20°}$	$6.2^{60°}$	i.
26	colorl. liq.	0.800	......	106	v. sl. s.	s.	s.
27	colorl. need.	0.967	35–8	172–3	s. c.; v. s. h.	v. s.	....
28	colorl. liq.	$0.859^{20°}$	......	156	v. sl. s.	∞ abs.	∞
29	colorl.	....	125	......	i.	v. s.	s.
30	yel. need.	....	216–7	......	v. sl. s.	s. h.	s.
31	colorl. liq.	$0.862^{20°}$	−17	106	∞	∞	....
32	colorl. monocl.	....	129–30	......	v. sl. s. c.	6.7; $23^{60°}$	2.8
33	need. f. w.	....	37	263	0.2 c.	v. s.	v. s.
34	colorl. need.	....	anh. 180	......	0.05 c.	s.	s.
35	colorl. gas	1.558 (A)	......	−38–9	6.5c.c.$^{18°}$	790c.c.$^{17°}$	926c.c.$^{17°}$
36	colorl. liq.	$1.005^{20°}$	......	124.5	......	s.	s.
37	colorl. liq.	$0.972^{20°}$	......	114–5	s.	∞	∞
38	need.	....	6	144 d.	s.	s.	s.
39	....	$0.926^{20°}$	21.5	131–5	......	......	....
40	colorl. leaf.	$0.960^{80°}$	79	213	s.	s.	s.

* Anhydrous form melts about 170° C. with decomposition.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Propionanilide...	....	$C_6H_5\cdot NH\cdot CO\cdot C_2H_5$	149.12
2	Propionic acid...	....	$CH_3\cdot CH_2\cdot COOH$..	74.06
3	aldehyde.......	....	$CH_3\cdot CH_2\cdot CHO$....	58.06
4	anhydride......	....	$[CH_3\cdot CH_2\cdot CO]_2O$..	130.11
5	Proponal........	dipropyl barbituric acid	$C_{10}H_{16}O_3N_2$........	212.20
6	Propyl acetate...	....	$CH_3\cdot COO\cdot C_3H_7$...	102.11
7	acetylene.......	....	$C_3H_7\cdot C\vdots CH$......	68.09
8	alcohol........	....	$CH_3\cdot CH_2\cdot CH_2OH$..	60.08
9	amine (n.)......	....	$CH_3\cdot CH_2\cdot CH_2NH_2$.	59.10
10	aniline.........	....	$C_6H_5\cdot NH(C_3H_7)$....	135.16
11	benzene........	....	$C_6H_5\cdot CH_2\cdot CH_2\cdot CH_3$	120.14
12	benzoate.......	....	$C_6H_5\cdot COO\cdot C_3H_7$...	164.15
13	benzoic acid (o.).	....	$C_3H_7\cdot C_6H_4\cdot COOH$.	164.15
14	" " (p.)	....	$C_3H_7\cdot C_6H_4\cdot COOH$.	164.15
15	bromide........	....	$CH_3\cdot CH_2\cdot CH_2Br$..	122.99
16	butyrate.......	....	$C_3H_7\cdot COO\cdot C_3H_7$...	130.15
17	carbamate......	....	$NH_2\cdot COOC_3H_7$....	103.09
18	chloride........	....	$CH_3\cdot CH_2\cdot CH_2Cl$...	78.52
19	chloride (sec.)...	....	$CH_3\cdot CHCl\cdot CH_3$...	78.52
20	cyanide........	butyro-nitrile....	$CH_3\cdot CH_2\cdot CH_2\cdot CN$.	69.09
21	ether..........	....	$C_3H_7\cdot O\cdot C_3H_7$......	102.14
22	formate........	....	$H\cdot COO\cdot C_3H_7$......	88.08
23	hexyl ketone....	....	$C_3H_7\cdot CO\cdot C_6H_{13}$....	156.21
24	hydroxylamine(β)	....	$C_3H_7\cdot NHOH$......	75.10
25	iodide..........	....	$CH_3\cdot CH_2\cdot CH_2I$....	169.98
26	isovaleriate.....	....	$(CH_3)_2\cdot CH\cdot CH_2\cdot COO\cdot C_3H_7$	144.17
27	mercaptan......	....	$CH_3\cdot CH_2\cdot CH_2SH$..	76.14
28	naphthylamine(α)	....	$C_{10}H_7\cdot NH\cdot C_3H_7$...	185.20
29	nitramine......	....	$C_3H_7\cdot NH(NO_2)$....	104.10
30	nitrate.........	....	$C_3H_7\cdot NO_3$.........	105.08
31	nitrite.........	....	$C_3H_7\cdot NO_2$.........	89.08
32	phenol (m.)....	....	$C_3H_7\cdot C_6H_4\cdot OH$....	136.14
33	phenyl ketone..	butyro-phenone..	$C_3H_7\cdot CO\cdot C_6H_5$....	148.15
34	propionate.....	....	$C_2H_5\cdot COO\cdot C_3H_7$...	116.13
35	sulphide.......	....	$(C_3H_7)_2S$..........	118.21
36	tartrate........	....	$C_4H_4O_6\cdot (C_3H_7)_2$....	228.15
37	urea...........	....	$C_3H_7\cdot NH\cdot CO\cdot NH_2$	102.12
38	Propylene.......	....	$CH_3\cdot CH : CH_2$.....	42.06
39	bromide........	dibrompropane...	$CH_3\cdot CHBr\cdot CH_2Br$.	201.96
40	chloride........	dichlorpropane...	$CH_3\cdot CHCl\cdot CH_2Cl$.	112.98
41	glycol (α)......	....	$CH_3\cdot CH(OH)\cdot CH_2OH$	76.08
42	oxide..........	....	$CH_3\cdot (CH\cdot CH_2)\cdot O$	58.06
43	Protocatechuic	....	$(HO)_2\cdot C_6H_3\cdot COOH$	172.10
44	acid (3, 4, 1)		$+H_2O$	
45	aldehyde (3, 4, 1)	....	$(HO)_2\cdot C_6H_3\cdot CHO$..	138.08
46	Pseudo-cumene...	trimethyl benzene (uns.)	$C_6H_3\cdot (CH_3)_3$ (1, 2, 4)	120.14
47	Pseudo-cumidine.	....	$(CH_3)_3\cdot C_6H_2\cdot NH_2$ (1, 2, 4, 5)	135.16
48	Pulegone........	....	$C_{10}H_{16}O$...........	152.18
49	Purine..........	....	$C_5H_4N_4$...........	120.10

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. leaf.	....	104	.....	$0.42^{24°}$	v. s.	v. s.
2	colorl. liq.	$0.987^{20°}$	−22	140.7	∞	∞	∞
3	colorl. liq.	$0.807^{20°}$	−81	48.8	$20^{20°}$	∞	∞
4	colorl. liq.	1.017	......	168.6	dec.	dec.	....
5	colorl.	....	145	......	0.06 c.; $1.4^{100°}$	v. s.	v. s.
6	colorl. liq.	$0.891^{18°}$	......	102	$2.36^{20°}$	∞	∞
7	colorl. liq.	....	......	48–9	i.	......	s.
8	colorl. liq.	$0.804^{20°}$	......	97.4	∞	∞	∞
9	colorl. liq.	$0.719^{20°}$	......	49	s.	......	....
10	liq.	$0.949^{18°}$	......	222	......	......	....
11	colorl. liq.	$0.862^{20°}$	......	158	i.	s.	s.
12	colorl. liq.	1.032	......	229.5	v. sl. s.	∞	∞
13	leaf. f. al.	....	58	272	s.	v. s.	v. s.
14	colorl. leaf.	....	......	140	sl. s. h.	v. s.	v. s.
15	liq.	1.364	......	71.5	$0.25^{20°}$	∞	....
16	colorl. liq.	0.879	......	143	......	∞	∞
17	colorl. pr.	....	53 (60)	194–5	v. s.	v. s.	s.
18	colorl. liq.	$0.895^{18°}_{18}$	......	46.5	$0.27^{20°}$	∞	∞
19	colorl. liq.	$0.859^{20°}$	......	36.5	......	∞	∞
20	....	$0.794^{20°}$	......	118	sl. s.	∞	∞
21	colorl. liq.	$0.744^{21°}$	......	90.7	s.	∞	∞
22	colorl. liq.	$0.901^{20°}$	......	81	$2.87^{20°}$	∞	∞
23	colorl. liq.	$0.824^{20°}$	−9	267	v. sl. s.	∞	∞
24	need. f. eth.	....	abt. 46	......	......	......	....
25	....	1.748	......	102.4	$0.11^{20°}$	∞	∞
26	colorl. liq.	....	......	153–6	i.	∞	∞
27	liq.	....	......	67–8	v. sl. s.	s.	s.
28	oil	....	......	abt. 317	i.	......	....
29	....	$1.103^{15°}$	−21	128^{40mm}	sl. s.	v. s.	v. s.
30	liq.	1.063	......	110.5	......	s.	s.
31	liq.	$0.935^{21°}$	......	57	......	s.	s.
32	colorl.	....	26	228	v. sl. s.	s.	....
33	colorl. liq.	$1.009^{0°}$	8.5	220–2	i.	s.	....
34	colorl. liq.	....	......	122.4	0.5	∞	∞
35	....	0.814	......	141.5–2.5	i.	s.	s.
36	liq.	$1.134^{20°}$	......	303	i.	v. s.	v. s.
37	colorl.	....	107	......	s.	......	....
38	colorl. gas.	1.498 (A)	......	−50.2	44.6 c.c.	1250 c.c.	....
39	colorl. liq.	1.931	......	141.6	$0.25^{20°}$	s.	v. s.
40	colorl. liq.	1.166	......	96.8	$0.27^{20°}$	v. s.	v. s.
41	colorl. liq.	$1.051^{0°}$	......	188	......	......	....
42	colorl. liq.	0.859	35	......	33	∞	∞
43	colorl.	$1.542^{4°}$	199 d.	......	s.	v. s.	s.
44	monocl.	anh.					
45	colorl. tab.	....	153–4	dec.	5	v. s.	v. s.
46	colorl. liq.	$0.879^{20°}$	−57.5	169.8	i.	......	....
47	colorl. need. f. al.	....	66	234–5	......	s.	....
48	colorl. liq.	0.932	......	221–2	i.	∞	∞
49	mic. need. f. al.	....	216–7	dec.	v. s.	s.	v. sl. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Purpurine (1, 2, 4)	trioxyanthraquinone	$C_6H_4\cdot(CO)_2\cdot C_6H\cdot(OH)_3$	256.13
2	Pyrantin........	....	$C_{12}H_{13}O_3N$........	219.17
3	Pyrazine........	....	$C_4H_4N_2$...........	80.07
4	Pyrazole........	....	$C_3H_4N_2$...........	68.07
5	Pyrazoline.......	....	$C_3H_6N_2$...........	70.08
6	Pyrene..........	....	$C_{16}H_{10}$............	202.16
7	Pyridazine.......	....	$C_4H_4N_2$...........	80.07
8	Pyridine.........	....	C_5H_5N............	79.08
9	sulphonic acid (3)	....	$C_5H_4N\cdot SO_3H$......	159.14
10	Pyridone.	See *hydroxypyridine*		
11	Pyrocatechin.	See *catechol*		
12	Pyrocoll.........	....	$C_4H_3N\cdot(CO)_2\cdot NC_4H_3$	186.12
13	Pyrogallol.......	pyrogallic acid...	$C_6H_3\cdot(OH)_3$ (1, 2, 3)	126.08
14	trimethyl ether .	....	$C_6H_3\cdot(OCH_3)_3$ (1, 2, 3)	168.14
15	Pyromellitic acid.	benzene tetracarbonic acid (1, 2, 4, 5)	$C_6H_2\cdot(COOH)_4 + 2H_2O$	290.13
16	Pyromucic acid..	....	$C_4H_3O\cdot COOH$.....	112.06
17	Pyrone..........	....	$C_5H_4O_2$...........	96.06
18	Pyrotartaric acid.	....	$CH_3\cdot CH(COOH)\cdot CH_2\cdot COOH$	132.09
19	Pyrrol..........	....	$C_4H_4:NH$.........	67.07
20	Pyrrolidine......	pentazane.......	$C_4H_8:NH$.........	71.10
21	Pyrroline........	....	$C_4H_6:NH$.........	69.09
22	Pyruvic acid.....	pyroracenic acid..	$CH_3\cdot CO\cdot COOH$...	88.05
23	Quercite (d.).....	....	$C_6H_7\cdot(OH)_5$.......	164.13
24	Quercitrine......	....	$C_{21}H_{22}O_{12}+2H_2O$...	502.31
25	Quinaldine. See	*methyl quinoline* (2)		
26	Quinhydrone.....	....	$C_6H_4\cdot O_2\cdot C_6H_4\cdot(OH)_2$	218.14
27	Quinic acid......	....	$(HO)_4\cdot C_6H_7\cdot COOH$	192.13
28	Quinine.........	....	$C_{20}H_{24}O_2N_2$........	324.31
29	hydrochloride...	....	$C_{20}H_{24}O_2N_2\cdot HCl + 2H_2O$	396.81
30	sulphate.......	....	$(C_{20}H_{24}O_2N_2)_2H_2SO_4 + 7H_2O$	872.81
31	Quinol..........	hydroquinone....	$C_6H_4\cdot(OH)_2$ (p.)...	110.08
32	Quinoline........	....	C_9H_7N............	129.11
33	Quinolinic acid...	pyridine dicarbonic acid (2, 3)	$C_5H_3N\cdot(COOH)_2$..	167.09
34	Quinone.........	benzoquinone....	$C_6H_4\cdot O_2$	108.06
35	Racemic acid....	....	$[CH(OH)\cdot COOH]_2 + H_2O$	168.08

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	red need. f. al.	....	256	dec.	s.	s.	s.
2	pr. f. al.	....	155	......	$0.075^{17°}$; $1.2^{100°}$	v. s. h.	i.
3	pr. f. w.	....	47	118	∞	v. s.	v. s.
4	need f. al.	....	69.5–70.0	186–8	v. s.	v. s.	v. s.
5	colorl. liq.	....	......	144	∞	∞	....
6	monocl. tab.	....	148–9	......	i.	1.4	v. s.
7	colorl. liq.	$1.111\frac{18°}{18}$	−8	206	∞	v. s.	v. s.
8	liq.	0.990	......	115	∞	∞	∞
9	need.	....	......	......	v. s.	v. sl. s.	i.
10							
11							
12	yel. leaf.	....	268.9	subl.	i.	v. sl. s.	v. sl. s.
13	need. or leaf.	....	133	293 d.	v. s.	$100^{25°}$	v. s.
14	colorl. need.	....	47	235 (241)	......	v. s.	v. s.
15	triclinic tab.	....	anh. 264 d.	......	$14.2^{16°}$	v. s.	....
16	monocl.	....	132–4	subl.	$3.6^{15°}$; v. s. h.	v. s.	v. s.
17	prisms	....	32.5	315	v. sl. s.	s.	v. s.
18	triclinic	1.411	112 (118)	......	v. s.	v. s.	v. s
19	colorl. liq.	$0.967^{21°}$	......	130	i.	v. s.	v. s.
20	colorl. liq.	$0.852^{22.5°}$	......	87.5–8.5	∞	∞	∞
21	liq.	$0.910^{20°}$	......	90	v. s.	∞	∞
22	colorl.	$1.288^{18°}$	13.6	165 sl. d.	∞	∞	∞
23	colorl. monocl.	$1.585^{13°}$	234 (225)	......	10 c.	sl. s.	i.
24	yel. need. or leaf.	....	168 d.	......	v. sl. s.	sl. s.	0.8
25							
26	dk. gr'n. pr.	....	......	subl.	s. h.	v. s.	v. s.
27	colorl. monocl.	1.637	161.6	dec.	$40^{9°}$	s.	v. sl. s.
28	silky need. f. bz.	....	174–5	......	$0.057^{25°}$	166	22
29	silky need.	....	156–190	......	$5.6^{25°}$	$166^{25°}$	$0.42^{25°}$
30	silky need.	....	205 ($2H_2O$)	......	$0.14^{25°}$	$1.16^{25°}$	sl. s.
31	hex. pr. f. w.	....	169	285	$5.9^{15°}$	v. s.	v. s.
32	colorl. liq.	1.090	−22.6	236.2	sl. s.	∞	∞
33	monocl. pr.	....	231 d.	......	$0.55^{6.5°}$	sl. s.	v. sl. s.
34	yel. pr. f. w.	1.31	115.7	subl.	sl. s.	v. s.	v. s.
35	colorl. tricl.	....	205–6	......	$20.6^{20°}$	2.1 c.	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Raffinose........	....	$C_{18}H_{32}O_{16}+5H_2O$...	594.43
2	Resorcinol.......	dihydroxybenzene (m.)	$C_6H_4\cdot(OH)_2$ (m.)...	110.08
3	dimethyl ether..	....	$C_6H_4\cdot(OCH_3)_2$.....	138.12
4	Retene..........	....	$C_{18}H_{18}$...........	234.23
5	Rhamnose.......	isodulcite........	$C_6H_{12}O_5+H_2O$.....	182.14
6	Ricinoleïc acid...	....	$C_{18}H_{34}O_3$..........	298.36
7	Rosaniline.......	....	$C(OH)\cdot(CH_3\cdot C_6H_3\cdot NH_2)\cdot(C_6H_4\cdot NH_2)_2$	319.30
8	Rosolic acid.....	....	$C_{20}H_{16}O_3$..........	304.23
9	Rufigallic acid...	....	$C_{14}H_2O_2\cdot(OH)_6$....	304.13
10	Sabinene........	....	$C_{10}H_{16}$............	136.18
11	Saccharine.......	....	$C_7H_5O_3NS$.........	183.15
12	Safrol...........	....	$C_{10}H_{10}O_2$..........	162.13
13	Salicin..........	....	$C_{13}H_{13}O_2\cdot(OH)_5$....	286.21
14	Salicyl amide....	....	$HO\cdot C_6H_4\cdot CO\cdot NH_2$ (o.)	137.10
15	Salicylic acid.....	....	$HO\cdot C_6H_4\cdot COOH$ (o.)	138.08
16	aldehyde.......	....	$HO\cdot C_6H_4\cdot CHO$ (o.)	122.08
17	Saligenin........	....	$HO\cdot C_6H_4\cdot CH_2OH$ (o.)	124.10
18	Salipyrine.......	antipyrene salicylate	$C_{18}H_{18}O_4N_2$........	326.25
19	Salol.	See *phenyl salicytate*		
20	Santonin........	....	$C_{15}H_{18}O_3$..........	246.22
21	Sarcolactic acid ..	paralactic acid...	$CH_3\cdot CH(OH)\cdot COOH$	90.06
22	Sarcosine........	methyl glycine...	$CH_3NH\cdot CH_2\cdot COOH$	89.08
23	Sebacic acid.....	....	$(CH_2)_8\cdot(COOH)_2$...	202.19
24	Semicarbazide....	....	$NH_2\cdot CO\cdot NH\cdot NH_2$.	75.07
25	hydrochloride...	....	$NH_2\cdot CO\cdot NH\cdot NH_2\cdot HCl$	111.54
26	Silver fulminate..	....	$Ag_2C_2N_2O_2$........	299.79
27	Skatole..........	methyl indole (3).	C_9H_9N............	131.13
28	Sobrerol (d. or l.)	pinol hydrate....	$C_{10}H_{18}O_2$..........	138.19
29	Sorbic acid......	....	$CH_3\cdot CH:CH\cdot CH:CH\cdot COOH$....	112.06
30	Sorbinose........	....	$C_6H_{12}O_6$...........	180.13
31	Sorbite (d.)	....	$C_6H_{14}O_6+\frac{1}{2}H_2O$....	191.15
32	Sparteine........	....	$C_{15}H_{26}N_2$..........	234.30
33	bisulphate......	....	$C_{15}H_{26}N_2\cdot H_2SO_4+5H_2O$	422.45
34	Starch..........	....	$(C_6H_{10}O_5)x$........	(162.11)x
35	Stearic acid......	....	$CH_3\cdot(CH_2)_{16}\cdot COOH$	284.38
36	Stearine.........	tristeraine.......	$(C_{18}H_{35}O_2)_3C_3H_5$....	891.20
37	Stearolic acid....	....	$C_{18}H_{32}O_2$..........	280.35

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 10 c.c. of Water	Alcohol	Ether
1	need.	1.465	118–9 anh.	......	$14^{20°}$	v. s.	....
2	colorl. tab.	1.272	116	276.5	v. s.	v. s.	v. s.
3	colorl. liq.	$1.080^{0°}$	......	214–5	v. sl. s.	s.	s.
4	leaf.	1.13	98.5	390	......	v. s. h.	s.
5	colorl. f. w.	1.471	92–3	......	50 c.	v. sl. s.	....
6	colorl.	0.945	16–7	......	i.	∞	∞
7	red need. or tab.	....	......	......	sl. s.	s.	s.
8	red leaf.	....	270	dec.	v. sl. s.	v. s. h.	s.
9	or. red	....	......	......	i.	s. conc. H_2SO_4	s.; s. alk.
10	colorl. liq.	$0.840^{20°}$	......	162–66	i.	∞	∞
11	colorl. monocl.	....	220 d.	......	$0.43^{25°}$	3.1	....
12	colorl.	1.108	11	233	i.	v. s.	v. s.
13	colorl. leaf.	1.43	201	......	$3.6^{15°}$	s.	i.
14	colorl. leaf.	....	138 (140)	270 d.	sl. s.	s. Na_2CO_3 sol.	......
15	colorl. need.	....	158	......	$0.27^{20°}$	$46.85^{25°}$	$47.68^{25°}$
16	....	$1.173^{13°}$	−10	196.5	sl. s.	v. s.	v. s.
17	colorl. rhomb.	$1.161^{25°}$	86	subl.100	v. s.	v. s.	v. s.
18	cryst. powd.	....	92	......	$0.5^{15°}$; $4.0^{100°}$	v. s. chl.	s.
19							
20	colorl. pr.	1.187	169–70	......	0.02 c.; 0.4 h.	s.	sl. s.
21	liq.	....	......	......	∞	∞	∞
22	rhomb.	....	210 d.	......	v. s.	sl. s.	....
23	thin colorl. leaf.	....	133–3.5	295^{100mm}	$0.1^{17°}$ $2.0^{100°}$	v. s.	v. s.
24	pr. f. al.	....	96	......	v. s.	s.	s. bz.
25	prisms	....	175 d.	......	v. s.	i. abs.	i.
26	sm. need.	....	exp.	......	sl. s.	s. NH_4OH	i. HNO_3
27	leaf. f. lgr.	....	95	265–6	0.05 c.	v. s.	....
28	colorl.	....	150	270–1	$3.3^{15°}$	v. s.	v. s.
29	colorl. need. f. w.	....	134.5	228 d.	sl. s.	v. s.	v. s.
30	colorl. rhomb.	1.654	164	......	200	v. sl. s. h.	....
31	colorl.	....	110–11	......	s.	v. sl. s.	....
32	colorl. oil.	$1.020^{20°}$	......	abt. 328 d.	v. sl. s.	v. s.	v. s.
33	rh'b'dr.	....	136	......	$91^{25°}$	$42^{25°}$	i.
34	wh. amor.	1.5	no m. p.	......	i.	i.	i.
35	colorl. leaf.	$0.843^{80°}$	69.3	291^{100mm}	i.	2.5 c.	v. s.
36	colorl.	$0.862^{80°}$	71–1.5	......	i.	v. sl. s.	s.
37	colorl. pr. f. al.	....	48	260	i.	sl. s. c.	v. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Stilbene.........	diphenyl ethylene	$C_6H_5 \cdot CH : CH \cdot C_6H_5$	180.17
2	Strychnine.......	....	$C_{21}H_{22}O_2N_2$........	334.30
3	hydrochloride...	....	$C_{21}H_{22}O_2N_2 \cdot HCl + 1\frac{1}{2}H_2O$	397.79
4	nitrate.........	....	$C_{21}H_{22}O_2N_2 \cdot HNO_3$.	397.32
5	sulphate.......	....	$(C_{21}H_{22}O_2N_2)_2 \cdot H_2SO_4 + 5H_2O$	856.76
6	Suberic acid.....	....	$(CH_2)_6 \cdot (COOH)_2$...	174.15
7	Suberone........	cycloheptanone...	$C_7H_{12}O$...........	112.13
8	Succinamide.....	....	$NH_2 \cdot CO \cdot CH_2 \cdot CH_2 \cdot CO \cdot NH_2$	116.10
9	Succinic acid.....	....	$HOOC \cdot CH_2 \cdot CH_2 \cdot COOH$	118.07
10	anhydride......	....	$(CH_2 \cdot CO)_2 \cdot O$.....	100.05
11	Succinimide......	....	$C_4H_5O_2N + H_2O$....	117.08
12	Succinonitrile.....	See *ethylene cyanide*		
13	Succinyl chloride.	....	$ClOC \cdot CH_2 \cdot CH_2 \cdot COCl$...........	154.97
14	Sucrose.........	cane sugar.......	$C_{12}H_{22}O_{11}$.........	342.24
15	Sulphamine benzoic acid (o.)	....	$NH_2 \cdot SO_2 \cdot C_6H_4 \cdot COOH$	201.16
16	Sulphanilic acid..	aminobenzene sulphonic acid (p.)	$NH_2 \cdot C_6H_4 \cdot SO_3H$ (p.) $+ H_2O$	191.17
17	Sulphoacetic acid	....	$SO_3H \cdot CH_2 \cdot COOH + H_2O$	158.12
18	Sulphobenzid....	....	$(C_6H_5)_2 \cdot SO_2$.......	218.20
19	Sulphobenzoic acid (o.)	....	$SO_3H \cdot C_6H_4 \cdot COOH + 3H_2O$	256.18
20	Sulphobenzoic acid (m.)	....	$SO_3H \cdot C_6H_4 \cdot COOH + 2H_2O$	236.16
21	Sulphobenzoic acid (p.)	....	$SO_3H \cdot C_6H_4 \cdot COOH + 3H_2O$	256.18
22	Sulphocyanic acid	thiocyanic acid...	CNSH............	59.08
23	Sulphonal.......	acetone diethyl sulphone	$(CH_3)_2C(SO_2C_2H_5)_2$	228.28
24	Tannic acid......	tannin..........	$C_{14}H_{10}O_9$.........	322.15
25	Tartaric acid (i.)..	mesotartaric acid.	$HOOC(CHOH)_2 \cdot COOH + H_2O$	168.08
26	" " (d. or l.)	....	$HOOC(CHOH)_2 \cdot COOH$	150.07
27	Tartronic acid...	....	$CH(OH) \cdot (COOH)_2 + \frac{1}{2}H_2O$	129.06
28	Terephthalic acid.	....	$C_6H_4 \cdot (COOH)_2$ (p.)	166.09
29	aldehyde.......	....	$C_6H_4 \cdot (CHO)_2$ (p.)..	134.09
30	nitrile.........	....	$C_6H_4 \cdot (CN)_2$ (p.)...	128.09
31	Terpinene.......	....	$C_{10}H_{16}$...........	136.18
32	Terpineol........	....	$C_{10}H_{18}O$..........	154.19
33	Terpine hydrate..	....	$C_{10}H_{20}O_2 + H_2O$.....	190.23

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. tab.	....	124	306–7	i.	sl. s.	v. s.
2	tetr. f. al.	....	abt. 268 d.	......	$0.016^{25°}$	0.9	0.018
3	colorl. trim.	....	......	......	2.9 c.	1.7	....
4	colorl. need.	....	dec.	......	$2.4^{25°}$	$0.83^{25°}$	$0.64^{25°}$ chl.
5	colorl. pr.	....	anh. 200	......	$3.2^{25°}$	$1.5^{25°}$	i.
6	colorl. need. or tab.	....	140	abt. 300	$0.14^{16°}$	s.	v. sl. s.
7	oil	$0.969^{0°}$	......	180	sl. s.	v. s.	s.
8	colorl. need.	....	242–3	......	$0.45^{15°}$; $11^{100°}$	i.	i.
9	colorl. monocl.	1.564	185	234	$6.8^{20°}$; $121^{100°}$	sl. s.	sl. s.
10	colorl. need. f. al.	$1.104^{20°}$	119.6	......	i.	s.	v. sl. s.
11	octah'dr.	....	124	287–8	v. s.	s.	v. sl. s.
12							
13	colorl.	1.412	16–7	190–2	......	......	....
14	colorl. monocl.	$1.588^{18°}$	abt. 160–70 d.	......	200 c.	sl. s.	....
15	rh'b'dr.	....	165–7 (155)	......	v. s.	v. s.	v. s.
16	rhomb. pl.	....	d. 280	......	$0.89^{15°}$	v. sl. s.	v. sl. s.
17	tab. f. w.	....	84–6	......	s.	v. s.	i.
18	tab.	....	123–4	......	i.	sl. s.	sl. s.
19	trim.	....	anh. 250*	......	50	v. s.	i.
20	....	....	anh. 141	......	......	......	v. s.
21	need.	....	259–60	......	v. s.	v. s.	v. s.
22	liq.	....	5	......	∞	v. s.	v. s.
23	prisms	....	126	300 d.	$2^{15°}$; $6.7^{100°}$	50 h. abs.	sl. s.
24	amor. powd.	....	abt. 200	......	20	167	v. sl. s.
25	tab.	1.666	140–3 anh.	......	125 c.	......	....
26	colorl. monocl.	1.76	168–70	......	$139^{20°}$	v. s.	v. sl. s.
27	colorl. pr. f. eth.	....	185–7 d.	......	v. s.	v. s.	sl. s.
28	powd.	....	subl.	......	v. v. sl. s.	v. sl. s.	v. sl. s.
29	need. f. w.	....	116	245–8	$1.5^{100°}$	v. s.	v. sl. s.
30	colorl.	....	215 (222)	......	i.	sl. s.	sl. s.
31	colorl. liq.	$0.865^{20°}$	......	179–82	i.	∞	∞
32	colorl.	$0.936^{20°}$	25	218	i.	v. s.	v. s.
33	colorl. rhomb.	....	116–7	......	$0.5^{25°}$	10	v. s.

* The anhydride melts at 118° C.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Terpinolene		$C_{10}H_{16}$	136.18
2	Tetrabrom-ethane (sym.)		$CHBr_2 \cdot CHBr_2$	345.81
3	fluoresceïn	See *eosine*		
4	Tetrachlor-acetone (sym.)		$CHCl_2 \cdot CO \cdot CHCl_2 + 2H_2O$	231.90
5	aniline		$NH_2 \cdot C_6HCl_4$ (1, 2, 3, 4, 5)	230.90
6	benzene		$C_6H_2Cl_4$ (1, 2, 3, 4)	215.88
7	"		$C_6H_2Cl_4$ (1, 2, 3, 5)	215.88
8	"		$C_6H_2Cl_4$ (1, 2, 4, 5)	215.88
9	ethane	See *acetylene tetrachloride*		
10	ethylene		$CCl_2 : CCl_2$	165.85
11	Tetradecane (n.)		$C_{14}H_{30}$	198.31
12	Tetraethyl-ammonium hydroxide		$(C_2H_5)_4NOH$	147.22
13	benzene (sym.)		$C_6H_2 \cdot (C_2H_5)_4$ (1, 2, 4, 5)	190.25
14	urea		$(C_2H_5)_2N \cdot CO \cdot N(C_2H_5)_2$	158.22
15	Tetrahydro-benzene		C_6H_{10}	82.11
16	naphthalene		$C_{10}H_{12}$	132.15
17	naphthylamide		$C_{10}H_{11} \cdot NH_2$ (α, ar.)	147.16
18	"		$C_{10}H_{11} \cdot NH_2$ (β, ac.)	147.16
19	quinoline		$C_9H_{11}N$	133.14
20	Tetrahydroxy-benzene (sym.)		$C_6H_2 \cdot (OH)_4$ (1, 2, 4, 5)	142.08
	Tetramethyl-			
21	ammonium hydroxide		$(CH_3)_4 \cdot NOH + 5H_2O$	181.21
22	benzene (1, 2, 3, 4)		$C_6H_2 \cdot (CH_3)_4$	134.16
23	" (1, 2, 3, 5)	See *isodurene*		
24	" (1, 2, 4, 5)	durene	$C_6H_2 \cdot (CH_3)_4$	134.16
25	diamino-benzo-phenone	Michler's ketone	$(CH_3)_2N \cdot C_6H_4 \cdot CO \cdot C_6H_4 \cdot N(CH_3)_2$	268·27
26	leuco-aniline		$[(CH_3)_2 \cdot N \cdot C_6H_4]_2 \cdot CH \cdot C_6H_4 \cdot NH_2$	345.36
27	Tetramethyl-urea		$(CH_3)_2N \cdot CO \cdot N(CH_3)_2$	116.14
28	Tetramethylene-diamine		$NH_2 \cdot (CH_2)_4 \cdot NH_2$	88.14
	Tetranitro-			
29	diphenyl		$C_{12}H_6 \cdot (NO_2)_4$	334.15
30	diphenyl methane		$C_{13}H_8 \cdot (NO_2)_4$	348.17
31	methane		$C(NO_2)_4$	196.05
32	naphthalene (α)		$C_{10}H_4 \cdot (NO_2)_4$	308.12
33	" (1, 3, 6, 8)		$C_{10}H_4 \cdot (NO_2)_4$	308.12
34	" (1, 3, 5, 8)		$C_{10}H_4 \cdot (NO_2)_4$	308.12
35	phenol		$HO \cdot C_6H \cdot (NO_2)_4$ (1, 2, 3, 4, 6)	274.09

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. liq.	....	......	183–5	i.	∞	∞
2	....	2.972	<–20	......	i.	∞	∞
3							
4	....	....	48	......	......	......	....
5	....	....	118	......	v. s. bz.	v. s.	v. s.
6	need.	....	45–6	254	......	sl. s.	v. s.
7	need.	....	50–1	246	i.	v. sl. s.	....
8	monocl.	$1.858^{21°}$	140–1	243–6	......	sl. s h.	s.
9							
10	colorl. liq.	$1.608^{25°}$	–19	119	i.	∞	∞
11	" "	$0.765^{20°}$	5.5	252.5	i.	v. s.	v. s.
12	need.	....	d. 190	....	......	s.	....
13	colorl. liq.	0.888	13	250	i.	v. s.	v. s.
14	liq.	....	......	210–5	s. a.	......	....
15	colorl. liq.	....	......	82–4	......	......	....
16	colorl. liq.	$0.981^{13°}$	......	205	i.	v. s.	v. s.
17	oil	....	......	277	s. dil. a.	......	....
18	liq.	$1.034\frac{15}{15}°$	......	251–2	......	......	....
19	colorl.-br.	$1.063\frac{15}{15}°$	abt. 20	251	v. sl. s.	∞	∞
20	leaf.	....	215–20	......	s.	s.	v. s.
21	....	....	62–3	dec.	$\infty^{63°}$	v. s.	....
22	colorl.	$0.882^{9°}$	–4	204	......	......	....
23							
24	monocl. leaf.	$0.838^{81°}$	79	abt. 190	v. s. bz.	v. s.	v. s.
25	glit. leaf.	....	171.5 (174)	d. 360	......	v. s.	v. s.
26	glit. cryst.	....	151–2	......	......	v. sl. s.	....
27	liq.	0.972	......	177	......	v. s.	v. s.
28	leaf.	....	27–8	159	v. s.	......	....
29	....	....	140	......	i.	sl. s.	sl. s.
30	yel. pr. f. glac. acet. a.	....	172	......	......	i.	i.
31	....	1.650	13	126	i.	s.	s.
32	rhomb. f. chl.	....	259	exp.	v. sl. s.	v. sl. s.	v. sl. s.
33	long need. f. al.	....	203	exp.	i.	......	....
34	yel. tetr. f. acet.	....	194–5	......	v. s. acet.	sl. s.	sl. s. chl.
35	yel. need.	....	130	exp.!	v. s.	v. sl. s. bz.	v. sl. s. lgr.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Tetraphenyl-ethane (sym.)	....	$(C_6H_5)_2CH \cdot CH(C_6H_5)_2$	334.31
2	ethylene.......	....	$(C_6H_5)_2C : C(C_6H_5)_2$	332.29
3	urea...........	....	$(C_6H_5)_2N \cdot CO \cdot N(C_6H_5)_2$	220.25
4	Tetrolic acid.....	....	$CH_3 \cdot C \vdots C \cdot COOH$..	84.05
5	Tetronal........	....	$C_9H_{20}O_4S_2$.........	256.33
6	Thebaine.......	paramorphine....	$C_{19}H_{21}O_3N$........	311.27
7	hydrochloride...	....	$C_{19}H_{21}O_3N \cdot HCl + H_2O$	365.76
8	Theïne.	See *caffeïne*		
9	Theobromine....	dimethylxanthine.	$C_7H_8O_2N_4$.........	180.14
10	Theophylline.....	....	$C_7H_8O_2N_4 + H_2O$....	198.16
11	Thiazole.........	....	C_3H_3NS...........	85.11
12	Thio-acetamide...	....	$CH_3 \cdot CS \cdot NH_2$......	75.12
13	acetanilide.....	....	$C_6H_5 \cdot NH \cdot CS \cdot CH_3$.	151.18
14	acetic acid.....	....	$CH_3 \cdot COSH$........	76.10
15	benzoic acid....	....	$C_6H_5 \cdot COSH$.......	138.14
16	carbonyl chloride.	See *thio-phosgene*		
17	cyanic acid. See	*sulphocyanic acid*		
18	cyanuric acid ...	....	$C_3N_3S_3H_3$.........	177.25
19	diphenyl-amine.	....	$S \cdot (C_6H_4)_2 \cdot NH$.....	199.20
20	naphthene......	benzothiophene...	C_8H_6S............	134.15
21	phenol.........	phenyl mercaptan	$C_6H_5 \cdot SH$..........	110.14
22	phosgene.......	thiocarbonyl chloride	$CSCl_2$.............	114.99
23	semicarbazide...	....	$NH_2 \cdot CS \cdot NH \cdot NH_2$.	91.14
24	urea...........	....	$NH_2 \cdot CS \cdot NH_2$.....	76.12
25	Thiophene.......	....	C_4H_4S............	84.11
26	Thujone.........	tanacetone.......	$C_{10}H_{16}O$..........	152.18
27	Thymol.........	methyl-isopropyl phenol (3, 6)	$CH_3 \cdot C_6H_3(OH) \cdot C_3H_7$	150.16
28	Tiglic acid.......	....	$CH_3 \cdot CH : C(CH_3) \cdot COOH$	100.09
29	Tin diethyl......	....	$Sn(C_2H_5)_2$.........	176.80
30	tetraethyl......	....	$Sn(C_2H_5)_4$.........	234.90
31	tetramethyl....	....	$Sn(CH_3)_4$..........	178.82
32	Tolane..........	diphenyl acetylene	$C_6H_5 \cdot C \vdots C \cdot C_6H_5$...	178.15
33	Tolidine (o.).....	4, 4′-diamino-3, 3′-dimethyl-diphenyl	$(NH_2)CH_3 : C_6H_3 \cdot C_6H_3 \cdot CH_3(NH_2)$	212.22
34	Toluamide (o.)...	....	$CH_3 \cdot C_6H_4 \cdot CO \cdot NH_2$	135.12
35	" (m.)..	....	$CH_3 \cdot C_6H_4 \cdot CO \cdot NH_2$	135.12
36	" (p.)...	....	$CH_3 \cdot C_6H_4 \cdot CO \cdot NH_2$.	135.12
37	Toluene.........	....	$C_6H_5 \cdot CH_3$.........	92.10
38	sulphonic acid (o.)	....	$CH_3 \cdot C_6H_4 \cdot SO_3H + 2H_2O$	208.19

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. need. f. chl.	1.182	209	279–83	s. acet. a.	sl. s. h.	14 bz.
2	colorl. monocl.	....	221	415–25	i.	v. sl. s.	v. s. bz.
3	colorl.	....	183	......	i.	......	....
4	colorl. tab.	....	76	203	v. s.	v. s.	v. s.
5	glit. leaf.	....	85	......	0.22 c.	v. s.	v. s.
6	glit. pr. f. al.	....	193	......	v. sl. s.	10 c.; v. s. bz.	$0.71^{10°}$; v. s. chl.
7	rhomb.	....	......	......	......	$6.3^{10°}$	....
8							
9	rhomb. f. w.	....	337	subl.	$0.03^{18°}$; $0.67^{100°}$	$0.023^{17°}$	0.95 h. chl.
10	need. f. w.	....	264	......	$0.44^{15°}$; $1.3^{37°}$	sl. s.	sl. s.
11	colorl. liq.	$1.200^{17°}$	......	117	......	......	.....
12	monocl. tab. f. eth.	....	108	......	v. s.	s.	s.
13	need.	....	75	dec.	i.	s. alk.	....
14	colorl. liq.	$1.074^{10°}$	......	93	∞	∞	∞
15	....	....	24	......	i.	∞	∞
16							
17							
18	yel. need.	....	d. 200	......	v. s. h.	v. sl. s.	v. sl. s.
19	rhomb.	....	180	371 d.	v. s. bz.	sl. s.	s.
20	leaf......	....	31	221	....	.....	....
21	liq.	1.078	......	168	i.	v. s.	∞
22	red liq.	1.508	......	73	i.	s.	s.
23	need. f. w.	....	181–3	......	s.	......	....
24	prisms	....	180	......	9	v. sl. s.	v. sl. s.
25	liq.	1.071	......	84	i.	s.	s. H_2SO_4
26	colorl. liq.	$0.913^{20°}$	......	203	......	......	....
27	colorl. pl.	$0.979^{15°}_{15}$	49.6	228–32	$0.083^{15°}$; $0.11^{100°}$	v. s.	v. s.
28	colorl. pr.	$0.964^{76°}$	64.5	198.5	sl. s. c.; v. s. h.	s.	s.
29	oil	....	......	dec.	i.	s.	....
30	colorl. liq.	$1.187^{23°}$	......	181	i.	s.	....
31	colorl. liq.	$1.314^{0°}$	......	78	i.	......	s.
32	colorl. leaf.	....	60	275–300	......	s.	v. s.
33	colorl. sc. f. h. w.	....	129–30	......	sl. s.	v. s.	v. s.
34	colorl. need.	....	abt. 139	......	sl. s. c.; v. s. h.	v. s.	v. s.
35	....	....	94 (97)	......	sl. s.	......	....
36	colorl. need. f. w.	....	158–9 (165)	......	sl. s. c.; v. s. h.	v. s.	sl. s.
37	colorl. liq.	$0.866^{20°}$	......	111	i.	∞	∞
38	cryst.	....	......	129^{25mm}	v. s.	s.	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Toluene sulphonic acid (m.)	....	$CH_3 \cdot C_6H_4 \cdot SO_3H + H_2O$	190.14
2	" " (p.)	....	$CH_3 \cdot C_6H_4 \cdot SO_3H + 4H_2O$	244.17
3	" amide (o.)	....	$CH_3 \cdot C_6H_4 \cdot SO_2 \cdot NH_2$	171.18
4	Toluic acid (o.)...	....	$CH_3 \cdot C_6H_4 \cdot COOH$..	136.10
5	" " (m.)..	....	$CH_3 \cdot C_6H_4 \cdot COOH$..	136.10
6	" " (p.)..	....	$CH_3 \cdot C_6H_4 \cdot COOH$..	136.10
7	" anhydride (o.)	....	$(CH_3 \cdot C_6H_4 \cdot CO)_2O$	254.19
8	Toluidine (o.)....	amino-toulene (o.)	$CH_3 \cdot C_6H_4 \cdot NH_2$....	107.12
9	" (m.)....	" " (m.)	$CH_3 \cdot C_6H_4 \cdot NH_2$....	107.12
10	" (p.)....	" " (p.)	$CH_3 \cdot C_6H_4 \cdot NH_2$....	107.12
11	Tolunitrile (o.)...	....	$CH_3 \cdot C_6H_4 \cdot CN$.....	117.11
12	" (m.)..	....	$CH_3 \cdot C_6H_4 \cdot CN$.....	117.11
13	" (p.)...	....	$CH_3 \cdot C_6H_4 \cdot CN$.....	117.11
14	Toluylene diamine (2, 4)	diamino-toluene..	$CH_3 \cdot C_6H_3 \cdot (NH_2)_2$..	122.14
15	Toluylene diamine (3, 4)	" "	$CH_3 \cdot C_6H_3 \cdot (NH_2)_2$..	122.14
16	Tolyl acetic acid (o.)	....	$CH_3 \cdot C_6H_4 \cdot CH_2 \cdot COOH$	150.13
17	" " (p.)..	....	$CH_3 \cdot C_6H_4 \cdot CH_2 \cdot COOH$	150.13
18	carbinol (o.)....	....	$CH_3 \cdot C_6H_4 \cdot CH_2OH$.	122.12
19	" (m.)...	....	$CH_3 \cdot C_6H_4 \cdot CH_2OH$.	122.12
20	" (p.)....	....	$CH_3 \cdot C_6H_4 \cdot CH_2OH$.	122.12
21	chloride (o.)....	....	$CH_3 \cdot C_6H_4 \cdot CH_2Cl$..	140.57
22	" (m.)...	....	$CH_3 \cdot C_6H_4 \cdot CH_2Cl$..	140.57
23	" (p.)....	....	$CH_3 \cdot C_6H_4 \cdot CH_2Cl$..	140.57
24	hydrazine (o.)..	....	$CH_3 \cdot C_6H_4 \cdot NH \cdot NH_2$	122.12
25	" (p.)..	....	$CH_3 \cdot C_6H_4 \cdot NH \cdot NH_2$	122.12
26	hydroxylamine..	....	$CH_3 \cdot C_6H_4 \cdot NH(OH)$	123.12
27	mustard oil (o.).	....	$CH_3 \cdot C_6H_4 \cdot NCS$....	149.17
28	" " (p.).	....	$CH_3 \cdot C_6H_4 \cdot NCS$....	149.17
29	phenyl ketone. S	ee *phenyl tolyl ketone*		
30	Triacetin........	glyceryl triacetate	$(CH_3 \cdot COO)_3C_3H_5$..	218.16
31	Triamino-azobenzene	Bismarck brown..	$NH_2 \cdot C_6H_4 \cdot N_2 \cdot C_6H_3 \cdot (NH_2)_2$ (3, 2′, 4′)	227.21
32	Tribrom-acetic acid	....	$CBr_3 \cdot COOH$.......	296.78
33	aniline	....	$Br_3 \cdot C_6H_2 \cdot NH_2$ (2, 4, 6, 1)	329.83
34	benzene (sym.) .	....	$C_6H_3 \cdot Br_3$ (1, 3, 5)..	314.81
35	hydrine........	glyceryl tribromhydrine	$CH_2Br \cdot CHBr \cdot CH_2Br$	280.82
36	phenol (sym.)...	....	$HO \cdot C_6H_2Br_3$ (2, 4, 6)	330.81

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point °C	Solublity in gms. per 100 c.c. of Water	Alcohol	Ether
1	need.	....	......	......	v. s.	s.	....
2	leaf. or pr.	....	92	......	v. s.	s.	....
3	octahd'r.	....	155	......	$0.1^{9°}$	$3.6^{5°}$	....
4	colorl. need.	....	102 (104)	259	s. h.	v. s.	s. chl.
5	colorl. pr. f. w.	....	110.5	263	$1.67^{100°}$	v. s.	v. s.
6	colorl. need.	....	176–7	275	s. h.	v. s.	v. s.
7	colorl. f. eth.	....	36–7	abt. 325	......	......	....
8	liq.	$1.003^{15°}_{15}$	......	199.5	sl. s.	∞	∞
9	"	$0.989^{20°}$	......	203	sl. s.	∞	∞
10	leaf.	....	42.9 (45)	200.5	$0.74^{21°}$	......	....
11	liq.	0.998	......	205.2	i.	∞	∞
12	"	....	......	208–10	0.085 c.; 1.67 h.	......	....
13	....	....	38 (29.5)	217.3	i.	v. s.	v. s.
14	colorl. need. f. lgr.	....	99	280	s.	v. s.	v. s.
15	colorl. sc.	....	88.5	265	s.	......	....
16	colorl. need.	....	88–9	......	v. s. h.	......	....
17	colorl. need.	....	91	266	sl. s. c.; v. s. h.	......	....
18	colorl. need.	$1.023^{40°}$	34	223	1 c.	v. s.	v. s.
19	colorl. liq.	$1.036^{0°}$	<–20	217	5 c.	......	s.
20	colorl. need.	....	59	217	sl. s. c.	v. s.	v. s.
21	colorl. liq.	....	......	197–9	i.	v. s.	v. s.
22	....	....	......	195–6	i.	v. s.	v. s.
23	....	....	......	200	i.	v. s.	v. s.
24	colorl. tab. f. lgr.	....	56	......	v. s. chl.	v. s.	v. s.
25	colorl. leaf.	....	65–6 (61)	240–4 d.	v. s. bz.	v. s.	v. s.
26	colorl. leaf. f. bz.	....	94	......	1 c.; 50 h.	v. s.	v. s.
27	....	....	......	238–9	i.	v. s.	∞
28	....	....	26–7	242.4	i.	v. s.	v. s.
29							
30	colorl. liq.	$1.161^{15°}_{5}$	......	258–9	sl. s.	∞	∞
31	or. red.	....	143.5	......	......	v. s.	v. s.
32	colorl. lab.	....	135	245 d.	v. s.	v. s.	v. s.
33	sm. need.	....	119	......	i.	sl. s.	s.
34	need.	....	119.6	278	i.	sl. s. h.	....
35	prisms	$2.436^{23°}$	16	220	i.	......	....
36	monocl. pr.	....	92(96)	subl.	sl. s.	v. s.	s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Tribrom-resorcinol......	....	$(HO)_2 \cdot C_6H \cdot Br_3$ (2, 4, 6)	346.81
2	Tributyl amine...	....	$(C_4H_9)_3N$..........	185.29
3	Tributyrine......	See *butyrene*		
4	Tricarballylic acid	....	$(CH_2 \cdot COOH)_2 \cdot CH \cdot COOH$	176.09
5	Trichlor-acetal...	....	$CCl_3 \cdot CH(OC_2H_5)_2$..	221.50
6	acetamide......	....	$CCl_3 \cdot CO \cdot NH_2$.....	162.41
7	acetic acid.....	....	$CCl_3 \cdot COOH$.......	163.39
8	acetyl chloride..	....	$CCl_3 \cdot COCl$	181.85
9	benzene........	....	$C_6H_3Cl_3$ (1, 2, 4)...	181.43
10	ethane (α).....	....	$CCl_3 \cdot CH_3$.........	133.41
11	" (β).....	....	$CH_2Cl \cdot CHCl_2$.....	133.41
12	ethyl alcohol....	....	$CCl_3 \cdot CH_2OH$......	149.41
13	ethylene........	....	$CHCl : CCl_2$.......	131.40
14	hydrine........	glyceryl trichlor-hydrine	$CH_2Cl \cdot CHCl \cdot CH_2Cl$	147.44
15	hydroquinone...	....	$(HO)_2 \cdot C_6H \cdot Cl_3$ (2, 3, 5)	213.43
16	methane........	See *chloroform*		
17	methyl-chloro-formate	diphosgene......	$Cl \cdot COO \cdot CCl_3$	197.85
18	phenol.........	....	$HO \cdot C_6H_2 \cdot Cl_3$ (2, 4, 6)	197.43
19	propane (1, 2, 3).	See *trichlorhydrine*		
20	quinone........	....	$O_2 \cdot C_6H \cdot Cl_3$ (2, 3, 5)	211.42
21	Tricyanogen chloride	cyanuric chloride	$C_3N_3Cl_3$...........	184.43
22	Tridecane (n.)...	....	$C_{13}H_{28}$............	184.29
23	Tridecylene......	....	$C_{13}H_{26}$............	182.28
	Triethyl			
24	amine.........	....	$(C_2H_5)_3N$..........	101.16
25	arsine.........	....	$(C_2H_5)_3As$.........	162.11
26	benzene (sym.)..	....	$C_6H_3 \cdot (C_2H_5)_3$ (1, 3, 5)	162.20
27	carbinol........	....	$(C_2H_5)_3 \cdot COH$......	116.16
28	phosphine......	....	$(C_2H_5)_3 \cdot P$.........	118.19
29	phosphite......	....	$(C_2H_5)_3PO_3$........	166.19
30	Trihydroxy-benzoic acid	pyrogallol carboxylic acid....	$HOOC \cdot C_6H_2 \cdot (OH)_3$ (2, 3, 4)	170.08
31	glutaric acid (d. or l.)	....	$COOH \cdot (CHOH)_3 \cdot COOH$	180.09
32	glutaric acid (i.)	....	$COOH \cdot (CHOH)_3 \cdot COOH$	180.09
33	pyridine (sym.)	....	$NC_5H_2 \cdot (OH)_3$ (2, 4, 6)	127.07
34	Triiodo-acetic acid	....	$CI_3 \cdot COOH$........	437.78
35	Triisobutyl amine	....	$(C_4H_9)_3N$..........	185.28
36	Trimellitic acid....	....	$C_6H_3 \cdot (COOH)_3$ (1, 2, 4)	210.09
37	Trimesic acid (sym.)	....	$C_6H_3 \cdot (COOH)_3$ (1, 3, 5)	210.09
38	Trimethyl-acetic acid	....	$(CH_3)_3C \cdot COOH$....	102.11

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	need.	....	111	......	sl. s.	v. s.	s.
2	....	$0.778^{20\circ}$	......	216.5	......	v. s.	v. s.
3							
4	colorl. rhomb.	....	166	dec.	v. s.	v. s.	sl. s.
5	....	1.288	......	197	0.5	∞	∞
6	tab. f. w.	....	141	239	v. sl. s.	v. s.	v. s.
7	colorl. rhomb.	$1.630^{60\circ}$	57.3	195	v. s.	s.	s.
8	colorl. liq.	....	......	118	......	......	......
9	colorl.	$1.466^{10\circ}$	16–17	213	i.	......	......
10	colorl. liq.	$1.325^{26\circ}$	......	74.5	i.	∞	∞
11	" "	$1.478^{0\circ}$	......	114	i.	∞	∞
12	rhomb. tab.	$1.550^{23\circ}$	18	151	sl. s.	∞	∞
13	colorl. liq.	$1.460^{25\circ}_{25}$	–70	87.1	i.	∞	∞
14	....	1.417	......	158	i.	......	......
15	prisms	....	134	subl.	$0.6^{15\circ}$	v. s.	v. s.
16							
17	....	....	......	127.5–80	......	......	......
18	rhomb.	....	68	244	$0.08^{25\circ}$	v. s.	v. s.
19							
20	yel. leaf.	....	165–6	......	i.	sl. s.	v. s.
21	....	....	146	190	sl. s.	v. s.	v. s.
22	colorl. liq.	$0.757^{20\circ}$	–6.2	234	i.	v. s.	v. s.
23	" "	0.845	......	233	i.	v. s.	v. s.
24	colorl. liq.	0.733	......	89	v. s.	∞	∞
25	....	1.151	......	140 d.	......	......	......
26	colorl. liq.	$0.864^{17\circ}$	......	214–8	i.	v. s.	v. s.
27	colorl. liq.	$0.840^{20\circ}$	......	140–2	sl. s.	s.	s.
28	colorl. liq.	0.812	......	127	i.	s.	s.
29	....	....	......	155.5–6.5	i.	v. s.	v. s.
30	need. f. w.	....	d. 195–200	......	$0.13^{12\circ}$	s.	v. s.
31	colorl. f. acet.	....	128	......	v. s.	v. s.	s. acet.
32	colorl. tab. f. acet.	....	152 d.	......	v. s.	v. s. h.	s. acet.
33	cryst.	....	d. 220–30	......	s.	......	......
34	yel. leaf.	....	150 d.	......	s.	......	......
35	colorl. liq.	$0.785^{21\circ}$	......	184–6	i.	v. s.	∞
36	colorl.	....	216 d. (228)	......	s. h.	......	s.
37	colorl. pr. f. w.	....	345–50	subl. <300	s.	v. s.	s.
38	colorl.	$0.905^{5\circ}$	35.5	163.7	2.2	v. s.	v. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Trimethyl-			
1	amine..........	....	$(CH_3)_3N$..........	59.10
2	amine hydro-	....	$(CH_3)_3N\cdot HCl$......	95.56
3	chloride.......			
4	arsine..........	....	$(CH_3)_3As$..........	120.06
5	benzoic acid....	....	$(CH_3)_3\cdot C_6H_2\cdot COOH$ (1, 2, 4, 5)	164.12
6	" "	β-isodurylic acid.	$(CH_3)_3\cdot C_6H_2\cdot COOH$ (1, 3, 5)	164.12
7	carbinol........	....	$(CH_3)_3COH$........	74.10
8	citrate.........	....	$C_6H_5O_7(CH_3)_3$......	234.17
9	phosphate......	....	$(CH_3)_3PO_4$.........	140.13
10	phosphine......	....	$(CH_3)_3P$...........	76.13
11	pyridine........	See *collidine* (γ)		
12	urea...........	....	$(CH_3)NH\cdot CO\cdot N(CH_3)_2$	102.12
13	Trimethylene....	cyclo-propane....	C_3H_6...............	42.06
14	glycol..........	....	$CH_2(OH)\cdot CH_2\cdot CH_2(OH)$	76.08
15	Trimyristine.	See *myristine*		
	Trinitro-			
16	benzene........	....	$C_6H_3\cdot(NO_2)_3$ (1, 2, 4)	213.08
17	" (sym.) .	....	$C_6H_3(NO_2)_3$ (1, 3, 5)	213.08
18	cresol.........	....	2, 4, 6–$(NO_2)_3\cdot C_6H\cdot CH_3(OH)$ (1, 3)	243.11
19	naphthalene....	....	$C_{10}H_5\cdot(NO_2)_3$ (1, 2, 5)	263.12
20	"	....	$C_{10}H_5\cdot(NO_2)_3$ (1, 3, 5)	263.12
21	"	....	$C_{10}H_5\cdot(NO_2)_3$ (1, 3, 8)	263.12
22	phenol (sym)....	See *picric acid*		
23	" ..	....	$HO\cdot C_6H_2\cdot(NO_2)_3$ (1, 2, 3, 6)	229.08
24	tertiary-butyl-toluene (2, 4, 6)	artificial musk...	$(NO_2)_3C_6H\cdot CH_3[C(CH_3)_3]$	283.19
25	toluene (sym.)..	"T. N. T.".....	$CH_3\cdot C_6H_2\cdot(NO_2)_3$ (1, 2, 4, 6)	227.10
26	"	....	$CH_3\cdot C_6H_2\cdot(NO_2)_3$ (1, 2, 3, 4)	227.10
27	"	....	$CH_3\cdot C_6H_2\cdot(NO_2)_3$ (1, 2, 4, 5)	227.10
28	triphenyl carbinol	....	4, 4′, 4″-$(NO_2\cdot C_6H_4)_3\cdot COH$	395.23
29	" methane	....	4, 4′, 4″-$(NO_2\cdot C_6H_4)_3\cdot CH$	379.23
30	xylene.........	....	$(CH_3)_2\cdot C_6H\cdot(NO_2)_3$ (1, 4) (2, 4, 6)	241.13
31	"	....	$(CH_3)_2\cdot C_6H\cdot(NO_2)_3$ (1, 3) (2, 4, 6)	241.13
32	Trional.........	....	$C_8H_{18}O_4S_2$.........	242.30

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. $H_2O=1$ (A) Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl.	$0.662^{-5°}$	......	3.5	v. s.	v. s.	s.
2	....	....	271–5 d.	......	v. s.	s.	i.
3							
4	liq.	....	......	<100	sl. s.	......	....
5	colorl. need. f. bz.	....	149–50	......	v. sl. s. h.	v. s.	v. s.
6	colorl.	....	152	......	v. sl. s.	v. s.	v. s.
7	colorl.	....	25	82.9	v. s.	s.	∞
8	colorl. tricl.	....	78.5–9.0	283–7 d.	......	......	....
9	....	1.220	......	197	......	s.	s.
10	....	....	......	40	i.	......	s.
11							
12	....	....	75.5	232.5	v. s.	v. s.	s.
13	gas	....	–126.6	–34	i.	v. s.	v. s.
14	visc. liq.	$1.053^{18°}$	......	214	∞	......	....
15							
16	yel.	....	57.5	......	sl. s.	......	....
17	yl. pl. f. bz.	1.688	122	......	$0.04^{16°}$	$1.9^{16°}$	v. s.
18	yel. need. f. w.	....	105–6	......	$0.22^{20°}$; $0.81^{100°}$	v. s.	v. s.
19	colorl. need. f. al.	....	112–3	......	......	s.	....
20	yel. monocl. f. chl.	....	122	......	v. s. chl.	v. s.	v. s. glac. acet. a.
21	monocl. f. chl.	....	218	......	v. sl. s. chl.	$0.046^{23°}$ (88%)	v. sl. s.
22							
23	need.	....	117	......	sl. s.	v. s.	v. s.
24	need. f. al.	....	96–7	......	......	s.	....
25	colorl. monocl. f. al.	1.654	82 (80.8)	......	0.02^{15}	v. sl. s. c. v. s. h.	sl. s.
26	leaf. f. al.	1.62	112	......	i.	sl. s. c.	v. s.
27	....	....	104	......	i.	sl. s. c.	v. s.
28	cryst. f. bz.	....	171–2	......	s. bz.	sl. s. h.	sl. s.
29	sc. f. bz.	....	206–7 (203)	......	v. sl. s. glac. acet. a.	v. sl. s. bz.	v. sl. s.
30	need.	....	139	......	v. sl. s.	......	....
31	need.	....	182	......	i.	v. sl. s. c.;	sl. s.
32	colorl. tab.	....	76	dec.	0.3	v. s.	v. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Trioxymethylene	metaformaldehyde	$C_3H_6O_3$	90.06
2	"	(isomer of above)	$C_3H_6O_3$	90.06
3	Tripalmitin	See *palmitin*		
4	Triphenyl-acetic acid		$(C_6H_5)_3C \cdot COOH$	288.23
5	amine		$(C_6H_5)_3N$	245.22
6	benzene		$C_6H_3 \cdot (C_6H_5)_3$ (1, 3, 5)	306.26
7	carbinol		$(C_6H_5)_3COH$	260.22
8	methane		$(C_6H_5)_3CH$	244.22
9	phosphine		$(C_6H_5)_3P$	262.25
10	Tripropyl-amine		$(C_3H_7)_3N$	143.22
11	Tristearine	See *stearine*		
12	Tropacocaine		$C_8H_{14}ON \cdot CO \cdot C_6H_5$	245.24
13	hydrochloride		$C_8H_{14}ON \cdot CO \cdot C_6H_5 \cdot HCl$	281.71
14	Tropine		$C_8H_{15}ON$	141.26
15	Tyrosine		$HO \cdot C_6H_4 \cdot CH_2 \cdot CH(NH) \cdot COOH$	181.14
16	Undecane (n.)		$C_{11}H_{24}$	156.25
17	Undecylene		$C_{11}H_{22}$	154.23
18	Undecylenic acid		$CH_3 \cdot C_2H_2 \cdot C_7H_{14} \cdot COOH$	184.21
19	Undecylic acid		$C_{10}H_{21} \cdot COOH$	186.23
20	Urea	carbamide	$NH_2 \cdot CO \cdot NH_2$	60.06
21	Urethane	ethyl carbamate	$NH_2 \cdot COO \cdot C_2H_5$	89.08
22	Uric acid		$C_5H_4O_3N_4$	168.10
23	Uvic acid	pyrotritartaric acid	$(CH_3)_2 \cdot C_4HO \cdot COOH$	140.10
24	Uvitic acid		$CH_3 \cdot C_6H_3 \cdot (COOH)$ (1, 3, 5)	180.11
25	Valeric acid		$CH_3 \cdot (CH_2)_3 \cdot COOH$	102.11
26	aldehyde		$C_4H_9 \cdot CHO$	86.11
27	anhydride		$(C_5H_9O)_2 \cdot O$	186.19
28	Valero nitrile	See *butyl cyanide*		
29	Vanillic acid		$CH_3O \cdot C_6H_3(OH)$ COOH (3, 4, 1)	168.10
30	alcohol		$CH_3O \cdot C_6H_3(OH)$ CH_2OH (3, 4, 1)	154.12
31	Vanilline		$CH_3O \cdot C_6H_3(OH)$ CHO (3, 4, 1)	152.10
32	Veratrol		$C_6H_4 \cdot (OCH_3)_2$ (o.)	138.12
33	Veronal		$C_8H_{12}O_3N_2$	184.16

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	wh.	....	171	......	i.	i.	i.
2	long need.	....	60–1	subl.	s.	s.	s.
3							
4	monocl. pr.	....	264 d.	......	sl. s.	s.	sl. s.
5	monocl. pr. f. eth.	....	127	347–8	s. acet.	sl. s.	v. s. bz.
6	rhomb. tab. f. eth.	1.206	169–70	......	s. bz.	sl. s.	sl. s.
7	hex. pr.	....	162	abt. 360	v. s. bz.	v. s.	v. s.
8	colorl. leaf.	$1.057\frac{25°}{25}$	92	358–9	v. s. chl.	sl. s. c.; v. s. h.	v. s.
9	monocl. pr.	....	75 (79)	abt. 360	i.	s.	v. s.
10	colorl. liq.	....	......	157	v. sl. s.	∞	s.
11							
12	glit. cryst. f. eth.	....	49	......	sl. s.	v. s.; v. s. bz.	v. s.; v. s. chl.
13	need.	....	271 (283 d.)	......	s.	......	....
14	need.	....	63	229	v. s.	v. s.	v. s.
15	sm. silky need.	....	abt. 295 d.	......	$0.04^{17°}$; $0.65^{100°}$	$0.01^{17°}$; i. abs.	i.
16	colorl. liq.	$0.741^{20°}$	–26.5	194.5	i.	∞	∞
17	colorl. liq.	$0.773^{20°}$	......	abt. 195	i.	∞	∞
18	colorl.	$0.907^{24°}$	24.5	......	......	......	....
19	scales	....	28.5	212.5_{100mm}	i.	v. s.	....
20	tetr.	1.323	132.6	dec.	v. s.	5 c.	sl. s.
21	colorl. need. f. lgr.	$0.986^{21°}$	49–50	180	v. s. c.	v. s.	v. s.
22	scales	1.85+	dec.	......	0.06 h.	i.	i.
23	colorl. need.	....	135	......	$0.25^{100°}$	v. s.	v. s.
24	colorl. need. f. w.	....	287–8	subl.	sl. s.	v. s.	v. s.
25	colorl. liq.	$0.942^{20°}$	–58.5	186–6.4	$3.7^{16°}$	∞	∞
26	colorl. liq.	$0.819^{11°}$	......	103.4	sl. s.	......	....
27	colorl. liq.	....	......	215	dec. h.	......	....
28							
29	colorl. need.	....	207	......	$0.12^{14°}$	v. s.	v. s.
30	colorl. need.	....	115	dec.	v. s. h.	v. s.	v. s.
31	colorl. need. f. w.	....	80–1	......	1. c.; 5 h.	v. s.	v. s.
32	colorl.	1.086	23	205–6	sl. s.	s.	s.
33	cryst. powd.	....	191 (182)	......	$0.69^{20°}$; $8.3^{100°}$	s.	v. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Vinyl acetic acid	....	$CH_2:CH\cdot CH_2\cdot COOH$	86.07
2	bromide.......	....	$CH_2:CHBr$.......	106.95
3	chloride........	....	$CH_2:CHCl$........	62.49
4	ether.........	....	$CH_2:CH\cdot O\cdot CH:CH_2$	70.07
5	sulphide.......	....	$CH_2:CH\cdot S\cdot CH:CH_2$	86.13
6	Xanthene.......	....	$C_{13}H_{10}O$...........	182.14
7	Xanthine........	....	$C_5H_4O_2N_4$.........	152.10
8	Xylene (o.)......	xylol (o.)........	$C_6H_4\cdot(CH_3)_2$.......	106.12
9	" (m.).....	" (m.).......	$C_6H_4\cdot(CH_3)_2$.......	106.12
10	" (p.)......	" (p.)........	$C_6H_4\cdot(CH_3)_2$.......	106.12
11	Xylenol (1, 2, 3).	....	$(CH_3)_2\cdot C_6H_3\cdot OH$...	122.12
12	" (1, 2, 4).	....	$(CH_3)_2\cdot C_6H_3\cdot OH$...	122.12
13	" (1, 3, 2).	....	$(CH_3)_2\cdot C_6H_3\cdot OH$...	122.12
14	" (1, 3, 4).	....	$(CH_3)_2\cdot C_6H_3\cdot OH$...	122.12
15	" (1, 3, 5).	....	$(CH_3)_2\cdot C_6H_3\cdot OH$...	122.12
16	" (1, 4, 3).	....	$(CH_3)_2\cdot C_6H_3\cdot OH$...	122.12
17	Xylic acid. See *di*	*methy lbenzoic acid*	(2, 4)	
18	Xylidine (1, 2, 3).	dimethyl-amino benzene (1, 2, 3)	$(CH_3)_2\cdot C_6H_3\cdot NH_2$..	121.14
19	" (1, 2, 4).	dimethyl-amino benzene (1, 2, 4)	$(CH_3)_2\cdot C_6H_3\cdot NH_2$..	121.14
20	" (1, 3, 2).	dimethyl-amino benzene (1, 3, 2)	$(CH_3)_2\cdot C_6H_3\cdot NH_2$..	121.14
21	" (1, 3, 4).	dimethyl-amino benzene (1, 3, 4)	$(CH_3)_2\cdot C_6H_3\cdot NH_2$..	121.14
22	" (1, 3, 5).	dimethyl-amino benzene (1, 3, 5)	$(CH_3)_2\cdot C_6H_3\cdot NH_2$..	121.14
23	" (1, 4, 3).	dimethyl-amino benzene (1, 4, 3)	$(CH_3)_2\cdot C_6H_3\cdot NH_2$..	121.14
24	Xylose..........	....	$C_5H_{10}O_5$..........	150.11
25	Xylyl hydrazine (1, 3, 4)	....	$(CH_3)_2C_6H_3\cdot NH\cdot NH_2$	136.14
26	Yohimbine......	....	$C_{22}H_{28}O_3N_2$........	368.35
27	Zinc ethyl.......	....	$Zn(C_2H_5)_2$.........	123.47
28	methyl.........	zinc methide.....	$Zn(CH_3)_2$..........	95.43

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O=1$ (A)Air=1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	....	....	<−20	168	s.	∞	∞
2	....	1.517	16 (23)	......	i.	∞	∞
3	....	....	......	−18	......	s.	....
4	colorl. liq.	....	......	39	......	s.	∞
5	oil	0.913	......	101	sl. s.	∞	∞
6	leaf. f. al.	....	99	312–5	v. sl. s.	sl. s.	s.
7	yel.-wh. powd.	....	>360	......	$0.067^{100°}$	$0.033^{17°}$	v. s. alk.
8	colorl. liq.	$0.881^{20°}$	−28	142	i.	v. s.	v. s.
9	colorl. liq.	$0.866^{20°}$	−54	139.2	i.	v. s.	v. s.
10	colorl. monocl.	....	15	138	i.	s.	v. s.
11	long. need. f. w.	....	75	218	s.	s.	....
12	need. f. w.	....	65	225	s.	s.	....
13	colorl. leaf.	....	49	211.2	s. h.	s.	....
14	colorl. need.	....	26	211.5	v. sl. s.	∞	∞
15	need. f. w.	....	64 or 68	219.5	sl. s.	s.	....
16	colorl. monocl.	1.169	74.5	211.5	s.	s.	v. s
17							
18	liq.	0.991	<−15	224–6	v. sl. s.	v. s.	v. s.
19	monocl. tab.	$1.076^{17°}$	49	225	sl. s.	v. s. lgr.	....
20	liq.	0.980	......	216 (212)	......	......	....
21	liq.	....	......	216.5 (212)	v. sl. s.	......	....
22	liq.	$0.993^{0°}$	......	220–1	......	......	....
23	....	....	15.5	217–8	v. sl. s.	0.980	....
24	need.	....	150–3	......	$117^{20°}$	v. sl. s. c.	v. sl. s.
25	need. f. eth.	....	85	......	......	......	v. s.
26	colorl. need.	....	234–4.5	......	v. sl. s.	v. s.	s.; s. chl.
27	colorl. liq.	1.18	−28	118	dec.	dec.	s.
28	....	1.39	−40	46	dec.	dec.	....

CONSTANTS OF ANIMAL

No.	Name	Specific gravity at 15.5° C.	Solidifying point °C.
1	Almond	0.9178–0.9183	− 10 to − 20
2	Beech-nut	....	....
3	Black mustard	0.916–0.920	− 17
4	Candlenut	0.925	Below − 18
5	Castor	0.960–0.9679	− 10 to − 18
6	Cocoanut	0.9259	22–14
7	Cod liver	0.923–0.930	0 to − 10
8	Corn (maize)	0.9213–0.9250	− 10 to − 15
9	Cotton seed	0.922–0.925	− 1 to 0
10	Croton	0.9375–0.9428	− 16
11	Grape seed	0.926–0.9350	− 10 to 13
12	Hazel nut	0.9146–0.9170	− 10 to − 20
13	Hemp seed	0.9255–0.9280	− 27
14	Lard oil	0.915–0.9175	− 4 to 10
15	Linseed	0.932–0.937	− 17 to − 27
16	Menhaden	0.929–0.933	− 4
17	Neat's foot	0.9133–0.9175	0 to 1.5
18	Olive	0.9150–0.9180	− 6 to 2
19	Palm	0.9210–0.9240	....
20	Palm kernel	$0.9119^{40°}$	20.5–24
21	Peach kernel	0.9180–0.9215	Below − 20
22	Peanut (Arachis)	0.917–0.9209	− 3 to 0
23	Poppy seed	0.9255–0.9268	− 18
24	Porpoise (body oil)	0.9258–0.9350	− 16
25	Pumpkin seed	0.9197	− 16
26	Rape	0.9133–0.9168	− 2 to − 10
27	Safflower (saffron)	0.9246–0.9280	− 13 to − 18
28	Seal	0.9244–0.9336	− 2 to − 3
29	Sesame	0.9203–0.9237	− 4 to − 6
30	Soja bean (Soya, Soy)	0.924–0.9279	− 8 to − 15
31	Sperm	0.875–0.8808	15.5
32	Sunflower	0.924–0.9258	− 16 to − 18.5
33	Tung (Chinese wood oil)	0.9410–0.9440	2 to 3
34	Walnut	0.9259	− 27.5
35	Whale	0.9170–0.9272	....
36	White mustard	0.9142	− 15 to − 16.3

AND VEGETABLE OILS

No.	Saponification value	Iodine value	Hehner's number	Maumené number	Acid value
1	189–193	93–104	96.2	51–53	0.5–5.0
2	....	....	....	....	....
3	174	96–110	95.1	43	1.36–7.35
4	189–195	153–164	95.5	....	8.1
5	176–184	82–90	....	46–47	0.14–14.60
6	246–268	8–9.5	88.6–90	21	5–50
7	182–189	135–198	95.3–97.5	102–115	0.36–25
8	188–193	111–130	93–96	81–86	1.35–2.86
9	193–195	106–115	95–96	75–90	0.0
10	210–215	102–106	89.0	....	....
11	178.5	96	92	53	16.2
12	192	83–90	95.6	36	....
13	192.5	148–160	....	97	....
14	195–196	65–85	96.2	41–45	....
15	189–195	175–200	95.5	103–126	0.8–10
16	190–195	150–170	....	123–128	5–8
17	194–197	66–72	....	43–49	4–10
18	185–196	75–88	95	41.5–47	1.9–50
19	200–203	52–56	91–95	....	20–185
20	244–248	10–17	87.6–96	....	5–22
21	189–193	93–109	....	42.5	....
22	189–196	83–103	95.8	45–67	0.5–5.0
23	190.1–197	132.6–136	95.2	86–88	0.7–11
24	195–225	110–120	85.5	50–61	1.2
25	188.4–190.2	120–131	96.2	....	....
26	167.7–179	94–106	95.1	51–64	1.4–13.2
27	186.6–194.4	130–150	95.4	....	....
28	178–196	129.4–152.4	95.5	....	....
29	188–193	103–115	95.7	65.5	0.23
30	190.6–192.5	124–143	95	87–88	....
31	120–147.4	70.4–96.4	....	51	13.2
32	188–194	119–135	95	72	11.2
33	190–197	156–176	96.2	....	Under 12
34	188.7–191	143–151.7	95.4	96–110	....
35	188–194	110–136	93.5	85–92	....
36	170–178	92–103	96.2	44–49	5.4

CONSTANTS OF ANIMAL

No.	Name	Refractive index	Temperature of reading	Reichert-Meissl number
1	Almond	1.4555	60°	....
2	Beech-nut	....	....	....
3	Black mustard	1.4740–1.4770	15.5	....
4	Candlenut	1.4760	25	....
5	Castor	1.4799	15	1.1
6	Cocoanut	1.4410	60	6.7–8.4
7	Cod liver	1.4800–1.4852	15	0.8–0.9
8	Corn (maize)	1.4766	15	4–5
9	Cotton seed	1.4743–1.4752	15	0.95
10	Croton	1.4757–1.4770	27	12–13.6
11	Grape seed	1.4713	25	0.35–1.9
12	Hazel nut	....	....	....
13	Hemp seed	....	....	....
14	Lard oil	1.4702–1.4720	15.5	....
15	Linseed	1.4820–1.4852	15	0.00
16	Menhaden	1.4787	25	2.2
17	Neat's foot	1.4695–1.4708	15	2.0
18	Olive	1.4698–1.4716	15	0.6
19	Palm	1.4510	60	1.0
20	Palm kernel	1.4431	60	5.0–7.6
21	Peach kernel	1.4697–1.4705	25	....
22	Peanut (Arachis)	1.4707–1.4730	15.5	....
23	Poppy seed	1.4766–1.4774	15.5	0.0
24	Porpoise (body oil)	1.4677	25	46.9
25	Pumpkin seed	1.4724–1.4738	25	....
26	Rape	1.4720–1.4757	15	0.6
27	Safflower (saffron)	1.4770	16	0.0–1.63
28	Seal	1.4776	....	0.96–1.69
29	Sesame	1.4748–1.4762	15	1.2
30	Soja (Soya, Soy)	1.4760–1.4775	15.5	....
31	Sperm	1.4646–1.4655	20	0.6
32	Sunflower	1.4611	60	....
33	Tung (Chinese wood oil)	1.5110–1.5202	20	....
34	Walnut	1.4804	....	....
35	Whale	1.4762	20	0.7–2.0
36	White mustard	1.4750	15.5	....

AND VEGETABLE OILS (Continued)

No.	Unsaponifiable matter	Insoluble Fatty Acids			
		Melting-point °C.	Solidifying-point °C.	Iodine value	Acid value
1	0.5–1.0	13–14	9.5–12	93.5–96.5	204
2	....	24	17	114	....
3	....	16.2	....	87–93	179.2
4	....	20–21	13	185.7	....
5	0.3–0.6	13	3	86.6–88.3	192.1
6	0.2	24–27	16–20	8.4–8.8	258
7	0.5–1.5	22–25	13–24	164–171	204–207
8	1.5	18–20	14–16	113–125	198.4
9	.73–1.64	35–38	32–35	111–115	201.6–203.9
10	0.55	....	18.6–19	111–112	201
11	....	23–26	18–20	99–132	187.4
12	....	22–25	19–20	87.5–90.1	200.6
13	....	19	15	141	....
14	0.3–0.5	....	....	....	....
15	....	17–24	13.3–17	179–209.8	196–198.8
16	0.61–1.60	....	....	....	....
17	0.1–0.6	28.5–30.8	26.1	62–77	201.2–206.3
18	0.46–1.0	19–27	17–22	86–90	193
19	....	47–50	....	53.3	204–207
20	0.5	25–28.5	20–25	12	251–265
21	....	10–18.9	13.0–13.5	94.1–101.9	205–209.9
22	0.54–0.94	27–32	28–29	95.5–103.4	201.6
23	0.43	20.5	16.2	139	199
24	3.7	....	....	126	207
25	....	26.5–29.8	....	....	....
26	0.58–1.0	16–22	16–18.5	100–106	....
27	....	16–16.5	16	132.5–148.2	199
28	0.38–1.4	23–33	13–17	186.5–201.8	190.4–198
29	0.95–1.32	23–32	22.9–23.8	109–112	196–201.6
30	....	26–29	21.2	122	....
31	39–42	13.3–21.4	16.1	88–99	23.6
32	0.31	22–24	17–18	124–134	201.6
33	0.4–1.3	40–43.8	31.2–37	145–159.4	188.8
34	0.5–1.0	15–20	16	150	....
35	0.5–3.3	14–18	23	130.3–132	....
36	....	12–16	9–10	94.7–110.4	181–185.8

CONSTANTS OF

No.	Name	Specific Gravity	°C	Solidifying point
1	Beef marrow	0.9311–0.938	15	31–29
2	Beef tallow	0.943–0.952	15	35–27
3	Beeswax	0.962–0.970	15	60.5–63.4
4	Bone fat	0.914–0.916	15.5	15–17
5	Butter fat	0.936–0.942	15.5	19–24.5
6	Carnaüba wax	0.990–1.0	15.5	80–87
7	Chinese vegetable tallow	0.918	15	24–35
8	Cocoa butter	0.950–0.976	15	21.5–27.3
9	Cotton seed stearin	0.9188–0.923	15.5	16–22
10	Goose (domestic)	0.9229–0.9300	15	18–20
11	Goose (wild)	0.9158	15	18–20
12	Hare fat	0.9349	15	17–23
13	Horse fat	0.916–0.922	15	20–45
14	Human fat	0.9179	15	15
15	Insect (Chinese) wax	0.970	15	80.5–81
16	Japan wax (tallow)	0.975	15	48.5–50.8
17	Lard (hog fat)	0.934–0.938	15	27.1–29.9
18	Laurel (bayberry) oil	0.9332	15	24–25
19	Mutton tallow	0.937–0.953	15	36–41
20	Myrtle wax	0.995	15	39–45
21	Nutmeg (mace) butter	0.945–0.996	15	40–44
22	Rabbit fat (tame)	0.9342	15	22–24
23	Rabbit fat (wild)	0.9393	15	17–22
24	Spermaceti	0.905–0.960	15	42–49
25	Sperm oil	0.875–0.8808	15.5	15.5
26	Wool wax	0.9413–0.9449	17	30–30.2

No.	Name	Refractive index	°C	Reichert-Meissl number
1	Beef marrow	1.4628	25	2.2
2	Beef tallow	1.4510	60	0.5
3	Beeswax	1.4398–1.4451	75	0.34–0.54
4	Bone fat	....	....	....
5	Butter fat	1.4590–1.4620	25	20.6–33.2
6	Carnaüba wax	1.4520–1.4541	84	....
7	Chinese vegetable tallow	1.4510	50	0.69
8	Cocoa butter	1.4565–1.4578	40	0.2–0.83
9	Cotton seed stearin	....	....	....
10	Goose (domestic)	1.4593–1.4596	40	0.2–0.3
11	Goose (wild)	....	....	....
12	Hare fat	1.4586	40	2.64
13	Horse fat	1.4603–1.4717	40	1.64–2.14
14	Human fat	1.459–1.4613	40	0.25–0.55
15	Insect (Chinese) wax	....	....	....
16	Japan wax (tallow)	1.4577–1.4591	40	....
17	Lard (hog fat)	1.4539	60	0.49–1.1
18	Laurel (bayberry) oil	1.4643	40	3.2–5.4
19	Mutton tallow	1.4501	60	....
20	Myrtle wax	1.4363	80	0.5
21	Nutmeg (mace) butter	1.4704	40	1–4.2
22	Rabbit fat (tame)	1.4587	40	2.64
23	Rabbit fat (wild)	....	....	1.4–5.6
24	Spermaceti	....	....	....
25	Sperm oil	1.4646–1.4655	20	0.6
26	Wool wax	1.4781–1.4822	40	8

FATS AND WAXES

No.	Saponification value	Iodine value	Hehner's number	Unsaponifiable matter	Acid value
1	196–199.6	39–55.4	....	....	1.6
2	193.2–200	35.4–47.5	95.6	....	3.5–50
3	88–97.6	8.3–11	....	52–55	18–21
4	190–195	46.3–55.8	....	0.5–1.5	1–50
5	220–237	26–38	86.5–89.8	0.3–0.45	0.45–35.4
6	78–88	13.5	....	55	2–7
7	199–206	23–38	93	....	2.2–7.5
8	192–202	34.3–37	94.5	....	1.1–1.88
9	195	89–103	95.9	....	....
10	193	59–71.5	95	....	0.59
11	196	99.6	....	....	0.86
12	201–205	102.2–107	95.4	....	2.73
13	195–197	71.4–86.3	95	....	0.0–2.44
14	193.3–199	64	....	....	....
15	80.4–91.65	1.4	....	....	1.5
16	217.5–237.5	4.2–15.1	90.6	1.1–1.63	7.33
17	195.2–196.6	49.9–70.4	93–96	0.23	0.54–1.28
18	197–210	80.5	....	....	26.3
19	192–195.2	32.7–46.2	95.5	....	1.7–14
20	205.7–217	1.95	....	....	3–4.4
21	153.5–161	59.3–65	....	....	17–44.8
22	202.6	67.6	....	....	6.2
23	199.3	99.8	....	....	7.2
24	122.7–134.6	3.5–9.3	....	51.5	0.5–1.35
25	120–147.4	70.4–96.4	....	39–42	13.2
26	102.4	17.1–28.9	91	43.1–51.8	....

No.	Insoluble Fatty Acids			
	Melting-point °C.	Solidifying point °C.	Iodine value	Acid value
1	45–46	37.9–40	55.5	204.5
2	43–47	37.9–46.2	41.3	197.2
3	67.2	....	....	....
4	30	28	55.7–57.4	200
5	38–40	33–37	28–31	210–220
6	85	....	....	....
7	47–57	40–56	34.2	182–208.5
8	48–53	46–51	32.6–39	190
9	27–30	35.1	94	....
10	37–41	31–32	65.3	202.4
11	34–40	32–34	65.1	196.4
12	44–50	36–41	93.3	209
13	37.5–39.5	37.7	83.9–87.1	202.6
14	35.5	30.5	64	....
15	92.2	....	....	....
16	54.5–59.6	53–56.5	....	213.7
17	35–47	34–42	64.2	201.8
18	....	....	81.6–82	....
19	46–54	39–41	34.8	198
20	47.5–48.5	46	....	230.9
21	42.5	40–45	31.6	....
22	40–50	37–41	64.4	218.1
23	39–41	35–36	101.1	209.5
24	....	....	....	....
25	13.3–21.4	16.1	88–99	23.6
26	41.8	40	17	....

COMMON NAMES OF CHEMICALS, THEIR CORRECT CHEMICAL NAMES AND FORMULÆ

Common Name	Chemical Name	Formula
Aldehyde	Acetaldehyde	CH_3CHO
Alum Alum flour Alum meal	Generally refers to potassium aluminum sulfate	$K_2Al_2(SO_4)\cdot 24H_2O$
Alumina	Aluminum oxide	Al_2O_3
Amidol	Diaminophenol hydrochloride	$C_6H_3(NH_2)_2OH\cdot 2HCl$
Antichlor	Sodium thiosulfate	$Na_2S_2O_3\cdot 5H_2O$
Antifebrin	Acetanilide	$C_6H_5NHCOCH_3$
Antimony bloom	Antimony trioxide	Sb_2O_3
Antimony black Antimony glance	Antimony trisulfide	Sb_2S_3
Antimony red Antimony vermilion	Antimonous oxysulfide	$Sb_2S_3 + Sb_2O_3$
Aqua fortis	Nitric acid	HNO_3
Aqua regia	Nitric acid + hydrochloric acid	$HNO_3 + 3HCl$
Arsenic glass	Arsenious oxide	As_2O_3
Aspirin	Acetyl-salicylic acid	$C_6H_4{<}\substack{OCOCH_3\\COOH}$
Baking soda	Sodium bicarbonate	$NaHCO_3$
Baryta	Barium oxide	BaO
Barytes	Barium sulfate	$BaSO_4$
Benzol	Benzene	C_6H_6
Bitter salt	Magnesium sulfate	$MgSO\cdot 7H_2O$
Black ash	Impure sodium carbonate	....
Blanc-fixe	Barium sulfate	$BaSO_4$
Bleaching powder	Calcium hypochlorite	$CaOCl_2$
Blue copperas Blue stone Blue vitriol	Copper sulfate	$CuSO_4\cdot 5H_2O$
Blue salts	Nickel sulfate	$NiSO_4\cdot 7H_2O$
Bone ash	Impure calcium phosphate	....
Boracic acid	Boric acid	H_3BO_3
Borax	Sodium tetraborate	$Na_2B_4O_7\cdot 10H_2O$
Brimstone	Sulfur	....
Burnt alum	Anhydrous potassium aluminum sulphate	$K_2Al_2(SO_4)_4$
Burnt lime	Calcium oxide	CaO
"Butter of"	Refers to the chloride.	
Cadmium yellow	Cadmium sulfide	CdS
Calomel	Mercurous chloride	$HgCl$
Cane sugar	Sucrose	$C_{12}H_{22}O_{11}$
Carbolic acid	Phenol	C_6H_5OH
Carbonic anhydride	Carbon dioxide	CO_2
Carborundum	Silicon carbide	SiC
"Caustic" refers to the hy	droxide of a metal.	
Chalk	Calcium carbonate	$CaCO_3$
Chili niter Chili saltpeter	Sodium nitrate	$NaNO_3$
Chrome alum	Potassium chromium sulfate	$K_2Cr_2(SO_4)_4\cdot 24H_2O$
Chrome green	Chromium oxide	Cr_2O_3
Chrome yellow	Lead chromate	$PbCrO_4$
Chromic acid	Chromium trioxide	CrO_3
Cobalt black	Cobalt oxide	CoO
Common salt	Sodium chloride	$NaCl$
Copperas	Ferrous sulfate	$FeSO_4\cdot 7H_2O$

COMMON NAMES OF CHEMICALS, THEIR CORRECT CHEMICAL NAMES AND FORMULÆ (Continued)

Common Name	Chemical Name	Formula
Corn sugar	Glucose	$C_6H_{12}O_6 \cdot H_2O$
Corrosive sublimate	Mercuric chloride	$HgCl_2$
Corundum	Aluminum oxide	Al_2O_3
Cream of tartar	Potassium acid tartrate	$KHC_6H_4O_6$
Cresylic acid	Mixture of the three cresols.	$C_6H_4(CH_3)OH$
Derinatol	Basic bismuth gallate	$Bi(OH)_2C_7H_5O_5$
Dextrose	Glucose	$C_6H_{12}O_6 \cdot H_2O$
Epsom salts	Magnesium sulfate	$MgSO_4 \cdot 7H_2O$
"Flowers of" a metal is a	synonym for the oxide.	
Fluorspar	Calcium fluoride	CaF_2
Formalin	Forty per cent solution of formaldehyde in water	
Fruit sugar	Fructose	$C_6H_{12}O_6$
Glauber's salt	Sodium sulfate	$Na_2SO_4 \cdot 10H_2O$
Grain alcohol	Ethyl alcohol	C_2H_5OH
Grape sugar	Glucose	$C_6H_{12}O_6 \cdot H_2O$
Green vitriol	Ferrous sulfate	$FeSO_4 \cdot 7H_2O$
Gypsum	Calcium sulfate	$CaSO_4 \cdot 2H_2O$
Hypo	Sodium thiosulfate	$Na_2S_2O_3 \cdot 5H_2O$
King's yellow	Arsenious sulfide	As_2S_3
Laughing gas	Nitrous oxide	N_2O
Lemon chrome	Barium chromate	$BaCrO_4$
Levulose	Fructose	$C_6H_{12}O_6$
Lime	Calcium oxide	CaO
Litharge	Lead monoxide	PbO
Lithopone	Zinc sulfide + barium sulfate	$ZnS+BaSO_4$
Lunar caustic	Silver nitrate	$AgNO_3$.
Magnesia	Magnesium oxide	MgO
Marble	Calcium carbonate	$CaCO_3$
Metol	Monomethylpara-amido-metacresol sulfate or chloride	$(C_6H_3(OH)CH_3NHCH_3)_2 \cdot H_2SO_4$
Microcosmic salt	Sodium ammonium Hydrogen phosphate	$Na(NH_4)HPO_4 \cdot 4H_2O$
Milk of barium	Barium hydroxide	$Ba(OH)_2 \cdot 8H_2O$
Milk of magnesium	Magnesium hydroxide	$Mg(OH)_2$
Milk sugar	Lactose	$C_{12}H_{22}O_{11} \cdot H_2O$
Minium	Lead tetroxide	Pb_3O_4
Mohr's salt	Ferrous ammonium sulfate.	$Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O$
"Muriate of" a metal is syn	onymous with the chloride.	
Muriatic acid	Hydrochloric acid	HCl
Niter	Potassium nitrate	KNO_3
Nordhausen acid	Fuming sulfuric acid	$H_2SO_4+SO_3$
Oil of almond, artificial	Benzaldehyde	C_6H_5CHO
Oil of mirbane	Nitrobenzene	$C_6H_5NO_2$
Oil of mustard, artificial	Allyl isothiocyanide	C_3H_5SCN
Oil of vitriol	Sulfuric acid	H_2SO_4
Oil of wintergreen, artificial.	Methyl salicylate	$C_8H_8O_3$
Pearl ash	Potassium carbonate	K_2CO_3
Permanent white	Barium sulfate	$BaSO_4$
Phosgene	Carbonyl chloride	$COCl_2$
Plaster of Paris	Calcium sulfate	$2CaSO_4+1H_2O$
Plumbago	Graphite	....
Precipitated chalk	Calcium carbonate	$CaCO_3$
Prussian blue	Ferric ferrocyanide	$Fe_4(Fe(CN)_6)_3$
Prussic acid	Hydrocyanic acid	HCN

COMMON NAMES OF CHEMICALS, THEIR CORRECT CHEMICAL NAMES AND FORMULÆ (Continued)

Common Name	Chemical Name	Formula
Pyrolusite	Manganese dioxide	MnO_2
Quick lime	Calcium oxide	CaO
Quinol	Hydroquinone	$C_6H_4(OH)_2(1.4)$
Realgar	Arsenic disulfide	As_2S_2
Red lead	Lead tetroxide	Pb_3O_4
Red prussiate of potash	Potassium ferricyanide	$K_3Fe(CN)_6$
Rochelle salt	Potassium sodium tartrate	$KNaC_4H_4O_6 \cdot 4H_2O$
Sal ammoniac	Ammonium chloride	NH_4Cl
Sal soda	Sodium carbonate	$Na_2CO_3.10H_2O$
Salol	Phenyl salicylate	$C_6H_4\begin{cases} OH(1) \\ COOC_6H_5(2) \end{cases}$
Salt	Sodium chloride	$NaCl$
Salt cake	Impure sodium sulfate	....
Salt of lemon } Salt of sorrel }	Potassium acid oxalate	$KHC_2O_4 \cdot H_2O$
Salt of tartar } Salt of wormwood }	Potassium carbonate	K_2CO_3
Salt peter	Potassium nitrate	KNO_3
Scheele's green	Copper hydrogen arsenite	$CuHAsO_3$
Silica	Silicon dioxide	SiO_2
Slaked lime	Calcium hydroxide	$Ca(OH)_2$
Soda	Sodium carbonate	$Na_2CO_3 \cdot 10H_2O$
Sodium hyposulfite	Sodium thiosulfate	$Na_2S_2O_3 \cdot 5H_2O$
Soluble glass	Sodium silicate	$Na_2SiO_3+H_2O$
Soluble tartar	Potassium tartrate	$2K_2C_4H_4O_6+1H_2O$
Sulfuric ether	Diethyl ether	$(C_2H_5)_2O$
Sugar of lead	Lead acetate	$Pb(CH_3CO_2)_2 \cdot 3H_2O$
Sugar of milk	Lactose	$C_{12}H_{22}O_{11} \cdot 1H_2O$
Table salt	Sodium chloride	$NaCl$
Tartar emetic	Potassium antimonyl tartrate	$2K(SbO)C_4H_4O_6 \cdot 1H_2O$
T. N. T.	Trinitro toluene	$C_6H_2(CH_3)(NO_2)_3$ (1, 2, 4, 6)
Turnbull's blue	Ferrous ferricyanide	$Fe_3(Fe(CN)_6)_2$
Ultramarine yellow	Barium chromate	$BaCrO_4$
Unslaked lime	Calcium oxide	CaO
Venetian red	Ferric oxide	Fe_2O_3
Verdigris	Basic copper acetate	$2Cu(C_2H_3O_2)_2+CuO(?)$
Vermilion	Red mercuric sulfide	HgS
"Vitriolate of" a metal is	synonymous with the sulfate.	
Washing soda	Sodium carbonate	$Na_2CO_3 \cdot 10H_2O$
Water glass	Sodium silicates dissolved in water	....
White lead	Basic lead carbonate	$2PbCO_3+Pb(OH)_2$
White vitriol	Zinc sulfate	$ZnSO_4 \cdot 7H_2O$
Whiting	Calcium carbonate	$CaCO_3$
Wood alcohol	Methyl alcohol	CH_3OH
Yellow prussiate of potash	Potassium ferrocyanide	$K_4Fe(CN)_6 \cdot 3H_2O$
Zinc white	Zinc oxide	ZnO
Zinc vitriol	Zinc sulfate	$ZnSO_4 \cdot 7H_2O$

PERIODIC ARRANGEMENT OF THE ELEMENTS — MENDELEJEFF'S (REVISED TO 1917)

SERIES	ZERO GROUP	GROUP I — R_2O	GROUP II — RO	GROUP III — R_2O_3	GROUP IV RH_4 RO_2	GROUP V RH_3 R_2O_5	GROUP VI RH_2 RO_3	GROUP VII RH R_2O_7	GROUP VIII — RO_4		
0											
1		Hydrogen H = 1.008									
2	Helium He = 4.00	Lithium Li = 6.94	Glucinum (Beryllium) Gl = 9.1	Boron B = 11.0	Carbon C = 12.00	Nitrogen N = 14.01	Oxygen O = 16.00	Fluorine F = 19.0			
3	Neon Ne = 20.2	Sodium Na = 23.00	Magnesium Mg = 24.32	Aluminum Al = 27.1	Silicon Si = 28.3	Phosphorus P = 31.04	Sulphur S = 32.06	Chlorine Cl = 35.46			
4	Argon A = 39.88	Potassium K = 39.10	Calcium Ca = 40.07	Scandium Sc = 44.1	Titanium Ti = 48.1	Vanadium V = 51.0	Chromium Cr = 52.0	Manganese Mn = 54.93	Iron Fe = 55.84	Cobalt Co = 58.97	Nickel Ni = 58.68 (Cu)
5		Copper Cu = 63.57	Zinc Zn = 65.37	Gallium Ga = 69.9	Germanium Ge = 72.5	Arsenic As = 74.96	Selenium Se = 79.2	Bromine Br = 79.92			
6	Krypton Kr = 82.92	Rubidium Rb = 85.45	Strontium Sr = 87.63	Yttrium Yt = 88.7	Zirconium Zr = 90.6	Columbium (Niobium) Cb = 93.5	Molybdenum Mo = 96.0		Ruthenium Ru = 101.7	Rhodium Rh = 102.9	Palladium Pd = 106.7 (Ag)
7		Silver Ag = 107.88	Cadmium Cd = 112.40	Indium In = 114.8	Tin Sn = 118.7	Antimony Sb = 120.2	Tellurium Te = 127.5	Iodine I = 126.92			
8	Xenon Xe = 130.2	Caesium Cs = 132.81	Barium Ba = 137.37	Lanthanum La = 139.0	Cerium Ce = 140.25	Praesodymium Pr = 140.9	Neodymium Nd = 144.3				
9		Samarium Sa = 150.4		Gadolinium Gd = 157.3	Terbium Tb = 159.2		Erbium Er = 167.7				
10		Thulium Tm = 168.5		Ytterbium (Neoytterbium) Yb = 173.5		Tantalum Ta = 181.5	Tungsten W = 184.0		Osmium Os = 190.9	Iridium Ir = 193.1	Platinum Pt = 195.2 (Au)
11		Gold Au = 197.2	Mercury Hg = 200.6	Thalium Tl = 204.0	Lead Pb = 207.2	Bismuth Bi = 208.0					
12	Niton Nt = 222.4		Radium Ra = 226.0		Thorium Th = 232.4		Uranium U = 238.2				

QUALITATIVE ANALYSIS SCHEME

(From A. A. Noyes' Qualitative Analysis, by permission.)

Basic Constituents

Separation of the Basic Constituents into Groups

<table>
<tr><td colspan="7">Solution in dilute nitric acid containing all the common basic constituents. Add NH_4Cl.</td></tr>
<tr><td rowspan="4">Precipitate:
Silver-Group
(Bi, Pb, Ag, Hg),
as chlorides.</td><td colspan="6">Filtrate: Saturate with H_2S gas.</td></tr>
<tr><td colspan="2">Precipitate: Copper-Group and Tin-Group as sulphides.
Treat with $(NH_4)_2S_4$.</td><td colspan="4">Filtrate: add NH_4OH and $(NH_4)_2S$.</td></tr>
<tr><td rowspan="2">Residue:
Copper-Group
(Hg, Pb, Bi, Cu, Cd),
as sulphides.</td><td rowspan="2">Solution:
(Tin-Group
As, Sb, Sn),
as ammonium
sulpho-salts.</td><td colspan="2">Precipitate: Aluminum-Group and Iron-Group, as hydroxides and sulphides.
Dissolve in acid, add NaOH and H_2O_2.</td><td colspan="2">Filtrate: add $(NH_4)_2CO_3$.</td></tr>
<tr><td>Filtrate:
Aluminum-Group
(Al, Cr, Zn),
as sodium salts.</td><td>Precipitate:
Iron-Group
(Mn, Fe, Co, Ni),
as hydroxides.</td><td>Precipitate:
Alkaline-Earth
Group
(Ba, Sr, Ca, Mg),
as carbonates.</td><td>Filtrate:
Alkali-Group
(NH_4, K, Na),
as nitrates.</td></tr>
</table>

Analysis of the Silver-Group

<table>
<tr><td colspan="4">Precipitate: BiOCl, $PbCl_2$, AgCl, Hg_2Cl_2. Treat with HCl.</td></tr>
<tr><td>Solution $BiCl_3$.
Evaporate, pour into water.</td><td colspan="3">Residue: $PbCl_2$, AgCl, Hg_2Cl_2. Treat with hot water.</td></tr>
<tr><td rowspan="3">Precipitate: BiOCl.</td><td>Solution: $PbCl_2$. Add H_2SO_4.</td><td colspan="2">Residue: AgCl, Hg_2Cl_2. Pour NH_4OH through the filter.</td></tr>
<tr><td rowspan="2">Precipitate: $PbSO_4$.</td><td rowspan="2">Black residue: Hg and NH_2HgCl.</td><td>Solution: $(NH_3)_2$ AgCl. Add HNO_3</td></tr>
<tr><td>White precipitate: AgCl.</td></tr>
</table>

QUALITATIVE ANALYSIS SCHEME (Continued)

Separation of the Copper and Tin Groups

<table>
<tr><td colspan="3">Hydrogen sulphide precipitate: HgS, PbS, Bi_2S_3, CuS, CdS, As_2S_3, As_2S_5, Sb_2S_3, Sb_2S_5, SnS, SnS_2. Treat with ammonium polysulphide.</td></tr>
<tr><td rowspan="2">Residue: HgS, PbS, Bi_2S_3, CuS, CdS.</td><td colspan="2">Solution $(NH_4)_3\ AsS_4$, $(NH_4)_3SbS_4$, $(NH_4)_2SnS_3$. Add HCl.</td></tr>
<tr><td>Precipitate: As_2S_5, Sb_2S_5, SnS_2.</td><td>Filtrate: NH_4Cl. Reject.</td></tr>
</table>

Analysis of the Copper-Group

<table>
<tr><td colspan="6">Residue from Ammonium Sulphide Treatment: HgS, PbS, Bi_2S_3, CuS, CdS. Boil with HNO_3.</td></tr>
<tr><td colspan="2">Residue: HgS.
Add Br_2 solution</td><td colspan="4">Solution: Pb, Bi, Cu, Cd as nitrates. Add H_2SO_4, evaporate, add water.</td></tr>
<tr><td rowspan="4">Residue:
Sulphur.</td><td rowspan="2">Solution: $HgBr_2$.
Add $SnCl_2$.</td><td rowspan="3">Precipitate:
$PbSO_4$.
Dissolve
in NH_4Ac.
Add
K_2CrO_4.</td><td colspan="3">Filtrate: add NH_4OH.</td></tr>
<tr><td rowspan="2">Precipitate: $Bi(OH)_3$.
Add Na_2SnO_2.</td><td colspan="2">Filtrate: $Cu(NH_3)_4SO_4$, $Cd(NH_3)_4SO_4$.</td></tr>
<tr><td rowspan="2">White or gray
precipitate:
Hg_2Cl_2 or Hg.</td><td>To a small part add HAc and $K_4Fe(CN)_6$.</td><td>To the remainder add KCN and H_2S.</td></tr>
<tr><td>Yellow
precipitate:
$PbCrO_4$.</td><td>Black Residue: Bi.</td><td>Red precipitate: $Cu_2Fe(CN)_6$.
White precipitate:
$Cd_2Fe(CN)_6$.</td><td>Yellow precipitate: CdS.
Solution $K_3Cu(CN)_4$.</td></tr>
</table>

QUALITATIVE ANALYSIS SCHEME (Continued)

Analysis of the Tin-Group

Precipitate from Ammonium Sulphide Solution: As_2S_5, Sb_2S_5, SnS_2. Heat with 10 c.c. 12 normal HCl.

Solution: $SbCl_3$, $SnCl_4$. Dilute to 50 c.c., heat, and pass in H_2S.		Residue: As_2S_5. Dissolve in HCl and $KClO_3$.
Orange Precipitate: Sb_2S_3. Dissolve in HCl, add Sn and Pt.	Solution: $SnCl_4$. Cool, dilute, pass in H_2S.	Solution: H_3AsO_4. Add NH_4OH, NH_4Cl and $MgCl_2$.
Black deposit: Sb. Treat with NaClO.	Yellow Precipitate: SnS_2. Evaporate without filtering, add Pb, boil.	White precipitate: $MgNH_4AsO_4$. Dissolve in HCl and add H_2S.
Black deposit: Sb.	Solution: $SnCl_2$. Add $HgCl_2$.	Yellow precipitate: As_2S_5, As_2S_3 and S.
	White precipitate: Hg_2Cl_2.	

Separation of the Aluminum and Iron Groups

The Ammonium Hydroxide and Ammonium Sulphide Precipitate: $Al(OH)_3$, $Cr(OH)_3$, FeS, ZnS, MnS, CoS, NiS. Dissolve in HCl and HNO_3, add NaOH.

Precipitate: $Fe(OH)_3$, $Mn(OH)_2$, $Co(OH)_2$, $Ni(OH)_2$.
Solution: $NaAlO_2$, $NaCrO_2$, Na_2ZnO_2.
Add Na_2O_2 and filter.

Filtrate: $NaAlO_2$, Na_2CrO_4, Na_2ZnO_2.	Precipitate: $Fe(OH)_3$, $MnO(OH)_2$, $Co(OH)_3$, $Ni(OH)_2$.

QUALITATIVE ANALYSIS SCHEME (Continued)

Analysis of the Aluminum-Group

Filtrate from the Sodium Hydroxide and Peroxide Treatment: Na_2ZnO_2, $NaAlO_2$, Na_2CrO_4. Acidify with HNO_3 and add NH_4OH.

<table>
<tr>
<td>Precipitate: $Al(OH)_3$.
Dissolve in HNO_3,
Add $Co(NO_3)_2$, evaporate, ignite.</td>
<td colspan="2">Filtrate: add HAc and $BaCl_2$.</td>
</tr>
<tr>
<td rowspan="3">Blue residue: $Co(AlO_2)_2$.</td>
<td>Precipitate: $BaCrO_4$.
Dissolve in HCl and H_2SO_3, evaporate.</td>
<td>Filtrate: Zinc salt. Pass in H_2S.</td>
</tr>
<tr>
<td rowspan="2">Green color: $CrCl_3$.</td>
<td>White precipitate: ZnS. Dissolve in HNO_3.
Add $Co(NO_3)_2$ and Na_2CO_3, ignite.</td>
</tr>
<tr>
<td>Green residue: $CoZnO_2$.</td>
</tr>
</table>

Analysis of the Iron Group

Precipitate produced by sodium hydroxide and peroxide:
A. Phosphate absent: $MnO(OH)_2$, $Fe(OH)_3$, $Co(OH)_3$, $Ni(OH)_2$, $Zn(OH)_2$.
B. Phosphate present: Also $BaCO_3$, $SrCO_3$, $CaCO_3$, $MgCO_3$, $FePO_4$, $Ca_3(PO_4)_2$, etc.
Dissolve in HNO_3 and H_2O_2, evaporate, heat with HNO_3 and $KClO_3$.

<table>
<tr>
<td>Precipitate: MnO_2.
Add HNO_3 and bismuth peroxide.</td>
<td colspan="3">Solution: Test a portion for a phosphate with $(NH_4)_2MoO_4$.
A. Phosphate absent: add NH_4OH.
B. Phosphate present: add NH_4Ac and $FeCl_3$, dilute and boil.</td>
</tr>
<tr>
<td rowspan="2">Violet Color:
$HMnO_4$.</td>
<td rowspan="2">Precipitate:
A. $Fe(OH)_3$.
B. Basic ferric acetate and $FePO_4$.</td>
<td colspan="2">Filtrate: add NH_4OH, pass in H_2S.</td>
</tr>
<tr>
<td>Precipitate: ZnS, CoS, NiS.</td>
<td>Filtrate:
A. Ammonium salts. Reject.
B. Ba, Ca, Sr, Mg. Treat with Alkali-Earth group.</td>
</tr>
</table>

QUALITATIVE ANALYSIS SCHEME (Continued)

Separation of Zinc, Nickel and Cobalt

- Hydrogen sulphide precipitate: ZnS, NiS, CoS. Treat with dil. HCl.
  - Solution: $ZnCl_2$, $NiCl_2$, $CoCl_2$, add NaOH and Na_2O_2.
    - Filtrate: Na_2ZnO_2. Add HAc and H_2S.
      - White precipitate: ZnS.
    - Precipitate: $Ni(OH)_2$, $Co(OH)_3$, add HCl, evaporate.
  - Residue: NiS, CoS. Dissolve in HCl and HNO_3.
  - Residue: $NiCl_2$, $CoCl_2$, add HCl and ether.
    - Yellow residue: $NiCl_2$. Dissolve in water, add tartaric acid, NaOH and H_2S.
      - Brown coloration: presence of nickel.
    - Blue solution: $CoCl_2$, evaporate, add HAc and KNO_2.
      - Yellow precipitate: $K_3Co(NO_2)_6$.

Analysis of the Alkaline-Earth Group

- Ammonium carbonate precipitate: $BaCO_3$, $SrCO_3$, $CaCO_3$, $MgCO_3$, $(NH_4)_2CO_3$. Dissolve in HAc, add NH_4Ac and K_2CrO_4.
  - Precipitate: $BaCrO_4$. Dissolve in HCl, evaporate.
    - Test in flame.
      - Green Color: Ba.
    - Add HAc, NH_4Ac, and K_2CrO_4.
      - Precipitate: $BaCrO_4$.
  - Filtrate: add NH_4OH and alcohol.
    - Precipitate: $SrCrO_4$. Treat with $(NH_4)_2CO_3$.
      - Residue: $SrCO_3$. Dissolve in HAc. Add $CaSO_4$.
        - Precipitate: $SrSO_4$.
    - Filtrate: Ca and Mg salts. Add $(NH_4)_2C_2O_4$.
      - Precipitate: CaC_2O_4. Dissolve in dilute H_2SO_4, add alcohol.
        - Precipitate: $CaSO_4$.
      - Filtrate: add NH_4OH and Na_2HPO_4.
        - Precipitate: $MgNH_4PO_4$.

QUALITATIVE ANALYSIS SCHEME (Continued)

Analysis of the Alkali-Group

Filtrate from Ammonium Carbonate precipitate: NH_4, Na, K salts. Evaporate and ignite the residue.		
Vapor: NH_4 salts.	Residue: KCl, NaCl. Add $HClO_4$, evaporate, add alcohol.	
	Residue: $KClO_4$. Dissolve in hot water, add $Na_3Co(NO_2)_6$.	Solution: $NaClO_4$. Saturate with HCl gas.
	Yellow precipitate: $K_2NaCO(NO_2)_6$.	Precipitate: NaCl. Dissolve in water, add $K_2H_2Sb_2O_7$.
		Crystalline precipitate: $Na_2H_2Sb_2O_7$.

Acidic Constituents

Detection of the Readily Volatile Acidic Constituents

Heat the substance with dilute H_2SO_4. Vapors: CO_2, SO_2, H_2S, NO_2, Cl_2, Br_2, I_2, HCN. Expose to the vapors:			
$Ba(OH)_2$ solution.	PbAc paper.	Starch and KI paper.	$Fe(OH)_2$ or $Fe(OH)_3$ and NaOH on paper.
White turbidity: $BaCO_3$ or $BaSO_3$. (Shows carbonate, sulphite or thiosulphate.)	Black color: PbS. (Shows sulphide.)	Blue color: I_2 (Shows nitrite, hypochlorite, chlorate, bromate, or iodide.)	Formation of $Na_4Fe(CN)_6$. Dip in HCl.
			Blue color: $Fe_4(Fe(CN)_6)_3$. (Shows cyanide.)

QUALITATIVE ANALYSIS SCHEME (Continued)

Detection of the Acidic Constituents Precipitated from Acid Solutions by Barium and Silver Salts

<table>
<tr><td colspan="4">To a HNO_3 solution of the substance add $BaCl_2$.</td></tr>
<tr><td rowspan="3">Precipitate: $BaSO_4$. (Shows sulphate.)</td><td colspan="3">Filtrate: add Br_2.</td></tr>
<tr><td rowspan="2">Precipitate: $BaSO_4$. (Shows sulphite.)</td><td colspan="2">Filtrate: add NH_4Ac.</td></tr>
<tr><td>Yellow precipitate: $BaCrO_4$. (Shows chromate.)</td><td>Filtrate: add $CaCl_2$. Precipitate: CaF_2: (Shows fluoride.)</td></tr>
</table>

<table>
<tr><td colspan="3">To a HNO_3 solution of the substance add $Cd(NO_3)_2$.</td></tr>
<tr><td rowspan="3">Yellow precipitate: CdS. (Shows sulphide.)</td><td colspan="2">Filtrate: add $AgNO_3$.</td></tr>
<tr><td rowspan="2">Precipitate: $AgCl$, $AgBr$, AgI, $Ag_2(CN)_2$, $AgSCN$, (Shows halides, cyanide or thiocyanates.)</td><td>Filtrate: $AgClO_3$, $AgBrO_3$. Add H_2SO_3.</td></tr>
<tr><td>Precipitate: $AgCl$, $AgBr$. (Shows chlorate or bromate.)</td></tr>
</table>

Detection of Phosphate and the Separate Halides

<table>
<tr><td colspan="5">To portions of the HNO_3 solution of the substance.</td></tr>
<tr><td>Add $(NH_4)_2MoO_4$.</td><td>Add $FeCl_3$.</td><td colspan="3">Add NaAc, HAc, $KMnO_4$ and $CHCl_3$.</td></tr>
<tr><td rowspan="3">Yellow precipitate: $(NH_4)_3PO_4$, $12MoO_3$. (Shows phosphate.)</td><td rowspan="3">Red color: $Fe(SCN)_3$. (Shows thiocyanate.)</td><td rowspan="3">Chloroform layer, purple: I_2. (Shows iodide.)</td><td colspan="2">Water layer: add H_2SO_4, more $KMnO_4$ and $CHCl_3$.</td></tr>
<tr><td rowspan="2">Chloroform layer, orange: Br_2. (Shows bromide.)</td><td>Water layer: Boil out the Br_2, add HNO_3 and $AgNO_3$.</td></tr>
<tr><td>Precipitate: $AgCl$. (Shows chloride.)</td></tr>
</table>

FLAME AND BEAD TESTS

Flame Colorations

VIOLET.

Potassium compounds. Purple red through blue glass. Easily obscured by sodium flame. Bluish green through green glass. Rubidium and Caesium compounds impart same flame as potassium compounds.

BLUES.

Azure. — Copper chloride. Copper bromide gives azure blue followed by green. Other copper compounds give same coloration when moistened with hydrochloric acid.

Light Blue. — Lead, Arsenic, Selenium.

GREENS.

Emerald. — Copper compounds except the halides, and when not moistened with hydrochloric acid.

Pure Green. — Compounds of thallium and tellurium.

Yellowish. — Barium compounds. Some molybdenum compounds. Borates, especially when treated with sulphuric acid or when burned with alcohol.

Bluish. — Phosphates with sulphuric acid.

Feeble. — Antimony compounds. Ammonium compounds.

Whitish. — Zinc.

REDS.

Carmine. — Lithium compounds. Violet through blue glass. Invisible through green glass. Masked by barium flame.

Scarlet. — Strontium compounds. Violet through blue glass. Yellowish through green glass. Masked by barium flame.

Yellowish. — Calcium compounds. Greenish through blue glass. Green through green glass. Masked by barium flame.

YELLOWS.

Yellow. All sodium compounds. Invisible with blue glass.

OXIDES WHICH IMPART DECIDED COLORS TO THE BEADS

Borax Beads

Oxides of	Oxidizing Flame	Reducing Flame
Chromium	Green	Green
Cobalt	Blue	Blue
Copper	Greenish blue	Red-opaque
Iron	Yellow	Green
Manganese	Violet	Colorless
Molybdenum	Colorless	Brown
Nickel	Brown	Gray-opaque
Titanium	Colorless	Yellow
Tungsten	Colorless	Brown
Uranium	Red	Green
Vanadium	Colorless	Green

FLAME AND BEAD TESTS (Continued)

Salt of Phosphorus Beads

Oxides of	Oxidizing Flame	Reducing Flame
Chromium	Green	Green
Cobalt	Blue	Blue
Copper	Blue	Red-opaque
Iron	Brown	Colorless
Manganese	Violet	Colorless
Molybdenum	Colorless	Green
Nickel	Yellow	Yellow
Titanium	Colorless	Violet
Tungsten	Colorless	Blue
Uranium	Green	Green
Vanadium	Yellow	Green

Sodium Carbonate Bead

Manganese	Green	Colorless

PREPARATION AND PROPER CONCENTRATION OF LABORATORY REAGENTS FOR GENERAL USE

Dilute Acids. Sulphuric acid. One volume strong acid to 6 volumes water.

Nitric Acid. One volume strong acid to 2 volumes water.

Hydrochloric acid. Five volumes strong acid to 8 volumes water.

Acetic acid. One volume strong acid to 2½ volumes water.

Dilute Bases. Potassium hydroxide. 280 grams per liter of solution with water.

Sodium hydroxide. 200 grams per liter of solution with water.

Ammonium hydroxide. One volume strong ammonia (sp. gr. 90) to 2 volumes water.

Other Reagents. Ammonium sulphide. 600 cc. ammonium hydroxide is saturated with hydrogen sulphide. Dilute to one liter with ammonium hydroxide.

Sodium sulphide. Dissolve 200 grams sodium hydroxide in 800 cc. water. Saturate 400 cc. of this solution with hydrogen sulphide. Add the remaining 400 cc. of sodium hydroxide and dilute the whole to one liter.

Ammonium chloride. 267.5 grams per liter of solution with water.

Ammonium carbonate. 200 grams solid salt dissolved in 350 cc. ammonium hydroxide and dilute with water to 1 liter.

Ammonium acetate. Dilute 300 cc. strong acetic acid with 300 cc. water and neutralize with strong ammonia. Dilute to 1 liter.

Sodium acetate, 136.14 grams per liter with water.

Sodium phosphate, 119.45 grams per liter with water.

Calcium chloride, 109.51 grams per liter with water.

Magnesium sulphate, 123.28 grams per liter with water.

Barium chloride, 122.17 grams per liter with water.

Ferric chloride, 54.11 grams per liter with water and add sufficient HCl to keep in solution.

Potassium ferrocyanide, 105.72 grams per liter with water.

Lead acetate, 189.51 grams per liter with water.

Stannous chloride, 112.72 grams of the solid salt plus 200 cc. 5N HCl diluted to 1 liter with water. Add metallic tin to the solution in the bottle to keep it from oxidizing.

Mercurous nitrate, 262.34 grams per liter with water. Add sufficient nitric acid to keep solution clear and put metallic mercury in the bottle to prevent oxidation.

Cobalt nitrate, 145 grams per liter with water.

Ammonium oxalate, 35.5 grams per liter with water.

Mercuric chloride, 67.8 grams per liter with water.

Zinc sulphate, 71.9 grams per liter with water.

Manganese sulphate, 55.78 grams per liter with water.
Nickel sulphate, 70.22 grams per liter with water.
Cadmium sulphate, 64.05 grams per liter with water.
Copper sulphate, 62.4 grams per liter with water.

Miscellaneous Reagents. Aqua regia, mix 1 part HNO_3 with three parts of concentrated HCl.

Silver nitrate N/10, 17 grams per liter with water.

Magnesia mixture, dissolve 68 grams crystallized $MgCl_2$ and 165 grams NH_4Cl in 300 cc. water. Add 300 cc. dilute ammonium hydroxide and dilute to 1 liter.

Molybdate solution, dissolve 60 grams molybdic oxide (MoO_3) in 440 cc. of water and 60 cc. strong ammonia (sp. gr. 90). Pour into 500 cc. of cold nitric acid which has been diluted 250 cc. concentrated acid to 250 cc. water. Let stand in a warm place several days. Decant or filter before using.

Phenolsulphonic acid, dissolve 150 grams of phenol in 600 grams of concentrated sulphuric acid.

Yellow ammonium sulphide, 50 to 75 grams of sulphur to a liter of colorless ammonium sulphide.

Ferrous sulphate, dissolve 200 grams $FeSO_4.7H_2O$ in a liter of water. Place scraps of iron in the solution and add a few drops of H_2SO_4 from time to time.

SPECIAL SOLUTIONS AND REAGENTS

Acid Cuprous Chloride. Cover the bottom of a two-liter flask with copper oxide, extend from the top to the bottom of the bottle several pieces of copper wire, and fill the bottle with 1.10 sp. gr. hydrochloric acid. Shake occasionally, and when solution becomes nearly colorless pour into reagent bottles containing copper wire. The stock bottle should be kept filled with 1.10 hydrochloric acid.

Ammoniacal Cuprous Chloride. The acid solution, described above, is treated with ammonia until a slight odor of this reagent is noticeable. Copper wire should be kept in the solution.

Ammonium Molybdate. Mix well 100 gm. of molybdic acid with 400 cc. of distilled water and add 80 cc. of ammonia (sp. gr. 0.90). When complete solution has taken place pour slowly and with stirring into a mixture of 400 cc. of nitric acid (sp. gr. 1.42) and 600 cc. of distilled water. Add 50 milligrams of microcosmic salt, allow to stand 24 hrs. and filter.

Cochineal. Extract 1 gm. of cochineal for four days with 20 cc. of alcohol and 60 cc. of distilled water. Filter.

Congo Red. Dissolve 0.5 gm. of congo red in 90 cc. of distilled water and 10 cc. of alcohol.

Eschka's Compound. Two parts of calcined magnesia are thoroughly mixed with one part of anhydrous sodium carbonate.

Fehling Solution. A. *The Copper Sulphate Solution.* Dissolve 34.66 gm. of copper sulphate ($CuSO_4 \cdot 5H_2O$) in water and dilute to 500 cc. B. *The Alkaline Tartrate Solution.* Dissolve

173 gm. of potassium sodium tartrate (Rochelle salt, $KNaC_4H_4O_6 \cdot 4H_2O$) and 50 gm. of sodium hydroxide in water and dilute when cold to 500 cc. For use, mix equal volumes of the two solutions at the time of using.

Fuchsin-Sulphurous Acid. To a solution of 0.5 gm. of fuchsin and 9 gm. of sodium bisulphite in 500 cc. of water add 10 cc. of hydrochloric acid. Keep in well-stoppered bottles and away from light.

Iodo-potassium Iodide. Dissolve 5 gm. of iodine and 10 gm. of potassium iodide in 100 cc. of water.

Magnesia Mixture. Dissolve 110 gm. of magnesium chloride in a small amount of water. To this solution add 280 gm. of ammonium chloride and 700 cc. of ammonia (sp. gr. 0.90), and dilute to 2000 cc. After standing several hours the solution is filtered. From time to time filter off any silica that may accumulate from the reagent bottle.

Mayer's Reagent. Dissolve 1.35 gm. of mercuric chloride and 5 gm. of potassium iodide in 100 cc. of water.

Methyl Orange Solution. Dissolve 1 gm. of methyl orange in 1000 cc. of water.

Methyl Red. Dissolve 0.20 gm. of methyl red in 100 cc. of alcohol.

Millon's Reagent. Dissolve 1 part of mercury in 1 part of cold fuming nitric acid. Dilute with twice the volume of water and decant the clear solution after several hours.

Nessler's Solution. Dissolve 50 gm. of potassium iodide in the smallest possible quantity of cold water. Add a saturated solution of mercuric chloride until an excess is indicated by the formation of a precipitate. Add 400 cc. of a 50% solution of potassium hydroxide. Make up to 1 liter, allow to settle, and draw off the clear solution.

Phenolphthalein. Dissolve 1 gm. of phenolphthalein in 100 cc. of alcohol.

Soap Solution. Dissolve 100 gm. of dry castile soap in 1 liter of 80% alcohol. Allow to stand several days and dilute with 70% to 80% alcohol until 6.4 cc. produces a permanent lather with 20 cc. of standard calcium solution. The latter solution is made by dissolving 0.2 gm. of calcium carbonate in a small amount of dilute hydrochloric acid, evaporating to dryness, and making up to 1 liter.

Sodium Cobaltic Nitrite. Dissolve 4 gm. of cobalt chloride and 10 gm. of sodium nitrite in 50 cc. of distilled water, add 2 cc. of acetic acid and make up to 100 cc.

Starch. Dissolve 5 gm. of soluble starch in cold water, pour the solution into 2 liters of hot water and boil for a few minutes. Keep in a glass-stoppered bottle.

Starch Solution from other than soluble starch. One part of starch is made into an emulsion with water and this is poured into 200 parts of boiling water, the boiling continued a few minutes, then the solution allowed to stand. Use only the clear solution.

Tannic Acid. Dissolve 1 gm. of tannic acid in 1 cc. of alcohol, and make up to 10 cc. with water.

Tincture of Iodine. To 50 cc. of water add 70 gm. of iodine and 50 gm. of potassium iodide. Make up to 1 liter with alcohol.

Trinitrophenol Solution. Dissolve 1 gm. of trinitrophenol in 100 cc. of water. Cool and filter.

Turmeric Tincture. Digest the ground turmeric root with several small quantities of water. Dry the residue and digest it several days with six times its weight of alcohol, and filter.

Turmeric Paper. Impregnate white, unsized paper with the tincture, and dry.

DECI-NORMAL SOLUTIONS OF SALTS AND OTHER REAGENTS

Name.	Formula.	At. or mol. wt.	Hydrogen equivalent.	One H equiv. in gms.
Acetic acid	$HC_2H_3O_2$	60.04	$HC_2H_3O_2$	6.004
Ammonia	NH_3	17.03	NH_3	1.703
Ammonium	NH_4	18.04	NH_4	1.804
Ammonium chloride	NH_4Cl	53.50	NH_4Cl	5.350
Ammonium sulphate	$(NH_4)_2SO_4$	132.14	$\frac{1}{2}(NH_4)_2SO_4$	6.607
Ammonium sulphocyanate	NH_4CNS	76.12	NH_4CNS	7.612
Barium	Ba	137.37	$\frac{1}{2}Ba$	6.869
Barium carbonate	$BaCO_3$	197.37	$\frac{1}{2}BaCO_3$	9.869
Barium chloride	$BaCl_2.2H_2O$	244.32	$\frac{1}{2}BaCl_2.2H_2O$	12.216
Barium hydroxide	$Ba(OH)_2$	171.38	$\frac{1}{2}Ba(OH)_2$	8.569
Barium oxide	BaO	153.37	$\frac{1}{2}BaO$	7.669
Bromine	Br	79.92	Br	7.992
Calcium	Ca	40.07	$\frac{1}{2}Ca$	2.004
Calcium carbonate	$CaCO_3$	100.07	$\frac{1}{2}CaCO_3$	5.004
Calcium chloride	$CaCl_2$	110.99	$\frac{1}{2}CaCl_2$	5.550
Calcium chloride	$CaCl_2.6H_2O$	219.08	$\frac{1}{2}CaCl_2.6H_2O$	10.954
Calcium hydroxide	$Ca(OH)_2$	74.08	$\frac{1}{2}Ca(OH)_2$	3.704
Calcium oxide	CaO	56.07	$\frac{1}{2}CaO$	2.804
Chlorine	Cl	35.46	Cl	3.546
Citric acid	$C_6H_8O_7.H_2O$	210.11	$\frac{1}{3}C_6H_8O_7.H_2O$	7.003
Cobalt	Co	58.97	$\frac{1}{2}Co$	2.949
Copper	Cu	63.57	$\frac{1}{2}Cu$	3.179
Copper oxide	CuO	79.57	$\frac{1}{2}CuO$	3.979
Copper sulphate	$CuSO_4.5H_2O$	249.71	$\frac{1}{2}CuSO_4.5H_2O$	12.486
Cyanogen	CN	26.02	CN	2.602
Hydrochloric acid	HCl	36.47	HCl	3.647
Hydrocyanic acid	HCN	27.02	HCN	2.702

DECI-NORMAL SOLUTIONS OF SALTS AND OTHER REAGENTS (Continued.)

Name.	Formula.	At. or mol. wt.	Hydrogen equivalent.	One H equiv. in gms.
Iodine	I	126.92	I	12.692
Lactic acid	$C_3H_6O_3$	90.06	$C_3H_6O_3$	9.006
Malic acid	$C_4H_6O_5$	134.07	$\frac{1}{2}C_4H_6O_5$	6.703
Magnesium	Mg	24.32	$\frac{1}{2}Mg$	1.216
Magnesium carbonate	$MgCO_3$	84.33	$\frac{1}{2}MgCO_3$	4.217
Magnesium chloride	$MgCl_2$	95.24	$\frac{1}{2}MgCl_2$	4.762
Magnesium chloride	$MgCl_2.6H_2O$	203.33	$\frac{1}{2}MgCl_2.6H_2O$	10.166
Magnesium oxide	MgO	40.32	$\frac{1}{2}MgO$	2.016
Manganese	Mn	54.93	$\frac{1}{2}Mn$	2.747
Manganese sulphate	$MnSO_4$	150.99	$\frac{1}{2}MnSO_4$	7.550
Mercuric chloride	$HgCl_2$	271.52	$\frac{1}{2}HgCl_2$	13.576
Nickel	Ni	58.68	$\frac{1}{2}Ni$	2.934
Nitric acid	HNO_3	63.02	HNO_3	6.302
Nitrogen	N	14.01	N	1.401
Nitrogen pentoxide	N_2O_5	108.02	$\frac{1}{2}N_2O_5$	5.401
Oxalic acid	$H_2C_2O_4$	90.03	$\frac{1}{2}H_2C_2O_4$	4.502
Oxalic acid	$H_2C_2O_4.2H_2O$	126.06	$\frac{1}{2}H_2C_2O_4.2H_2O$	6.303
Oxalic anhydride	C_2O_3	72.01	$\frac{1}{2}C_2O_3$	3.601
Phosphoric acid	H_3PO_4	98.06	$\frac{1}{3}H_3PO_4$	3.269
Potassium	K	39.10	K	3.910
Potassium bicarbonate	$KHCO_3$	100.11	$KHCO_3$	10.011
Potassium carbonate	K_2CO_3	138.21	$\frac{1}{2}K_2CO_3$	6.910
Potassium chloride	KCl	74.56	KCl	7.456
Potassium cyanide	KCN	65.12	KCN	6.512
Potassium hydroxide	KOH	56.11	KOH	5.611
Potassium oxide	K_2O	94.20	$\frac{1}{2}K_2O$	4.710
Potassium permanganate for Co estimation	$KMnO_4$	158.03	$\frac{1}{6}KMnO_4$	2.634
Potassium permanganate for Mn estimation	$KMnO_4$	158.03	$\frac{1}{3}KMnO_4$	5.268
Potassium tartrate	$K_2H_4C_4O_6$	226.25	$\frac{1}{2}K_2H_4C_4O_6$	11.313
Silver	Ag	107.88	Ag	10.788
Silver nitrate	$AgNO_3$	169.89	$AgNO_3$	16.989
Sodium	Na	23.00	Na	2.300
Sodium bicarbonate	$NaHCO_3$	84.01	$NaHCO_3$	8.401
Sodium carbonate	Na_2CO_3	106.01	$\frac{1}{2}Na_2CO_3$	5.301
Sodium chloride	$NaCl$	58.46	$NaCl$	5.846
Sodium hydroxide	$NaOH$	40.01	$NaOH$	4.001
Sodium oxide	Na_2O	62.00	$\frac{1}{2}Na_2O$	3.100
Sodium sulphide	Na_2S	78.06	$\frac{1}{2}Na_2S$	3.903
Sulphuric acid	H_2SO_4	98.08	$\frac{1}{2}H_2SO_4$	4.904
Sulphur trioxide	SO_3	80.06	$\frac{1}{2}SO_3$	4.003
Tartaric acid	$C_4H_6O_6$	150.07	$\frac{1}{2}C_4H_6O_6$	7.504
Zinc	Zn	65.37	$\frac{1}{2}Zn$	3.269
Zinc sulphate	$ZnSO_4.7H_2O$	287.54	$\frac{1}{2}ZnSO_4.7H_2O$	14.377

DECI-NORMAL SOLUTIONS OF OXIDATION AND REDUCTION REAGENTS

Name.	Formula.	At. or mol. wt.	Hydrogen equivalent.	One H equiv. in gms.
Antimony	Sb	120.20	$\frac{1}{2}Sb$	6.010
Arsenic	As	74.96	$\frac{1}{2}As$	3.748
Arsenic trisulphide	As_2S_3	246.10	$\frac{1}{4}As_2S_3$	6.153
Arsenous oxide	As_2O_3	197.92	$\frac{1}{4}As_2O_3$	4.948
Barium peroxide	BaO_2	169.37	$\frac{1}{2}BaO_2$	8.469
Barium peroxide, hydrated	$BaO_2.8H_2O$	313.50	$\frac{1}{2}BaO_2.8H_2O$	15.675
Calcium	Ca	40.07	$\frac{1}{2}Ca$	2.004
Calcium carbonate	$CaCO_3$	100.07	$\frac{1}{2}CaCO_3$	5.004
Calcium hypochlorite	$Ca(ClO)_2$	142.99	$\frac{1}{2}Ca(ClO)_2$	7.150
Calcium oxide	CaO	56.07	$\frac{1}{2}CaO$	2.804
Chlorine	Cl	35.46	Cl	3.546
Chromium trioxide	CrO_3	100.00	$\frac{1}{3}CrO_3$	3.333
Ferrous ammonium sulphate	$FeSO_4(NH_4)_2SO_4.6H_2O$	392.15	$FeSO_4(NH_4)_2SO_4.6H_2O$	39.215
Hydroferrocyanic acid	$H_4Fe(CN)_6$	215.96	$H_4Fe(CN)_6$	21.596
Hydrogen peroxide	H_2O_2	34.02	$\frac{1}{2}H_2O_2$	1.701
Hydrogen sulphide	H_2S	34.08	$\frac{1}{2}H_2S$	1.704
Iodine	I	126.92	I	12.692
Iron	Fe	55.84	Fe	5.584
Iron oxide, ferrous	FeO	71.84	FeO	7.184
Iron oxide, ferric	Fe_2O_3	159.68	$\frac{1}{2}Fe_2O_3$	7.984
Lead peroxide	PbO_2	239.20	$\frac{1}{2}PbO_2$	11.960
Manganese peroxide	MnO_2	86.93	$\frac{1}{2}MnO_2$	4.347
Nitric acid	HNO_3	63.02	$\frac{1}{3}HNO_3$	2.101
Nitrogen trioxide	N_2O_3	76.02	$\frac{1}{4}N_2O_3$	1.801
Nitrogen pentoxide	N_2O_5	108.02	$\frac{1}{6}N_2O_5$	1.800
Oxalic acid	$C_2H_2O_4$	90.03	$\frac{1}{2}C_2H_2O_4$	4.502
Oxalic acid	$C_2H_2O_4.2H_2O$	126.06	$\frac{1}{2}C_2H_2O_4.2H_2O$	6.303
Oxygen	O	16.00	$\frac{1}{2}O$	0.800
Potassium bichromate	$K_2Cr_2O_7$	294.20	$\frac{1}{6}K_2Cr_2O_7$	4.903
Potassium chlorate	$KClO_3$	122.56	$KClO_3$	12.256
Potassium chromate	K_2CrO_4	194.20	$\frac{1}{2}K_2CrO_4$	9.710
Potassium ferrocyanide	$K_4Fe(CN)_6$	368.33	$K_4Fe(CN)_6$	36.833
Potassium ferrocyanide	$K_4Fe(CN)_6.3H_2O$	422.38	$K_4Fe(CN)_6.3H_2O$	42.238
Potassium iodide	KI	166.02	KI	16.602
Potassium nitrate	KNO_3	101.11	$\frac{1}{3}KNO_3$	3.370
Potassium perchlorate	$KClO_4$	138.56	$KClO_4$	13.856
Potassium permanganate	$KMnO_4$	158.03	$\frac{1}{5}KMnO_4$	3.161
Sodium chlorate	$NaClO_3$	106.46	$NaClO_3$	10.646
Sodium nitrate	$NaNO_3$	85.01	$\frac{1}{3}NaNO_3$	2.834
Sodium phosphate, sec.	$Na_2HPO_4.12H_2O$	358.24	$\frac{1}{3}Na_2HPO_4.12H_2O$	11.941
Sodium thiosulphate	$Na_2S_2O_3.5H_2O$	248.20	$Na_2S_2O_3.5H_2O$	24.820
Stannous chloride	$SnCl_2$	189.62	$\frac{1}{2}SnCl_2$	9.481
Stannous oxide	SnO	134.70	$\frac{1}{2}SnO$	6.735
Sulphur dioxide	SO_2	64.06	$\frac{1}{2}SO_2$	3.203
Tin	Sn	118.70	$\frac{1}{2}Sn$	5.935

SOLUBILITY CHART

	Acetate.	Arsenate.	Arsenite.	Borate.	Bromide.	Carbonate.	Chlorate.	Chloride.	Chromate.	Cyanide.	Ferricyanide	Ferrocyanide.	Fluoride.	Hydroxide.	Iodide.	Nitrate.	Oxalate.	Oxide.	Phosphate.	Silicate.	Sulphate.	Sulphide.	Tartrate.
Al.....	W	a	..	A	W	..	W	W	..	..	..	w	I	A	W	W	A	A	A	a	W	A	W
NH_4....	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	..	W	..	W	W	W
Sb.....	..	a	A	..	w	..	..	w	A	..	..	..	W	..	w	..	A	A	w	..	w	A	A
Ba.....	W	A	A	A	W	A	W	W	A	w	w	w	a	W	W	W	A	W	A	A	I	W	A
Bi.....	W	A	..	A	w	A	W	w	A	w	..	w	A	A	A	W	A	A	A	..	W	A	A
Cd.....	W	A	..	w	W	A	W	W	A	A	A	..	w	A	W	W	A	A	A	A	W	A	w
Ca.....	W	A	A	w	W	A	W	W	w	W	W	W	a	w	W	W	A	w	A	A	A	W	A
Cr.....	W	A	..	A	W	..	W	W	A	A	..	..	W	A	W	W	w	A	A	A	W	A	W
Co.....	W	A	A	A	W	A	W	W	A	a	I	I	w	A	W	W	A	A	A	A	W	A	W
Cu.....	W	A	A	W	W	A	W	W	W	A	I	I	A	A	W	W	A	A	A	A	W	A	W
Au.....	..	..	..	..	W	..	..	W	..	A	..	..	..	A	A	..	..	A	..	..	..	A	..
H.....	W	W	..	W	W	..	W	W	..	W	W	W	W	W	W	W	W	W	W	W	W	w	W
Fe″....	W	A	A	A	W	A	W	W	..	a	I	I	w	A	W	W	A	A	A	A	W	A	w
Fe‴....	W	A	A	A	W	..	W	W	W	..	W	I	W	A	W	W	A	A	A	A	W	A	W
Pb.....	W	A	A	A	a	A	W	a	a	A	w	A	A	A	w	W	A	A	A	A	a	A	A
Mg.....	W	A	A	w	W	A	W	W	W	W	W	W	a	A	W	W	A	A	A	A	W	A	W
Mn.....	W	A	A	A	W	A	W	W	W	W	I	A	A	A	W	W	w	A	A	A	W	A	w
Hg′.....	w	A	A	..	a	A	W	a	A	A	..	..	W	..	A	W	A	A	A	..	w	A	w
Hg″....	W	A	A	..	W	A	W	W	w	A	A	A	w	..	A	W	A	A	A	..	W	A	A
Ni.....	W	A	A	A	W	A	W	W	A	a	I	I	w	A	W	W	A	A	A	A	W	A	A
K.....	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Ag.....	w	A	A	A	I	A	W	I	A	I	I	I	W	..	I	W	A	A	A	..	w	A	A
Na.....	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Sn⁗....	W	A	..	..	W	..	..	W	..	..	..	I	W	A	W	w	W	A	A	..	W	A	..
Sn″....	W	A	A	A	W	..	W	W	A	..	..	I	W	A	W	..	A	A	A	..	W	A	A
Sr.....	W	A	A	A	W	A	W	W	w	A	W	W	a	A	W	W	A	w	A	A	a	W	A
Zn.....	W	A	A	A	W	A	W	W	W	A	A	I	w	A	W	W	A	A	A	A	W	A	A

W Soluble in water.
A Insoluble in water but soluble in acids.
w Sparingly soluble in water but soluble in acids.
a Insoluble in water and only sparingly soluble in acids.
I Insoluble in both water and acids.

SOLUBILITY OF INORGANIC SALTS IN WATER

The table shows the number of grams of the substance indicated by the formula at the side which can be dissolved in 100 grams of water at the temperature in degrees Centigrade given at the top.

Substance.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
$AgNO_3$	115.0	160.0	215.0	270.0	335.0	400.0	470.0	550.0	650.0	760.0	910.0
$Al_2(SO_4)_3$	31.3	33.5	36.2	40.4	45.7	52.1	59.1	66.2	73.1	80.8	89.1
$Al_2K_2(SO_4)_4$	3.0	.....	.....	8.4	.....	.....	24.8	.....	.....	.....	154.0
$Al_2(NH_4)_2(SO_4)_4$	2.6	4.5	6.6	9.1	12.4	15.9	21.1	27.0	35.2	.....	.....
B_2O_3	1.1	1.5	2.2	.....	4.0	.....	6.2	.....	9.5	.....	15.7
$BaCl_2$	31.6	33.3	35.7	38.2	40.8	43.6	46.4	49.4	52.4	55.6	58.8
$Ba(NO_3)_2$	5.0	7.0	9.2	11.6	14.2	17.1	20.3	23.6	27.0	30.6	34.2
$Ba(OH)_2.8H_2O$	1.7	2.5	3.9	.....	8.2	.....	20.9	.....	101.4	.....	.....
$CaCl_2$	59.5	65.0	74.5	101.0	115.3	.....	136.8	141.7	147.0	152.7	159.0
$Ca(OH)_2$	0.185	0.176	0.165	.....	0.141	.....	0.116	.....	0.094	.....	0.077
$CdSO_4.\frac{8}{3}H_2O$	76.5	76.0	76.6	.....	78.5	.....	83.7	Bec	omes H_2O	CdS at	O_4.-74°
$CoCl_2$	40.5	45.0	50.0	56.5	65.0	93.5	94.0	95.0	96.0	.....	103.0
$CsCl$	161.4	174.4	186.5	197.3	208.0	218.5	229.0	239.5	250.0	260.1	270.5
$CsNO_3$	9.3	14.9	23.0	33.9	47.2	64.4	83.8	107.0	134.0	163.0	197.0
Cs_2SO_4	167.1	173.1	178.7	184.1	189.9	194.9	199.9	205.0	210.3	214.9	220.3
$Cu(NO_3)_2$	81.8	.....	125.0	.....	159.8	.....	179.1	.....	207.8	.....	.....
$CuSO_4$	14.9	.....	20.0	25.5	29.5	33.6	39.0	45.7	53.5	62.7	73.5
$FeCl_2$	.....	.....	68.5	.....	.....	82.0	.....	.....	104.0	105.0	106.0
Fe_2Cl_6	74.4	81.9	91.8	.....	.....	315.1	.....	.....	525.8	.....	535.7
$FeSO_4$	15.6	20.8	26.4	33.0	40.2	48.6	55.0	56.0	50.6	43.0	.....
H_3BO_3	1.0	2.5	4.0	5.5	7.0	9.0	11.0	13.0	17.0	22.0	27.5
$HgCl_2$	4.3	6.6	7.4	8.4	9.6	11.3	13.9	17.3	24.3	37.1	54.0
KBr	54.0	.....	65.0	.....	76.0	.....	86.0	.....	95.5	.....	105.0
K_2CO_3	105.0	.....	.....	114.0	117.0	121.0	127.0	133.0	140.0	147.0	156.0
KCl	28.5	31.2	34.3	37.3	40.1	42.9	45.5	48.3	51.0	53.8	56.6
$KClO_3$	3.3	5.0	7.1	10.1	14.5	19.7	26.0	32.5	39.6	47.5	56.0
K_2CrO_4	58.9	60.9	62.9	65.0	67.0	69.0	71.0	73.0	75.1	77.1	79.1
$K_2Cr_2O_7$	5.0	8.5	13.1	.....	29.2	.....	50.5	.....	73.0	.....	102.0
$KHCO_3$	22.5	27.7	33.2	39.0	45.3	52.2	60.0	.....	.....	.....	.....
KI	127.9	136.1	144.2	152.3	160.0	168.0	176.0	184.0	192.0	201.0	209.0
KNO_3	13.3	20.9	31.6	45.8	63.9	85.5	109.9	138.0	169.0	204.0	246.0
KOH	97.0	103.0	112.0	126.0	136.0	140.0	146.0	151.0	159.0	168.0	178.0
K_2PtCl_6	0.7	0.9	1.1	1.4	1.8	2.2	2.6	3.2	3.8	4.5	5.2
K_2SO_4	7.4	9.2	11.1	13.0	14.8	16.5	18.2	19.8	21.4	22.8	24.1
$LiOH$	12.7	12.7	12.8	12.9	13.0	13.3	13.8	14.4	15.3	.....	17.5
$MgCl_2$	52.8	53.5	54.5	.....	57.5	.....	61.0	.....	66.0	.....	73.0
$MgSO_4.7H_2O$	26.0	30.9	35.6	40.9	45.6	.....	.....	.....	.....	.....	.....
$MgSO_4.6H_2O$	40.8	42.2	43.9	45.3	.....	50.4	55.0	59.6	64.2	68.9	73.8
NH_4Cl	29.7	33.3	37.2	41.4	45.8	50.4	55.2	60.2	65.6	71.3	77.3
NH_4HCO_3	11.9	15.9	21.0	27.0	.....	.....	.....	.....	.....	.....	.....
NH_4NO_3	118.3	.....	.....	241.8	297.0	.....	.....	.....	580.0	740.0	871.0
$(NH_4)_2SO_4$	70.6	73.0	75.4	78.0	81.0	84.4	88.0	91.6	95.3	99.2	103.3
$NaBr$	79.5	84.5	90.3	.....	105.8	116.0	117.0	.....	118.5	.....	120.5
$Na_2B_4O_7$	.....	1.6	.....	3.9	.....	10.5	20.0	24.4	31.4	40.8	52.3
$Na_2CO_3.10H_2O$	7.1	12.6	21.4	40.9	.....	.....	.....	.....	.....	.....	.....
$Na_2CO_3.7H_2O$	20.4	26.3	33.5	43.5	(1 H_2O)	47.5	46.4	45.8	45.2	45.2	45.2
$NaCl$	35.6	35.7	35.8	36.0	36.3	36.7	37.1	37.5	38.0	38.5	39.1
$NaClO_3$	82.0	89.0	99.0	.....	123.5	.....	147.0	.....	175.0	.....	204.0
Na_2CrO_4	31.7	50.2	90.0	.....	96.0	105.0	115.0	.....	124.0	.....	126.0
$Na_2Cr_2O_7$	163.0	170.0	180.0	197.0	220.0	248.0	283.0	323.0	386.0	.....	433.0
$NaHCO_3$	6.9	8.2	9.6	11.1	12.7	14.5	16.4	.....	.....	.....	.....
Na_2HPO_4	2.5	3.9	9.3	24.1	63.9	.....	.....	94.9	.....	.....	98.8
NaI	159.0	169.0	179.0	190.0	205.0	228.0	257.0	.....	295.0	.....	302.0
$NaNO_3$	73.0	80.5	88.0	96.2	104.9	114.0	124.6	136.0	148.0	161.0	175.5
$NaOH$	42.0	51.5	109.0	119.0	129.0	145.0	174.0	.....	313.0	.....	.....
$Na_4P_2O_7$	3.2	3.9	6.2	9.9	13.5	17.4	22.0	25.5	30.0	.....	.....

SOLUBILITY OF INORGANIC SALTS IN WATER (Cont.)

Substance.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
Na_2SO_3	14.1	....	28.7	....	49.5	....	....	....	....	....	33.0
$Na_2SO_4.10H_2O$	5.0	9.0	19.4	40.0	Bec	omes	Na_2S	O_4 at	32°	....	....
$Na_2SO_4.7H_2O$	19.6	30.5	44.7	Na_2-SO_4	48.2	46.8	45.5	44.5	43.7	42.9	42.7
$Na_2S_2O_3$	52.5	61.0	70.0	84.7	102.6	169.7	206.7	....	248.8	254.2	266.0
$NiCl_2$	....	60.0	64.0	68.0	72.0	76.0	81.0	....	....	....	....
$NiSO_4$	27.2	....	....	42.5	....	50.2	54.8	59.4	63.2	68.8	77.6
$PbBr_2$	0.5	0.6	0.8	1.2	1.5	2.0	2.4	2.8	3.3	....	4.8
$Pb(NO_3)_2$	36.5	44.4	52.3	60.7	69.4	78.7	88.0	97.7	107.6	117.4	127.0
$RbCl$	77.0	84.4	91.1	97.6	103.5	109.3	115.5	121.4	127.2	133.1	138.9
$RbNO_3$	19.5	33.0	53.3	81.3	116.7	155.6	200.0	251.0	309.0	375.0	452.0
Rb_2SO_4	36.4	42.6	48.2	53.5	58.5	63.1	67.4	71.4	75.0	78.7	81.8
SnI_2	....	....	1.0	1.2	1.4	1.7	2.1	2.5	3.0	3.4	4.0
$SrCl_2$	44.2	48.3	53.9	60.0	66.7	74.4	83.1	89.6	92.4	96.2	101.9
$Sr(NO_3)_2$	39.5	54.9	70.8	87.6	91.3	92.6	94.0	95.6	97.2	99.0	101.1
$Th(SO_4)_2.9H_2O$	0.7	1.0	1.4	2.0	3.0	5.1	....	....	....	....	....
$Th(SO_4)_2.4H_2O$	....	....	....	....	4.0	2.5	1.6	1.1	....	....	....
$TlCl$	0.2	0.2	0.3	0.5	0.6	0.8	1.0	1.3	1.6	2.0	....
$TlNO_3$	3.9	6.2	9.6	14.3	20.9	30.4	46.2	69.5	111.0	200.0	414.0
Tl_2SO_4	2.7	3.7	4.9	6.2	7.6	9.2	10.9	12.7	14.6	16.5	....
$Yb_2(SO_4)_3$	44.2	....	....	....	....	....	10.4	7.2	6.9	5.8	4.7
$Zn(NO_3)_2$	94.8	....	....	....	206.9	....	....	....	....	....	....
$ZnSO_4$	....	....	....	....	70.0	76.8	....	89.0	86.0	92.0	78.5

SOLUBILITY OF CANE SUGAR IN WATER

Grams of sugar in 100 grams of water, temperature in degrees Centigrade.

	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
$C_{12}H_{22}O_{11}$	179.2	190.5	203.9	219.5	238.1	260.4	287.3	320.5	362.1	415.7	487.2

INDICATORS

R. T. Thomson's table, showing the hydrogen atoms replaced by NaOH or KOH when a compound neutral to the indicator is formed. The blank spaces indicate that the end-reaction is obscure.

(From Cohn's Indicators and Test-papers, John Wiley and Sons, publishers, by permission.)

Acid	Formula	Methyl-orange Cold	Phenolphthalein		Litmus	
			Cold	Boiling	Cold	Boiling
Sulphuric	H_2SO_4	2	2	2	2	2
Hydrochloric	HCl	1	1	1	1	1
Nitric	HNO_3	1	1	1	1	1
Thiosulphuric	$H_2S_2O_3$	2	2	2	2	2
Carbonic	H_2CO_3	0	1 dilute	0	..	0
Sulphurous	H_2SO_3	1	2	..	..	..
Hydrosulphuric	H_2S	0	1 dilute	0	..	0
Phosphoric	H_3PO_4	1	2	..	..	..
Arsenic	H_3AsO_4	1	2	..	..	..
Arsenous	H_3AsO_3	4	..	..	0	0
Nitrous	HNO_2	indicator destroyed	1	..	1	..
Silicic	H_4SiO_4	0	..	..	0	0
Boric	H_3BO_3	0	..	..	..	..
Chromic	H_2CrO_4	1	2	2	..	..
Oxalic	$H_2C_2O_4$	..	2	2	2	2
Acetic	$HC_2H_3O_2$	..	1	..	1 nearly	..
Butyric	$HC_4H_7O_2$	..	1	..	1 nearly	..
Succinic	$H_2C_4H_4O_4$	..	2	..	2 nearly	..
Lactic	$HC_3H_5O_3$	..	1	..	1	..
Tartaric	$H_2C_4H_4O_6$	..	2	..	2	..
Citric	$H_3C_6H_5O_7$	..	3	..	..	..

TABLE OF INDICATORS

Water has a concentration of H^+ ion of 10^{-7} and of OH^- ion of 10^{-7} moles per liter. Due to hydrolysis the composition of a titrated weak acid solution is basic and of a titrated weak base, acid. A truly neutral titrated solution of a strong acid or base has the same concentration of H^+ and OH^- as water.

Indicator	Color		OH^- concentration at change	H^+ concentration at change	For titration of
	Alkaline	Acid			
Benzopurpurin	Red	Yellow	1	10^{-14}	Very weak acids
Trinitrobenzene	Orange	Colorless	10^{-1}	10^{-13}	Very weak acids
Thymolphthalein	Blue	Colorless	10^{-4}	10^{-10}	Weak acids
Phenolphthalein*	Red	Colorless	10^{-5}	10^{-9}	Weak acids
Cochineal	Lilac	Yellow	10^{-8}	10^{-6}	Strong acids or bases
Litmus	Violet	Red	10^{-7}	10^{-7}	Strong acids or bases
Congo red	Orange	Violet	10^{-8}	10^{-6}	Strong acids or bases
Methyl red	Yellow	Pink	10^{-8}	10^{-6}	Strong acids or bases
Rosolic acid	Red	Yellow	10^{-7}	10^{-7}	Strong acids or bases
Alizarin	Red	Greenish yellow	10^{-9}	10^{-5}	Weak bases
Methyl orange**	Yellow	Pink	10^{-9}	10^{-5}	Ammonia and weak bases

* May be used in the presence of weak bases. ** May be used in the presence of carbon dioxide or hydrogen sulphide.

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

To facilitate the use of the table the group of substances weighed given under each element as well as the substances sought under each substance weighed are arranged in the alphabetical order of their formulæ.

Weighed	Sought	Factor	Logarithm
Aluminum: Al = 27.1			−10
Al	Al_2O_3	1.8856	10.27545
	$AlPO_4$	4.5070	10.65389
$AlCl_3$	Al_2O_3	0.38282	9.58300
Al_2O_3	Al	0.53033	9.72455
	$AlCl_3$	2.6122	10.41700
	$AlPO_4$	2.3897	10.37834
	$Al_2(SO_4)_3$	3.3501	10.52506
	$Al_2(SO_4)_3 \cdot 18H_2O$	6.5232	10.81446
	$K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$	9.2860	10.96791
	$(NH_4)_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$	8.8739	10.94811
$AlPO_4$	Al	0.22193	9.34621
	Al_2O_3	0.41841	9.62166
	P_2O_5	0.58175	9.76474
$Al_2(SO_4)_3$	Al_2O_3	0.29850	9.47494
$Al_2(SO_4)_3 \cdot 18H_2O$	Al_2O_3	0.15330	9.18554
$K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$	Al_2O_3	0.10769	9.03218
$(NH_4)_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$	Al_2O_3	0.11269	9.05186
P_2O_5	$AlPO_4$	1.7190	10.23526
Ammonium: NH_4 = 18.04			
Ag	NH_4Br	0.90813	9.95815
	NH_4Cl	0.49592	9.69541
	NH_4I	1.3440	10.12841
AgBr	NH_4Br	0.52166	9.71739
AgCl	NH_4Cl	0.37323	9.57198
AgI	NH_4I	0.61752	9.79065
$BaSO_4$	$(NH_4)_2SO_4$	0.56608	9.75288
Br	NH_4Br	1.2258	10.08843
Cl	NH_4	0.50874	9.70650
	NH_4Cl	1.5087	10.17861
HCl	NH_4Cl	1.4669	10.16641
I	NH_4I	1.1425	10.05782
$MgNH_4PO_4 \cdot 6H_2O$	NH_3	0.06936	8.84116
	NH_4	0.07347	8.86619
	$(NH_4)_2O$	0.10607	9.02559
N	NH_3	1.2153	10.08477
	NH_4	1.2877	10.10980
	NH_4Cl	3.8187	10.58191

Weighed	Sought	Factor	Logarithm
Ammonium:			−10
N	NH_4NO_3	5.7138	10.75693
	$(NH_4)_2O$	1.8587	10.26920
	$(NH_4)_2SO_4$	4.7161	10.67358
NH_3	$MgNH_4PO_4 \cdot 6H_2O$	14.4160	11.15884
	N	0.82268	9.91523
	NH_4Cl	3.1415	10.49714
	$(NH_4)_2CO_3$	2.8207	10.45036
	NH_4HCO_3	4.6413	10.66664
	NH_4NO_3	4.6994	10.67204
	$(NH_4)_2O$	1.5288	10.18435
	NH_4OH	2.0577	10.31338
	$(NH_4)_2PtCl_6$	13.0372	11.11518
	$(NH_4)_2SO_4$	3.8787	10.58868
	N_2O_5	3.1714	10.50126
	Pt	5.7311	10.75824
	SO_3	2.35020	10.37110
NH_4	Cl	1.9656	10.29350
	$MgNH_4PO_4 \cdot 6H_2O$	13.6085	11.13381
	N	0.77660	9.89020
	NH_4Cl	2.96560	10.47211
	$(NH_4)_2PtCl_6$	12.3068	11.09015
	Pt	5.4101	10.73321
NH_4Br	Ag	1.1011	10.04185
	AgBr	1.9169	10.28261
	Br	0.81577	9.91157
NH_4Cl	Ag	2.0164	10.30459
	AgCl	2.6793	10.42802
	Cl	0.66281	9.82139
	HCl	0.68169	9.83359
	N	0.26187	9.41809
	NH_3	0.31831	9.50286
	NH_4	0.33720	9.52789
	$(NH_4)_2O$	0.48673	9.68729
	NH_4OH	0.65516	9.81634
	$(NH_4)_2PtCl_6$	4.14995	10.61804
	Pt	1.8243	10.26110
$(NH_4)_2CO_3$	NH_3	0.35460	10.54974
NH_4HCO_3	NH_3	0.21543	9.33331
NH_4I	Ag	0.74403	9.87159
	AgI	1.6194	10.20935
	I	0.87535	9.94218
NH_4NO_3	NH_3	0.21274	9.32785
	$(NH_4)_2PtCl_6$	2.7735	10.44303
	N_2O_5	0.67470	9.82911
	Pt	1.2193	10.08609
$(NH_4)_2O$	$MgNH_4PO_4 \cdot 6H_2O$	9.4279	10.97441
	N	0.53802	9.73080
	NH_3	0.65418	9.81570
	NH_4Cl	2.0545	10.31271

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Ammonium:			−10
$(NH_4)_2O$.	$(NH_4)_2PtCl_6$	8.5260	10.93075
	N_2O_5	2.0741	10.31683
	Pt	3.7489	10.57381
NH_4OH.	N	0.39971	9.60175
	NH_3	0.48599	9.68663
	NH_4	0.51475	9.71160
	NH_4Cl	1.5264	10.18366
	$(NH_4)_2PtCl_6$	6.3343	10.80170
	Pt	2.7846	10.44476
$(NH_4)_2PtCl_6$	NH_3	0.07670	8.88482
	NH_4	0.08126	8.90985
	NH_4Cl	0.24097	9.38196
	NH_4NO_3	0.36054	9.55697
	$(NH_4)_2O$	0.11721	9.06925
	NH_4OH	0.15787	9.19830
	$(NH_4)_2SO_4$	0.29759	9.47362
$(NH_4)_2SO_4$	$BaSO_4$	1.7665	10.24611
	H_2SO_4	0.74224	9.87054
	N	0.21207	9.32648
	NH_3	0.25782	9.41131
	$(NH_4)_2PtCl_6$	3.3604	10.52639
	Pt	1.4772	10.16944
	SO_3	0.60587	9.78238
N_2O_5	NH_3	0.31531	9.49874
	NH_4NO_3	1.4821	10.17089
	$(NH_4)_2O$	0.48214	9.68317
Pt	NH_3	0.17449	9.24176
	NH_4	0.18484	9.26679
	NH_4NO_3	0.82018	9.91391
	$(NH_4)_2O$	0.26680	9.42619
	NH_4OH	0.35913	9.55524
	$(NH_4)_2SO_4$	0.67695	9.83056
SO_3	NH_3	0.42554	9.62894
	$(NH_4)_2SO_4$	1.6505	0.21762
Antimony: Sb = 120.2			
$KSbOC_4H_4O_6 \cdot \frac{1}{2}H_2O$	Sb	0.36168	9.55832
	Sb_2O_3	0.43390	9.63739
	Sb_2O_4	0.45796	9.66083
	Sb_2S_3	0.50640	9.70449
Sb	$KSbOC_4H_4O_6 \cdot \frac{1}{2}H_2O$	2.7649	10.44168
	Sb_2O_3	1.1997	10.07907
	Sb_2O_4	1.2662	10.10251
	Sb_2O_5	1.3328	10.12476
	Sb_2S_3	1.4001	10.14616
	Sb_2S_5	1.6639	10.22013
Sb_2O_3	$KSbOC_4H_4O_6 \cdot \frac{1}{2}H_2O$	2.3047	10.36261
	Sb	0.83355	9.92093
	Sb_2O_4	1.0555	10.02344
	Sb_2O_5	1.1109	10.04569
	Sb_2S_3	1.1671	10.06711

Weighed	Sought	Factor	Logarithm
Antimony:			−10
Sb_2O_3	Sb_2S_5	1.3894	10.14283
Sb_2O_4	$KSbOC_4H_4O_6 \cdot \frac{1}{2}H_2O$	2.1886	10.33917
	Sb	0.78975	9.89749
	Sb_2O_3	0.94746	9.97656
	Sb_2O_5	1.0526	10.02225
	Sb_2S_3	1.1057	10.04364
	Sb_2S_5	1.3164	10.11939
Sb_2O_5	Sb	0.75031	9.87524
	Sb_2O_3	0.90014	9.95431
	Sb_2O_4	0.95006	9.97775
	Sb_2S_5	1.2506	10.09712
Sb_2S_3	$KSbOC_4H_4O_6 \cdot \frac{1}{2}H_2O$	1.9748	10.29553
	Sb	0.71424	9.85384
	Sb_2O_3	0.85685	9.93290
	Sb_2O_4	0.90439	9.95636
	Sb_2O_5	0.95192	9.97860
Sb_2S_5	Sb	0.59995	9.77812
	Sb_2O_3	0.71974	9.85718
	Sb_2O_4	0.75967	9.88063
	Sb_2O_5	0.79960	9.90287
Arsenic: As = 74.96			
As	As_2O_3	1.3202	10.12063
	As_2O_5	1.5336	10.18571
	As_2S_3	1.6415	10.21524
	As_2S_5	2.0692	10.31580
	$BaSO_4$	4.6711	10.66942
	$Mg_2As_2O_7$	2.0715	10.31629
	$MgNH_4AsO_4 \cdot \frac{1}{2}H_2O$	1.9227	10.28405
As_2O_3	As	0.75748	9.87937
	As_2O_5	1.1616	10.06508
	As_2S_3	1.2434	10.09461
	As_2S_5	1.5674	10.19518
	$BaSO_4$	3.5382	10.54878
	$Mg_2As_2O_7$	1.5691	10.19565
	$MgNH_4AsO_4 \cdot \frac{1}{2}H_2O$	1.9227	10.28405
As_2O_5	As	0.65203	9.81429
	As_2S_3	1.0704	10.02955
	As_2S_5	1.3493	10.13011
	$BaSO_4$	3.0458	10.48370
	$Mg_2As_2O_7$	1.3504	10.13057
	$MgNH_4AsO_4 \cdot \frac{1}{2}H_2O$	1.6556	10.21897
AsO_3	$BaSO_4$	2.8476	10.45448
	$Mg_2As_2O_7$	1.2629	10.10136
	$MgNH_4AsO_4 \cdot \frac{1}{2}H_2O$	1.5479	10.18975
AsO_4	$BaSO_4$	2.5198	10.40137
	$Mg_2As_2O_7$	1.1175	10.04823
	$MgNH_4AsO_4 \cdot \frac{1}{2}H_2O$	1.3700	10.13672
As_2S_3	As	0.60918	9.78475
	As_2O_3	0.80423	9.90538
	As_2O_5	0.93425	9.97046

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS
(Continued)

Weighed	Sought	Factor	Logarithm
			−10
Arsenic:			
As_2S_3	As_2S_5	1.2605	10.10054
	$Mg_2As_2O_7$	1.2619	10.10102
As_2S_5	As	0.48327	9.68419
	As_2O_3	0.63800	9.80482
	As_2O_5	0.73715	9.86756
$BaSO_4$	As	0.21408	9.33058
	As_2O_3	0.28263	9.45122
	As_2O_5	0.32832	9.51630
	AsO_3	0.35117	9.54552
	AsO_4	0.39686	9.59864
$Mg_2As_2O_7$	As	0.48273	9.68371
	As_2O_3	0.63730	9.80435
	As_2O_5	0.74033	9.86943
	AsO_3	0.79183	9.89864
	AsO_4	0.89490	9.95177
	As_2S_3	0.79244	9.89897
$MgNH_4AsO_4\cdot\frac{1}{2}H_2O$	As	0.39383	9.59532
	As_2O_3	0.51993	9.71595
	As_2O_5	0.60399	9.78103
	AsO_3	0.64603	9.81025
	AsO_4	0.72993	9.86328
Barium: Ba = 137.37			
Ba	$BaCO_3$	1.4368	10.15739
	$BaCrO_4$	1.8457	10.26604
	$BaSiF_6$	2.0359	10.30876
	$BaSO_4$	1.6993	10.23027
$BaCl_2$	$BaCO_3$	0.94757	9.97661
	$BaCrO_4$	1.2170	10.08526
	$BaSO_4$	1.1207	10.04949
$BaCl_2\cdot 2H_2O$	$BaSO_4$	0.95524	9.98019
$BaCO_3$	Ba	0.69610	9.84261
	$BaCl_2$	1.0551	10.02339
	$BaCrO_4$	1.2842	10.10865
	$Ba(HCO_3)_2$	1.3142	10.11867
	BaO	0.7707	9.89046
	$BaSO_4$	1.1827	10.07287
	CO_2	0.22293	9.34817
$BaCrO_4$	Ba	0.54195	9.73396
	$BaCl_2$	0.82175	9.91474
	$BaCO_3$	0.77866	9.89135
	BaO	0.60507	9.78181
BaF_2	$BaSiF_6$	1.5948	10.20270
$Ba(HCO_3)_2$	$BaCO_3$	0.76090	9.88133
$Ba(NO_3)_2$	$BaSO_4$	0.89303	9.95087
BaO	$BaCO_3$	1.2869	10.10954
	$BaCrO_4$	1.6526	10.21819
	$BaSiF_6$	1.8235	10.26091
	$BaSO_4$	1.5220	10.18241
	CO_2	0.28689	9.45771
BaO_2	$BaSO_4$	1.3782	10.13931
BaS	$BaSO_4$	1.3777	10.13915

Weighed	Sought	Factor	Logarithm
			−10
Barium:			
$BaSiF_6$	Ba	0.49118	9.69124
	BaF_2	0.62705	9.73909
	BaO	0.54839	9.79730
$BaSO_4$	Ba	0.58849	9.76974
	$BaCl_2$	0.89230	9.95051
	$BaCl_2\cdot 2H_2O$	1.0467	10.01982
	$BaCO_3$	0.84554	9.92713
	$Ba(NO_3)_2$	1.1198	10.04914
	BaO	0.65703	9.81759
	BaO_2	0.72557	9.86068
	BaS	0.72583	9.86083
CO_2	BaO	3.4853	10.54224
	$BaCO_3$	4.4853	10.65179
Bismuth: Bi = 208			
Bi	Bi_2O_3	1.1154	10.04743
	BiOCl	1.2474	10.09601
	Bi_2S_3	1.2312	10.09033
$BiAsO_4$	Bi	0.59948	9.77778
	Bi_2O_3	0.66866	9.82521
$Bi(NO_3)_3\cdot 5H_2O$	Bi_2O_3	0.47922	9.68054
	BiOCl	0.53594	9.72912
Bi_2O_3	Bi	0.89654	9.95257
	BiOCl	1.1184	10.04858
	$Bi(NO_3)_3\cdot 5H_2O$	2.0867	10.31946
	$BiONO_3$	1.2328	10.09090
BiOCl	Bi	0.80166	9.90399
	$Bi(NO_3)_3\cdot 5H_2O$	1.8658	10.27088
	Bi_2O_3	0.89417	9.95142
	$BiONO_3$	1.1024	10.04232
$BiONO_3$	Bi_2O_3	0.81115	9.90910
	BiOCl	0.90715	9.59768
Bi_2S_3	Bi	0.81221	9.90967
	Bi_2O_3	0.90593	9.95709
Boron: B = 11			
B	B_2O_3	3.1818	10.50268
	KBF_4	11.4640	11.05933
B_2O_3	B	0.31428	9.49732
	H_3BO_3	1.7721	10.24849
	KBF_4	3.6029	10.55665
	$Na_2B_4O_7\cdot 10H_2O$	2.7297	10.43612
H_3BO_3	B_2O_3	0.56430	9.75151
	KBF_4	2.0331	10.30816
KBF_4	B	0.08723	8.94068
	B_2O_3	0.27755	9.44335
	H_3BO_3	0.49186	9.69184
	$Na_2B_4O_7\cdot 10\,H_2O$	0.75765	9.87947
Bromine: Br = 79.92			
Ag	Br	0.74083	9.86972
	BrO_3	1.1858	10.07400
	HBr	0.75053	9.87537

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Bromine:			−10
$AgBr$	Br	0.42556	9.62896
	BrO_3	0.68114	9.83324
	HBr	0.43113	9.63461
Br	Ag	1.3498	10.13029
	$AgBr$	2.3498	10.37104
	O	0.10009	9.00038
BrO_3	Ag	0.84333	9.92600
	$AgBr$	1.4681	10.16676
HBr	Ag	1.3324	10.12463
	$AgBr$	2.3195	10.36539
O	Br	9.9913	10.99962
Cadmium: $Cd = 112.4$			
Cd	$CdCl_2$	1.6308	10.21239
	CdO	1.1426	10.05780
	CdS	1.2852	10.10897
	$CdSO_4$	1.8546	10.26825
$CdCl_2$	Cd	0.61321	9.78761
	CdO	0.70051	9.84541
	CdS	0.78802	9.89654
	$CdSO_4$	1.1371	10.05580
$Cd(NO_3)_2$	Cd	0.47543	9.67708
	CdO	0.54310	9.73488
	CdS	0.61103	9.78600
	$CdSO_4$	0.88173	9.94534
CdO	Cd	0.87539	9.94220
	$CdCl_2$	1.4276	10.15459
	$Cd(NO_3)_2$	1.8413	10.26512
	CdS	1.1251	10.05119
	$CdSO_4$	1.6235	10.21045
CdS	Cd	0.77807	9.89102
	$CdCl_2$	1.2690	10.10346
	$Cd(NO_3)_2$	1.6366	10.21394
	CdO	0.88883	9.94882
$CdSO_4$	Cd	0.53919	9.73174
	$CdCl_2$	0.87940	9.94419
	$Cd(NO_3)_2$	1.1341	10.05465
	CdO	0.61595	9.78955
Calcium: $Ca = 40.07$			
$BaSO_4$	CaS	0.30900	9.48996
	$CaSO_4$	0.58317	9.76580
	$CaSO_4 \cdot 2H_2O$	0.73752	9.86777
Ca	$CaCl_2$	2.7699	10.44246
	$CaCO_3$	2.4974	10.39748
	CaO	1.3993	10.14591
	$CaSO_4$	3.3973	10.53113
	Cl	1.7699	10.24795
$Ca_3(AsO_4)_2$	$Mg_2As_2O_7$	0.77995	9.89207
$CaCl_2$	Ca	0.36103	9.55754
	$CaCO_3$	0.90162	9.95502
	CaO	0.50518	9.70345
	$CaSO_4$	1.2265	10.08867
	Cl	0.63899	9.80549
$CaCO_3$	Ca	0.40043	9.60252
Calcium:			−10
$CaCO_3$	$CaCl_2$	1.1091	10.04498
	$Ca(HCO_3)_2$	1.6198	10.20945
	CaO	0.56031	9.74843
	$CaSO_4$	1.3602	10.13360
	$CaSO_4 \cdot 2H_2O$	1.7204	10.23563
	HCl	0.72890	9.86267
CaF_2	$CaSO_4$	1.7437	10.24147
$Ca(HCO_3)_2$	$CaCO_3$	0.61737	9.79055
	CaO	0.34592	9.53898
$Ca(NO_3)_2$	N_2O_5	0.65830	9.81842
CaO	Ca	0.71465	9.85409
	$CaCl_2$	1.9793	10.29652
	$CaCO_3$	1.7847	10.25157
	$Ca(HCO_3)_2$	2.8908	10.46102
	$Ca_3(PO_4)_2$	1.8449	10.26593
	$CaSO_4$	2.4279	10.38523
	$CaSO_4 \cdot 2H_2O$	3.0687	10.48695
	Cl	1.2649	10.10204
	MgO	0.71910	9.85679
	SO_3	1.4279	10.15470
$Ca_3(PO_4)_2$	CaO	0.54209	9.73407
	$CaSO_4$	1.3162	10.11932
	$Mg_2P_2O_7$	0.71777	9.85598
	$(NH_4)_3PO_4 \cdot 12MoO_3$	12.0989	11.08275
	P_2O_5	0.45787	9.66075
CaS	$BaSO_4$	3.2362	10.51003
$CaSO_4$	$BaSO_4$	1.7148	10.23421
	Ca	0.29435	9.46886
	$CaCl_2$	0.81532	9.91133
	$CaCO_3$	0.73511	9.86635
	CaF_2	0.57350	9.75853
	CaO	0.41189	9.61478
	SO_3	0.58811	9.76946
$CaSO_4 \cdot 2H_2O$	$BaSO_4$	1.3559	10.13223
	$CaCO_3$	0.58126	9.76437
	CaO	0.32569	9.51280
	SO_3	0.46503	9.66748
$CaWO_4$	WO_3	0.80530	9.90596
Cl	Ca	0.56500	9.75205
	$CaCl_2$	1.5650	10.19451
	CaO	0.79060	9.89796
CO_2	CaO	1.2743	10.10528
	$CaCO_3$	2.2743	10.35685
HCl	$CaCO_3$	1.3719	10.13733
$Mg_2As_2O_7$	$Ca_3(AsO_4)_2$	1.2821	10.10793
MgO	CaO	1.3906	10.14321
$Mg_2P_2O_7$	$Ca_3(PO_4)_2$	1.3932	10.14402
$(NH_4)_3PO_4 \cdot 12MoO_3$	$Ca_3(PO_4)_2$	0.08265	8.91725
N_2O_5	$Ca(NO_3)_2$	1.5191	10.18158
P_2O_5	$Ca_3(PO_4)_2$	2.1840	10.33925
SO_3	CaO	0.70035	9.84532

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Calcium:			−10
SO_3	$CaSO_4$	1.7003	10.23053
	$CaSO_4 \cdot 2H_2O$	2.1504	10.33252
WO_3	$CaWO_4$	1.2418	10.09404
Carbon: C = 12.005			
Ag	HCN	0.25049	9.39879
	KCN	0.60359	9.78074
AgCN	HCN	0.20182	9.30496
	KCN	0.48631	9.68691
$BaCO_3$	C	0.06082	8.78390
	CO_2	0.22295	9.34819
	CO_3	0.30402	9.48290
BaO	CO_2	0.28692	9.45776
	CO_2, bicarbonate	0.57384	9.75879
C	$BaCO_3$	16.4411	11.21593
	CO_2	3.6656	10.56414
$CaCO_3$	CO_2	0.43972	9.64318
$Ca(HCO_3)_2$	CO_2	0.54295	9.73476
CaO	CO_2	0.78482	9.89477
	CO_2, bicarbonate	1.5696	10.19579
CO_2	$BaCO_3$	4.4863	10.65189
	$Ba(HCO_3)_2$	2.9473	10.46942
	BaO	3.4853	10.54224
	C	0.27281	9.43586
	$CaCO_3$	2.2742	10.35683
	$Ca(HCO_3)_2$	1.8416	10.26519
	CaO	1.2742	10.10524
	CO_3	1.3636	10.13469
	$FeCO_3$	2.6325	10.42037
	$Fe(HCO_3)_2$	2.0210	10.30557
	K_2CO_3	3.1407	10.49703
	$KHCO_3$	2.2751	10.35700
	K_2O	2.1407	10.33056
	Li_2CO_3	1.6790	10.22505
	$LiHCO_3$	1.5443	10.18873
	Li_2O	0.67901	9.83188
	$MgCO_3$	1.9163	10.28246
	$Mg(HCO_3)_2$	1.6628	10.22084
	MgO	0.91626	9.96202
	$MnCO_3$	2.6119	10.41696
	$Mn(HCO_3)_2$	2.0106	10.30333
	MnO	1.6119	10.20734
	Na_2CO_3	2.4089	10.38182
	$NaHCO_3$	1.9092	10.28085
	Na_2O	1.4089	10.14888
	$(NH_4)_2CO_3$	2.1836	10.33917
	NH_4HCO_3	1.7965	10.25443
	$PbCO_3$	6.0721	10.78334
	$SrCO_3$	3.3550	10.52569
	$Sr(HCO_3)_2$	2.3822	10.37698
	SrO	2.3550	10.37199
CO_3	$BaCO_3$	3.2892	10.51709
	CO_2	0.73336	9.86532

Weighed	Sought	Factor	Logarithm
Carbon:			−10
$FeCO_3$	CO_2	0.37986	9.57962
$Fe(HCO_3)_2$	CO_2	0.49481	9.69444
HCN	Ag	3.9922	10.60121
	AgCN	4.9549	10.69503
KCN	Ag	1.6568	10.21927
	AgCN	2.0563	10.31309
K_2CO_3	CO_2	0.31840	9.50297
$KHCO_3$	CO_2	0.43954	9.64300
K_2O	CO_2	0.46714	9.66945
Li_2CO_3	CO_2	0.59559	9.77495
$LiHCO_3$	CO_2	0.64756	9.81128
Li_2O	CO_2	1.4727	10.16711
$MgCO_3$	CO_2	0.52185	9.71755
$Mg(HCO_3)_2$	CO_2	0.60139	9.77916
MnO	CO_2	0.62035	9.79264
Na_2CO_3	CO_2	0.41512	9.61817
$NaHCO_3$	CO_2	0.52378	9.71915
Na_2O	CO_2	0.70976	9.85111
$(NH_4)_2CO_3$	CO_2	0.45796	9.66083
NH_4HCO_3	CO_2	0.55664	9.74557
$PbCO_3$	CO_2	0.16469	9.21667
$SrCO_3$	CO_2	0.29807	9.47432
$Sr(HCO_3)_2$	CO_2	0.41978	9.62302
SrO	CO_2	0.42463	9.62801
Chlorine: Cl = 35.46			
Ag	Cl	0.32870	9.51680
	HCl	0.33796	9.52886
AgCl	Cl	0.24738	9.39337
	HCl	0.25435	9.40543
$BaCrO_4$	Cl	0.27988	9.44697
Ca	Cl	1.7699	10.24795
Cl	Ag	3.0423	10.48320
	AgCl	4.0423	10.60663
	$BaCrO_4$	3.5730	10.55303
	Ca	0.56500	9.75205
	HCl	1.0284	10.01216
	K	1.1027	10.04244
	KCl	2.1026	10.32277
	Li	0.19579	9.29162
	Mg	0.34292	9.53519
	$MgCl_2$	1.3430	10.12805
	MnO_2	1.2257	10.08840
	Na	0.64862	9.81199
	NaCl	1.6486	10.21712
	NH_4	0.50874	9.70650
	$PbCrO_4$	4.5572	10.65870
HCl	Ag	2.9590	10.47114
	AgCl	3.9316	10.59457
	NH_4Cl	1.4669	10.16641
	$(NH_4)_2SO_4$	1.8116	10.25806
K	Cl	0.90691	9.95756
KCl	Cl	0.47558	9.67723

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Chlorine:			−10
Li	Cl	5.10947	10.70838
Mg	Cl	2.9162	10.46481
$MgCl_2$	Cl	0.74465	9.87195
MnO_2	Cl	0.81583	9.91160
Na	Cl	1.5417	10.18801
NaCl	Cl	0.60657	9.78288
NH_4	Cl	1.9656	10.29350
$PbCrO_4$	Cl	0.21943	9.34130
Chromium: Cr = 52			
$BaCrO_4$	Cr	0.20529	9.31236
	Cr_2O_3	0.29992	9.47707
	CrO_3	0.39469	9.59626
	CrO_4	0.45784	9.66072
	$Cr_2(SO_4)_3 \cdot 18H_2O$	1.4139	10.15042
Cr	$BaCrO_4$	4.8712	10.68764
	Cr_2O_3	1.46154	10.16481
	$PbCrO_4$	6.2154	10.79347
Cr_2O_3	$BaCrO_4$	3.33389	10.52293
	Cr	0.68422	9.83519
	CrO_3	1.31570	10.11919
CrO_3	$BaCrO_4$	2.5336	10.40376
	Cr_2O_3	0.76000	9.88081
	K_2CrO_4	1.9420	10.28825
	$K_2Cr_2O_7$	1.4693	10.16731
	$PbCrO_4$	3.2320	10.50947
CrO_4	$BaCrO_4$	2.1842	10.33928
	$PbCrO_4$	2.7862	10.44501
$Cr_2(SO_4)_3 \cdot 18H_2O$	$BaCrO_4$	0.70727	9.84959
	$PbCrO_4$	0.90220	9.95530
K_2CrO_4	CrO_3	0.51494	9.71175
	$PbCrO_4$	1.6637	10.22108
$K_2Cr_2O_7$	CrO_3	0.68028	9.83269
	$PbCrO_4$	2.1971	10.34185
$PbCrO_4$	Cr	0.16089	9.20653
	Cr_2O_3	0.23515	9.37135
	CrO_3	0.30941	9.49053
	CrO_4	0.35891	9.55499
	$Cr_2(SO_4)_3 \cdot 18H_2O$	1.1084	10.04470
	K_2CrO_4	0.60087	9.77878
	$K_2Cr_2O_7$	0.45514	10.65815
Cobalt: Co = 58.97			
Co	$Co(NO_3)_2 \cdot 6H_2O$	4.9361	10.69339
	$Co(NO_2)_3(KNO_2)_3$	7.6706	10.88483
	CoO	1.2714	10.10426
	Co_3O_4	1.3618	10.13411
	$CoSO_4$	2.6290	10.41979
	$CoSO_4 \cdot 7H_2O$	4.7675	10.67829
	$(CoSO_4)_2(K_2SO_4)_3$	7.0616	10.84890

Weighed	Sought	Factor	Logarithm
Cobalt:			−10
$Co(NO_3)_2 \cdot 6H_2O$	Co	0.20258	9.30661
$Co(NO_2)_3(KNO_2)_3$	Co	0.13037	9.11517
	CoO	0.16574	9.21943
CoO	Co	0.78657	9.89574
	$Co(NO_2)_3(KNO_2)_3$	6.0335	10.78057
	Co_3O_4	1.0711	10.02985
	$CoSO_4$	2.0679	10.31553
	$(CoSO_4)_2(K_2SO_4)_3$	5.5545	10.74465
Co_3O_4	Co	0.73433	9.86890
	CoO	0.93358	9.97015
$CoSO_4$	Co	0.38038	9.58022
	CoO	0.48358	9.68447
$CoSO_4 \cdot 7H_2O$	Co	0.20975	9.32170
	CoO	0.26666	9.42596
$(CoSO_4)_2(K_2SO_4)_3$	Co	0.1416	9.15109
	CoO	0.18003	9.25534
Copper: Cu = 63.57			
Cu	$Cu_2\{C_2H_3O_2 \cdot (AsO_2)_3\}$	3.9880	10.60076
	CuCNS	1.9136	10.28185
	CuO	1.2517	10.09750
	Cu_2O	1.1258	10.05147
	Cu_2S	1.2522	10.09767
	$CuSO_4 \cdot 5H_2O$	3.9281	10.59418
$Cu\{C_2H_3O_2(AsO_2)_3\}$	Cu	0.25075	9.39924
	$Mg_2As_2O_7$	0.91874	9.96319
CuCNS	Cu	0.52259	9.71816
	CuO	0.65412	9.81566
CuO	Cu	0.79891	9.90250
	CuCNS	1.5288	10.18435
	Cu_2S	1.0004	10.00017
	$CuSO_4 \cdot 5H_2O$	3.1382	10.49668
Cu_2O	Cu	0.88824	9.94853
	Cu_2S	1.1122	10.04618
$CuSO_4 \cdot 5H_2O$	Cu	0.25458	9.40582
	CuO	0.31865	9.50331
	Cu_2S	0.31877	9.50348
$Mg_2As_2O_7$	$Cu_2\{C_2H_3O_2(AsO_2)_3\}$	1.0885	10.08081

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Fluorine:			
F = 19			−10
BaF_2	$BaSiF_6$	1.5948	10.20270
$BaSiF_6$	BaF_2	0.62705	9.79730
	F	0.40762	9.61025
	HF	0.42924	9.63270
	H_2SiF_6	0.51602	9.71267
	SiF_4	0.37294	9.57163
	SiF_6	0.50880	9.70655
CaF_2	F	0.48675	9.68730
	HF	0.51258	9.70976
	H_2SiF_6	1.6228	10.21028
$CaSO_4$	F	0.27914	9.44582
	HF	0.29395	9.46827
F	$BaSiF_6$	2.45330	10.38975
	CaF_2	2.05447	10.31270
	$CaSO_4$	3.5824	10.55417
	H_2SiF_6	1.2660	10.10242
	K_2SiF_6	1.9342	10.28651
HF	$BaSiF_6$	2.3297	10.36730
	CaF_2	1.9509	10.29024
	$CaSO_4$	3.4019	10.53172
	K_2SiF_6	1.8368	10.26406
2HF	H_2SiF_6	3.6065	10.55708
6HF	H_2SiF_6	1.2022	10.07997
H_2SiF_6	$BaSiF_6$	1.93790	10.28733
	CaF_2	0.61620	9.78972
	F	0.78992	9.89758
	2HF	0.27728	9.44292
	6HF	0.83182	9.92003
	SiF_4	0.72270	9.85896
	SiF_6	0.98601	9.99388
KF	K_2SiF_6	1.8976	10.27820
K_2SiF_6	F	0.51700	9.71349
	HF	0.54443	9.73594
	H_2SiF_6	0.65451	9.81598
	KF	0.52699	9.72180
	SiF_6	0.64534	9.80979
SiF_4	$BaSiF_6$	2.6814	10.42837
	H_2SiF_6	1.3837	10.14104
SiF_6	$BaSiF_6$	1.9654	10.29345
	H_2SiF_6	1.0141	10.00612
	K_2SiF_6	1.5495	10.19021
Gold:			
Au = 197.2			
Au	$AuCl_3$	1.5394	10.18736
	$HAuCl_4 \cdot 4H_2O$	2.0898	10.32010
	$KAu(CN)_4 \cdot H_2O$	1.8172	10.25941
$AuCl_3$	Au	0.64959	9.81264
$HAuCl_4 \cdot 4H_2O$	Au	0.47852	9.67990
$KAu(CN)_4 \cdot H_2O$	Au	0.55028	9.74059
Hydrogen:			
H = 1.008			
H	H_2O	8.9363	10.95116
Hydrogen:			−10
H	O	7.9365	10.89963
H_2O	H	0.11190	9.04884
O	H	0.12595	9.10020
Iodine:			
I = 126.92			
Ag	HI	1.1859	10.07403
	I	1.1765	10.07059
AgI	HI	0.54484	9.73627
	I	0.54055	9.73283
	IO_3	0.74497	9.87214
	IO_4	0.81313	9.91016
	I_2O_5	0.71091	9.85181
	I_2O_7	0.77904	9.89156
HI	Ag	0.84328	9.92597
	AgI	1.8354	10.26373
	Pd	0.41703	9.62016
	PdI_2	1.4092	10.14896
	TlI	2.5868	10.41276
I	Ag	0.84998	9.92941
	AgI	1.8500	10.26717
	Pd	0.42034	9.62360
	PdI_2	1.4204	10.15240
	TlI	2.6074	10.41620
IO_3	AgI	1.3423	10.12786
	PdI_2	1.0306	10.01309
IO_4	AgI	1.2298	10.08984
	PdI_2	0.94421	9.97507
	TlI	1.7333	10.23887
I_2O_5	AgI	1.4067	10.14819
	PdI_2	1.0799	10.03342
	TlI	1.9825	10.29722
I_2O_7	AgI	1.2836	10.10844
	PdI_2	0.98553	9.99361
	TlI	1.8091	10.25747
Pd	HI	2.3979	10.37984
	I	2.3790	10.37640
PdI_2	HI	0.70965	9.85104
	I	0.70404	9.84760
	IO_3	0.97031	9.98691
	IO_4	1.0591	10.02493
	I_2O_5	0.92593	9.96658
	I_2O_7	1.0147	10.00633
TlI	HI	0.38658	9.58724
	I	0.38353	9.58380
	IO_3	0.52858	9.72311
	IO_4	0.57694	9.76113
	I_2O_5	0.50440	9.70278
	I_2O_7	0.55275	9.74253
Iron:			
Fe = 55.84			
Ag	$Fe_7(CN)_{18}$, prussian blue	0.44240	9.64582
CN	$Fe_7(CN)_{18}$	1.8349	10.26362
CO_2	FeO	1.6325	10.21285
	$FeCO_3$	2.6325	10.42037
	$Fe(HCO_3)_2$	2.0210	10.30557

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Iron:			−10
Fe	$Fe(HCO_3)_2$	3.1851	10.50313
	FeO	1.2865	10.10943
	Fe_2O_3	1.4298	10.15527
	$FePO_4$	2.7020	10.43168
	FeS	1.5741	10.19703
	$FeSO_4$	2.7203	10.43462
	$FeSO_4 \cdot 7H_2O$	4.9787	10.69712
	$FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$	7.0227	10.84650
$FeAsO_4$	$Mg_2As_2O_7$	0.79714	9.90162
$FeCl_3$	Fe_2O_3	0.49211	9.69212
$Fe_7(CN)_{18}$, prussian blue	Ag	2.26036	10.35418
	CN	0.54496	9.73637
$FeCO_3$	CO_2	0.37986	9.57962
	FeO	0.62017	9.79251
	Fe_2O_3	0.68924	9.83836
$Fe(HCO_3)_2$	CO_2	0.49480	9.69443
	Fe	0.31396	9.49687
	FeO	0.40392	9.60629
	Fe_2O_3	0.44889	9.65214
FeO	CO_2	0.61254	9.78713
	Fe	0.77728	9.89058
	$FeCO_3$	1.6124	10.20749
	$FeHCO_3$	2.47577	10.39371
	Fe_2O_3	1.1114	10.04585
	$FePO_4$	2.1002	10.32226
	FeS	1.2236	10.08764
	SO_3	1.1144	10.04704
Fe_3O_4	Fe_2O_3	1.0346	10.01477
Fe_2O_3	Fe	0.69940	9.84473
	$FeCl_3$	2.0318	10.30788
	$FeCO_3$	1.4509	10.16164
	$Fe(HCO_3)_2$	2.2278	10.34786
	$Fe(HCO_3)_2$	2.2278	10.34786
	FeO	0.89980	9.95415
	Fe_3O_4	0.96657	9.98523
	$FePO_4$	1.8898	10.27641
	FeS	1.1010	10.04179
	$FeSO_4$	1.9026	10.27935
	$FeSO_4 \cdot 7H_2O$	3.4821	10.54184
	$FeSO_4 (NH_4)_2SO_4 \cdot 6H_2O$	4.91157	10.69122
	$Fe_2(SO_4)_3$	2.5041	10.39865
$FePO_4$	Fe	0.37010	9.56832
	FeO	0.47615	9.67774
	Fe_2O_3	0.52920	9.72362
FeS	Fe	0.63527	9.80296
	FeO	0.81729	9.91238
	Fe_2O_3	0.90830	9.95823
$FeSO_4$	Fe	0.36761	9.56539
	Fe_2O_3	0.52561	9.72066
	SO_3	0.52706	9.72186

Weighed	Sought	Factor	Logarithm
Iron:			−10
$FeSO_4 \cdot 7H_2O$	Fe	0.20086	9.30289
	Fe_2O_3	0.28718	9.45815
$FeSO_4 \cdot (NH_4)_2 SO_4 \cdot 6H_2O$	Fe	0.14239	9.15348
	Fe_2O_3	0.20360	9.30878
$Fe_2(SO_4)_3$	Fe_2O_3	0.39934	9.60134
$Mg_2As_2O_7$	$FeAsO_4$	1.2542	10.09838
SO_3	FeO	0.89733	9.95295
	$FeSO_4$	1.8973	10.27814
Lead: Pb = 207.2			
$BaSO_4$	$PbSO_4$	1.2991	10.11364
Pb	$PbCl_2$	1.3426	10.12795
	$PbCO_3$	1.2896	10.11045
	$(PbCO_3)_2 \cdot Pb(OH)_2$	1.2478	10.09601
	$PbCrO_4$	1.5598	10.19307
	PbO	1.0772	10.03230
	PbO_2	1.1544	10.06236
	PbS	1.1547	10.06247
	$PbSO_4$	1.4636	10.16542
$PbCl_2$	Pb	0.74500	9.87216
	PbO	0.80253	9.90447
$Pb(C_2H_3O_2)_2 \, 3H_2O$	$PbCrO_4$	0.85210	9.93049
	$PbSO_4$	0.79953	9.90283
$PbCO_3$	Pb	0.77545	9.88955
	PbO	0.83533	9.92186
	$PbSO_4$	1.1350	10.05500
$(PbCO_3)_2 \cdot Pb(OH)_2$	Pb	0.80142	9.90386
	$PbCrO_4$	1.2501	10.09694
	$PbSO_4$	1.1730	10.06930
$PbCrO_4$	Pb	0.64109	9.80692
	$Pb(C_2H_3O_2)_2 \cdot 3H_2O$	1.1736	10.06952
	$(PbCO_3)_2 \cdot Pb(OH)_2$	0.79994	9.90306
	PbO	0.69059	9.83922
	Pb_3O_4	0.70710	9.84948
	$PbSO_4$	0.93830	9.97234
$Pb(NO_3)_2$	PbO	0.67387	9.82858
	PbO_2	0.72218	9.85865
	$PbSO_4$	0.91558	9.96170
PbO	Pb	0.92832	9.96770
	$PbCl_2$	1.2461	10.09556
	$PbCO_3$	1.1967	10.07799
	$PbCrO_4$	1.4480	10.16077
	$Pb(NO_3)_2$	1.4840	10.17143
	PbS	1.0720	10.03019
	$PbSO_4$	1.3587	10.13312
PbO_2	Pb	0.86622	9.93763
	$Pb(NO_3)_2$	1.3847	10.14136

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS
(Continued)

Weighed	Sought	Factor	Logarithm
Lead:			−10
PbO_2	$PbSO_4$	1.2678	10.10305
Pb_3O_4	$PbCrO_4$	1.4142	10.15051
	$PbSO_4$	1.3270	10.12287
$Pb(OH)_2$	Pb	0.85898	9.93398
PbS	Pb	0.86580	9.93742
	PbO	0.93288	9.96983
	$PbSO_4$	1.2675	10.10295
$PbSO_4$	$BaSO_4$	0.76974	9.88634
	Pb	0.68324	9.83457
	$Pb(C_2H_3O_2)_2 \cdot 3H_2O$	1.2508	10.09721
	$PbCO_3$	0.88109	9.94502
	$(PbCO_3)_2 \cdot Pb(OH)_2$	0.85254	9.93071
	$PbCrO_4$	1.0658	10.02768
	$Pb(NO_3)_2$	1.0922	10.03830
	PbO	0.73600	9.86688
	PbO_2	0.78876	9.89694
	Pb_3O_4	0.75359	9.87714
	PbS	0.78896	9.89706
Lithium: Li = 6.94			
CO_2	Li_2CO_3	1.6790	10.22505
	$LiHCO_3$	1.5443	10.18873
	Li_2O	0.67901	9.83188
Li	LiCl	6.1096	10.78601
	Li_2CO_3	5.3227	10.72614
	Li_2O	2.1539	10.33322
	Li_3PO_4	5.5629	10.74530
	Li_2SO_4	7.9207	10.89876
LiCl	Li	0.16368	9.21399
	Li_2CO_3	0.87124	9.94013
	Li_2O	0.35227	9.54698
	Li_3PO_4	0.91052	9.95929
	Li_2SO_4	1.2965	10.11277
Li_2CO_3	CO_2	0.59559	9.77495
	Li	0.18789	9.27386
	LiCl	1.1479	10.05987
	$LiHCO_3$	1.8395	10.26469
	Li_2O	0.40444	9.60685
	Li_3PO_4	1.0451	10.01916
$LiHCO_3$	CO_2	0.64756	9.81128
	Li_2CO_3	0.54366	9.73531
	Li_2O	0.21960	9.34216
Li_2O	CO_2	1.4727	10.16811
	Li	0.46427	9.66678
	LiCl	2.8381	10.45302
	Li_2CO_3	2.4630	10.39315
	$LiHCO_3$	4.5482	10.65784
	Li_3PO_4	2.5842	10.41231
	Li_2SO_4	3.6794	10.56578
	SO_3	2.6794	10.42804
Li_3PO_4	Li	0.17976	9.25470
	LiCl	1.0983	10.04071
	$LiCO_3$	0.95689	9.98084
	$LiHCO_3$	1.7601	10.24553
	Li_2O	0.38700	9.58769
	Li_2SO_4	1.4234	10.15333

Weighed	Sought	Factor	Logarithm
Lithium:			−10
Li_3PO_4	$Li_2SO_4 \cdot H_2O$	1.6572	10.21937
Li_2SO_4	Li	0.12625	9.10123
	LiCl	0.77133	9.88724
	Li_2O	0.27178	9.43422
SO_3	Li_2O	0.37322	9.57196
	Li_2SO_4	1.3732	10.13773
Magnesium: Mg = 24.32			
$BaSO_4$	$MgSO_4$	0.51570	9.71240
	$MgSO_4 \cdot 7H_2O$	1.0559	10.02362
Br	Mg	0.15213	9.18222
	$MgBr_2$	1.1520	10.06146
	$MgBr_2 \cdot 6H_2O$	1.8282	10.26203
Cl	Mg	0.34292	9.53519
	$MgCl_2$	1.3430	10.12805
	$MgCl_2 \cdot 6H_2O$	2.8672	10.45746
CO_2	$MgCO_3$	1.9163	10.28246
	MgO	0.91626	9.96202
I	Mg	0.09581	8.98140
	MgI_2	1.0958	10.03973
Mg	Br	6.5732	10.81778
	Cl	2.9162	10.46481
	I	10.4380	11.01860
	MgO	1.6579	10.21956
	$Mg_2P_2O_7$	4.5790	10.66077
	$MgSO_4$	4.9449	10.69459
$MgBr_2$	Br	0.86806	9.93855
$MgBr_2 \cdot 6H_2O$	Br	0.54698	9.73797
$MgCl_2$	Cl	0.74465	9.87195
	$Mg_2P_2O_7$	1.1692	10.06791
$MgBr_2 \cdot 6H_2O$	Br	0.54698	9.73797
$MgCl_2 \cdot 6H_2O$	Cl	0.34877	9.54250
	$Mg_2P_2O_7$	0.54765	9.73854
$MgCl_2 \cdot KCl \cdot 6H_2O$	$Mg_2P_2O_7$	0.40072	9.60284
$MgCO_3$	CO_2	0.52185	9.71755
	$Mg(HCO_3)_2$	1.7355	10.23943
	MgO	0.47818	9.67959
	$Mg_2P_2O_7$	1.3206	10.12080
$Mg(HCO_3)_2$	$MgCO_3$	0.57619	9.76057
	MgO	0.27553	9.44016
	$Mg_2P_2O_7$	0.76097	9.88137
MgI_2	I	0.91258	9.96027
MgO	CO_2	1.0914	10.03798
	Mg	0.60317	9.78044
	$MgCO_3$	2.0912	10.32041
	$Mg(HCO_3)_2$	3.6294	10.55984
	$Mg_2P_2O_7$	2.7619	10.44121
	$MgSO_4$	2.9856	10.47503
$Mg_2P_2O_7$	Mg	0.21839	9.33923

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Magnesium:			−10
$Mg_2P_2O_7$	$MgCl_2$	0.85524	9.93209
	$MgCl_2 \cdot 6H_2O$	1.8260	10.26150
	$MgCl_2 \cdot KCl \cdot 6H_2O$	2.4955	10.39716
	$MgCO_3$	0.75719	9.87920
	$Mg(HCO_3)_2$	1.3141	10.11862
	MgO	0.36207	9.55879
	$MgSO_4$	1.0810	10.03383
	$MgSO_4 \cdot 7H_2O$	2.2135	10.34508
$MgSO_4$	$BaSO_4$	1.9391	10.28760
	Mg	0.20203	9.30542
	MgO	0.33494	9.52497
	$Mg_2P_2O_7$	0.92507	9.96617
	SO_3	0.66506	9.82286
$MgSO_4 \cdot 7H_2O$	$BaSO_4$	0.94702	9.97636
	$Mg_2P_2O_7$	0.45178	9.65493
	SO_3	0.32480	9.51162
SO_3	MgO	0.50362	9.70210
	$MgSO_4$	1.5036	10.17713
	$MgSO_4 \cdot 7H_2O$	3.0788	10.48838
Manganese: $Mn = 54.93$			
$BaSO_4$	$MnSO_4$	0.64687	9.81082
CO_2	$MnCO_3$	2.6119	10.41696
	MnO	1.6119	10.20734
Mn	$MnCO_3$	2.0923	10.32062
	MnO	1.2913	10.11102
	Mn_2O_3	1.4369	10.15744
	Mn_3O_4	1.3884	10.14251
$MnCO_3$	CO_2	0.38287	9.58305
	Mn	0.47795	9.67938
	MnO	0.61716	9.79040
	Mn_3O_4	0.66358	9.82189
	$Mn_2P_2O_7$	1.2353	10.09177
	MnS	0.75690	9.87904
$Mn(HCO_3)_2$	$MnCO_3$	0.64950	9.81258
	MnO	0.40084	9.60298
	Mn_3O_4	0.43099	9.63447
MnO	CO_2	0.62040	9.79267
	Mn	0.77442	9.88898
	$MnCO_3$	1.6203	10.20960
	$MnHCO_3$	2.4947	10.39702
	Mn_2O_3	1.1128	10.04641
	Mn_3O_4	1.0752	10.03149
	$Mn_2P_2O_7$	2.0016	10.30137
	MnS	1.2264	10.08863
	SO_3	1.1287	10.05258
Mn_2O_3	Mn	0.69593	9.84256
	MnO	0.89865	9.95359
	Mn_3O_4	0.96623	9.98508
Mn_3O_4	Mn	0.72026	9.85749
	$MnCO_3$	1.5070	10.17811
	$Mn(HCO_3)_2$	2.3203	10.36553
Manganese:			−10
Mn_3O_4	MnO	0.93006	9.96851
	Mn_2O_3	1.0349	10.01492
	MnO_2	1.1398	10.05685
	$MnSO_4$	1.9803	10.29673
MnO_2	Mn_3O_4	0.87730	9.94315
	$Mn_2P_2O_7$	1.6332	10.21303
$Mn_2P_2O_7$	Mn	0.38691	9.58761
	$MnCO_3$	0.80952	9.90823
	MnO	0.49961	9.69863
	MnO_2	0.61231	9.78697
	$MnSO_4$	1.0635	10.02674
MnS	Mn	0.63145	9.80034
	$MnCO_3$	1.3212	10.12097
	MnO	0.81538	9.91136
	$MnSO_4$	1.7357	10.23947
$MnSO_4$	$BaSO_4$	1.5460	10.18921
	Mn_3O_4	0.50509	9.70337
	$Mn_2P_2O_7$	0.94026	9.97325
	MnS	0.57613	9.76052
	SO_3	0.53023	9.72446
SO_3	MnO	0.88596	9.94741
	$MnSO_4$	1.8860	10.27554
Mercury: $Hg = 200.6$			
Hg	$HgCl$	1.1768	10.07069
	$HgCl_2$	1.3535	10.13147
	HgO	1.0797	10.03330
	HgS	1.1598	10.06438
$HgCl$	Hg	0.84978	9.92931
	$HgCl_2$	1.1502	10.06078
	$HgNO_3$	1.1102	10.04538
	Hg_2O	0.88364	9.94629
	HgO	0.91756	9.96264
	HgS	0.98560	9.99370
$HgCl_2$	Hg	0.73880	9.86853
	$HgCl$	0.86940	9.93922
	HgS	0.85688	9.94292
$Hg(CN)_2$	HgS	0.92097	9.96425
$HgNO_3$	$HgCl$	0.90078	9.95462
	HgS	0.88595	9.94741
$Hg(NO_3)_2$	HgS	0.71672	9.85535
$Hg(NO_3)_2 \cdot H_2O$	HgS	0.67902	9.83188
Hg_2O	$HgCl$	1.1317	10.05371
	HgS	1.1153	10.04739
HgO	Hg	0.92612	9.96667
	$HgCl$	1.0898	10.03736
	HgS	1.0741	10.03104
HgS	$HgCl_2$	1.1670	10.06707
	$Hg(CN)_2$	1.0858	10.03575
	$HgNO_3$	1.1287	10.05258
	$Hg(NO_3)_2$	1.3953	10.14467
	$Hg(NO_3)_2 \cdot H_2O$	1.4727	10.16711
	Hg_2O	0.89659	9.95259
	HgO	0.93097	9.96894
	$HgSO_4$	1.2751	10.10554
$HgSO_4$	HgS	0.78424	9.89445

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Molybdenum: Mo = 96.			−10
Mo	MoO_3	1.5000	10.17609
	MoS_3	2.0019	10.30144
	$PbMoO_4$	3.8239	10.58251
MoO_3	Mo	0.66667	9.82391
	MoS_3	1.3346	10.12535
	$(NH_4)_2MoO_4$	1.3617	10.13408
	$(NH_4)_3PO_4 \cdot 12MoO_3$	1.0863	10.03596
MoS_3	Mo	0.49953	9.69856
	MoO_3	0.74930	9.87466
	$(NH_4)_2MoO_4$	1.0201	10.00864
$(NH_4)_2MoO_4$	MoO_3	0.73437	9.86592
	MoS_3	0.9803	9.99136
	$(NH_4)_3PO_4 \cdot 12MoO_3$	0.79778	9.90188
$(NH_4)_3PO_4 \cdot 12MoO_3$	MoO_3	0.92053	9.96404
	$(NH_4)_2MoO_4$	1.2535	10.09812
$PbMoO_4$	Mo	0.26144	9.41737
	MoO_3	0.39216	9.59346
	$(NH_4)_2MoO_4$	0.53399	9.72753
Nickel: Ni = 58.68			
Ni	Ni, glyoxime	4.9236	10.69228
	$Ni(NO_3)_2 \cdot 6H_2O$	4.9556	10.69510
	NiO	1.2726	10.10471
	$NiSO_4$	2.6370	10.42111
	$NiSO_4 \cdot 7H_2O$	4.7861	10.67998
Ni, glyoxime	Ni	0.2031	9.30771
$Ni(NO_3)_2 \cdot 6H_2O$	Ni	0.20179	9.30490
	NiO	0.25681	9.40961
	$NiSO_4$	0.53212	9.72601
NiO	Ni	0.78576	9.89529
	$Ni(NO_3)_2 \cdot 6H_2O$	3.8939	10.59039
	$NiSO_4$	2.0720	10.31639
	$NiSO_4 \cdot 7H_2O$	3.7607	10.57527
$NiSO_4$	Ni	0.37922	9.57889
	$Ni(NO_3)_2 \cdot 6H_2O$	1.8793	10.27400
	NiO	0.48262	9.68361
	$NiSO_4 \cdot 7H_2O$	1.81149	10.25886
Nickel:			−10
$NiSO_4 \cdot 7H_2O$	Ni	0.20894	9.32011
	NiO	0.26591	9.42494
	$NiSO_4$	0.55097	9.74113
Nitrogen: N = 14.01			
$AgNO_2$	HNO_2	0.30554	9.48507
	N_2O_3	0.24699	9.39269
HNO_2	$AgNO_2$	3.2729	10.51493
HNO_3	N	0.22231	9.34696
	NH_3	0.27023	9.43173
	NH_4Cl	0.84893	9.92887
	$(NH_4)_2PtCl_6$	3.5230	10.54691
	Pt	1.5480	10.18997
	SO_3	0.63520	9.80291
KNO_3	N_2O_5	0.53417	9.72768
N	HNO_3	4.4982	10.65304
	$NaNO_3$	6.0678	10.78303
	NH_3	1.2155	10.08477
	NH_4Cl	3.8187	10.58191
	$(NH_4)_2PtCl_6$	15.8469	11.19995
	$(NH_4)_2SO_4$	4.7156	10.67354
	NO_2	3.2841	10.51641
	N_2O_3	2.7131	10.43346
	NO_3	4.4261	10.64602
	N_2O_5	3.8551	10.58603
	Pt	6.9665	10.84301
	SO_3	2.8572	10.45594
$NaNO_3$	N	0.16481	9.21697
	N_2O_5	0.63533	9.80300
N_2O_3	$AgNO_2$	4.0487	10.60731
	N	0.36858	9.56654
N_2O_5	KNO_3	1.8721	10.27232
	N	0.25940	9.41397
	$NaNO_3$	1.5740	10.19700
	NH_3	0.31531	9.49874
	$(NH_4)_2PtCl_6$	4.1101	10.61392
	$(NH_4)_2SO_4$	1.2232	10.08750
	Pt	1.8071	10.25698
	SO_3	0.74116	9.86991
NO_2	N	0.30450	9.48359
NO_3	N	0.22593	9.35398
NH_3	HNO_3	3.7006	10.56827
	N	0.82268	9.91523
	N_2O_5	3.1714	10.50126
NH_4Cl	HNO_3	1.1780	10.07113
	N	0.26187	9.41809
$(NH_4)_2PtCl_6$	HNO_3	0.28380	9.45301
	N	0.06310	8.80005
	N_2O_5	0.24327	9.38609
$(NH_4)_2SO_4$	N	0.21206	9.32646
	N_2O_5	0.81753	9.91250
Pt	HNO_3	0.64570	9.81003
	N	0.14345	9.15699
	N_2O_5	0.55338	9.74302
SO_3	HNO_3	1.5741	10.19703

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS
(Continued)

Weighed	Sought	Factor	Logarithm
Nitrogen:			−10
SO_3	N	0.34999	9.54406
	N_2O_5	1.3492	10.13008
Phosphorus: P = 31.04			
$AgPO_4$	P	0.07414	8.87004
	PO_4	0.22700	9.35603
	P_2O_5	0.16968	9.22963
$Ag_4P_2O_7$	P	0.10251	9.01077
	PO_4	0.31388	9.49676
	P_2O_5	0.23461	9.37035
Al_2O_3	P_2O_5	1.3890	10.14308
$AlPO_4$	PO_4	0.77830	9.89115
	P_2O_5	0.58175	9.76474
$Ca_3(PO_4)_2$	P_2O_5	0.45787	9.66075
$FePO_4$	PO_4	0.62991	9.79928
	P_2O_5	0.47080	9.67289
$Mg_2P_2O_7$	Na_2HPO_4	1.2756	10.10571
	$Na_2HPO_4 \cdot 12H_2O$	3.2164	10.50744
	$NaNH_4HPO_4 \cdot 4H_2O$	1.8771	10.27373
	P	0.27861	9.44511
	PO_4	0.85384	9.93138
	P_2O_5	0.63852	9.80517
Na_2HPO_4	$Mg_2P_2O_7$	0.78395	9.89429
	P_2O_5	0.50010	9.69906
$Na_2HPO_4 \cdot 12H_2O$	$Mg_2P_2O_7$	0.31006	9.49256
	P_2O_5	0.19830	9.29733
$NaNH_4HPO_4 \cdot 4H_2O$	$Mg_2P_2O_7$	0.53244	9.72627
	P_2O_5	0.33966	9.53104
$(NH_4)_3PO_4 \cdot 12MoO_3$	P	0.01653	8.21842
	PO_4	0.05063	8.70441
	P_2O_5	0.03784	8.57800
P	Ag_3PO_4	13.4884	11.12996
	$Ag_4P_2O_7$	9.7550	10.98923
	$Mg_2P_2O_7$	3.5877	10.55481
	$(NH_4)_3PO_4 \cdot 12MoO_3$	60.4755	11.78158
	P_2O_5	2.2886	10.35958
	$U_2P_2O_{11}$	11.5090	11.06104
PO_4	$AgPO_4$	4.4052	10.64397
	$Ag_4P_2O_7$	3.1860	10.50324
	$AlPO_4$	1.2845	10.10885
	$FePO_4$	1.5875	10.20072
	$Mg_2P_2O_7$	1.1712	10.06862
	$(NH_4)_3PO_4 \cdot 12MoO_3$	19.7591	11.29559
	$U_2P_2O_{11}$	3.7588	10.57505
P_2O_5	Ag_3PO_4	5.8935	10.77038
	$Ag_4P_2O_7$	4.2623	10.62965
	Al_2O_3	0.71933	9.85692

Weighed	Sought	Factor	Logarithm
Phosphorus:			−10
P_2O_5	$AlPO_4$	1.7190	10.23526
	$FePO_4$	2.1238	10.32711
	$Mg_2P_2O_7$	1.5662	10.19483
	Na_2HPO_4	1.9996	10.30094
	$Na_2HPO_4 \cdot 12H_2O$	5.0428	10.70267
	$NaNH_4HPO_4 \cdot 4H_2O$	2.9441	10.46896
	$(NH_4)_3PO_4 \cdot 12MoO_3$	26.4243	11.42200
	$U_2P_2O_{11}$	5.0287	10.70146
$U_2P_2O_{11}$	P	0.08689	8.93897
	PO_4	0.26604	9.42495
	P_2O_5	0.19886	9.29855
Platinum: Pt = 195.2			
$H_2PtCl_6 \cdot 6H_2O$	K_2PtCl_6	0.93844	9.97239
K_2PtCl_6	$H_2PtCl_6 \cdot 6H_2O$	1.0656	10.02761
	Pt	0.40151	9.60370
	$PtCl_4$	0.69326	9.84090
	$PtCl_4 \cdot 5H_2O$	0.87856	9.94377
$(NH_4)_2PtCl_6$	Pt	0.43960	9.64306
	$PtCl_4$	0.75904	9.88026
	$PtCl_6$	0.91876	9.96320
Pt	$H_2PtCl_6 \cdot 6H_2O$	2.6558	10.42419
	K_2PtCl_6	2.4906	10.39630
	$(NH_4)_2PtCl_6$	2.2748	10.35694
	$PtCl_4$	1.7266	10.23720
	$PtCl_4 \cdot 5H_2O$	2.1881	10.34007
$PtCl_4$	K_2PtCl_6	1.4424	10.15910
	$(NH_4)_2PtCl_6$	1.3175	10.11974
	Pt	0.57917	9.76280
$PtCl_6$	$(NH_4)_2PtCl_6$	1.0884	10.03680
$PtCl_4 \cdot 5H_2O$	K_2PtCl_6	1.1382	10.05623
	Pt	0.45701	9.65993
Potassium: K = 39.1			
Ag	KBr	1.1033	10.04268
	KCl	0.69114	9.83957
	$KClO_3$	1.1361	10.05541
	$KClO_4$	1.2844	10.10870
	KCN	0.60354	9.78071
	KI	1.5390	10.18722
AgBr	KBr	0.63375	9.80192
	$KBrO_3$	0.88934	9.94907
AgCl	KCl	0.52017	9.71614
	$KClO_3$	0.85503	9.93198
	$KClO_4$	0.96666	9.98527
AgCN	KCN	0.48630	9.68690
AgI	KI	0.70707	9.84946
	KIO_3	0.91148	9.95975

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Potassium:			−10
$BaCrO_4$	K_2CrO_4	0.76650	9.88451
	$K_2Cr_2O_7$	0.58019	9.76357
$BaSO_4$	$KHSO_4$	0.58334	9.76592
	K_2S	0.47235	9.67426
	K_2SO_4	0.74652	9.87304
Br	K	0.48924	9.68952
	KBr	1.4892	10.17296
CaF_2	$KF\cdot 2H_2O$	2.4108	10.38216
$CaSO_4$	$KF\cdot 2H_2O$	1.3829	10.14079
Cl	K	1.1027	10.04244
	KCl	2.1026	10.32277
	$KClO_3$	3.4563	10.53861
	$KClO_4$	3.9075	10.59190
	K_2O	1.3282	10.12328
CO_2	K_2O	2.1407	10.33056
	K_2CO_3	3.1407	10.49703
I	KI	1.3081	10.11663
	KIO_3	1.6863	10.22692
K	Br	2.0440	10.31048
	Cl	0.90691	9.95756
	KBr	3.0440	10.48355
	KCl	1.9069	10.28033
	KI	4.2460	10.62798
	K_2O	1.2046	10.08084
	KNO_3	2.5859	10.41261
	K_2PtCl_6	6.2169	10.79357
	K_2SO_4	2.2284	10.34799
	Pt	2.4961	10.39727
K_3AsO_4	$Mg_2As_2O_7$	0.60596	9.78244
KBr	Ag	0.90640	10.95732
	AgBr	1.5779	10.19808
	Br	0.67149	9.82704
	K	0.32852	9.51656
	K_2O	0.39573	9.59740
$KBrO_3$	AgBr	1.1244	10.05093
KCl	Ag	1.4469	10.16043
	AgCl	1.9225	10.28386
	Cl	0.47558	9.67723
	K	0.52440	9.71967
	K_2CO_3	0.92677	9.96609
	$K_2Cr_2O_7$	1.9705	10.29480
	$KHCO_3$	1.3427	10.12796
	KNO_3	1.3560	10.13228
	K_2O	0.63169	9.80051
	K_2PtCl_6	3.2602	10.51324
	K_2SO_4	1.1685	10.06763
	Pt	1.3090	10.11694
$KClO_3$	Ag	0.88022	9.94459
	AgCl	1.1696	10.06802
	Cl	0.28933	9.46139
$KClO_4$	Ag	0.77857	9.89130
	AgCl	1.0345	10.01473
	Cl	0.25592	9.40810
	K	0.28219	9.45054
	KCl	0.53811	9.73087
	K_2O	0.33992	9.53138
KCN	AgCN	2.0564	10.31310
K_2CO_3	CO_2	0.31840	9.50297

Weighed	Sought	Factor	Logarithm
Potassium:			−10
K_2CO_3	KCl	1.0790	10.03303
	KOH	0.81201	9.90956
	K_2O	0.68161	9.83354
K_2CO_3	$KPtCl_6$	3.5178	10.54627
	K_2SO_4	1.2609	10.10068
K_2CrO_4	$BaCrO_4$	1.3045	10.11549
$K_2Cr_2O_7$	$BaCrO_4$	1.7236	10.23643
	KCl	0.50699	9.70500
	K_2O	0.32019	9.50541
$KF\cdot 2H_2O$	CaF_2	0.41480	9.61784
	$CaSO_4$	0.72310	9.85920
$KHAsO_4$	$Mg_2As_2O_7$	0.71172	9.85232
$KHCO_3$	KCL	0.74480	9.87204
	K_2O	0.94098	9.97358
	K_2PtCl_6	4.8563	10.68631
	K_2SO_4	0.87034	9.93969
$KHSO_4$	$BaSO_4$	1.7143	10.23409
	K_2SO_4	0.63986	9.80609
KI	Ag	0.64981	9.81278
	AgI	1.4143	10.15054
	I	0.76448	9.88337
	K	0.23551	9.37202
	K_2O	0.28370	9.45286
KIO_3	AgI	1.0971	10.04025
	I	0.59304	9.77308
K_2MnO_4	Mn_2O_3	0.38686	9.58756
	MnS	0.44128	9.64471
$KMnO_4$	Mn_2O_3	0.48259	9.68358
	MnS	0.55047	9.74073
KNO_2	K_2SO_4	1.0237	10.01017
	N_2O_3	0.44660	9.64992
KNO_3	K	0.38671	9.58739
	KCl	0.73742	9.86772
	K_2O	0.46583	9.66823
	K_2PtCl_6	2.4042	10.38096
	N	0.13857	9.14165
	NH_3	0.16843	9.22642
	NO	0.29681	9.47248
	N_2O_5	0.53417	9.72768
K_2O	Cl	0.75287	9.87672
	CO_2	0.46714	9.66945
	K	0.83015	9.91916
	KBr	2.5270	10.40260
	KCl	1.5830	10.19949
	K_2CO_3	1.4671	10.16646
	$K_2Cr_2O_7$	3.1231	10.49459
	$KHCO_3$	1.0627	10.02642
	KI	3.5248	10.54714
	KOH	1.1913	10.07602
	KNO_3	2.14660	10.33177
	K_2PtCl_6	5.1610	10.74273
	K_2SO_4	1.8499	10.26715
	N_2O_5	1.1467	10.05945
KOH	K_2CO_3	1.2315	10.09044
	K_2O	0.83942	9.92398
K_2PtCl_6	K	0.16056	9.20564
	K_2CO_3	0.28427	9.45373
	KCl	0.30674	9.48676

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Potassium:			−10
K_2PtCl_6	$KHCO_3$	0.20591	9.31369
	KNO_3	0.41595	9.61904
	K_2O	0.19376	9.28727
	K_2SO_4	0.35844	9.55442
	$K_2SO_4.Al_2(SO_4)_3\cdot 24H_2O$	1.9521	10.29050
	$K_2SO_4.Cr_2(SO_4)_3\cdot 24H_2O$	2.0545	10.31269
K_2S	$BaSO_4$	2.1171	10.32574
	K_2SO_4	1.5804	10.19877
K_2SiO_3	SiO_2	0.30929	9.59139
K_2SO_4	$BaSO_4$	1.3396	10.12698
	KCl	0.85573	9.93234
	K_2CO_3	0.79307	9.89931
	$KHCO_3$	1.1490	10.06032
	$KHSO_4$	1.5628	10.19390
	KNO_2	0.97682	9.98981
	KNO_3	1.1604	10.06461
	K_2O	0.54057	9.73285
	K_2PtCl_6	2.7899	10.44559
	K_2S	0.63273	9.80122
	SO_3	0.45943	9.66222
$K_2SO_4\cdot Al_2(SO_4)_3\cdot 24H_2O$	K_2PtCl_6	0.51228	9.70951
$K_2SO_4\cdot Cr_2(SO_4)_3\cdot 24H_2O$	K_2PtCl_6	0.48673	9.68729
$Mg_2As_2O_7$	K_3AsO_4	1.6503	10.21756
	K_2HAsO_4	1.4050	10.14768
Mn_2O_3	K_2MnO_4	2.5848	10.41244
	$KMnO_4$	2.0721	10.31642
MnS	K_2MnO_4	2.2661	10.35528
	$KMnO_4$	1.8166	10.25926
N	KNO_3	7.2169	10.85835
NH_3	KNO_3	5.9372	10.77358
NO	KNO_3	3.3692	10.52752
N_2O_3	KNO_2	2.2391	10.35008
N_2O_5	K_2O	0.87207	9.94055
	KNO_3	1.8721	10.27232
Pt	K	0.40062	9.60273
	KCl	0.76394	9.88306
SiO_2	K_2SiO_3	2.5622	10.40861
SO_3	K_2SO_4	2.1766	10.33778
Silicon: Si = 28.3			
$BaSiF_6$	SiF_4	0.37294	9.57163
	SiO_2	0.21561	9.33367
H_2SiO_3	SiO_2	0.76993	9.88645
K_2SiF_6	SiF_4	0.47301	9.67487
	SiO_2	0.27347	9.43691
Si	SiO_2	2.1307	10.32853
SiF_4	$BaSiF_6$	2.6814	10.42837
	K_2SiF_6	2.1141	10.32513
	SiO_2	0.57815	9.76204
SiO_2	$BaSiF_6$	4.6380	10.66633

Weighed	Sought	Factor	Logarithm
Silicon:			−10
SiO_2	H_2SiO_3	1.2988	10.11355
	K_2SiF_6	3.6567	10.56309
	Si	0.46933	9.67147
	SiF_4	1.7296	10.23796
SiO_2	SiO_3	1.2653	10.10220
	SiO_4	1.5307	10.18488
	Si_2O	1.3980	10.14551
	$Si(OH)_4$	1.5975	10.20344
SiO_3	SiO_2	0.79031	9.89780
SiO_4	SiO_2	0.65331	9.81512
Si_2O	SiO_2	0.71530	9.85449
$Si(OH)$	SiO_2	0.62598	9.79656
Silver: Ag = 107.88			
Ag	$AgBr$	1.7408	10.24076
	$AgCl$	1.3287	10.12343
	$AgCN$	1.2411	10.09381
	AgI	2.1765	10.33776
	$AgNO_3$	1.5748	10.19723
	Ag_2O	1.0742	10.03107
	Ag_3PO_4	1.2932	10.11182
	$Ag_4P_2O_7$	1.4034	10.14719
	Br	0.74083	9.86972
	Cl	0.32870	9.51680
	I	1.1765	10.07059
$AgBr$	Ag	0.57443	9.75924
	Br	0.42556	9.62896
$AgCl$	Ag	0.75261	9.87657
	$AgNO_3$	1.1852	10.07380
	Ag_2O	0.80842	9.90764
	Cl	0.24738	9.39337
$AgCN$	Ag	0.80573	9.90619
AgI	Ag	0.45945	9.66224
	I	0.54055	9.73283
Ag_2O	Ag	0.93095	9.96893
	$AgCl$	1.2370	10.09236
Ag_3PO_4	Ag	0.77317	9.88828
$Ag_4P_2O_7$	Ag	0.71253	9.85281
Br	Ag	1.3498	10.13028
	$AgBr$	2.3498	10.37104
Cl	Ag	3.0423	10.48320
	$AgCl$	4.0423	10.60663
I	Ag	0.84998	9.92941
	AgI	1.8500	10.26717
Sodium: Na = 23			
Ag	$NaBr$	0.95622	9.98056
	$NaCl$	0.54190	9.73392
	NaI	1.3897	10.14292
$AgBr$	$NaBr$	0.54802	9.73880
$AgCl$	$NaCl$	0.40784	9.61049
AgI	NaI	0.63850	9.80516
$BaSO_4$	$NaHSO_4$	0.51437	9.71128
	$NaHSO_4\cdot H_2O$	0.59153	9.77198
	Na_2S	0.33440	9.52427
	Na_2SO_3	0.54003	9.73242
	$Na_2SO_3\cdot 7H_2O$	1.0803	10.03354

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS
(Continued)

Weighed	Sought	Factor	Logarithm −10
Sodium:			
$BaSO_4$	Na_2SO_4	0.60858	9.78432
	$Na_2SO_4 \cdot 10H_2O$	1.3804	10.14001
B_2O_3	$Na_2B_4O_7$	1.4429	10.15922
	$Na_2B_4O_7 \cdot 10H_2O$	2.7297	10.43612
Br	Na	0.28779	9.45907
	NaBr	1.2878	10.10984
	Na_2O	0.38788	9.58870
$CaCl_2$	NaCl	1.0534	10.02259
$CaCO_3$	Na_2CO_3	1.0590	10.02492
CaF_2	NaF	1.0757	10.03168
CaO	Na_2CO_3	1.8898	10.27642
$CaSO_4$	Na_2CO_3	0.77867	9.89135
Cl	Na	0.64862	9.81193
	NaCl	1.6486	10.21712
	Na_2O	0.87422	9.94162
CO_2	Na_2CO_3	2.4089	10.38182
	Na_2O	1.4089	10.14888
H_3BO_3	$Na_2B_4O_7$	0.81420	9.91073
	$Na_2B_4O_7 \cdot 10H_2O$	1.5404	10.18763
I	Na	0.18122	9.25820
	NaI	1.1812	10.07233
	Na_2O	0.24425	9.38783
KBF_4	$Na_2B_4O_7$	0.40047	9.60257
	$Na_2B_4O_7 \cdot 10H_2O$	0.75765	9.87947
$Mg_2As_2O_7$	Na_2HAsO_3	1.0947	10.39300
	Na_2HAsO_4	1.1978	10.07837
$MgCl_2$	NaCl	1.2276	10.08906
$Mg_2P_2O_7$	Na_2HPO_4	1.2756	10.10571
	$Na_2HPO_4 \cdot 12H_2O$	3.2169	10.50744
	$NaNH_4HPO_4 4H_2O$	1.8781	10.27373
	$Na_4P_2O_7 \cdot 10H_2O$	2.0036	10.30181
Na	Br	3.4748	10.54093
	Cl	1.5417	10.18801
	I	5.5182	10.74180
	NaBr	4.4747	10.65077
	NaCl	2.5418	10.40514
	Na_2CO_3	2.3044	10.36255
	$NaHCO_3$	3.6525	10.56259
	NaI	6.5183	10.81413
	Na_2O	1.3478	10.12963
	Na_2SO_4	3.0883	10.48972
$Na_2B_4O_7$	B_2O_3	0.69308	9.84078
	H_3BO_3	1.2282	10.08927
	KBF_4	2.4971	10.39743
$Na_2B_4O_7 \cdot 10H_2O$	B_2O_4	0.36634	9.56388
	H_3BO_3	0.64918	9.81237
	KBF_4	1.3199	10.12053
NaBr	Ag	1.0458	10.01944
	AgBr	1.8247	10.26120
	Br	0.77654	9.89016
Sodium:			
NaBr	Na	0.22348	9.34923
	Na_2O	0.30120	9.47886
NaCl	Ag	1.8453	10.26608
	AgCl	2.4520	10.38951
	Cl	0.60657	9.78288
	Na	0.39343	9.59487
	Na_2CO_3	0.90661	9.95742
	$NaHCO_3$	1.4370	10.15746
	Na_2HPO_4	1.2150	10.08456
	Na_2O	0.53028	9.72451
Na_2CO_3	Na_2SO_4	1.2150	10.08458
	$CaCO_3$	0.94423	9.97508
	CaO	0.52915	9.72358
	$CaSO_4$	1.2842	10.10863
	CO_2	0.41509	9.61814
	Na	0.43396	9.63745
	NaCl	1.1030	10.04258
	$NaHCO_3$	1.5850	10.20003
	Na_2O	0.58490	9.76708
	NaOH	0.75486	9.87787
	Na_2SO_4	1.3402	10.12717
$Na_2CO_3 \cdot 10H_2O$	Na_2SO_4	0.49643	9.69585
NaF	CaFe	0.92965	9.96832
Na_2HAsO_3	$Mg_2As_2O_7$	0.91348	9.96070
Na_2HAsO_4	$Mg_2As_2O_7$	0.83490	9.92163
$NaHCO_3$	Na	0.27379	9.43741
	NaCl	0.69589	9.84254
	Na_2CO_3	0.63090	9.79996
	Na_2O	0.36901	9.56704
$NaNH_4HPO_4 \cdot 4H_2O$	$Mg_2P_2O_7$	0.53244	9.72627
	NH_3	0.08144	8.91084
	P_2O_5	0.33966	9.53104
Na_2HPO_4	$Mg_2P_2O_7$	0.78395	9.89429
	Na_2O	0.43646	9.63995
	$Na_4P_2O_7$	0.93656	9.97154
	P_2O_5	0.50010	9.69906
$Na_2HPO_4 \cdot 12H_2O$	$Mg_2P_2O_7$	0.31086	9.49256
	$Na_4P_2O_7$	0.37139	9.56981
	P_2O_5	0.19830	9.29733
$NaHSO_3$	SO_2	0.61555	9.78926
$NaHSO_4$	$BaSO_4$	1.9441	10.28872
$NaHSO_4 \cdot H_2O$	$BaSO_4$	1.6905	10.22802
NaI	Ag	0.71958	9.85708
	AgI	1.5661	10.19484
	I	0.84659	9.92767
	Na	0.15341	9.18587
	Na_2O	0.20678	9.31550
$NaNO_3$	Na_2O	0.36467	9.56189
	N	0.16481	0.21697
	NH_3	0.20038	9.30185
	NO	0.35302	9.54780

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Sodium:			−10
	N_2O_5	0.63533	9.80300
Na_2O	Br	2.5781	10.41130
	Cl	1.1439	10.05838
Na_2O	CO_2	0.70968	9.85106
	I	4.0942	10.61217
	Na	0.74194	9.87037
	NaBr	3.3200	10.52114
	NaCl	1.8858	10.27549
	Na_2CO_3	1.7097	10.23292
	NaI	4.8350	10.68440
	Na_2HPO_4	2.2911	10.36005
	NaOH	1.2906	10.11079
	Na_2SO_4	2.2913	10.36008
	N_2O_5	1.7422	10.24111
	SO_3	1.2913	10.11103
NaOH	Na_2CO_3	1.3247	10.12213
	Na_2O	0.77484	9.88921
$Na_4P_2O_7 \cdot 10H_2O$	$Mg_2P_2O_7$	0.49911	9.69820
Na_2S	$BaSO_4$	2.9904	10.47573
Na_2SO_3	$BaSO_4$	1.8517	10.26757
	SO_2	0.50817	9.70601
$Na_2SO_3 \cdot 7H_2O$	$BaSO_4$	0.92569	9.96647
	SO_2	0.25403	9.40489
Na_2SO_4	$BaSO_4$	1.6432	10.21569
	Na	0.32381	9.51029
	NaCl	0.82303	9.91542
	Na_2CO_3	0.74616	9.87283
	$Na_2CO_3 \cdot 10H_2O$	2.0144	10.30415
	Na_2O	0.43644	9.63992
	SO_3	0.56356	9.75094
$Na_2SO_4 \cdot 10H_2O$	$BaSO_4$	0.72444	9.86000
N	$NaNO_3$	6.0678	10.78303
NH_3	$NaNO_3$	4.9918	10.69826
	$NaNH_4HPO_4 \cdot 4H_2O$	12.2790	11.08416
NO	$NaNO_3$	2.8327	10.45220
N_2O_5	$NaNO_3$	1.5740	10.19700
	Na_2O	0.57397	9.75889
P_2O_5	Na_2HPO_4	1.9996	10.30094
	$Na_2HPO_4 \cdot 12H_2O$	5.0428	10.70267
	$NaNH_4HPO_4 \cdot 4H_2O$	2.9441	10.46896
SO_2	$NaHSO_3$	1.6246	10.21075
	Na_2SO_3	1.9678	10.29398
	$Na_2SO_3 \cdot 7H_2O$	3.9365	10.59511
SO_3	Na_2O	0.77442	9.88898
	Na_2SO_4	1.7744	10.24905
Strontium: Sr=87.63			
CO_2	$SrCO_3$	3.3550	10.52569
SO_3	SrO	1.2994	10.11207
	$SrSO_4$	2.2944	10.36067

Weighed	Sought	Factor	Logarithm
Strontium:			−10
Sr	$SrCO_3$	1.6847	10.22652
	SrO	1.1827	10.07285
Sr	$SrSO_4$	2.0962	10.32142
$SrCl_2$	$SrCO_3$	0.93110	9.96900
	SrO	0.65363	9.81533
	$SrSO_4$	1.1586	10.06393
$SrCO_3$	CO_2	0.29804	9.47428
	Sr	0.59358	9.77348
	$SrCl_2$	1.0740	10.03100
	$Sr(HCO_3)_2$	1.4201	10.15232
	$Sr(NO_3)_2$	1.4337	10.15645
	SrO	0.70198	9.84633
	$SrSO_4$	1.2443	10.09493
$Sr(HCO_3)_2$	$SrCO_3$	0.70417	9.84768
	SrO	0.49432	9.69401
$Sr(NO_3)_2$	$SrCO_3$	0.69751	9.84355
	$SrSO_4$	0.86790	9.93847
SrO	SO_3	0.77256	9.88793
	Sr	0.84558	9.92715
	$SrCl_2$	1.5299	10.18467
	$SrCO_3$	1.42453	10.15367
	$Sr(HCO_3)_3$	2.0228	10.30599
$SrSO_4$	SO_3	0.43584	9.63933
	Sr	0.47705	9.67856
	$SrCl_2$	0.86314	9.93608
	$SrCO_3$	0.80369	9.90509
	$Sr(NO_3)_2$	1.1522	10.06153
	SrO	0.56416	9.75140
Sulphur: S=32.06			
As_2S_3	H_2S	0.41539	9.61846
	S	0.39053	9.59165
$BaSO_4$	H_2S	0.14598	9.16429
	H_2SO_3	0.35161	9.54606
	H_2SO_4	0.42015	9.62340
	S	0.13734	9.13780
	SO_2	0.27443	9.43843
	SO_3	0.34297	9.53526
	SO_4	0.41152	9.61439
CdS	H_2S	0.23589	9.37271
	S	0.22193	9.34622
H_2S	As_2S_3	2.4074	10.38155
	$BaSO_4$	6.8503	10.83571
	CdS	4.2393	10.62729
	SO_3	2.3495	10.37098
H_2SO_3	$BaSO_4$	2.8441	10.45394
H_2SO_4	$BaSO_4$	2.3801	10.37660
	$(NH_4)_2SO_4$	1.3472	10.12943
	SO_3	0.81631	9.91186
$(NH_4)_2SO_4$	SO_3	0.60592	9.78242
	H_2SO_4	0.74227	9.87056
S	As_2S_3	2.5587	10.40802
	$BaSO_4$	7.2810	10.86219
	CdS	4.5059	10.65378
SO_2	$BaSO_4$	3.6439	10.56157
SO_3	$BaSO_4$	2.9157	10.46474
SO_4	$BaSO_4$	2.4300	10.38560

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Tin: $Sn = 118.7$			−10
Sn	$SnCl_2$	1.5975	10.20344
	$SnCl_2 \cdot 2H_2O$	1.9010	10.27898
	$SnCl_4$	2.1949	10.34141
	$SnCl_4(NH_4Cl)_2$	3.0964	10.49086
	SnO	1.1348	10.05492
	SnO_2	1.2696	10.10367
$SnCl_2$	Sn	0.62599	9.79657
	SnO_2	0.79475	9.90023
$SnCl_2 \cdot 2H_2O$	Sn	0.52609	9.72102
	SnO_2	0.66785	9.82468
$SnCl_4$	Sn	0.45559	9.65857
	SnO_2	0.57841	9.76224
$SnCl_4(NH_4Cl)_2$	Sn	0.32296	9.50915
	SnO_2	0.41002	9.61281
SnO	Sn	0.88122	9.94508
	SnO_2	1.1188	10.04875
SnO_2	Sn	0.78766	9.89634
	$SnCl_2$	1.2583	10.09975
	$SnCl_2 \cdot 2H_2O$	1.4973	10.17531
	$SnCl_4$	1.7289	10.23777
	$SnCl_4(NH_4Cl)_2$	2.4389	10.38719
	SnO	0.89383	9.95125
Titanium: $Ti = 48.1$			
Ti	TiO_2	1.6652	10.22148
TiO_2	Ti	0.60051	9.77852
Tungsten: $W = 184$			
W	WO_2	1.1739	10.06963
	WO_3	1.2609	10.10067
WO_2	W	0.85187	9.93037
WO_3	W	0.79310	9.89933
Uranium: $U = 238.2$			
U	UO_2	1.1343	10.05473
	U_3O_8	1.1791	10.07155
	$U_2P_2O_{11}$	1.4997	10.17600
UO_2	U	0.88157	9.94526
Uranium:			−10
UO_2	U_3O_8	1.0395	10.01682
	$U_2P_2O_{11}$	1.3221	10.12126
U_3O_8	U	0.84809	9.92844
	UO_2	0.96202	9.98318
	$UO_2(NO_3)_2 \cdot 6H_2O$	1.7885	10.25249
$UO_2(NO_3)_2 \cdot 6H_2O$	U_3O_8	0.55914	9.74752
$U_2P_2O_{11}$	U	0.67624	9.83010
	UO_2	0.76709	9.88485
Vanadium: $V = 51$			
V	V_2O_5	1.7843	10.25147
VO_4	V_2O_5	0.79130	9.89834
V_2O_5	V	0.56045	9.74853
	VO_4	1.2638	10.10166
Zinc: $Zn = 65.37$			
$BaSO_4$	$ZnSO_4 \cdot 7H_2O$	1.2318	10.09054
Zn	ZnO	1.2447	10.09508
	$Zn_2P_2O_7$	2.3315	10.36763
	ZnS	1.4904	10.17330
$ZnCl_2$	ZnO	0.59702	9.77599
$ZnCO_3$	ZnO	0.64903	9.81227
ZnO	Zn	0.80338	9.90492
	$ZnCl_2$	1.6749	10.22401
	$ZnCO_3$	1.5407	10.18773
	$Zn_2P_2O_7$	1.8773	10.27254
	ZnS	1.1974	10.07825
$Zn_2P_2O_7$	Zn	0.42891	9.63237
	ZnO	0.53390	9.72746
ZnS	$BaSO_4$	2.3959	10.37947
	Zn	0.67094	9.82668
	ZnO	0.83516	9.92177
	$ZnSO_4 \cdot 7H_2O$	2.9506	10.46991
$ZnSO_4 \cdot 7H_2O$	$BaSO_4$	0.81182	9.90946
	ZnO	0.28299	9.45177
	ZnS	0.33884	9.52999

HEATS OF FORMATION AND SOLUTION

The following table gives the heat of formation and heat of solution in small calories. To convert to British Thermal Units multiply the values by 0.003968.

The values are given for a temperature of about 15° C. unless otherwise stated. The heat of solution is given in most cases for a definite number of water molecules to one of the substance. Where this is not stated the dilution may be understood to be such that additional dilution produces a negligible thermal effect.

In the second column the formulæ indicate the substances entering the reaction or the nature of the compound where only the heat of solution is given.

(Compiled from various sources.)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water. mols.	Heat of solution. Calories.
Acetic Acid	C_2, H_4, O_2	liquid	117,200	200	+375
Aluminum					
bromide	Al, Br_3	solid	121,950	2970	+85,300 9°
carbide	Al_4, C_3	solid	232,000	.....	....
chloride	Al, Cl_3	solid	161,800	2500	+153,690
chloride	$AlCl_3$	....	....	1250	+76,845
fluoride	Al, F_3	dil. sol.	275,220	.....	....
hydroxide	Al, O_3, H_3	solid	301,300	.....	....
hydroxide	Al_2, O_3, $3H_2O$	solid	288,920	.....	....
iodide	Al, I_3	solid	70,300	2250	+89,000 9°
oxide	Al_2, O_3	solid	392,600	.....	....
potassium sulphate	$K_2Al_2(SO_4)_4.24H_2O$	....	....	2400	−20,240
silicate	Al_2, Si_2, O_7	solid	767,500	.....	....
silicate	Al_2, Si_2, O_9, H_4	solid	927,420	.....	....
sulphate	Al_2, S_3, O_{12}	dil. sol.	879,700	.....	....
sulphide	Al_2, S_3	solid	126,400	.....	....
Ammonia	N, H_3	gas	12,000	.....	....
ammonia	N, H_3	liquid	21,000	.....	....
Ammonium					
acetate	N, H_7, C_2, O_2	solid	150,250	200	+250 24°
bromide	N, H_4, Br	solid	65,350	200	−4,380
bromide	NH_3, HBr	solid	45,500	.....	....
carbonate	N_2, H_8, C, O_3, Aq	dil. sol.	221,600	.....	....
carbonate, acid	N_2, H_5, C, O_3	solid	208,600	220–440	−6,300°
chloride	N, H_4, Cl	solid	76,800	200	−3,088 18°
chloride	NH_3, HCl	solid	41,900	.....	....
chloride	NH_4, Cl	....	75,790	.....	....
chloroplatinite	$(NH_4)_2PtCl_4$	....	....	660	−8,480
cyanate	N_2, H_4, C, O, Aq	dil. sol.	68,900	.....	....
cyanide	N_2, H_4, C	solid	2,300	820	−4,400
cyanide	NH_3, HCN	solid	20,600	.....	....
ferrocyanide	$(NH_4)_4Fe(CN)_6.3H_2O$	....	....	.....	−6,800 14°
fluoride	N, H_4, F	solid	101,250	.....	−1,500
fluoride	NH_3, HF	solid	37,300	.....	....
fluosilicate	N_2, H_8, Si, F_6	solid	458,900	2400	−8,400 7°
hydroxide	N, H_5, O	....	88,800	.....	....
hydroxide	N, H_5, O, Aq	dil. sol.	90,000	.....	....
iodide	N, H_4, I	solid	49,300	200	−3,550
iodide	NH_3, HI	solid	43,460	.....	....
iodide	NH_4, I	solid	49,310	.....	....
nitrate	N_2, H_4, O_3	solid	88,060	220–440 200	−6,200 15° −6,320
nitrate	NH_3, HNO_3	....	34,800	.....	....
nitrite	N_2, H_4, O_2	....	68,950	400	−4,750 12.5°

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Ammonium					
oxalate	N_2, H_8, C_2, O_4	solid	270,100	345–690	−8,000
oxalate	$(NH_4)_2C_2O_4.H_2O$	......	....	395–790	−11,500
phosphate	N_3, H_{12}, P, O_4, Aq	dil. sol.	403,000	......	....
" (di-basic)	N_2, H_9, P, O_4, Aq	dil. sol.	375,000	......	....
" (m.-bas.)	N, H_6, P, O_4, Aq	dil. sol.	341,200	......	....
sulphate	N_2, H_8, S, O_4	solid	283,500	400	−2,370
sulphate, acid	N, H_5, S, O_4	solid	244,600	200	−20
sulphate, per-	N_2, H_8, S_2, O_8	solid	392,900	1100	−9,700 $^{9.4°}$
sulphide	N_2, H_8, S	solid	66,200	......	....
sulphide, acid	N_2, H_5, S	solid	40,000	890	−3,250 $^{12.5°}$
sulphide, acid	NH_3, H_2S	solid	22,400	......	....
sulphite	N_2, H_8, S, O_3	solid	215,500	440	−1,540 $^{8°}$
sulphite	$(NH_4)_2SO_3.H_2O$	....	....	440	−5,360 $^{10°}$
sulphocyanate	N_2, H_4, C, S	solid	20,700	......	−5,670 $^{12°}$
sulphydrate	NH_3, H_2S	solid	22,400	890	−3,250 $^{13°}$
sulphydrate	N, H_5, S	solid	40,000	......	....
Antimony					
acid (stibnic)	$3H_2O, Sb_2, O_5$	solid	228,780	......	....
acid (stibnous)	$3H_2O, Sb_2, O_3$	solid	167,420	......	....
bromide	Sb, Br_3	solid	61,400	......	....
chloride, tri-	Sb, Cl_3	solid	91,390	......	+8,910
chloride, penta-	Sb, Cl_5	liquid	104,870	1100	+35,200
fluoride	Sb, F_3	solid	141,000	......	....
hydride (stibine)	Sb, H_3	gas const vol.	−34,270	......	....
hydride	Sb, H_3	const. press.	−33,960	......	....
iodide	Sb, I_3	solid	28,800	......	....
oxide, tri-	Sb_2, O_3	solid	166,900	......	....
oxide, penta-	Sb_2,O_5	solid	131,200	......	....
oxychloride	Sb_2, O_2, Cl_2	solid	179,600	......	....
sulphide	Sb_2, S_3	solid	34,400	......	....
Arsenic					
acid	H_3, As, O_4	solid	215,630	......	−400
bromide	As, Br_3	solid	45,500	......	....
chloride	As, Cl_3	liquid	71,390	......	....
chloride	As, Cl_3	solid	—71,500	......	....
iodide	As, I_3	solid	13,500	......	....
hydride (arsine)	As (cryst.), H_3	gas	44,200	......	....
oxide, tri-	As_2, O_3	solid	154,670	......	−7,550
oxide	As_2, O_3, Aq	dil. sol.	147,120	......	....
oxide	As_2(cryst.), O_3	solid	156,400	......	−7,500
oxide, tri-	As_2(cryst.), O_3, Aq	dil. sol.	148,900	......	....
oxide, penta-	As_2, O_5	solid	219,380	......	....
oxide, penta-	As_2, O_5, Aq	dil. sol.	225,380	......	....
Aurichlorhydric Acid	$Au, Cl_4, H, 4H_2O$	solid	76,950	400	−5,830
Aurobromhydric Acid	Au, Br_4, H, Aq	dil. sol.	41,165	1000 ($5H_2O$)	−11,400
Barium					
acetate	$Ba(C_2H_3O_2)_2.3H_2O$	....	....	800	−1,150
acetate	Ba, C_4, H_6, O_4	solid	349,300	600	+5,200 $^{10.8°}$
arsenate	Ba_3, As_2, O_8 p'p't'd.	solid	629,200	......	....
bromide	Ba, Br_2	solid	172,100	400	+4,980
bromide	$Ba, Br_2, 2H_2O$	solid	181,210	400	−4,130
carbonate	Ba, C, O_3	amorph.	282,500	......	....
carbonate	Ba, C, O_3	cryst.	283,000	......	....
carbonate	BaO, CO_2	solid	63,440	......	....
chlorate	Ba, Cl_2, O_6	solid	171,200	500–1000	−6,700 $^{10°}$
chlorate	$Ba(ClO_3).H_2O$	....	....	600	−11,240

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Barium					
chlorate	$Ba, Cl_2, O_6, 6H_2O$	solid	179,710	......	....
chlorate, per-	Ba, Cl_2, O_8	solid	201,400	550-1100	$-1,800^{10°}$
chlorate, per-	$Ba, (ClO_4)_2, 3H_2O$	....	....	650-1300	−9,400
chloride	Ba, Cl_2	solid	196,880	400	+2,070
chloride	$Ba, Cl_2, 2H_2O$	solid	203,880	400	−4,930
cyanide	Ba, C_2, N_2	solid	48,300	......	$+1,800^{9°}$
cyanide	$Ba(CN)_2.2H_2O$	....	....	......	$-2,560^{7°}$
ferrocyanide	$Ba_2Fe(CN)_6.6H_2O$	....	....	......	$-11,400^{14°}$
fluoride	Ba, F_2	precip.	222,600	......	−1,900
hydride	Ba, H_2	solid	37,500	......	....
hydroxide	Ba, O_2, H_2	solid	217,000	......	+12,260
hydroxide	$Ba(OH)_2, 8H_2O$	....	....	400	−15,210
hypobromite	Ba, Br_2, O_2, Aq	dil. sol.	168,400	......	....
hypochlorite	Ba, Cl_2, O_2, Aq	dil. sol.	175,200	......	....
hypophosphite	Ba, H_4, P_2, O_4, Aq	dil. sol.	403,000	......	....
hypophosphite	$BaH_4(PO_2)_2, H_2O$	....	....	800	+290
iodide	Ba, I_2	solid	136,100	......	$+10,300^{16°}$
iodide	$Ba, I_2, 7H_2O$	solid	153,510	500	−6,850
nitrate	Ba, N_2, O_6	solid	228,400	400	−9,400
nitrate	$Ba(NO_3)_2.H_2O$	....	....	800	$-8,600^{12°}$
nitride	Ba_3, N_2	solid	149,400	......	....
nitrite	Ba, N_2, O_8	solid	179,600	......	....
oxide	Ba, O	solid	126,380	......	+34,520
oxide	$BaO.2H_2O$	....	....	666	+7,060
oxide, per-	Ba, O_2	solid	139,400	......	....
oxide, per-	BaO, O	solid	18,360	......	....
phosphate, tri-	Ba_3, P_2, O_8	cryst.	969,100	......	....
phosphate, di-	Ba, H, P, O_4	solid	424,600	......	....
phosphate, mono	Ba, H_4, P_2, O_8	solid	735,900	......	....
selenide	Ba, Se	solid	69,900	......	....
silicate	Ba, Si, O_3	solid	328,100	......	....
sulphate	Ba, S, O_4	solid	340,200	......	−5,580
sulphide	Ba, S	solid	102,900	......	+7,300
sulphide	Ba, S, Aq	dil. sol.	107,800	......	....
Beryllium					
chloride	Be, Cl_2	solid	155,000	......	+44,500
sulphate	$BeSO_4.4H_2O$	....	....	400	+1,100
Bismuth					
chloride	Bi, Cl_3	solid	90,630	1600	$+7,830^{18°}$
hydroxide	Bi, O_3, H_3	solid	171,700	......	....
hydroxide	$Bi_2, O_3, 3H_2O$	solid	137,740	......	....
oxide	Bi_2, O_3	solid	137,800	......	....
Boric Acid	$B_2O_3, 3H_2O$	solid	16,400	800	$-10,790^{18°}$
Boron					
bromide	B, Br_3	liquid	43,200	......	....
chloride	B, Cl_3	gas	89,100	......	....
chloride	B, Cl_3	liquid	93,400	......	....
fluoride	B, F_3	gas	234,800	......	....
oxide	B_2, O_3	solid	272,600	......	+7,300
Bromic Acid	H, Br, O_3	dil. sol.	12,500	......	....
Bromine					
chloride	Br, Cl	liquid	700	......	....
Cadmium					
bromide	Cd, Br_2	solid	75,200	......	....
bromide	$Cd, Br_2, 4H_2O$	solid	82,930	......	....
carbonate	Cd, C, O_3	solid	181,890	......	....
chloride	Cd, Cl_2	solid	93,240	400	+3,010
chloride	$Cd, Cl_2, 2H_2O$	solid	98,530	400	+760
cyanide	Cd, C_2, N_2	solid	−35,200	......	....
cyanide	$Cd, 2CN, Aq$	dil. sol.	+33,960	......	....

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Cadmium					
fluoride	Cd, F_2, Aq	dil. sol.	123,500	.....	....
hydroxide	Cd, O, H_2O	solid	65,680	.....	....
iodide	Cd, I_2	solid	48,830	400	−960
nitrate	Cd, N_2, O_6, H_2O	solid	113,300	400	+4,180
nitrate	Cd, N_2, O_6, $4H_2O$	solid	121,160	400	−5,040
oxide	Cd, O	solid	66,300	.....	....
selenide	Cd, Se	solid, cry.	14,300	.....	....
selenide	Cd, Se	solid precip.	23,700	.....	....
sulphate	Cd, SO_2, O_2	solid	150,470	400	+10,740
sulphate	Cd, S, O_4	solid	219,900	.....	....
sulphate	$CdSO_4.H_2O$	....	....	400	+6,050
sulphate	$CdSO_4.\frac{8}{3}H_2O$	....	....	400	+2,660
sulphide	Cd, S, xH_2O	solid	34,350	.....	....
telluride	Cd, Te	solid, cry.	16,600	.....	....
Caesium					
bromide	Cs, Br	solid	47,700	.....	−3,250
carbonate	Cs_2O, CO_2	solid	97,530	.....	....
carbonate	Cs_2, C, O_3	solid	274,540	.....	....
carbonate, acid	Cs, H, C, O_3	solid	232,920	.....	....
carbonate, acid	CsOH, CO_2	solid	11,250	.....	....
chloride	Cs, Cl	solid	109,860	.....	$-4{,}750^{15°}$
fluoride	Cs, F	solid	106,600	.....	+8,350
hydroxide	Cs, O, H	solid	101,300	330	+15,880
hydroxide	$CsOH.H_2O$	....	....	.....	+4,317
iodide	Cs, I	solid	83,600	.....	−1,450
oxide, mon-	Cs_2, O	solid	82,700	.....	+83,200
oxide, di-	Cs_2O, O	solid	28,260	.....	....
oxide, tri-	Cs_2O_2, O	solid	18,000	.....	....
oxide, tetr-	Cs_2O_3, O	solid	12,500	.....	....
sulphate	Cs_2, S, O_4	solid	349,830	.....	−4,970
sulphate, acid	Cs, H, S, O_4	solid	282,900	.....	−3,730
Calcium					
acetate	Ca, C_4, H_6, O_4	solid	335,000	440	$+7{,}000^{15°}$
acetate	$Ca(C_2H_3O_2)_2.H_2O$	....	....	600	$+5{,}400^{17°}$
aluminate,					
" mono-	Ca, Al_2, O_4	solid	524,550	.....	....
" di-	Ca_2, Al_2, O_5	solid	658,900	.....	....
" tri-	Ca_3, Al_2, O_6	solid	789,050	.....	....
aluminum silicate	Ca_3, Al_2, Si_2, O_{10}	solid	1,195,600	.....	....
arsenate	Ca_3, As_2, O_8	solid	732,800	.....	....
bromide	Ca, Br_2	solid	154,920	400	+24,510
bromide	Ca, Br_2, $6H_2O$	solid	180,520	400	−1,090
carbide	Ca, C_2	solid	13,150	.....	....
carbonate	Ca, C, O_3	solid precip.	269,100	.....	....
carbonate	Ca, C, O_3	solid rhomb.	270,800	.....	....
carbonate	CaO, CO_2	solid precip.	43,300	.....	....
carbonate	CaO, CO_2	(calcite)	42,000	.....	....
chloride	Ca, Cl_2	solid	190,400	300	+17,410
chloride	Ca, Cl_2, $6H_2O$	solid	205,640	400	$-4{,}055^{16°}$
cyanide	Ca, C_2, N_2, Aq	dil. sol.	38,300	.....	....
ferrocyanide	$Ca_2Fe(CN)_6.12H_2O$	....	....	.....	$-4{,}600^{10°}$
fluoride	Ca, F_2	solid precip.	218,400	.....	....
fluoride	Ca, F_2	solid	239,200	.....	−2,700
hydride	Ca, H_2	solid	46,200	.....	....
hydroxide	Ca, O, H_2O	solid	160,540	2500	+2,790

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Calcium					
hydroxide	Ca, O_2, H_2	solid	236,000	.....	....
iodide	Ca, I_2	solid	127,400	400	+27,690
nitrate	Ca, N_2, O_6	solid	216,770	400	+3,950
nitrate	$Ca(NO_3)_2.4H_2O$	....	....	400	−7,250
nitride	Ca_3, N_2	solid	112,200	.....	....
nitrite	$H_2N_2O_2, Ca(OH), 2H_2O$	dil. sol.	21,600	.....	....
oxalate	Ca, C_2, O_4	precip.	312,900	.....	....
oxide	Ca, O	solid	151,900	2500	+18,330
oxide, per-	CaO, O	solid	5,400	.....	....
oxide, per-	Ca, O_2	solid	156,010	.....	....
phosphate	Ca_3, P_2, O_8	solid	919,200	.....	....
silicate	Ca, Si, O_3	solid	344,400	.....	....
silicate	CaO, SiO_2	solid	33,100	.....	....
selenide	Ca, Se	solid	58,000	.....	....
sulphate	Ca, SO_2, O_2	solid	261,360	.....	+2,920 $9°$
sulphate	$Ca, SO_2, O_2, 2H_2O$	solid (gypsum)	266,100	.....	−690 $10°$
sulphate	$CaSO_4.\frac{1}{2}H_2O$	....	....	.....	+3,560 $10°$
sulphate	$CaSO_4.4H_2O$	....	....	400	−7,970
sulphide	Ca, S	solid	112,200	.....	+6,310
sulphydrate	Ca, S_2, H_2, Aq	dil. sol.	125,300	.....	....
Carbon					
chloride, di-	C_2, Cl_4	gas	−1,150	.....	....
chloride, di-	C_2, Cl_4	liquid	+6,000	.....	....
chloride, di-	C_2 (diamond), Cl_4	liquid	45,500	.....	....
chloride, tri-	C_2 (diamond), Cl_6	solid	107,400	.....	....
chloride, tetra-	C, Cl_4	gas	21,030	.....	....
chloride, tetra-	C, Cl_4	liquid	28,200	.....	....
chloride, tetra-	C (diamond), Cl_4	gas	68,500	.....	....
chloride, tetra-	C (diamond), Cl_4	liquid	75,700	.....	....
oxide, mon-	C, O	gas	29,000	.....	....
oxide, mon-	C (diamond), O	gas	26,100	.....	....
oxide, di-	C, O_2	gas	97,000	.....	....
oxide, di-	C (diamond), O_2	gas	94,310	.....	....
oxychloride	C, O, Cl_2	gas	44,000	.....	....
oxysulphide	C, O, S	solid	37,030	.....	....
sulphide, di-	C, S_2	gas	−25,400	.....	....
sulphide, di-	C, S_2	liquid	−19,000	.....	....
Cerium					
oxide	Ce, O_2	solid	+224,600	.....	....
Chloric acid	Cl, O_3, H, Aq	dil. sol.	22,000	.....	....
Chlorine					
oxide, mon-	Cl_2, O	gas	−17,930	.....	....
Chlorosulphonic acid	S, O_3, H, Cl	gas	+127,400	.....	....
acid	S, O_3, H, Cl	liquid	140,200	.....	....
Chromium					
bromide (ic)	$CrBr_3.6H_2O$	green	....	.....	+700
bromide (ic)	$CrBr_3.6H_2O$	blue	....	.....	+14,350
chloride (ic)	$CrCl_2, Aq, Cl$	dil. sol. violet	56,700	.....	....
chloride (ic)	$CrCl_3$	....	....	.....	+35,900
chloride (ic)	$2CrCl_3.13H_2O$	green	....	.....	−100
chloride (ic)	$2CrCl_3.13H_2O$	gray	....	.....	+24,040
chloride (ous)	$CrCl_2$	....	....	.....	+18,600
chloride (ous)	$CrCl_2.4H_2O$	....	....	.....	+2,000
oxide (ic)	Cr_2, O_3	cryst.	267,800	.....	....
oxide (ic)	Cr_2, O_3	amorph.	243,800	.....	....
oxide, tri-	Cr, O_3	solid	140,000	220	+1,900 $19°$

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Chromium					
sulphate (ic)....	$Cr_2(SO_4)_3.8H_2O$.......	green	....	.....	+13,600
sulphate (ic)....	$Cr_2(SO_4)_3.16H_2O$......	violet	....	.....	+6,200
Cobalt					
bromide (ous)..	Co, Br_2, Aq..........	dil. sol.	72,940	.....	....
chloride (ous)..	Co, Cl_2..............	solid	76,700	400	+18,340
chloride (ous)..	$CoCl_2.6H_2O$..........	....	....	400	−2,850
fluoride (ous)...	Co, F_2, Aq...........	dil. sol.	122,200	.....	....
hydroxide (ic)..	$Co_2, O_3, 3H_2O$........	solid	149,380	.....	....
hydroxide (ic)..	$2Co(OH)_2, O, H_2O$....	solid	22,580	.....	....
hydroxide (ous)	Co, O, H_2O..........	solid	63,400	.....	....
iodide (ous)....	Co, I_2, Aq...........	dil. sol.	40,700	.....	....
nitrate (ous)....	CoO, N_2O_5, Aq.......	dil. sol.	84,540	.....	....
nitrate (ous)....	$Co, N_2, O_6, 6H_2O$.....	solid	120,680	400	−4,960
oxide (ous).....	Co, O................	cryst.	57,500	.....	....
oxide (ous).....	Co, O................	amorph.	57,500	.....	....
oxide (ous, ic)..	Co_3, O_4.............	solid	193,400	.....	....
selenide (ous)...	Co, Se...............	cryst.	9,900	.....	....
selenide (ous)...	Co, Se...............	precip.	13,900	.....	....
sulphate (ous)..	Co, O, SO_3, Aq.......	dil. sol.	88,070	.....	....
sulphate (ous)..	$Co, O_2, SO_2, 7H_2O$....	solid	164,970	800	−3,570
sulphide (ous)..	Co, S, xH_2O..........	solid	19,730	.....	....
telluride (ous)..	Co, Te...............	solid	13,000	.....	....
Copper					
acetate (ic).....	Cu, C_4, H_6, O_4........	solid	213,900	320	+2,400 16°
acetate (ic).....	$Cu(C_2H_6O_2)_2.H_2O$....	....	....	440	+800 10°
bromide (ic)....	Cu, Br_2..............	solid	32,600	400	+8,250
bromide (ic)....	$CuBr_2.4H_2O$..........	....	....	.....	−1,500 8°
bromide (ous)..	Cu, Br...............	solid	24,980	.....	....
carbonate (ic)..	Cu, C, O_3............	precip.	142,800	.....	....
chlorate (ic)....	Cu, Cl_2, O_6, Aq.......	dil. sol.	28,600	.....	....
choride (ic).....	Cu, Cl_2..............	solid	51,400	600	+11,800
chloride (ic)....	$Cu, Cl_2, 2H_2O$........	solid	58,500	400	+4,210
chloride (ous)..	Cu, Cl...............	solid	35,400	.....	....
cyanide (ous)...	Cu, C, N.............	solid	−22,050	.....	....
fluoride (ic)....	Cu, F_2, Aq...........	dil. sol.	+89,600	.....	....
iodide (ous)....	Cu, I................	solid	16,260	.....	....
nitrate (ic).....	$Cu, N_2, O_6, 6H_2O$.....	solid	92,940	400	−10,710
oxide (ic).......	Cu, O................	solid	37,700	.....	....
oxide (ic).......	Cu_2O, O.............	solid	36,200	.....	....
oxide (ous).....	Cu_2, O..............	solid	43,800	.....	....
selenide (ic)....	Cu, Se...............	precip.	4,800	.....	....
selenide (ous)...	Cu_2, Se.............	cryst.	8,000	.....	....
sulphate (ic)....	Cu, O_2, SO_2..........	solid	111,490	400	+15,800
sulphate (ic)....	Cu, O_2, SO_2, H_2O.....	solid	117,950	400	+9,340
sulphate (ic)....	$Cu, O_2, SO_2, 5H_2O$....	solid	130,040	400	−2,750
sulphate (ic)....	Cu, S, O_4............	solid	181,700	.....	....
sulphide (ic)....	Cu, S................	solid	10,100	.....	....
sulphide (ous)..	Cu_2, S..............	solid	20,300	.....	....
telluride........	Cu_2, Te.............	solid	8,200	.....	....
Cyanic acid......	C (diam.), N, O, H, Aq................	dil. sol.	74,000	.....	....
Cyanogen........	C_2, N_2..............	gas	−65,700	.....	....
cyanogen.......	C_2 (diamond), N_2....	gas	−73,900	.....	....
cyanogen.......	C_2 (diamond), N_2....	liquid	+68,500	.....	....
chloride........	C (diamond), N, Cl..	gas	35,200	.....	....
chloride........	C (diamond), N, Cl..	liquid	−26,800	.....	....
iodide..........	C (diamond), N, I...	solid	−39,200	.....	−2,800
Dysprosium					
sulphate.......	$Dy_2(SO_4)_3.8H_2O$......	....	....	1200	+6,300
Erbium acetate...	$Er(C_2H_3O_2)_3.4H_2O$....	....	....	1500	+700

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Ferric and Ferrous salts, see under **Iron**					
Fluosilicic acid	Si, F_6, H_2, Aq	dil. sol.	374,400	.....	....
Glucinum (Beryllium)					
chloride	Gl, Cl_2	solid	155,000	.....	+44,500
sulphate	$GlSO_4.4H_2O$	....	....	400	+ 1,100
Gold					
bromide (ic)	Au, Br_3	solid	8,850	2000	− 3,760
bromide (ous)	Au, Br	solid	−80	.....	....
chloride (ic)	Au, Cl_3	solid	+22,820	900	+ 4,450
chloride (ic)	$AuCl_3.2H_2O$	....	....	600	− 1,690
chloride (ous)	Au, Cl	solid	5,810	.....	....
hydroxide (ic)	Au_2, O_3, $3H_2O$	solid	−13,190	.....	....
iodide (ous)	Au, I	solid	−5,520	.....	....
Hydrazine	N_2, H_4, Aq	dil. sol.	+1,700	.....	....
Hydrazoic acid	N_3, H, Aq	dil. sol.	58,200	.....	....
Hydrobromic acid	H, Br	gas	8,600	.....	+20,000
Hydrochloric acid	H, Cl	gas	22,000	.....	+17,400
Hydrocyanic acid	C (diamond), N, H	gas	−30,500	.....	....
" "	C (diamond), N, H	liquid	−24,800	.....	....
" "	C (diamond), N, H	dil. sol.	−24,400	.....	....
Hydroferricyanic acid	H_3, Fe, C_6N_6, Aq	dil. sol.	−127,500	.....	....
acid	H_3, Fe, C_6, N_6, Aq	dil. sol.	−147,500	.....	....
Hydroferrocyanic acid	H_4, Fe, C_6, N_6	solid	−102,000	.....	+500
acid	H_4, Fe, C_6, N_6	solid	−122,000	.....	....
Hydrofluoric acid	H, F	gas	+38,500	.....	....
" "	H, F	liquid	45,700	.....	....
" "	H, F	dil. sol.	50,300	.....	....
Hydr(o)iodic acid	H, I	gas	−6,400	.....	+19,600
Hydrogen					
oxide (water)	H_2, O	liquid	+69,000$^{0°}$	.....	....
oxide	H_2, O	solid	70,400$^{0°}$	.....	....
oxide	H_2, O	gas	58,300$^{0°}$	.....	....
peroxide	H_2, O_2, Aq	dil. sol.	45,300	.....	....
peroxide	H_2O, O, Aq	dil. sol.	−23,060	.....	....
peroxide	H_2, O_2	liquid	+46,840	.....	....
selenide	H_2, Se	gas	−19,400	.....	+ 9,300
sulphide	H_2, S	gas	+2,730	.....	+ 4,560
telluride	H_2, Te	gas	−34,900	.....	....
Hydrosulphurous acid	S_2, O_4, H_2, Aq	dil. sol.	+156,100	.....	....
Hydroxylamine	N, H_3, O, Aq	dil. sol.	24,290	.....	....
"	N, H_3, O	solid	27,600	.....	− 2,800
Iodic acid	I, O_3, H	solid	57,960	.....	− 2,160
Iodine					
bromide	I, Br	solid	2,500	.....	....
chloride, mono-	I, Cl	solid	6,800	.....	....
chloride, mono-	I, Cl	liquid	5,820	.....	....
chloride, tri-	I, Cl_3	solid	21,490	.....	....
oxide, pent-	I_2, O_5	solid	45,030	.....	− 1,790
Iron					
acetate (ic)	Fe, C_6, H_9, O_6, Aq	dil. sol.	359,350	.....	....
ammonium sulphate (ic)	$(NH_4)Fe(SO_4)_2.12H_2O$	....	....	500	−16,600
ammonium sulphate (ous)	$(NH_4)_2Fe(SO_4)_2.6H_2O$	....	....	.....	− 9,800
bromide (ic)	Fe, Br_3, Aq	dil. sol.	95,450	.....	....

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Iron					
bromide (ous)	Fe, Br_2, Aq	dil. sol.	78,070	.....	....
carbonate (ous)	Fe, C, O_3	cryst.	184,500	.....	....
carbonate	Fe, C, O_3	precip.	178,800	.....	....
carbonate	FeO, CO_2	solid	24,500	.....	....
chloride (ic)	Fe, Cl_3	solid	96,040	1000	+32,680
chloride (ic)	$FeCl_2$, Cl	solid	13,990	.....	....
chloride (ic)	$2FeCl_3.5H_2O$	....	....	2400	$+2\times21,000$
chloride (ic)	$FeCl_3.6H_2O$	....	....	1200	+ 5,650
chloride (ous)	Fe, Cl_2	solid	82,200	350	+17,850
chloride (ous)	$FeCl_2.2H_2O$	....	....	1000	+ 9,700[20°]
chloride ous	$FeCl_2.4H_2O$	....	....	400	+ 2,750
ferrocyanide (ic)	Fe_7, C_{18}, N_{18}	precip.	−317,000	.....	....
fluoride (ic)	Fe, F_3, Aq	dil. sol.	+162,900	.....	....
fluoride (ous)	Fe, F_2, Aq	dil. sol.	127,000	.....	....
hydroxide (ic)	Fe_2, O_3, $3H_2O$	solid	$2\times95,570$	.....	....
hydroxide (ic)	$2Fe(OH)_2$, O, H_2O	solid	$2\times27,290$	.....	....
hydroxide (ous)	Fe, O, H_2O	solid	68,280	.....	....
iodide (ic)	Fe, I_3, Aq	dil. sol.	23,850	.....	....
iodide (ous)	Fe, I_2, Aq	dil. sol.	47,650	.....	....
nitrate (ic)	Fe, N_3, O_9, Aq	dil. sol.	314,300	.....	....
nitrate (ous)	Fe, N_2, O_6, Aq	dil. sol.	119,000	.....	....
oxide (ic)	Fe_2, O_3	solid	197,700	.....	....
oxide (ous)	Fe, O	solid	65,700	.....	....
oxide (ous, ic)	Fe_3, O_4	solid	270,800	.....	....
pot. sul. (ic)	$KFe(SO_4)_2.12H_2O$	....	....	500	−16,000
pot. sul. (ous)	$K_2Fe(SO_4)_2.6H_2O$	....	....		−10,700
selenide (ous)	Fe, Se	cryst.	16,000	.....	....
selenide (ous)	Fe, Se	precip.	15,200	.....	....
silicate	Fe, Si, O_3	solid	254,600	.....	....
sulphate (ic)	Fe_2, S_3, O_{12}, Aq	dil. sol.	650,500	.....	....
sulphate (ic)	Fe_2, O_3, $3SO_3$, Aq	dil. sol.	224,900	.....	....
sulphate (ous)	Fe, SO_2, O_2, Aq	dil. sol.	93,200	.....	....
sulphate (ous)	Fe, SO_2, O_2, $7H_2O$	solid	169,040	400	− 4,510
sulphate (ous)	Fe, S, O_4, Aq	dil. sol.	234,900	.....	....
sulphide (ous)	Fe, S, xH_2O	solid	24,000	.....	....
telluride (ous)	Fe, Te	cryst.	12,000	.....	....
Lanthanum					
chloride	La, Cl_2	solid	175,300	.....	....
oxide	La_2, O_3	solid	447,300	.....	....
Lead					
acetate	Pb, C_4, H_6, O_4	solid	231,100	440	+ 1,400[16°]
acetate	$Pb(C_2H_3O_2)_2.3H_2O$	....	....	800	− 6,140
acetate	$Pb(C_2H_3O_2)_2.3H_2O$	....	....	240	− 5,500[11°]
bromide	Pb, Br_2	solid	64,450	25,000	−10,040
carbonate	Pb, C, O_3	solid	166,700	.....	....
chloride	Pb, Cl_2	solid	83,900	1800	− 6,800
dithionate	$PbS_2O_6.4H_2O$	....	....	400	− 8,540
fluoride	Pb, F_2	precip.	107,600	.....	....
iodide	Pb, I_2	solid	39,800	.....	....
nitrate	Pb, N_2, O_6	solid	105,460	400	− 7,610
oxalate	Pb, C_2, O_4	precip.	205,300	.....	....
oxide, mon-	Pb, O	solid	50,300	.....	....
oxide, per-	PbO, O	solid	12,600	.....	....
oxide, per-	Pb, O_2	solid	62,400	.....	....
oxybromide	$PbBr_2$, PbO	solid	3,300	.....	....
oxybromide	$PbBr_2$, 2PbO	solid	4,700	.....	....
oxybromide	$PbBr_2$, 3PbO	solid	6,300	.....	....
oxychloride	$PbCl_2$, PbO	solid	5,300	.....	....
oxychloride	$PbCl_2$, 2PbO	solid	6,600	.....	....
oxychloride	$PbCl_2$, 3PbO	solid	6,700	.....	....

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Lead					
oxyiodide	PbI_2, PbO	solid	3,600	....	....
phosphite	Pb, H, P, O_3	solid	227,700	....	....
selenide	Pb, Se	precip.	14,300	....	....
selenide	Pb, Se	cryst.	17,000	....	....
sulphate	Pb, S, O_4	solid	216,210	....	....
sulphate	Pb, SO_2, O_2	solid	145,130	....	....
sulphide	Pb, S	precip.	20,300	....	....
sulphocyanate	Pb, C_2, N_2, S_2	solid	6,100	....	....
telluride	Pb, Te	solid	6,200	....	....
thiosulphate	Pb, S_2, O_3	solid	145,600	....	....
Lithium					
bromide	Li, Br	solid	79,960	....	+11,331
carbide	Li_2, C_2	solid	11,300	....	....
carbonate	LiO, (CO_2)	solid	54,230	....	....
chloride	Li, Cl	solid	93,810	230	+ 8,440
cyanide	Li, C, N, Aq	dil. sol.	32,600	....	....
fluoride	Li, F	solid	120,000	....	− 3,120
fluosilicate	2LiF, SiF_4	solid	25,200	800	+ 1,800
hydride	Li, H	solid	21,600	....	....
hydroxide	Li, O, H	solid	112,300	400	+ 5,800
hydroxide	$LiOH.H_2O$	....	....	....	$+510^{15°}$
iodide	Li, I	solid	61,210	....	+14,886
nitrate	Li, N, O_3	solid	111,610	100	+300
nitride	Li_6, N_2	solid	93,500	....	....
oxide	Li_2, O	solid	143,300	222	$+31,200^{15°}$
oxide	$4Li_2O$, $5H_2O$	....	....	888	$+ 8,182^{15°}$
oxide	$4Li_2O$, $3H_2O$	....	....	888	$+16,026^{15°}$
selenide	Li_2, Se	solid	83,000	....	$+10,700^{20°}$
selenide	$Li_2Se.9H_2O$	....	....	1146–6426	−12,200
silicate	Li_2, Si, O_3	solid	347,100	....	....
sulphate	Li_2, S, O_4	solid	334,170	200	+ 6,050
sulphate	Li_2, S, O_4, H_2O	solid	336,810	400	+ 3,410
sulphide	Li_2, S, Aq	dil. sol.	115,400	....	....
sulphydrate	Li, S, H, Aq	dil. sol.	64,110	....	....
Magnesium					
ammonium					
phosphate	Mg, N, H_4, P, O_4	cryst.	898,800	....	....
sulphate	$MgSO_4$ $(NH_4)_2SO_4$. $6H_2O$	....	....	....	− 9,700
sulphite	$3(MgSO_3.6H_2O)$, $(NH_4)_2SO_3$	solid	−2,100	....	....
arsenate	Mg_3, As_2, O_4	cryst.	+712,600	....	....
bromide	Mg, Br_2	solid	121,700	....	+43,300
carbonate	Mg, C, O_3	precip.	266,600	....	....
chloride	Mg, Cl_2	solid	151,010	800	+35,920
chloride	Mg, Cl_2, $6H_2O$	solid	183,980	400	+ 2,950
cyanide	Mg, C_2, N_2, Aq	dil. sol.	34,000	....	....
dithionate	Mg, S_2, O_6, $6H_2O$	solid	390,570	400	+ 2,960
fluoride	Mg, F_2	precip.	208,100	....	+ 2,778
hydroxide	Mg, O_2, H_2	solid	217,800	....	....
iodide	Mg, I_2	solid	84,800	....	49,800
nitrate	Mg, N_2, O_6, $6H_2O$	solid	210,520	400	− 4,220
oxide	Mg, O	solid	143,900	....	....
phosphate	Mg_3, P_2, O_8	colloid	910,600	....	....
pot. chloride	$MgCl_2$, KCl	solid	3,100	....	....
pot. chloride	$MgCl_2$, $6H_2O$, KCl	solid	2,700	....	....
pot. sulphate	$MgSO_4$, K_2SO_4	solid	3,300	600	+10,600
pot. sulphate	$MgSO_4$, K_2SO_4, $6H_2O$	solid	23,920	600	−10,020
sodium sulphate	$MgSO_4$, Na_2SO_4	solid	3,700	....	....

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Magnesium					
sulphate	Mg, S, O_4	solid	301,500	400	+20,280
sulphate	$MgSO_4.H_2O$	....	....	400	+13,300
sulphate	$MgSO_4.7H_2O$	....	....	400	− 3,800
sulphide	Mg, S	solid	79,400	.....	....
sulphite	Mg, S, O_3	solid	282,000	.....	....
sulphydrate	Mg, S_2, H_2, Aq	dil. sol.	110,860	.....	....
Manganese					
bromide	Mn, Br_2, Aq	dil. sol.	107,000	.....	....
carbide	Mn_3, C	solid	9,900	.....	....
carbonate	Mn, C, O_3	amorp.	207,000	.....	....
carbonate	Mn, C, O	crystal	208,600	.....	....
carbonate	MnO, CO_2	solid	27,600	.....	....
chloride	Mn, Cl_2	solid	111,990	350	+16,010
chloride	Mn, Cl_2, $4H_2O$	solid	126,460	400	+ 1,540
dithionate	Mn, $2SO_2$, O_2, $6H_2O$	solid	188,600	400	+ 1,930
fluoride	Mn, F_2, Aq	dil. sol.	156,800	.....	....
fluoride	Mn, F_2	solid	209,500	.....	....
hydroxide	Mn, O, H_2O	solid	94,770	.....	....
iodide	Mn, I_2, Aq	dil. sol.	76,200	.....	....
nitrate	Mn, N_2, O_6, 6H O	solid	153,050	400	− 6,150
oxide (ous)	Mn, O	solid	90,800	.....	....
oxide (di-)	Mn, O_2	solid	126,000	.....	....
oxide (ous, ic)	Mn_3, O_4	solid	324,900	.....	....
phosphate	Mn_3, P , O_8	colloid	737,500	.....	....
pot. sulphate	$MnSO_4$, K_2SO	solid	990	600	+ 6,380
pot. sulphate	$MnSO_4$, K_2SO_4, $4H_2O$	solid	13,840	600	− 6,440
selenide	Mn, Se	precip.	22,400	.....	....
selenide	Mn, Se	cryst.	21,600	.....	....
silicate	MnO, SiO_2	solid	5,400	.....	....
sodium sulphate	$MnSO_4$, Na_2SO_4	solid	1,200	.....	− 9,700
sulphate	Mn, SO_2, O_2	solid	249,400	400	+13,790
sulphate	Mn, SO_2, O_2, H_2O	solid	184,760	400	+ 7,820
sulphate	Mn, SO_2, O_2, $5H_2O$	solid	192,540	400	+40
sulphide	Mn, S, xH_2O	solid	45,600	.....	....
Mercury					
acetate (ic)	Hg, C_4, H_6, O_4	solid	196,900	222	− 3,800
acetate (ous)	Hg, C_2, H , O_2	solid	101,050	.....	....
bromide (ic)	Hg, Br_2	solid	40,600	.....	− 3,400 12°
bromide (ous)	Hg, Br	solid	24,500	.....	....
chloride (ic)	Hg, Cl_2	solid	53,300	300	− 3,300
chloride (ous)	Hg, Cl	solid	31,300	.....	....
cyanide (ic)	Hg, $(CN)_2$	solid	11,400	1010	− 3,000 15°
fulminate	Hg, N_2, C_2, O_2	solid	−62,900	.....	....
iodide (ic)	Hg, I_2	solid	+25,200	.....	....
iodide (ous)	Hg, I	solid	14,300	.....	....
nitrate (ic)	Hg, N_2, O_6, Aq	dil. sol.	57,400	.....	....
nitrate (ic)	Hg, N_2, O_6, $\frac{1}{2}$ H_2O	solid	57,400	.....	....
nitrate (ous)	Hg, N, O_3, H_2O	solid	34,700	.....	....
nitrate (ous)	Hg, N, O_3, Aq	dil. sol.	28,900	.....	....
nitride, tri-(ous)	Hg, N_3	solid	−144,600	.....	....
oxide (ic)	Hg, O	solid	+21,500	.....	....
oxide (ous)	Hg_2, O	solid	2,200	.....	....
oxybromide (ic)	$HgBr_2$, HgO	solid	3,300	.....	....
oxychloride (ic)	$HgCl_2$, HgO	solid	3,300	.....	....
oxychloride	$HgCl_2$, 2HgO	solid	6,300	.....	....
oxychloride	$HgCl_2$, 3HgO	solid	8,000	.....	....
oxychloride	$HgCl_2$, 4HgO	solid	10,000	.....	....
potassium bromide (ic)	$HgBr_2$, KBr	solid	−1,000	.....	....
potassium bromide (ic)	$HgBr_2$, 2KBr	....	....	600	−9,750

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Mercury					
potassium chloride (ic)	$HgCl_2$, KCl	solid	2,400	770	− 9,500 14°
pot. chlo. (ic)	$HgCl_2$, 2KCl	solid	3,800	930	−15,000 14°
pot. chlo. (ic)	Hg, Cl_2, 2KCl, H_2O	solid	60,620	600	−16,390
pot. iodide (ic)	HgI_2, 2KI	solid	28,680	800	− 9,810
selenide (ic)	Hg, Se	precip.	6,300	.....	....
sulphate (ic)	Hg, S, O_4	solid	165,100	.....	....
sulphate (ous)	Hg_2, S, O_4	solid	175,000	.....	....
sulphide	Hg, S	precip.	10,600	.....	....
sulphocyanate	Hg, C_2, N_2, S_2	solid	−50,200	.....	....
Molybdenum					
oxide, di-	Mo, O_2	solid	+142,800	.....	....
oxide, tri-	Mo, O_3	solid	167,000	.....	....
Neodymium					
chloride	Nd, Cl_3	solid	249,500	.....	+35,400 17°
chloride	Nd, Cl_3, $6H_2O$	solid	268,900	.....	+ 7,600 15°
iodide	Nd, I_3	solid	157,700	.....	+48,900 19°
oxide	Nd_2, O_3	solid	435,100	.....	....
sulphate	Nd_2, S_3, $6O_2$	solid	928,200	.....	+36,500 14°
sulphide	Nd_2, S_3	solid	285,900	.....	....
Nickel					
bromide	Ni, Br_2, Aq	dil. sol.	71,820	.....	....
chloride	Ni, Cl_2	solid	74,530	400	+19,170
chloride	$NiCl_2$, $6H_2O$	solid	20,330	400	− 1,160
cyanide	Ni, C_2, N_2	precip.	−23,400	.....	....
dithionate	Ni, O_2, $2SO_2.6H_2O$	solid	+154,790	400	− 2,420
fluoride	Ni, F_2, Aq	dil. sol.	120,800	.....	....
hydroxide (ic)	Ni_2, O_3, $3H_2O$	solid	120,380	.....	....
hydroxide (ic)	$2Ni(OH)_2$, O, H_2O	solid	−1,300	.....	....
hydroxide (ous)	Ni, O, H_2O	solid	+60,840	.....	....
iodide	Ni, I_2, Aq	dil. sol.	41,400	.....	....
nitrate	Ni, O, N_2O_5, Aq	dil. sol.	83,420	.....	....
nitrate	Ni, N_2, O_6, $6H_2O$	solid	120,710	400	− 7,470
oxide	Ni, O	solid	57,900	.....	....
selenide	Ni, Se	precip.	14,700	.....	....
selenide	Ni, Se	cryst.	9,900	.....	....
sulphate	Ni, O, SO_3, Aq	dil. sol.	86,950	.....	....
sulphate	Ni, O_2, SO_2, $7H_2O$	solid	162,530	800	− 4,250
sulphide	Ni, S, xH_2O	solid	17,390	.....	....
telluride	Ni, Te	cryst.	11,600	.....	....
Nitric acid	N, O_3, H	liquid	41,600	300	+ 7,480
acid	N, O_3, H	gas	34,400	.....	....
Nitrogen					
carbide	N_2C_2	gas	....	.....	−73,000
oxide (ic)	N, O	gas	−21,600	.....	....
oxide (ous)	N_2, O	gas	−20,600	.....	....
oxide (ous)	N_2, O	liquid	−18,000	.....	....
oxide, pent-	N_2, O_5	gas	−1,200	.....	....
oxide, pent-	N_2, O_5	liquid	+3,600	.....	....
oxide, pent-	N_2, O_5	solid	11,900	.....	....
oxide, tetr-	N_2, O_4	gas	−2,650	.....	....
oxide, tri-	N_2, O_3	gas	−21,400	.....	....
selenide	N, Se	solid	−42,300	.....	....
sulphide	N, S	solid	−31,900	.....	....
Oxalic acid	H_2, C_2, O_4	solid	+197,600	.....	....
oxalic acid	$H_2C_2O_4.2H_2O$	....	....	530	− 8,590
Palladium					
am. chloride	$PdCl_2$, $2NH_3$	solid	40,000	.....	....
am. chloride	$PdCl_2$, $2NH_3$, $2NH_3$	solid	31,000	.....	....
am. iodide	PdI_2, $2NH_3$	solid	34,000	.....	....

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Palladium					
am. iodide	PdI_2, $2NH_3$, $2NH_3$	solid	25,800	....	....
bromide	Pd, Br_2	solid	24,900	....	....
cyanide	Pd, C_2, N_2	solid	−52,600	....	....
hydroxide	Pd, O, H_2O	solid	+21,000	....	....
hydroxide	Pd, O_2, $2H_2O$	solid	30,430	....	....
iodide	Pd, I_2	precip.	13,400	....	....
iodide	Pd, I_2, H_2O	solid	18,180	....	....
pot. bromide	$PdBr_2$, 2KBr, Aq	dil. sol.	2,800	....	....
pot. chloride	Pd, Cl_2, 2KCl	solid	52,670	....	....
Perchloric acid	Cl, O_4, H	liquid	18,800	....	+20,300
Periodic acid	I, O_4, H, Aq	dil. sol.	47,680	....	....
Permanganic acid	Mn_2, O_7, H_2O, Aq	dil. sol.	2×93,550	....	....
Phosphonium					
bromide	P,* H_4, Br	solid	40,300	....	....
iodide	P,* H_4, I	solid	28,100	....	....
Phosphoric acid					
meta-	P, O_3, H	solid	226,600	....	+10,100
ortho-	P, O_4, H_3	liquid	300,080	200	+ 5,350
ortho-	P, O_4, H_3	solid	302,600	120	+ 2,690
pyro-	P_2, O_7, H_4	liquid	533,400	....	....
pyro-	P_2, O_7, H_4	solid	535,700	....	+ 7,900
Phosphorous acid					
hypo-	P, O_2, H_3	liquid	137,660	....	....
hypo-	P, O_2, H_3	solid	139,970	....	−170
ortho-	P, O_3, H_3	liquid	224,630	120	+ 2,940
ortho-	P, O_3, H_3	solid	227,700	120	−130
pyro-	P_2, O_5, H_4, Aq	solid	369,900	550	+35,600
Phosphorus					
bromide, tri-	P, Br_3	solid	44,800	....	....
bromide, penta-	P, Br_5	solid	59,050	....	....
chloride, tri-	P, Cl_3	liquid	76,600	1000	+65,140
chloride, tri-	P, Cl_3	gas	69,700	....	....
chloride, penta-	P, Cl_5	solid	109,200	....	....
hydride (phosphine)	P,* H_3	gas	4,900	....	....
hydride (solid)	P_{12},* H_6	solid	53,400	....	....
iodide, tri-	P, I_3	solid	10,900	....	....
iodide, tetr-	P_2, I_4	solid	19,800	....	....
nitride	P_3,* N_5	solid	81,500	....	....
oxide, pent-	P_2, O_5	solid	365,200	550	+35,600
oxybromide	P, O, Br_3	solid	105,800	....	....
oxychloride	P, O, Cl_3	solid	143,900	....	....
sulphide, sesqui-	P_4, S_3	solid	77,530	....	....
Platinic acid					
brom-	$H_2PtBr_6.9H_2O$	....	....	....	− 2,900
chlor-	$H_2PtCl_6.6H_2O$	....	....	450	+ 4,340
Platinum					
bromide	Pt, Br_4	solid	42,400	....	+ 9,860
chloride	Pt, Cl_4	solid	60,400	....	+19,600
hydride	Pt_{10}, H	solid	14,200	....	....
hydroxide	Pt, O, H_2O	solid	19,220	....	....
iodide	Pt, I_4	solid	17,400	....	....
oxide	Pt, O	solid	17,000	....	....
Potassium					
acetate	K, C_2, H_3, O_2	solid	175,700	200	+ 3,340
arsenate	K_3, As, O_4, Aq	dil. sol.	396,200	....	....
arsenate	K_2, H, As, O_4, Aq	dil. sol.	339,800	....	....
arsenate, acid	K, H_2, As, O_4, Aq	dil. sol.	284,000	....	....
bromate	K, Br, O_3	solid	84,300	200	− 9,760
bromide	K, Br	solid	95,310	200	− 5,080

* P refers to white phosphorus where starred.

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Potassium					
bromoplatinate	Pt, Br_4, 2KBr	solid	59,260	2000	−12,260
bromoplatinite	Pt, Br_2, 2KBr	solid	32,310	800	−10,610
carbonate	K_2, C, O_3	solid	281,100	400	+ 6,490
carbonate	K_2O, CO_2	solid	94,260	.....	....
carbonate	$K_2CO_3.\frac{1}{2}H_2O$	....	....	400	+ 4,280
carbonate	$K_2CO_3.1\frac{1}{2}H_2O$	....	....	400	−380
carbonate, acid (bicarbonate)	K, H, C, O_3	solid	233,300	.....	− 5,300
chlorate	K, Cl, O	solid	95,860	400	−10,040
chloride	K, Cl	solid	105,610	200	− 4,440
chloropalladate	K_2PdCl_6	....	....	.....	−15,000
chloroplatinate	Pt, Cl_4, 2KCl	solid	89,500	.....	−13,760
chloroplatinite	Pt, Cl_2, 2KCl	solid	45,170	600	−12,220
chlorostannate	$SnCl_4$, 2KCl	solid	24,160	800	− 3,380
chromate	K_2CrO_4	....	....	543	− 5,250
cyanide	K, C, N	solid	30,100	180	− 2,900[20]
cyanide	K, CN	solid	67,100	175	− 3,010
cyanate	K, C, N, O	solid	102,500	660	− 5,200[20°]
dichromate	K_2, C_2O_3, O_4	solid	226,440	400	−16,700
dithionate see *thionate, di-*					
ferricyanide	K_3, Fe, C_6, N_6	solid	41,600	400	−14,400[12°]
ferricyanide	K_3, Fe, 6CN	solid	263,300	.....	....
ferrocyanide	K_4, Fe, C_6, N_6	solid	137,200	820	−12,000[12°]
ferrocyanide	K_4, Fe, 6CN	solid	358,900	.....	....
ferrocyanide	$K_4Fe(CN)_6.3H_2O$	....	....	940	−16,900[11°]
fluoride	K, F	solid	118,100	.....	+ 3,600[20°]
fluoride	$KF.2H_2O$	....	....	.....	− 1,000[20°]
fluoride, acid	KF, HF	solid	21,100	400	− 6,000
fluosilicate	2KF, SiF_4	solid	52,800	.....	....
hydroxide	K_2, O, H_2O	solid	137,980	.....	....
hydroxide	K, O, H	solid	104,600	250	+13,290
hypochlorite	K, Cl, O, Aq	dil. sol.	88,010	.....	....
iodate	K, I, O_3	solid	124,490	500	− 6,780
iodate, acid	KIO_3, HIO_3	solid	3,300	865	−11,800
iodide	K, I	solid	80,130	200	− 5,110
iodide, tri-	KI, I_2	solid	13,600	.....	....
nitrate	K, N, O_3	solid	119,000	200	− 8,520
nitrite	K, N, O_2, Aq	dil. sol.	88,900	.....	....
oxalate	K_2, C_2, O_4	solid	324,700	465–930	− 4,740[15°]
oxalate	$K_2C_2O_4.H_2O$	....	....	800	− 7,410
oxalate, acid	K, H, C_2, O_4	solid	266,900	.....	− 9,600
oxalate, tetra-	$KHC_2O_4.H_2C_2O_4$	....	....	.....	−15,700
oxide	K_2, O	solid	86,800	.....	+75,000
perchlorate	K, Cl, O_4	solid	113,500	200–400	12,100[10°]
periodate	K, I, O_4, Aq	dil. sol.	107,700	.....	....
permanganate	K, Mn, O_4	solid	200,050	700	−10,200[16°]
phos., ortho-	K_3, P, O_4, Aq	dil. sol.	483,600	.....	....
phos. hydrogen	K_2, H, P, O_4, Aq	dil. sol.	429,200	.....	....
phos. dihydro-	K, H_2, P, O_4, Aq	dil. sol.	374,400	.....	....
phos. dihydro-	KH_2PO	....	....	.....	− 4,850
selenide	K_2, Se	solid	79,600	1762–1965	+ 8,500[13°]
selenide	$K_2Se.9H_2O$	....	....	921–4844	−19,200[14°]
selenide	$K_2Se.14H_2O$	....	....	2145–5914	−20,400[13°]
selenide	$K_2Se.19H_2O$	....	....	.....	−29,300[14°]
sulphate	K_2, S, O_4	solid	344,300	400	− 6,380
sulphate	K_2, SO_2, O_2	solid	273,560	.....	....

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Potassium					
sulphate, acid..	K, H, S, O_4	solid	276,100	200	− 3,800
sulphate, per-...	K_2, S_2, O_8	solid	454,500	3300	−14,550
sulphate, pyro-.	K_2, S_2, O_7	solid	474,200	....	....
sulphide mono-.	K_2, S	solid	103,500	732	$+10,000^{18°}$
sulphide mono-.	$K_2S.2H_2O$	....	....	....	$+\ 3,800^{18°}$
sulphide mono-.	$K_2S.5H_2O$	....	....	....	$-\ 5,200^{16°}$
sulphide tetra-.	K_2, S_4	solid	118,600	600	$+\ 1,400^{10°}$
sulphide tetra-.	$K_2S_4.\frac{1}{2}H_2O$	....	....	....	$-\ 1,212^{16°}$
sulphite	K_2, S, O_3	solid	273,200	350	$+\ 1,440^{12°}$
sulphite	$K_2SO_3.H_2O$	....	....	245	$+\ 1,100^{12°}$
sulphide, acid..	K, H, S, O_3, Aq	dil. sol.	211,300	....	....
sulphocyanate..	K, C, N, S	solid	49,800	200	$-\ 6,100^{13°}$
sulphocyanate..	K, C N, S	solid	86,700	....	....
sulphydrate....	K, S, H	solid	64,500	154–1568	$+770^{17°}$
sulphydrate....	$KSH.\frac{1}{2}H_2O$	....	....	....	$+600^{16°}$
thionate, di-....	K_2, S_2, O_6	solid	415,720	500	−13,010
thionate, tri-...	K_2, S_3, O_6	solid	405,850	500	−12,460
thionate, tetra-	K_2, S_4, O_6	solid	397,210	500	−13,150
thionate, penta-	K_2, S_5, O_6	solid	390,100	....	....
thionate, penta-	$K_2S_5O_6.1\frac{1}{2}H_2O$	....	....	2030	$-13,100^{10°}$
thiosulphate....	K_2, S_2, O_3	solid	272,300	950	$-\ 5,000^{10°}$
thiosulphate....	$K_2S_2O_3.H_2O$	....	....	....	$-\ 6,200^{14°}$
Praseodymium					
oxide, tri-......	Pr_2, O_3	solid	412,400	....	....
Rubidium					
bromide	Rb, Br	solid	95,700	....	− 2,450
carbonate	Rb_2O, CO_2	solid	97,420	....	+ 9,077
carbonate, acid.	Rb, H, C, O	solid	231,920	....	+ 4,731
chloride	Rb, Cl	solid	105,000	....	$-\ 4,460^{15°}$
fluoride	Rb, F	solid	107,950	....	+ 5,800
hydroxide	Rb, O, H	solid	101,990	....	$+14,264^{15°}$
hydroxide	$RbOH.H_2O$	....	....	....	$+3,700^{25°}$
hydroxide	$RbOH.2H_2O$	....	....	....	$-650^{15°}$
iodide	Rb, I	solid	80,650	....	+300
oxide	Rb_2, O	solid	83,500	....	+80,000
sulphate	Rb_2, S, O_4	solid	344,680	....	− 6 600
sulphate, acid..	Rb, H, S, O_4	solid	277,370	....	− 3,730
Selenium					
chloride	Se_2,* Cl_2	liquid	22,150	....	....
chloride, tetra-.	Se,* Cl_4	solid	46,160	....	....
hydride	Se,* H_2	gas	−19,400	....	+ 9,300
hydride	Se (cryst.), H_2	gas	−25,100	....	+ 9,300
hydroxide (ic)..	Se, O_3, H_3	dil. sol.	+79,300	....	....
hydroxide (ous)	Se, O_2, H_2	solid	52,400	....	....
nitride	Se, N	solid	−42,300	....	....
oxide, di-......	Se,* O_2	solid	+57,080	....	−740
Selenic acid	Se, O_4, H_2	liquid	128,220	....	+16,800
Selenious acid	Se, O_3, H_2, Aq	dil. sol.	124,500	....	....
Silicon					
carbide	Si, C	solid	2,000	....	....
bromide, tetra-.	Si, Br_4	liquid	71,000	....	....
chloride, tetra-.	Si, Cl_4	gas	121,800	....	....
chloride, tetra-.	Si, Cl_4	liquid	128,100	....	....
fluoride, tetra-.	Si, F_4	gas	239,800	....	....
hydride	Si, H_4	gas	−6,700	....	....
iodide, tetra-...	Si, I_4	solid	+6,700	....	....
oxide, di-......	Si, O_2	solid	191,000	....	....
sulphide	Si, S_2	solid	10,400	....	....
Silver acetate....	Ag, C_2, H_3, O_2	solid	95,600	120	$-\ 4,300^{10°}$

* Amorphous selenuim.

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Silver					
bromide	Ag, Br	solid	23,400	....	....
carbide	Ag, C	solid	43,575	....	....
carbonate	Ag_2, O, CO_2	solid	120,500	....	....
chloride	Ag, Cl	solid	29,000	....	−15,900
chloride	2Ag, Cl	solid	29,500	....	....
cyanate	Ag, C, N, O	solid	+23,100	....	....
cyanide	Ag, C, N	solid	−31,410	....	....
fluoride	Ag, F	solid	23,200	....	+ 3,400$^{10°}$
fluoride	$AgF.2H_2O$	....	....	....	− 1,500$^{10°}$
iodide	Ag, I	solid	14,200	....	....
nitrate	Ag, N, O_3	solid	28,700	200	− 5,440
nitrite	Ag, N, O_2	solid	11,300	....	− 8,800
oxide	Ag_2, O	solid	7,000	....	....
pot. bromide	AgBr, KBr	solid	−400	....	....
pot. cyanide	AgCN, KCN	solid	+11,900	440	− 8,350$^{11°}$
pot. iodide	AgI, KI	solid	−1,800	....	....
pot. iodide	AgI, 3KI	solid	−900	....	....
selenide	Ag_2, Se	precip.	+2,000	....	....
sulphate	Ag_2, SO_2, O_2	solid	96,200	1400	− 4,480
sulphate	Ag_2, S, O_4	solid	167,100	....	....
sulphide	Ag_2, S	solid	3,000	....	....
sulphocyanate	Ag, C, N, S	solid	−21,900	....	....
thionate, di-	$Ag_2S_2O_6.2H_2O$	....	....	400	−10,360
Sodium					
acetate	Na, C_2, H_3, O_2	solid	+170,300	200	+ 3,870
acetate	$NaC_2H_3O_2$	....	....	400	− 4,810
aluminate	Na_2O, Al_2O_3	solid	30,000	....	....
amide	Na, N, H_2	solid	33,500	....	....
ammon. phos.	$Na(NH_4)HPO_4.4H_2O$	....	....	800	−10,750
arsenate	Na_3, As, O_4	solid	360,800	....	....
arsenate	$Na_3AsO_4.12H_2O$	....	....	670	−12,600$^{20°}$
arsenate, acid	Na_2, H, As, O_4, Aq	dil. sol.	329,700	....	....
arsenate, acid	Na, H_2, As, O_4, Aq	dil. sol.	273,700	....	....
borate, tetra-	Na_2, B_4, O_7	solid	748,100	....	+10,200
borate, tetra- (borax)	$Na_2B_4O_7.10H_2O$	....	....	1600	−25,860
bromide	Na, Br	solid	86,100	330 200	−300$^{10°}$ −190
bromide	Na, Br, $2H_2O$	solid	90,290	450 300	− 4,450$^{11°}$ − 4,710
bromoplatinate	2NaBr, Br_4, Pt	solid	46,790	600	9,990
bromoplatinate	2NaBr, Br_4, Pt, $6H_2O$	solid	65,330	800	− 8,550
carbide	Na, C	solid	−4,400	....	....
carbonate	Na_2, C, O_3	solid	+ 272,640	400	+ 5,640
carbonate	Na_2O, CO_2	solid	76,880	....	....
carbonate, acid (bicarb.)	Na, H, C, O_3	solid	227,700	....	− 4,300
chlorate	Na, Cl, O_3	solid	84,800	180-360	− 5,600$^{10°}$
chloride	Na, Cl	solid	97,900	325 100	− 1,010 1,180
chloroplatinate	2NaCl, Pt, Cl_4	solid	73,720	800	− 8,540
chloroplatinate	2NaCl, Pt, Cl_4, $6H_2O$	solid	92,890	900	−10,630
chromate	Na_2O, CrO_3	solid	77,000	360–720	+ 2,200$^{11°}$
chromate	$Na_2CrO_4.10H_2O$	....	....	760	−15,800$^{11°}$
cyanate	Na, C, N, O	solid	101,700	....	− 4,800$^{13°}$
cyanide	Na, C, N	solid	23,100	100	−500$^{9°}$
cyanide	$NaCN.\frac{1}{2}H_2O$	....	....	100	− 1,000$^{6°}$
cyanide	$NaCN.2H_2O$	....	....	....	− 4,400$^{9°}$
dithionate see under *thionate*.					

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Sodium					
fluoride	Na, F	solid	109,300	400	−600 12°
fluosilicate	2NaF, SiF_4	solid	35,400	.....	....
formate	$NaCHO_2$	....	....	150	−520 12°
hydroxide	Na, O, H	solid	102,700	200	+ 9,940
hydroxide	Na_2, O, H_2O	solid	135,380	.....	....
hypochlorite	Na, Cl, O, Aq	dil. sol.	84,700	.....	....
hypophosphite	Na_2, H, P, O_2, Aq	dil. sol.	198,400	.....	....
iodide	Na, I	solid	69,080	200	+ 1,200
iodide	Na, I, $2H_2O$	solid	74,310	300	− 4,010
manganate	Mn, O_3, Na_2O	solid	169,000	.....	....
manganate	MnO_2, O, Na_2O	solid	49,400	.....	....
molybdate	MoO_2, Na_2O_2	solid	101,200	.....	....
molybdate	MoO_3, Na_2O	solid	181,500	.....	....
nitrate	Na, N, O_3	solid	110,700	200	− 5,030
oxalate	Na_2, C_2, O_4	solid	315,000	.....	....
oxalate, acid	Na, H, C_2, O_4	solid	258,200	.....	....
oxide	Na_2, O	solid	100,700	.....	+56,500
oxide, per-	Na_2, O_2	solid	119,800	.....	....
perchlorate	Na, Cl, O_4	solid	100,300	200–400	− 3,500 10°
phos. (trisod.)	Na_3, P, O_4	solid	452,400	.....	....
phos. (trisod.)	$Na_3PO_4.12H_2O$	....	....	670	−14,500 20°
phos. (disod.)	Na_2, H, P, O_4	solid	414,900	400	+ 5,640
phos. (disod.)	$Na_2HPO_4.2H_2O$	....	....	400	−390
phos. (disod.)	$Na_2HPO_4.7H_2O$	....	....	.....	−11,000
phos. (disod.)	$Na_2HPO_4.12H_2O$	....	....	400	−22,830
phos. (monosodium)	Na, H_2, P, O_4, Aq	dil. sol.	355,000	.....	....
phos. pyro-	Na_4, P_2O_7	....	....	800	+11,850
phos. pyro-	$Na_4P_2O_7.10H_2O$	....	....	800	−11,670
phosphite	Na_2, H, P, O	solid	285,100	550	+ 9,150
phosphite, acid	Na, H_2, P, O_3	solid	333,800	550	+750 15°
phosphite, acid	$NaH_2PO_3.2\frac{1}{2}H_2O$	....	....	550	− 5,300 15°
selenate	Na_2, Se, O_4, Aq	dil. sol.	262,300	.....	....
selenate, acid	Na, H, Se, O_4, Aq	dil. sol.	203,200	.....	....
selenide	Na_2, Se	solid	60,900	789–2587	+18,600 14°
selenide, acid	Na, H, Se, Aq	dil. sol.	35,300	.....	....
selenide	$Na_2Se.4\frac{1}{2}H_2O$	....	....	1030–2125	− 7,900 13°
selenide	$Na_2Se.9H_2O$	....	....	723–1352	−10,600 12°
selenide	$Na_2Se.16H_2O$	....	....	1476–3572	−22,000 14°
stannate	Na_2O, Sn, O_2	solid	172,600	.....	....
sulphate	Na_2, S, O_4	solid	328,100	400	fused +460 efflor. +170
sulphate	$Na_2SO_4.H_2O$	....	....	400	− 1,900
sulphate	Na_2, SO_2, O_2, $10H_2O$	solid	276,730	400	−18,760
sulphate, acid	Na, H, S, O_4	solid	269,100	200 330–600	+ 1,190 −800
sulphide	Na_2, S	solid	89,300	584–1027	+15,000 14°
sulphide	$Na_2S.4\frac{1}{2}H_2O$	....	....	589–1059	− 5,000 17°
sulphide	$Na_2S.5H\ O$	....	....	513–1167	− 6,600 17°
sulphide	$Na_2S.9H_2O$	....	....	774–1495	−16,720 18°
sulphide, bi-	Na_2, S_2, Aq	dil. sol.	105,200	.....	....
sulphide, tri-	Na_2, S_3, Aq	dil. sol.	107,000	.....	....

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Sodium					
sulphide, tetra-.	Na_2, S_4	solid	99,000	600	$+ 9,800^{17°}$
sulphocyanate..	Na, C, N, S, Aq	dil. sol.	39,200	.....	....
sulphydrate....	Na, S, H.	solid	56,300	.....	$+ 4,400^{16°}$
sulphydrate....	$NaSH.2H_2O$	....	....	.....	$- 1,500^{18°}$
thionate, di-....	Na_2, S_2, O_6	solid	398,810	400	$- 5,370$
thionate, di-....	Na_2, S_2, O_6, $2H_2O$	solid	405,090	400	$-11,650$
thionate, tri-..	Na_2, S_3, O_6, Aq	dil. sol.	387,500	.....	....
thionate, tri-..	Na_2, S_3, O_6, $3H_2O$	....	....	675	$-10,100^{10°}$
thionate, tetra-.	Na_2, S_4, O_6, Aq	dil. sol.	375,800	.....	....
thionate, tetra-.	Na_2, $S_4O_6.2H_2O$	....	....	620	$- 9,700^{10°}$
thiosulphate....	Na_2, S_2, O_3	solid	256,300	440	$+ 1,700^{15°}$
thiosulphate....	Na_2, S_2, O_3, $5H_2O$	solid	265,070	400	$-11,370$
tungstate.......	N_2O, WO_3	solid	94,700	.....	....
Stannic acid......	Sn, O_2, H_2O	solid	133,500	.....	....
Stannic and Stannous salts, see under **Tin**					
Strontium acetate	Sr, C_4, H_6, O_4	solid	345,600	300	$+ 5,600^{12°}$
acetate..........	$Sr(C_2H_3O_2).\frac{1}{2}H_2O$	....	....	440	$+ 5,300^{12°}$
arsenate........	Sr_3, As_2, O_8	precip.	761,000	.....	....
bromide........	Sr, Br_2	solid	158,100	400	$+16,110$
bromide........	Sr, Br_2, $6H_2O$	solid	181,010	400	$- 7,220$
carbonate......	Sr, C, O_3	amorp.	278,100	.....	....
carbonate......	Sr, C, O_3	cryst.	279,200	.....	....
carbonate......	SrO, CO_2	solid	57,300	.....	....
chloride........	Sr, Cl_2	solid	184,700	400	$+11,140$
chloride........	Sr, Cl_2, $6H_2O$	solid	203,190	400	$- 7,500$
cyanide........	Sr, C_2, N_2, Aq	dil. sol.	47,000	.....	....
cyanide........	$Sr(CN)_2.4H_2O$	....	....	100	$- 4,150^{8°}$
dithionate......	Sr, $2SO_2$, O_2, $4H_2O$	solid	263,610	400	$- 9,250$
fluoride........	Sr, F_2	solid	234,400	.....	$- 2,100$
hydrate........	Sr, H_2	solid	45,600	.....	....
hydroxide......	Sr, O_2, H_2	solid	217,300	.....	$+11,640$
hydroxide......	Sr, O, H_2O	solid	146,140	.....	....
hydroxide......	$Sr(OH)_2.8H_2O$	....	....	.....	$-14,640$
bydroxide......	$Sr(OH)_2.9H_2O$	....	....	.....	$-14,600$
iodide..........	Sr, I_2	solid	122,900	.....	$+20,500^{12°}$
iodide..........	$SrI_2.7H_2O$	....	....	.....	$- 4,470$
nitrate..........	Sr, N_2, O_6	solid	219,900	400	$- 4,620$
nitrate..........	$Sr(NO_3)_2.4H_2O$	....	....	400	$-12,300$
oxide...........	Sr, O	solid	131,200	.....	$+29,340$
oxide, per-......	Sr, O_2	solid	151,710	.....	....
phosphate......	Sr_3, P_2, O_8	precip.	94,700	.....	....
selenide........	Sr, Se	solid	67,600	.....	$+ 7,400$
sulphate........	Sr, S, O_4	solid	330,090	.....	....
sulphydrate....	Sr, S_2, H_2, Aq	dil. sol.	119,750	.....	....
Sulphur					
bromide........	S_2, Br_2	liquid	2,000	.....	....
chloride........	S_2, Cl_2	liquid	14,260	.....	....
iodide..........	S_2, I_2	solid	13,600	.....	....
oxide, di-.......	S, O_2	gas	69,260	.....	....
oxide, di-.......	S, O_2	liquid	74,700	300	$+ 1,500$
oxide, tri-......	S, O_3	gas	91,900	.....	....
oxide, tri-......	S, O_3	liquid	103,240	1600	$+39,170$
oxide, di.......	S, O_3	solid	103,700	.....	....
oxide, hept-.....	$2S_2O_3$, O	solid	$-9,710$	.....	$+37,290$
oxychloride (ic)	S_2, O_2, Cl_2	liquid	$+89,780$	.....	....
oxychloride (ic)	SO_2, Cl_2	liquid	18,700	.....	....
oxychl. (ous)..	S, O, Cl_2	gas	40,900	.....	....
oxychl. (ous)..	S, O, Cl_2	liquid	47,400	.....	....

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Sulphur					
pentoxy dichloride	S_2, O_5, Cl_2	liquid	159,400	.....	....
Sulphuric acid	S, O_4, H_2	liquid	192,200	1600	+17,850
" "	SO_3, H_2O	liquid	21,300	.....	....
sulp. acid, per-	S_2, O_8, H_2, Aq	dil. sol.	316,400	.....	....
sulp. acid, thio-	S_2, O_3, H_2, Aq	dil. sol.	141,700	.....	....
Tantalum					
oxide	Ta_2, O_5	solid	301,500	.....	....
Telluric acid	Te, O_4, H_2, Aq	dil. sol.	166,740	.....	....
Tellurium					
chloride	Te, Cl_4	solid	77,380	.....	....
oxide	Te, O_2	solid	78,300	.....	....
Tellurous acid	Te, O_3, H_2	solid	145,600	.....	....
Thallium					
bromide	Tl, Br	solid	41,290	.....	....
bromide, tri-	Tl, Br_3, Aq	dil. sol.	56,450	.....	....
chloride	Tl, Cl	solid	48,580	4500	−10,100
chloride, tri-	Tl, Cl_3, Aq	dil. sol.	89,250	.....	....
fluoride	Tl, F, Aq	dil. sol.	52,000	.....	....
hydroxide (ic)	$Tl_2, O_3, 3H_2O$	solid	2×43,170	.....	....
hydroxide (ous)	Tl, O, H	solid	56,910	235	− 3,150
iodide	Tl, I	solid	30,180	.....	....
iodide, tri-	Tl, I_3, Aq	dil. sol.	10,820	.....	....
nitrate (ous)	Tl, N, O_3	solid	58,150	300	− 9,970
oxide	Tl_2, O	solid	42,240	570	− 3,080
selenide	Tl_2, Se	precip.	13,400	.....	....
sulphate (ous)	Tl_2, S, O_4	solid	220,980	1600	− 8,280
sulphate (ous)	Tl_2, SO_2, O_2	solid	149,900	.....	....
sulphide	Tl_2, S	solid	19,650	.....	....
Thionic acid					
thionic, di-	S_2, O_6, H_2, Aq	dil. sol.	279,440	.....	....
thionic, tri-	S_3, O_6, H_2, Aq	dil. sol.	272,900	.....	....
thionic, tetra-	S_4, O_6, H_2, Aq	dil. sol.	260,790	.....	....
thionic, penta-	S_5, O_6, H_2, Aq	dil. sol.	261,200	.....	....
Thorium					
chloride	Th, Cl_4	solid	300,200	.....	....
oxide	Th, O_2	solid	326,000	.....	....
Tin					
bromide (ic)	Sn, Br_4	solid	98,000	970	+16,600
bromide (ous)	Sn, Br_2	solid	61,500	.....	− 1,600
chloride (ic)	Sn, Cl_4	solid	129,800	300	+29,920
chloride (ous)	Sn, Cl_2	solid	80,790	300	+350
chloride (ous)	$SnCl_2.2H_2O$	....	....	200	− 5,370
hydroxide (ous)	Sn, O, H_2O	solid	68,090	.....	....
oxide (ic)	Sn, O_2	cryst.	137,200	.....	....
oxide (ous)	Sn, O	solid	70,700	.....	....
pot. chloride	$SnCl_4$, 2KCl	solid	24,160	800	− 3,380
Titanium					
oxide	Ti, O_2	amorp.	215,600	.....	....
oxide	Ti, O_2	cryst.	218,400	.....	....
Tungsten					
oxide, di-	W, O_2	solid	131,400	.....	....
oxide, tri-	W, O_3	solid	196,300	.....	....
Vanadium					
oxide	V_2, O_5	solid	310,500	.....	....
Water see *hydrogen oxide.*					
Zinc					
acetate	Zn, C_4, H_6, O_4	solid	267,400	720	+ 9,800[23°]
acetate	$Zn(C_2H_3O_2)_2.H_2O$	....	....	800	+ 7,000[23°]

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Zinc					
acetate	$Zn(C_2H_3O_2)_2.2H_2O$	....	....	500	$+ 4,200^{10°}$
bromide	Zn, Br_2	solid	76,000	400	+15,030
carbonate	Zn, C, O_3	precip.	194,200	.....	....
chloride	Zn, Cl_2	solid	97,400	300	+15,630
cyanide	Zn, C_2, N_2	solid	27,900	.....	....
dithionate	$Zn, 2SO_2, O_2, 6H_2O$	solid	173,850	.....	....
fluoride	Zn, F_2, Aq	dil. sol.	140,000	.....	....
hydroxide	Zn, O, H_2O	solid	82,680	.....	....
hydroxide	Zn, O_2, H_2	solid	83,500	.....	....
iodide	Zn, I_2	solid	49,231	400	+11,310
nitrate	$Zn, O_2, N_2O_4, 6H_2O$	solid	140,820	400	− 5,840
oxide	Zn, O	solid	84,800	.....	....
pot. sulphate	$ZnSO_4, K_2SO_4$	solid	4,145	600	+ 7,910
pot. sulphate	$ZnSO_4, K_2SO_4, 6H_2O$	solid	23,950	600	−11,900
selenide	Zn, Se	precip.	30,300	.....	....
selenide	Zn, Se	cryst.	29,600	.....	....
sulphate	Zn, S, O_4	solid	229,600	400	+18,430
sulphate	Zn, O_2, SO_2	solid	158,990	.....	....
sulphate	Zn, O_2, SO_2, H_2O	solid	167,470	400	+ 9,950
sulphate	$Zn, O_2, SO_2, 7H_2O$	solid	181,680	400	− 4,260
sulphide	Zn, S, xH_2O	solid	43,000	.....	....
telluride	Zn, Te	solid	31,000	.....	....
Zirconium					
oxide	Zr, O_2	solid	177,500	.....	....

HEATS OF FORMATION AND COMBUSTION

For Organic Compounds

The heat of formation is given in gram calories per gram molecular weight for the formation of the compound from the elements in the state in which they exist at ordinary temperatures. Carbon is assumed to be in its crystalline form, the diamond.

The heat of combustion is also given in gram calories per gram molecular weight. The compound is assumed to be originally at ordinary temperature and the products of combustion returned to ordinary temperature.

Name	Formula	Physical state	Heat of formation. Calories	Heat of combustion. Calories
Acetaldehyde	CH_3CHO	liquid	57,100	269,500
		gas	51,000	....
Acetamide	CH_3CONH_2	solid	78,400	282,700
Acetic acid	$CH_3.COOH$	solid	119,700	....
		liquid	117,200	209,400
		gas	112,100	....
anhydride	$(CH_3CO)_2O$	liquid	152,300	431,900
		gas	145,600	....
Acetone	$CH_3 \cdot CO \cdot CH_3$	liquid	66,300	423,600
			58,800	....
Acetonitrile (*methyl cyanide*)	$CH_3 \cdot CH$	liquid	450	291,600
Acetylene	$HC⫶CH$	gas	−58,100	315,700
Acetylurea	$NH_2 \cdot CO \cdot NH \cdot COCH_3$	solid	129,000	360,900
Alcohol, *see Ethyl alcohol*				
Amyl alcohol	$C_5H_{12}O$	liquid	91,600	793,900
		gas	80,900	....
Aniline	$C_6H_5 \cdot NH_2$	liquid	−11,200	818,500
		gas	−19,800	....
Anthracene	$C_6H_4:(CH)_2:C_6H_4$	solid	−42,400	1,707,600
Benzene	C_6H_6	solid	−1,800	....
		liquid	−4,100	776,900
		gas	−11,300	....
Benzoic acid	$C_6H_5.COOH$	solid	94,200	772,900
		liquid	91,900	....
Bromomethane (*Bromoform*)	$CHBr_3$	gas	13,700	....
Butyric acid	$CH_3 \cdot (CH_2)_2 \cdot COOH$	solid	130,300	....
		liquid	128,800	524,400
Camphor	$C_{10}H_{16}O$	solid	80,300	1,414,700
Carbon hexachloride	C_2Cl_6	solid	85,600	....
Carbon tetrachloride	CCl_4	liquid	75,700	....
		gas	68,500	....
Catechol	$C_6H_4(OH)_2$	solid	87,600	685,200
Chloroform	$CHCl_3$	liquid	53,900	107,000
		gas	46,600	....
Dichlormethane (*Methylene chloride*)	CH_2Cl_2	liquid	37,800	....
		gas	31,400	....
Dimethylamine	$(CH_3)_2NH$	gas	4,100	426,000
Ethane	$CH_3 \cdot CH_3$	gas	23,300	372,300
Ether	$C_2H_5 \cdot O \cdot C_2H_5$	liquid	70,500	651,700
			62,800	....
Ethyl acetate	$CH_3 \cdot COO \cdot C_2H_5$	liquid	116,100	537,100
		gas	105,200	....
alcohol	$C_2H_5 \cdot OH$	liquid	69,900	325,700
		gas	59,800	....
Ethylene	$CH_2:CH_2$	gas	−14,600	341,100

HEATS OF FORMATION AND COMBUSTION (Continued)

For Organic Compounds

Name	Formula	Physical state	Heat of formation. Calories	Heat of combustion. Calories
Formic acid	$H\cdot COOH$	solid	104,000	....
		liquid	101,500	61,700
		gas	96,700	....
Fructose	$C_6H_{12}O_6$	solid	303,900	675,900
Glucose	$C_6H_{12}O_6$	solid	302,600	677,200
Glycerine	$HOCH_2\cdot CHOH\cdot CH_2OH$	solid	165,600	....
		liquid	161,700	397,200
Hydroquinone	$C_6H_4\cdot(OH)_2$	solid	87,300	685,500
Lactose	$C_{12}H_{22}O_{11}$	solid	537,400	1,351,400
Maltose	$C_{12}H_{22}O_{11}$	solid	538,100	1,350,700
Methane	CH_4	gas	18,900	213,500
Methyl alcohol	CH_3OH	liquid	61,700	170,600
		gas	53,300	....
amine	CH_3NH_2	gas	9,900	256,900
chloride	CH_3Cl	liquid	33,900	....
		gas	29,000	....
formate	$H\cdot COO\cdot CH_3$	liquid	94,800	238,700
		gas	87,900	....
oxalate	$C_4H_6O_4$	solid	186,000	398,200
		liquid	181,700	....
Naphthalene	$C_{10}H_8$	solid	−22,800	1,241,800
		liquid	−27,400	....
Nitrobenzene	$C_6H_5\cdot NO_2$	solid	7,800	....
		liquid	5,100	733,200
		gas	−2,000	....
Nitroglycerine	$C_3H_5(NO_3)_3$	liquid	14,700	....
Nitromethane	$CH_3\cdot NO_2$	liquid	28,800	169,800
		gas	21,800	....
Oleic acid	$C_{17}H_{33}\cdot COOH$	liquid	188,000	2,682,000
Oxalic acid	$COOH\cdot COOH$	solid	197,600	60,200
Palmitic acid	$CH_3\cdot(CH_2)14\cdot COOH$	solid	214,400	2,398,400
		liquid	207,200	....
Phenol (*Carbolic acid*)	$C_6H_5\cdot OH$	solid	36,800	....
		liquid	34,500	736,000
Propane	$CH_3\cdot CH_2\cdot CH_3$	gas	30,500	528,400
Propylene	$CH_3\cdot CH{:}CH_2$	gas	−9,400	499,300
Resorcinol	$C_6H_4\cdot(OH)_2$	solid	89,400	683,400
Sucrose (*Cane sugar*)	$C_{11}H_{22}O_{11}$	solid	535,600	1,355,000
Stearic acid	$CH_3\cdot(CH_2)_{16}\cdot COOH$	solid	227,600	2,711,800
Succinic acid	$HOOC\cdot CH_2\cdot CH_2\cdot COOH$	solid	229,800	354,400
Tartaric acid	$HOOC(CHOH)_2\cdot COOH$	solid	302,300	281,000
Tetrachlor-ethylene	$CCl_2{:}CCl_2$	liquid	45,500	....
Toluene	$C_6H_5\cdot CH_3$	liquid	2,300	933,800
		gas	−5,400	....
Toluidine	$CH_3\cdot C_6H_4\cdot NH_2$	liquid	5,900	964,700
Trimethylamine	$(CH_3)_3N$	liquid	5,600	....
		gas	1,400	592,000
Urea	$NH_2\cdot CO\cdot NH_2$	solid	80,800	151,500
Xylenes	$C_6H_4\cdot(CH_3)_2$	liquid	15,200	1,084,300

HEATS OF COMBUSTION

Heat of combustion in gram calories per gram. Products of combustion gaseous unless stated.

Substance	Calories per gram of substance	Observer
Acetylene	11,923	Thomsen
Alcohol, *see Ethyl alcohol*	....	....
Amyl alcohol	8,958	Favre & Silbermann
Asphalt	9,532	Slossen & Colburn
Benzene	9,977	Stohmann
Butter	9,200	....
Carbon, crystal to CO_2	7,859	Berthelot
Carbon disulphide	3,244	"
Casein	5,860	....
Charcoal to CO_2	8,080	Favre & Silbermann
Coal, anthracite	70,000–84,000	....
bituminous	61,000–87,000	....
lignite	45,000–79,000	....
Coke	8,000	....
Copper to CuO	590	Thomsen
Dynamite, 75 %	1,290	Roux and Sarran
Egg white	5,700	....
yolk	8,100	....
Ethyl alcohol	7,080	....
Ethylene	11,293	Berthelot
Fats, animal, mean	9,500	....
Gas, coal	5,800–11,000	....
Glycerine, CO_2 and liq. H_2O	4,316	Stohmann
Graphite	7,901	Berthelot
Gunpowder	720–750	....
Hemoglobin	5,900	....
Hydrogen, to liquid	33,900	Mean
	34,500	Berthelot
to gas	29,150	"
Iron to Fe_2O_3	1,582	....
Magnesium to MgO	6,077	....
Methane	13,063	Favre & Silbermann
Methyl alcohol	5,307	" "
Naphthalene	9,354	Berthelot
Oil, cotton seed	9,500	....
lard	9,200–9,400	....
olive	9,328–9,442	Stohmann
paraffin	9,800	....
petroleum, crude	11,094	Mohler
" refined	11,045	"
" Russian	10,800	"

HEATS OF COMBUSTION (Continued)

Substance	Calories per gram of substance	Observer
Oil,		
rape	9,489	Stohmann
sperm	10,000	Gibson
Paraffin	10,340	Stohmann
Peat	5,940	Bainbridge
Pitch	8,400	....
Silicon to SiO_2	7,407	Berthelot
Wood		
Beech	4,774	....
Birch	4,771	....
Oak	4,620	....
Pine	5,085	....

SULPHURIC ACID

Specific Gravity of Aqueous Solutions.
Lunge, Isler and Naef

Sp. gr. at 15° C.	Deg. Bé.	Deg. Twaddell.	Per cent. H_2SO_4 by wt.	Total H_2SO_4 kg. in 1 liter.	Sp. gr. at 15° C.	Deg. Bé.	Deg. Twaddell.	Per cent. H_2SO_4 by wt.	Total H_2SO_4 kg. in 1 liter.
1.000	0.0	0	0.09	0.001	1.210	25.0	42	28.58	0.346
1.005	0.7	1	0.95	0.009	1.215	25.5	43	29.21	0.355
1.010	1.4	2	1.57	0.016	1.220	26.0	44	29.84	0.364
1.015	2.1	3	2.30	0.023	1.225	26.4	45	30.48	0.373
1.020	2.7	4	3.03	0.031	1.230	26.9	46	31.11	0.382
1.025	3.4	5	3.76	0.039	1.235	27.4	47	31.70	0.391
1.030	4.1	6	4.49	0.046	1.240	27.9	48	32.28	0.400
1.035	4.7	7	5.23	0.054	1.245	28.4	49	32.86	0.409
1.040	5.4	8	5.96	0.062	1.250	28.8	50	33.43	0.418
1.045	6.0	9	6.67	0.071	1.255	29.3	51	34.00	0.426
1.050	6.7	10	7.37	0.077	1.260	29.7	52	34.57	0.435
1.055	7.4	11	8.07	0.085	1.265	30.2	53	35.14	0.444
1.060	8.0	12	8.77	0.093	1.270	30.6	54	35.71	0.454
1.065	8.7	13	9.47	0.102	1.275	31.1	55	36.29	0.462
1.070	9.4	14	10.19	0.109	1.280	31.5	56	36.87	0.472
1.075	10.0	15	10.90	0.117	1.285	32.0	57	37.45	0.481
1.080	10.6	16	11.60	0.125	1.290	32.4	58	38.03	0.490
1.085	11.2	17	12.30	0.133	1.295	32.8	59	38.61	0.500
1.090	11.9	18	12.99	0.142	1.300	33.3	60	39.19	0.510
1.095	12.4	19	13.67	0.150	1.305	33.7	61	39.77	0.519
1.100	13.0	20	14.35	0.158	1.310	34.2	62	40.35	0.529
1.105	13.6	21	15.03	0.166	1.315	34.6	63	40.93	0.538
1.110	14.2	22	15.71	0.175	1.320	35.0	64	41.50	0.548
1.115	14.9	23	16.36	0.183	1.325	35.4	65	42.08	0.557
1.120	15.4	24	17.01	0.191	1.330	35.8	66	42.66	0.567
1.125	16.0	25	17.66	0.199	1.335	36.2	67	43.20	0.577
1.130	16.5	26	18.31	0.207	1.340	36.6	68	43.74	0.586
1.135	17.1	27	18.96	0.215	1.345	37.0	69	44.28	0.596
1.140	17.7	28	19.61	0.223	1.350	37.4	70	44.82	0.605
1.145	18.3	29	20.26	0.231	1.355	37.8	71	45.35	0.614
1.150	18.8	30	20.91	0.239	1.360	38.2	72	45.88	0.624
1.155	19.3	31	21.55	0.248	1.365	38.6	73	46.41	0.633
1.160	19.8	32	22.19	0.257	1.370	39.0	74	46.94	0.643
1.165	20.3	33	22.83	0.266	1.375	39.4	75	47.47	0.653
1.170	20.9	34	23.47	0.275	1.380	39.8	76	48.00	0.662
1.175	21.4	35	24.12	0.283	1.385	40.1	77	48.53	0.672
1.180	22.0	36	24.76	0.292	1.390	40.5	78	49.06	0.682
1.185	22.5	37	25.40	0.301	1.395	40.8	79	49.59	0.692
1.190	23.0	38	26.04	0.310	1.400	41.2	80	50.11	0.702
1.195	23.5	39	26.68	0.319	1.405	41.6	81	50.63	0.711
1.200	24.0	40	27.32	0.328	1.410	42.0	82	51.15	0.721
1.205	24.5	41	27.95	0.337	1.415	42.3	83	51.66	0.730

SULPHURIC ACID (Continued)

Sp. gr. at 15° C.	Deg. Bé.	Deg. Twaddell.	Per cent. H_2SO_4 by wt.	Total H_2SO_4 kg. in 1 liter.	Sp. gr. at 15° C.	Deg. Bé.	Deg. Twaddell.	Per cent. H_2SO_4 by wt.	Total H_2SO_4 kg. in 1 liter.
1.420	42.7	84	52.15	0.740	1.645	56.6	129	72.55	1.193
1.425	43.1	85	52.63	0.750	1.650	56.9	130	72.96	1.204
1.430	43.4	86	53.11	0.759	1.655	57.1	131	73.40	1.215
1.435	43.8	87	53.59	0.769	1.660	57.4	132	73.81	1.225
1.440	44.1	88	54.07	0.779	1.665	57.7	133	74.24	1.230
1.445	44.4	89	54.55	0.789	1.670	57.9	134	74.66	1.246
1.450	44.8	90	55.03	0.798	1.675	58.2	135	75.08	1.259
1.455	45.1	91	55.50	0.808	1.680	58.4	136	75.50	1.268
1.460	45.4	92	55.97	0.817	1.685	58.7	137	75.94	1.278
1.465	45.8	93	56.43	0.827	1.690	58.9	138	76.38	1.289
1.470	46.1	94	56.90	0.837	1.695	59.2	139	76.76	1.301
1.475	46.4	95	57.37	0.846	1.700	59.5	140	77.17	1.312
1.480	46.8	96	57.83	0.856	1.705	59.7	141	77.60	1.323
1.485	47.1	97	58.28	0.865	1.710	60.0	142	78.04	1.334
1.490	47.4	98	58.74	0.876	1.715	60.2	143	78.48	1.346
1.495	47.8	99	59.22	0.885	1.720	60.4	144	78.92	1.357
1.500	48.1	100	59.70	0.896	1.725	60.6	145	79.36	1.369
1.505	48.4	101	60.18	0.906	1.730	60.9	146	79.80	1.381
1.510	48.7	102	60.65	0.916	1.735	61.1	147	80.24	1.392
1.515	49.0	103	61.12	0.926	1.740	61.4	148	80.68	1.404
1.520	49.4	104	61.59	0.936	1.745	61.6	149	81.12	1.416
1.525	49.7	105	62.06	0.946	1.750	61.8	150	81.56	1.427
1.530	50.0	106	62.53	0.957	1.755	62.1	151	82.00	1.439
1.535	50.3	107	63.00	0.967	1.760	62.3	152	82.44	1.451
1.540	50.6	108	63.43	0.977	1.765	62.5	153	83.01	1.465
1.545	50.9	109	63.85	0.987	1.770	62.8	154	83.51	1.478
1.550	51.2	110	64.26	0.996	1.775	63.0	155	84.02	1.491
1.555	51.5	111	64.67	1.006	1.780	63.2	156	84.50	1.504
1.560	51.8	112	65.20	1.017	1.785	63.5	157	85.10	1.519
1.565	52.1	113	65.65	1.027	1.790	63.7	158	85.70	1.534
1.570	52.4	114	66.09	1.038	1.795	64.0	159	86.30	1.549
1.575	52.7	115	66.53	1.048	1.800	64.2	160	86.92	1.564
1.580	53.0	116	66.95	1.058	1.805	64.4	161	87.60	1.581
1.585	53.3	117	67.40	1.068	1.810	64.6	162	88.30	1.598
1.590	53.6	118	67.83	1.078	1.815	64.8	163	89.16	1.618
1.595	53.9	119	68.26	1.089	1.820	65.0	164	90.05	1.639
1.600	54.1	120	68.70	1.099	1.821	....	...	90.20	1.643
1.605	54.4	121	69.13	1.110	1.822	65.1	...	90.40	1.647
1.610	54.7	122	69.56	1.120	1.823	....	...	90.60	1.651
1.615	55.0	123	70.00	1.131	1.824	65.2	...	90.80	1.656
1.620	55.2	124	70.42	1.141	1.825	....	165	91.00	1.661
1.625	55.5	125	70.85	1.151	1.826	65.3	...	91.25	1.666
1.630	55.8	126	71.27	1.162	1.827	....	...	91.50	1.671
1.635	56.0	127	71.70	1.172	1.828	65.4	...	91.70	1.676
1.640	56.3	128	72.12	1.182	1.829	....	...	91.90	1.681

SULPHURIC ACID (Continued)

Sp. gr. at 15°C.	Deg. Bé.	Deg. Twaddell.	Per cent. H_2SO_4 by wt.	Total H_2SO_4 kg. in 1 liter.	Sp. gr. at 15°C.	Deg. Bé.	Deg. Twaddell.	Per. cent. H_2SO_4 by wt.	Total H_2SO_4 kg. in 1 liter.
1.830	....	166	92.10	1.685	1.840	65.9	168	95.60	1.759
1.831	65.5	...	92.43	1.692	1.8405	....	...	95.95	1.765
1.832	....	...	92.70	1.698	1.8410	....	...	96.38	1.774
1.833	65.6	...	92.97	1.704	1.8415	....	...	97.35	1.792
1.834	....	...	93.25	1.710	1.8410	....	...	98.20	1.808
1.835	65.7	167	93.56	1.717	1.8405	....	...	98.52	1.814
1.836	....	...	93.80	1.722	1.8400	....	...	98.72	1.816
1.837	....	...	94.25	1.730	1.8395	....	...	98.77	1.817
1.838	65.8	...	94.60	1.739	1.8390	....	...	99.12	1.823
1.839	....	...	95.00	1.748	1.8385	....	...	99.31	1.826

ACETIC ACID

Specific Gravity of Aqueous Solutions, at 15° C.

Oudemans

Specific gravity.	Pr. ct. by wt.	Specific gravity.	Per cent.	Specific gravity.	Per cent.	Specific gravity.	Per cent.
0.9992	0	1.0363	26	1.0631	52	1.0748	78
1.0007	1	1.0375	27	1.0638	53	1.0748	79
1.0022	2	1.0388	28	1.0646	54	1.0748	80
1.0037	3	1.0400	29	1.0653	55	1.0747	81
1.0052	4	1.0412	30	1.0660	56	1.0746	82
1.0067	5	1.0424	31	1.0666	57	1.0744	83
1.0083	6	1.0436	32	1.0673	58	1.0742	84
1.0098	7	1.0447	33	1.0679	59	1.0739	85
1.0113	8	1.0459	34	1.0685	60	1.0736	86
1.0127	9	1.0470	35	1.0691	61	1.0731	87
1.0142	10	1.0481	36	1.0697	62	1.0726	88
1.0157	11	1.0492	37	1.0702	63	1.0720	89
1.0171	12	1.0502	38	1.0707	64	1.0713	90
1.0185	13	1.0513	39	1.0712	65	1.0705	91
1.0200	14	1.0523	40	1.0717	66	1.0696	92
1.0214	15	1.0533	41	1.0721	67	1.0686	83
1.0228	16	1.0543	42	1.0725	68	1.0674	94
1.0242	17	1.0552	43	1.0729	69	1.0660	95
1.0256	18	1.0562	44	1.0733	70	1.0644	96
1.0270	19	1.0571	45	1.0737	71	1.0625	97
1.0284	20	1.0580	46	1.0740	72	1.0604	98
1.0298	21	1.0589	47	1.0742	73	1.0580	99
1.0311	22	1.0598	48	1.0744	74	1.0553	100
1.0324	23	1.0607	49	1.0746	75		
1.0337	24	1.0615	50	1.0747	76		
1.0350	25	1.0623	51	1.0748	77		

NITRIC ACID

Specific Gravity of Aqueous Solutions

Sp. gr. at 15° C.	Degrees Baumé.	Degrees Twaddell.	Per cent HNO_3 by weight.	Total HNO_3 kg. in 1 liter.
1.000	0.0	0	0.10	0.001
1.005	0.7	1	1.00	0.010
1.010	1.4	2	1.90	0.019
1.015	2.1	3	2.80	0.028
1.020	2.7	4	3.70	0.038
1.025	3.4	5	4.60	0.047
1.030	4.1	6	5.50	0.057
1.035	4.7	7	6.38	0.066
1.040	5.4	8	7.26	0.075
1.045	6.0	9	8.13	0.085
1.050	6.7	10	8.99	0.094
1.055	7.4	11	9.84	0.104
1.060	8.0	12	10.68	0.113
1.065	8.7	13	11.51	0.123
1.070	9.4	14	12.33	0.132
1.075	10.0	15	13.15	0.141
1.080	10.6	16	13.95	0.151
1.085	11.2	17	14.74	0.160
1.090	11.9	18	15.53	0.169
1.095	12.4	19	16.32	0.179
1.100	13.0	20	17.11	0.188
1.105	13.6	21	17.89	0.198
1.110	14.2	22	18.67	0.207
1.115	14.9	23	19.45	0.217
1.120	15.4	24	20.23	0.227
1.125	16.0	25	21.00	0.236
1.130	16.5	26	21.77	0.246
1.135	17.1	27	22.54	0.256
1.140	17.7	28	23.31	0.266
1.145	18.3	29	24.08	0.276
1.150	18.8	30	24.84	0.286
1.155	19.3	31	25.60	0.296
1.160	19.8	32	26.36	0.306
1.165	20.3	33	27.12	0.316
1.170	20.9	34	27.88	0.326
1.175	21.4	35	28.63	0.336
1.180	22.0	36	29.38	0.347
1.185	22.5	37	30.13	0.357
1.190	23.0	38	30.88	0.367
1.195	23.5	39	31.62	0.378
1.200	24.0	40	32.36	0.388
1.205	24.5	41	33.09	0.399
1.210	25.0	42	33.82	0.409
1.215	25.5	43	34.55	0.420

NITRIC ACID (Continued)

Sp. gr. at 15° C.	Degrees Baumé.	Degrees Twaddell.	Per cent HNO_3 by weight.	Total HNO_3 kg. in 1 liter.
1.220	26.0	44	35.28	0.430
1.225	26.4	45	36.03	0.441
1.230	26.9	46	36.78	0.452
1.235	27.4	47	37.53	0.463
1.240	27.9	48	38.29	0.475
1.245	28.4	49	39.05	0.486
1.250	28.8	50	39.82	0.498
1.255	29.3	51	40.58	0.509
1.260	29.7	52	41.34	0.521
1.265	30.2	53	42.10	0.533
1.270	30.6	54	42.87	0.544
1.275	31.1	55	43.64	0.556
1.280	31.5	56	44.41	0.568
1.285	32.0	57	45.18	0.581
1.290	32.4	58	45.95	0.593
1.295	32.8	59	46.72	0.605
1.300	33.3	60	47.49	0.617
1.305	33.7	61	48.26	0.630
1.310	34.2	62	49.07	0.643
1.315	34.6	63	49.89	0.656
1.320	35.0	64	50.71	0.669
1.325	35.4	65	51.53	0.683
1.330	35.8	66	52.37	0.697
1.3325	36.0	66.5	52.80	0.704
1.335	36.2	67	53.22	0.710
1.340	36.6	68	54.07	0.725
1.345	37.0	69	54.93	0.739
1.350	37.4	70	55.79	0.753
1.355	37.8	71	56.66	0.768
1.360	38.2	72	57.57	0.783
1.365	38.6	73	58.48	0.798
1.370	39.0	74	59.39	0.814
1.375	39.4	75	60.30	0.829
1.380	39.8	76	61.27	0.846
1.3833	40.0	.....	61.92	0.857
1.385	40.1	77	62.24	0.862
1.390	40.5	78	63.23	0.879
1.395	40.8	79	64.25	0.896
1.400	41.2	80	65.30	0.914
1.405	41.6	81	66.40	0.933
1.410	42.0	82	67.50	0.952
1.415	42.3	83	68.63	0.971
1.420	42.7	84	69.80	0.991
1.425	43.1	85	70.98	1.011
1.430	43.4	86	72.17	1.032
1.435	43.8	87	73.39	1.053
1.440	44.1	88	74.68	1.075

NITRIC ACID (Continued)

Sp. gr. at 15° C.	Degrees Baumé.	Degrees Twaddell.	Per cent HNO_3 by weight.	Total HNO_3 kg. in 1 liter.
1.445	44.4	89	75.98	1.098
1.450	44.8	90	77.28	1.121
1.455	45.1	91	78.60	1.144
1.460	45.4	92	79.98	1.168
1.465	45.8	93	81.42	1.193
1.470	46.1	94	82.90	1.219
1.475	46.4	95	84.45	1.246
1.480	46.8	96	86.05	1.274
1.485	47.1	97	87.70	1.302
1.490	47.4	98	89.60	1.335
1.495	47.8	99	91.60	1.369
1.500	48.1	100	94.09	1.411
1.505	48.4	101	96.39	1.451
1.510	48.7	102	98.10	1.481
1.515	49.0	103	99.07	1.501
1.520	49.4	104	99.67	1.515

HYDROCHLORIC ACID

Specific Gravity of Aqueous Solutions

Sp. gr. at 15° C.	Deg. Bé.	Deg. Twad-dell.	Per cent. HCl.	Total HCl kg. per liter.	Sp. gr. at 15° C.	Deg. Bé.	Deg. Twad-dell.	Per cent. HCl.	Total HCl kg. per liter.
1.000	0.0	0.0	0.16	0.0016	1.115	14.9	23	22.86	0.255
1.005	0.7	1	1.15	0.012	1.120	15.4	24	23.82	0.267
1.010	1.4	2	2.14	0.022	1.125	16.0	25	24.78	0.278
1.015	2.1	3	3.12	0.032	1.130	16.5	26	25.75	0.291
1.020	2.7	4	4.13	0.042	1.135	17.1	27	26.70	0.303
1.025	3.4	5	5.15	0.053	1.140	17.7	28	27.66	0.315
1.030	4.1	6	6.15	0.064	1.1425	18.0	..	28.14	0.322
1.035	4.7	7	7.15	0.074	1.145	18.3	29	28.61	0.328
1.040	5.4	8	8.16	0.085	1.150	18.8	30	29.57	0.340
1.045	6.0	9	9.16	0.096	1.152	19.0	..	29.95	0.345
1.050	6.7	10	10.17	0.107	1.155	19.3	31	30.55	0.353
1.055	7.4	11	11.18	0.118	1.160	19.8	32	31.52	0.366
1.060	8.0	12	12.19	0.129	1.163	20.0	..	32.10	0.373
1.065	8.7	13	13.19	0.141	1.165	20.3	33	32.49	0.379
1.070	9.4	14	14.17	0.152	1.170	20.9	34	33.46	0.392
1.075	10.0	15	15.16	0.163	1.171	21.0	..	33.65	0.394
1.080	10.6	16	16.15	0.174	1.175	21.4	35	34.42	0.404
1.085	11.2	17	17.13	0.186	1.180	22.0	36	35.39	0.418
1.090	11.9	18	18.11	0.197	1.185	22.5	37	36.31	0.430
1.095	12.4	19	19.06	0.209	1.190	23.0	38	37.23	0.443
1.100	13.0	20	20.01	0.220	1.195	23.5	39	38.16	0.456
1.105	13.6	21	20.97	0.232	1.200	24.0	40	39.11	0.469
1.110	14.2	22	21.92	0.243					

AMMONIUM HYDROXIDE

Specific Gravity of Aqueous Solutions at 15° C.

Specific gravity	Per cent NH_3	Total NH_3 g. per liter	Specific gravity	Per cent NH_3	Total NH_3 g. per liter
1.000	0.00	0.0	0.940	15.63	146.9
0.998	0.45	4.5	0.938	16.22	152.1
0.996	0.91	9.1	0.936	16.82	157.4
0.994	1.37	13.6	0.934	17.42	162.7
0.992	1.84	18.2	0.932	18.03	168.1
0.990	2.31	22.9	0.930	18.64	173.4
0.988	2.80	27.7	0.928	19.25	178.6
0.986	3.30	32.5	0.926	19.87	184.2
0.984	3.80	37.4	0.924	20.49	189.3
0.982	4.30	42.2	0.922	21.12	194.7
0.980	4.80	47.0	0.920	21.75	200.1
0.978	5.30	51.8	0.918	22.39	205.6
0.976	5.80	56.6	0.916	23.03	210.9
0.974	6.30	61.4	0.914	23.68	216.3
0.972	6.80	66.1	0.912	24.33	221.9
0.970	7.31	70.9	0.910	24.99	227.4
0.968	7.82	75.7	0.908	25.65	232.9
0.966	8.33	80.5	0.906	26.31	238.3
0.964	8.84	85.2	0.904	26.98	243.9
0.962	9.35	89.9	0.902	27.65	249.4
0.960	9.91	95.1	0.900	28.33	255.0
0.958	10.47	100.3	0.898	29.01	260.5
0.956	11.03	105.4	0.896	29.69	266.0
0.954	11.60	110.7	0.894	30.37	271.5
0.952	12.17	115.9	0.892	31.05	277.0
0.950	12.72	121.0	0.890	31.75	282.6
0.948	13.31	126.2	0.888	32.50	288.6
0.946	13.88	131.3	0.886	33.25	294.6
0.944	14.46	136.5	0.884	34.10	301.4
0.942	15.04	141.7	0.882	34.95	308.3

POTASSIUM HYDROXIDE

Specific Gravity of Aqueous Solutions at 15° C.

Specific gravity	Deg. Baumé	Deg. Twaddell	Per cent KOH by wt.	KOH, kg. per cu. m.
1·007	1	1·4	0.9	9
1·014	2	2·8	1·7	17
1·022	3	4·4	2.6	26
1·029	4	5·8	3·5	36
1·037	5	7·4	4·5	46
1·045	6	9·0	5·6	58
1·052	7	10·4	6·4	67
1·060	8	12·0	7·4	78
1·067	9	13·4	8·2	88
1·075	10	15·0	9·2	99
1·083	11	16·6	10·1	109
1.091	12	18·2	10·9	119
1·100	13	20·0	12·0	132
1·108	14	21·6	12·9	143
1·116	15	23·2	13·8	153
1·125	16	25·0	14·8	167
1·134	17	26·8	15·7	178
1·142	18	28·4	16·5	188
1·152	19	30·4	17·6	203
1·162	20	32·4	18·6	216
1·171	21	34·2	19·5	228
1·180	22	36·0	20·5	242
1.190	23	38·0	21·4	255
1·200	24	40·0	22·4	269
1·210	25	42·0	23·3	282
1·220	26	44·0	24·2	295
1·231	27	46·2	25·1	309
1·241	28	48·2	26·1	324
1·252	29	50·4	27·0	338
1·263	30	52·6	28·0	353
1·274	31	54·8	28·9	368
1·285	32	57·0	29·8	385
1·297	33	59·4	30·7	398
1·308	34	61·6	31·8	416
1·320	35	64.0	32·7	432
1·332	36	66·4	33·7	449
1·345	37	69.0	34·9	469
1·357	38	71·4	35.9	487
1·370	39	74·0	36·9	506
1·383	40	76·6	37·8	522
1·397	41	79.4	38.9	543
1·410	42	82.0	39·9	563
1·424	43	84·8	40.9	582
1·438	44	87·6	42·1	605
1·453	45	90·6	43·4	631
1·468	46	93·6	44·6	655
1·483	47	96·6	45·8	679
1·498	48	99.6	47·1	706
1·514	49	102·8	48·3	731
1·530	50	106·0	49·4	756
1·546	51	109·2	50·6	779
1·563	52	112·6	51·9	811
1·580	53	116·0	53·2	840
1·597	54	119.4	54·5	870
1·615	55	123·0	55·9	902
1·634	56	126·8	57·5	940

SODIUM HYDROXIDE

Specific Gravity of Aqueous Solutions at 15° C.

Specific gravity	Deg. Baumé	Deg. Twaddell	Per cent NaOH by wt.	NaOH, kg. per cu. m.
1·007	1	1·4	0·59	6·0
1·014	2	2·8	1·20	12·0
1·022	3	4·4	1·85	18·9
1·029	4	5·8	2·50	25·7
1·036	5	7·2	3·15	32·6
1·045	6	9·0	3·79	39·6
1·052	7	10·4	4·50	47·3
1·060	8	12·0	5·20	55·0
1·067	9	13·4	5·86	62·5
1·075	10	15·0	6·58	70·7
1·083	11	16·6	7·30	79·1
1·091	12	18·2	8·07	88·0
1·100	13	20·0	8·78	96·6
1·108	14	21·6	9·50	105.3
1·116	15	23·2	10·30	114·9
1·125	16	25·0	11·06	124·4
1·134	17	26·8	11·90	134·9
1·142	18	28·4	12·69	145·0
1·152	19	30·4	13·50	155·5
1·162	20	32·4	14·35	166·7
1·171	21	34·2	15·15	177·4
1·180	22	36·0	16·00	188·8
1·190	23	38·0	16·91	201·2
1·200	24	40·0	17·81	213·7
1·210	25	42·0	18·71	226·4
1·220	26	44·0	19·65	239·7
1·231	27	46·2	20·60	253·6
1·241	28	48·2	21·55	267·4
1·252	29	50·4	22·50	281·7
1·263	30	52·6	23·50	296·8
1·274	31	54·8	24·48	311·9
1·285	32	57·0	25·50	327·7
1·297	33	59·4	26·58	344·7
1·308	34	61·6	27·65	361·7
1·320	35	64·0	28·83	380·6
1·332	36	66·4	30·00	399·6
1·345	37	69·0	31·20	419·6
1·357	38	71·4	32·50	441·0
1·370	39	74·0	33·73	462·1
1·383	40	76·6	35·00	484·1
1·397	41	79·4	36·36	507·9
1·410	42	82·0	37·65	530·9
1·424	43	84·8	39·06	556·2
1·438	44	87·6	40·47	582·0
1·453	45	90·6	42·02	610·6
1·468	46	93·6	43·58	639·8
1·483	47	96·6	45·16	669·7
1·498	48	99·6	46·73	700·0
1·514	49	102·8	48·41	732·9
1·530	50	106·0	50·10	766·5

POTASSIUM CARBONATE

Specific Gravity of Aqueous Solutions at 15° C.

Specific gravity	Per cent K_2CO_3	Specific gravity	Per cent K_2CO_3	Specific gravity	Per cent K_2CO_3
1·00914	1	1·18265	19	1·38279	37
1·01829	2	1·19286	20	1·39476	38
1·02743	3	1·20344	21	1·40673	39
1·03658	4	1·21402	22	1·41870	40
1·04572	5	1·22459	23	1·43104	41
1·05513	6	1·23517	24	1·44338	42
1·06454	7	1·24575	25	1·45573	43
1·07396	8	1·25681	26	1·46807	44
1·08337	9	1·25787	27	1·48041	45
1·09278	10	1·27893	28	1·49314	46
1·10258	11	1·28999	29	1·50588	47
1·11238	12	1·30105	30	1·51861	48
1·12219	13	1·31261	31	1·53135	49
1·13199	14	1·32417	32	1·54408	50
1·14179	15	1·33573	33	1·55728	51
1·15200	16	1·34729	34	1·57048	52
1·16222	17	1·35885	35	1·57079	51·024
1·17243	18	1·37082	36	......	..

SODIUM CARBONATE

Specific Gravity of Aqueous Solutions at 15° C.

Specific gravity	Per cent $Na_2CO_3 + 10H_2O$	Per cent Na_2CO_3	Specific gravity	Per cent $Na_2CO_3 + 10H_2O$	Per cent Na_2CO_3
1·0038	1	·370	1·0628	16	5·929
1·0076	2	.741	1·0668	17	6·299
1·0141	3	1·112	1·0708	18	6·670
1·0153	4	1·482	1·0748	19	7·011
1·0192	5	1·853	1·0789	20	7·412
1·0231	6	2·223	1·0830	21	7·782
1·0270	7	2·594	1·0871	22	8·153
1·0309	8	2·965	1·0912	23	8·523
1·0348	9	3·335	1·0953	24	8·894
1·0388	10	3·706	1·0994	25	9·264
1·0428	11	4·076	1·1035	26	9·635
1·0468	12	4·447	1·1076	27	10·005
1·0508	13	4·817	1·1117	28	10·376
1·0548	14	5·188	1·1158	29	10·746
1·0588	15	5·558	1·1200	30	11·118

SODIUM CHLORIDE

Specific Gravity of Aqueous Solutions at 15° C. (Gerlach).

Specific gravity.	Per cent NaCl.	Specific gravity.	Per cent NaCl.	Specific gravity.	Per cent NaCl.
1.00725	1	1.07335	10	1.14315	19
1.01450	2	1.08097	11	1.15107	20
1.02174	3	1.08859	12	1.15931	21
1.02899	4	1.09622	13	1.16755	22
1.03624	5	1.10384	14	1.17580	23
1.04366	6	1.11146	15	1.18404	24
1.05108	7	1.11938	16	1.19228	25
1.05851	8	1.12730	17	1.20098	26
1.06593	9	1.13523	18	1.20433	26.395

POTASSIUM CHLORIDE

Specific Gravity of Aqueous Solutions at 15° C. (Gerlach).

Specific gravity.	Per cent KCl.	Specific gravity.	Per cent KCl.	Specific gravity.	Per cent KCl.
1.00650	1	1.06580	10	1.12179	18
1.01300	2	1.07271	11	1.12894	19
1.01950	3	1.07962	12	1.13608	20
1.02600	4	1.08652	13	1.14348	21
1.03250	5	1.09345	14	1.15088	22
1.03916	6	1.10036	15	1.15828	23
1.04582	7	1.10750	16	1.16568	24
1.05248	8	1.11465	17	1.17234	24.9
1.05914	9				

AMMONIUM CHLORIDE

Specific Gravity of Aqueous Solutions at 15° C. (Gerlach).

Specific gravity.	Per cent NH_4Cl.	Specific gravity.	Per cent NH_4Cl.	Specific gravity.	Per cent NH_4Cl.
1.00316	1	1.03081	10	1.05648	19
1.00632	2	1.03370	11	1.05929	20
1.00948	3	1.03658	12	1.06204	21
1.01264	4	1.03947	13	1.06479	22
1.01580	5	1.04325	14	1.06754	23
1.01880	6	1.04524	15	1.07029	24
1.02180	7	1.04805	16	1.07304	25
1.02481	8	1.05806	17	1.07575	26
1.02781	9	1.05367	18	1.07658	26.297

ETHYL ALCOHOL

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Giving the specific gravity at 15.56° C. referred to water at the same temperature. To reduce to specific gravity referred to water at 4° C. multiply by 0.99908.

(U. S. Department of Agriculture.)

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
1.00000	0.00	0.00	0.00	0.99431	3.90	3.12	3.10
0.99984	0.10	0.08	0.08	0.99417	4.00	3.20	3.18
0.99968	0.20	0.16	0.16	0.99403	4.10	3.28	3.26
0.99953	0.30	0.24	0.24	0.99390	4.20	3.36	3.34
0.99937	0.40	0.32	0.32	0.99376	4.30	3.44	3.42
0.99923	0.50	0.40	0.40	0.99363	4.40	3.52	3.50
0.99907	0.60	0.48	0.48	0.99349	4.50	3.60	3.58
0.99892	0.70	0.56	0.56	0.99335	4.60	3.68	3.66
0.99877	0.80	0.64	0.64	0.99322	4.70	3.76	3.74
0.99861	0.90	0.71	0.71	0.99308	4.80	3.84	3.81
0.99849	1.00	0.79	0.79	0.99295	4.90	3.92	3.89
0.99834	1.10	0.87	0.87	0.99281	5.00	4.00	3.97
0.99819	1.20	0.95	0.95	0.99268	5.10	4.08	4.05
0.99805	1.30	1.03	1.03	0.99255	5.20	4.16	4.13
0.99790	1.40	1.11	1.11	0.99241	5.30	4.24	4.21
0.99775	1.50	1.19	1.19	0.99228	5.40	4.32	4.29
0.99760	1.60	1.27	1.27	0.99215	5.50	4.40	4.37
0.99745	1.70	1.35	1.35	0.99202	5.60	4.48	4.44
0.99731	1.80	1.43	1.43	0.99189	5.70	4.56	4.52
0.99716	1.90	1.51	1.51	0.99175	5.80	4.64	4.60
0.99701	2.00	1.59	1.59	0.99162	5.90	4.72	4.68
0.99687	2.10	1.67	1.66	0.99149	6.00	4.80	4.76
0.99672	2.20	1.75	1.74	0.99136	6.10	4.88	4.84
0.99658	2.30	1.83	1.82	0.99123	6.20	4.96	4.92
0.99643	2.40	1.91	1.90	0.99111	6.30	5.05	5.00
0.99629	2.50	1.99	1.98	0.99098	6.40	5.13	5.08
0.99615	2.60	2.07	2.06	0.99085	6.50	5.21	5.16
0.99600	2.70	2.15	2.14	0.99072	6.60	5.29	5.24
0.99586	2.80	2.23	2.22	0.99059	6.70	5.37	5.32
0.99571	2.90	2.31	2.30	0.99047	6.80	5.45	5.40
0.99557	3.00	2.39	2.38	0.99034	6.90	5.53	5.48
0.99543	3.10	2.47	2.46	0.99021	7.00	5.61	5.56
0.99529	3.20	2.55	2.54	0.99009	7.10	5.69	5.64
0.99515	3.30	2.64	2.62	0.98996	7.20	5.77	5.72
0.99501	3.40	2.72	2.70	0.98984	7.30	5.86	5.80
0.99487	3.50	2.80	2.78	0.98971	7.40	5.94	5.88
0.99473	3.60	2.88	2.86	0.98959	7.50	6.02	5.96
0.99459	3.70	2.96	2.94	0.98947	7.60	6.10	6.04
0.99445	3.80	3.04	3.02	0.98934	7.70	6.18	6.11

ETHYL ALCOHOL (Continued)

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.98922	7.80	6.26	6.19	0.98435	12.00	9.67	9.52
0.98909	7.90	6.34	6.27	0.98424	12.10	9.75	9.60
0.98897	8.00	6.42	6:35	0.98413	12.20	9.83	9.68
0.98885	8.10	6.50	6.43	0.98402	12.30	9.92	9.76
0.98873	8.20	6.58	6.51	0.98391	12.40	10.00	9.84
0.98861	8.30	6.67	6.59	0.98381	12.50	10.08	9.92
0.98849	8.40	6.75	6.67	0.98370	12.60	10.16	10.00
0.98837	8.50	6.83	6.75	0.98359	12.70	10.24	10.07
0.98825	8.60	6.91	6.83	0.98348	12.80	10.33	10.15
0.98813	8.70	6.99	6.91	0.98337	12.90	10.41	10.23
0.98801	8.80	7.07	6.99	0.98326	13.00	10.49	10.31
0.98789	8.90	7.15	7.07	0.98315	13.10	10.57	10.39
0.98777	9.00	7.23	7.14	0.98305	13.20	10.65	10.47
0.98765	9.10	7.31	7.22	0.98294	13.30	10.74	10.55
0.98754	9.20	7.39	7.30	0.98283	13.40	10.82	10.63
0.98742	9.30	7.48	7.38	0.98273	13.50	10.90	10.71
0.98730	9.40	7.56	7.46	0.98262	13.60	10.98	10.79
0.99719	9.50	7.64	7.54	0.98251	13.70	11.06	10.87
0.98707	9.60	7.72	7.62	0.98240	13.80	11.15	10.95
0.98695	9.70	7.80	7.70	0.98230	13.90	11.23	11.03
0.98683	9.80	7.88	7.78	0.98219	14.00	11.31	11.11
0.98672	9.90	7.96	7.85	0.98209	14.10	11.39	11.19
0.98660	10.00	8.04	7.93	0.98198	14.20	11.47	11.27
0.98649	10.10	8.12	8.01	0.98188	14.30	11.56	11.35
0.98637	10.20	8.20	8.09	0.98177	14.40	11.64	11.43
0.98626	10.30	8.29	8.17	0.98167	14.50	11.72	11.51
0.98614	10.40	8.37	8.25	0.98156	14.60	11.80	11.59
0.98603	10.50	8.45	8.33	0.98146	14.70	11.88	11.67
0.98592	10.60	8.53	8.41	0.98135	14.80	11.97	11.75
0.98580	10.70	8.61	8.49	0.98125	14.90	12.05	11.82
0.98569	10.80	8.70	8.57	0.98114	15.00	12.13	11.90
0.98557	10.90	8.78	8.65	0.98104	15.10	12.21	11.98
0.98546	11.00	8.86	8.73	0.98093	15.20	12.29	12.06
0.98535	11.10	8.94	8.81	0.98083	15.30	12.38	12.14
0.98524	11.20	9.02	8.89	0.98073	15.40	12.46	12.22
0.98513	11.30	9.11	8.97	0.98063	15.50	12.54	12.30
0.98502	11.40	9.19	9.05	0.98052	15.60	12.62	12.37
0.98491	11.50	9.27	9.13	0.98042	15.70	12.70	12.45
0.98479	11.60	9.35	9.21	0.98032	15.80	12.79	12.53
0.98468	11.70	9.43	9.29	0.98021	15.90	12.87	12.61
0.98457	11.80	9.51	9.36	0.98011	16.00	12.95	12.69
0.98446	11.90	9.59	9.44	0.98001	16.10	13.03	12.77

ETHYL ALCOHOL (Continued)

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.97991	16.20	13.12	12.85	0.97568	20.40	16.59	16.18
0.97980	16.30	13.20	12.93	0.97558	20.50	16.67	16.26
0.97970	16.40	13.29	13.01	0.97547	20.60	16.75	16.34
0.97960	16.50	13.37	13.09	0.97537	20.70	16.84	16.42
0.97950	16.60	13.45	13.17	0.97527	20.80	16.92	16.50
0.97940	16.70	13.53	13.25	0.97517	20.90	17.01	16.58
0.97929	16.80	13.62	13.33	0.97507	21.00	17.09	16.66
0.97917	16.90	13.70	13.41	0.97497	21.10	17.17	16.74
0.97909	17.00	13.78	13.49	0.97487	21.20	17.26	16.82
0.97899	17.10	13.86	13.57	0.97477	21.30	17.34	16.90
0.97889	17.20	13.94	13.65	0.97467	21.40	17.43	16.98
0.97879	17.30	14.03	13.73	0.97457	21.50	17.51	17.06
0.97869	17.40	14.11	13.81	0.97446	21.60	17.59	17.14
0.97859	17.50	14.19	13.89	0.97436	21.70	17.67	17.22
0.97848	17.60	14.27	13.96	0.97426	21.80	17.76	17.30
0.97838	17.70	14.35	14.04	0.97416	21.90	17.84	17.38
0.97828	17.80	14.44	14.12	0.97406	22.00	17.92	17.46
0.97818	17.90	14.52	14.20	0.97396	22.10	18.00	17.54
0.97808	18.00	14.60	14.28	0.97386	22.20	18.09	17.62
0.97798	18.10	14.68	14.36	0.97375	22.30	18.17	17.70
0.97788	18.20	14.77	14.44	0.97365	22.40	18.26	17.78
0.97778	18.30	14.85	14.52	0.97355	22.50	18.34	17.86
0.97768	18.40	14.94	14.60	0.97345	22.60	18.42	17.94
0.97758	18.50	15.02	14.68	0.97335	22.70	18.51	18.02
0.97748	18.60	15.10	14.76	0.97324	22.80	18.59	18.10
0.97738	18.70	15.18	14.84	0.97314	22.90	18.68	18.18
0.97728	18.80	15.27	14.92	0.97304	23.00	18.76	18.26
0.97718	18.90	15.38	15.00	0.97294	23.10	18.84	18.33
0.97708	19.00	15.43	15.08	0.97283	23.20	18.92	18.41
0.97698	19.10	15.51	15.15	0.97273	23.30	19.01	18.49
0.97688	19.20	15.59	15.23	0.97263	23.40	19.09	18.57
0.97678	19.30	15.68	15.31	0.97253	23.50	19.17	18.65
0.97668	19.40	15.76	15.39	0.97242	23.60	19.25	18.73
0.97658	19.50	15.84	15.47	0.97232	23.70	19.34	18.18
0.97648	19.60	15.93	15.55	0.97222	23.80	19.42	18.88
0.97638	19.70	16.01	15.63	0.97211	23.90	19.51	18.96
0.97628	19.80	16.09	15.71	0.97201	24.00	19.59	19.04
0.97618	19.90	16.18	15.79	0.97191	24.10	19.67	19.12
0.97608	20.00	16.26	15.87	0.97180	24.20	19.76	19.20
0.97598	20.10	16.34	15.95	0.97170	24.30	19.84	19.28
0.97588	20.20	16.42	16.03	0.97159	24.40	19.93	19.36
0.97578	20.30	16.51	16.10	0.97149	24.50	20.01	19.44

ETHYL ALCOHOL (Continued)

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.97139	24.60	20.09	19.52	0.96681	28.80	23.64	22.85
0.97128	24.70	20.18	19.60	0.96669	28.90	23.72	22.93
0.97118	24.80	20.26	19.68	0.96658	29.00	23.81	23.01
0.97107	24.90	20.35	19.76	0.96646	29.10	23.89	23.09
0.97097	25.00	20.43	19.84	0.96635	29.20	23.98	23.17
0.97086	25.10	20.51	19.92	0.96623	29.30	24.06	23.25
0.97076	25.20	20.60	20.00	0.96611	29.40	24.15	23.33
0.97065	25.30	20.68	20.08	0.96600	29.50	24.23	23.41
0.97055	25.40	20.77	20.16	0.96587	29.60	24.32	23.49
0.97044	25.50	20.85	20.24	0.96576	29.70	24.40	23.57
0.97033	25.60	20.93	20.32	0.96564	29.80	24.49	23.65
0.97023	25.70	21.02	20.40	0.96553	29.90	24.57	23.73
0.97012	25.80	21.10	20.47	0.96541	30.00	24.66	23.81
0.97001	25.90	21.19	20.55	0.96529	30.10	24.74	23.89
0.96991	26.00	21.27	20.63	0.96517	30.20	24.83	23.97
0.96980	26.10	21.35	20.71	0.96505	30.30	24.91	24.04
0.96969	26.20	21.44	20.79	0.96493	30.40	25.00	24.12
0.96959	26.30	21.52	20.87	0.96481	30.50	25.08	24.20
0.96949	26.40	21.61	20.95	0.96469	30.60	25.17	24.28
0.96937	26.50	21.69	21.03	0.96457	30.70	25.25	24.36
0.96926	26.60	21.77	21.11	0.96445	30.80	25.34	24.44
0.96915	26.70	21.86	21.19	0.96433	30.90	25.42	24.52
0.96905	26.80	21.94	21.27	0.96421	31.00	25.51	24.60
0.96894	26.90	22.03	21.35	0.96409	31.10	25.60	24.68
0.96883	27.00	22.11	21.43	0.96396	31.20	25.68	24.76
0.96872	27.10	22.20	21.51	0.96384	31.30	25.77	24.84
0.96861	27.20	22.28	21.59	0.96372	31.40	25.85	24.92
0.96850	27.30	22.37	21.67	0.96360	31.50	25.94	25.00
0.96839	27.40	22.45	21.75	0.96347	31.60	26.03	25.08
0.96828	27.50	22.54	21.83	0.96335	31.70	26.11	25.16
0.96816	27.60	22.62	21.90	0.96323	31.80	26.20	25.24
0.96805	27.70	22.71	21.98	0.96310	31.90	26.28	25.32
0.96794	27.80	22.79	22.06	0.96298	32.00	26.37	25.40
0.96783	27.90	22.88	22.14	0.96285	32.10	26.46	25.48
0.96772	28.00	22.96	22.22	0.96273	32.20	26.54	25.56
0.96761	28.10	23.04	22.30	0.96260	32.30	26.63	25.64
0.96749	28.20	23.13	22.38	0.96248	32.40	26.71	25.71
0.96738	28.30	23.21	22.45	0.96235	32.50	26.80	25.79
0.96726	28.40	23.30	22.53	0.96222	32.60	26.89	25.87
0.96715	28.50	23.38	22.61	0.96210	32.70	26.97	25.95
0.96704	28.60	23.47	22.69	0.96197	32.80	27.06	26.03
0.96692	28.70	23.55	22.77	0.96185	32.90	27.14	26.11

ETHYL ALCOHOL (Continued)

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.96172	33.00	27.23	26.19	0.95603	37.20	30.88	29.52
0.96159	33.10	27.32	26.27	0.95589	37.30	30.96	29.60
0.96146	33.20	27.40	26.35	0.95574	37.40	31.05	29.68
0.96133	33.30	27.49	26.43	0.95560	37.50	31.14	29.76
0.96120	33.40	27.57	26.51	0.95545	37.60	31.23	29.84
0.96108	33.50	27.66	26.59	0.95531	37.70	31.32	29.92
0.96095	33.60	27.75	26.67	0.95516	37.80	31.40	30.00
0.96082	33.70	27.83	26.75	0.95502	37.90	31.49	30.08
0.96069	33.80	27.92	26.82	0.95487	38.00	31.58	30.16
0.96056	33.90	28.00	26.90	0.95472	38.10	31.67	30.24
0.96043	34.00	28.09	26.98	0.95457	38.20	31.76	30.32
0.96030	34.10	28.18	27.06	0.95442	38.30	31.85	30.40
0.96016	34.20	28.26	27.14	0.95427	38.40	31.94	30.48
0.96003	34.30	28.35	27.22	0.95413	38.50	32.03	30.56
0.95990	34.40	28.43	27.30	0.95398	38.60	32.12	30.64
0.95977	34.50	28.52	27.38	0.95383	38.70	32.20	30.72
0.95963	34.60	28.61	27.46	0.95368	38.80	32.29	30.79
0.95950	34.70	28.70	27.54	0.95353	38.90	32.37	30.87
0.95937	34.80	28.78	27.62	0.95338	39.00	32.46	30.95
0.95923	34.90	28.87	27.70	0.95323	39.10	32.55	31.03
0.95910	35.00	28.96	27.78	0.95307	39.20	32.64	31.11
0.95896	35.10	29.05	27.86	0.95292	39.30	32.72	31.18
0.95883	35.20	29.13	27.94	0.95277	39.40	32.81	31.26
0.95869	35.30	29.22	28.02	0.95262	39.50	32.90	31.34
0.95855	35.40	29.30	28.09	0.95246	39.60	32.99	31.42
0.95842	35.50	29.38	28.17	0.95231	39.70	33.08	31.50
0.95828	35.60	29.48	28.25	0.95216	39.80	33.17	31.58
0.95814	35.70	29.57	28.33	0.95200	39.90	33.27	31.66
0.95800	35.80	29.65	28.41	0.95185	40.00	33.35	31.74
0.95787	35.90	29.74	28.49	0.95169	40.10	33.44	31.82
0.95773	36.00	29.83	28.57	0.95154	40.20	33.53	31.90
0.95759	36.10	29.92	28.65	0.95138	40.30	33.61	31.98
0.95745	36.20	30.00	28.73	0.95122	40.40	33.70	32.06
0.95731	36.30	30.09	28.81	0.95107	40.50	33.79	32.14
0.95717	36.40	30.17	28.88	0.95091	40.60	33.88	32.22
0.95703	36.50	30.26	28.96	0.95075	40.70	33.97	32.30
0.95688	36.60	30.35	29.04	0.95059	40.80	34.06	32.38
0.95674	36.70	30.44	29.12	0.95044	40.90	34.15	32.46
0.95660	36.80	30.52	29.20	0.95028	41.00	34.24	32.54
0.95646	36.90	30.61	29.29	0.95012	41.10	34.33	32.62
0.95632	37.00	30.70	29.36	0.94996	41.20	34.42	32.70
0.95618	37.10	30.79	29.44	0.94980	41.30	34.50	32.78

ETHYL ALCOHOL (Continued)

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.94964	41.40	34.59	32.86	0.94258	45.60	38.39	36.19
0.94948	41.50	34.68	32.93	0.94241	45.70	38.48	36.26
0.94932	41.60	34.77	33.01	0.94223	45.80	38.57	36.34
0.94916	41.70	34.86	33.09	0.94206	45.90	38.66	36.42
0.94900	41.80	34.95	33.17	0.94188	46.00	38.75	36.50
0.94884	41.90	35.04	33.25	0.94170	46.10	38.84	36.58
0.94868	42.00	35.13	33.33	0.94152	46.20	38.93	36.66
0.94852	42.10	35.22	33.41	0.94134	46.30	39.03	36.74
0.94835	42.20	35.31	33.49	0.94116	46.40	39.12	36.82
0.94810	42.30	35.40	33.57	0.94098	46.50	39.21	36.90
0.94802	42.40	35.49	33.65	0.94080	46.60	39.30	36.98
0.94786	42.50	35.58	33.73	0.94062	46.70	39.39	37.06
0.94770	42.60	35.67	33.81	0.94044	46.80	39.49	37.13
0.94753	42.70	35.76	33.89	0.94026	46.90	39.58	37.21
0.94737	42.80	35.85	33.97	0.94008	47.00	39.67	37.29
0.94720	42.90	35.94	34.04	0.93990	47.10	39.76	37.37
0.94704	43.00	36.03	34.12	0.93971	47.20	39.85	37.45
0.94687	43.10	36.12	34.20	0.93953	47.30	39.95	37.53
0.94670	43.20	36.21	34.28	0.93934	47.40	40.04	37.61
0.94654	43.30	36.30	34.36	0.93916	47.50	40.13	37.69
0.94637	43.40	36.39	34.44	0.93898	47.60	40.22	37.77
0.94620	43.50	36.48	34.52	0.93879	47.70	40.32	37.85
0.94603	43.60	36.57	34.60	0.93861	47.80	40.41	37.93
0.94586	43.70	36.66	34.68	0.93842	47.90	40.51	38.01
0.94570	43.80	36.75	34.76	0.93824	48.00	40.60	38.09
0.94553	43.90	36.84	34.84	0.93805	48.10	40.69	38.17
0.94536	44.00	36.93	34.91	0.93786	48.20	40.78	38.25
0.94519	44.10	37.02	34.99	0.93768	48.30	40.88	38.33
0.94502	44.20	37.11	35.07	0.93749	48.40	40.97	38.41
0.94484	44.30	37.21	35.15	0.93730	48.50	41.06	38.49
0.94467	44.40	37.30	35.23	0.93711	48.60	41.15	38.57
0.94450	44.50	37.39	35.31	0.93692	48.70	41.24	38.65
0.94433	44.60	37.48	35.39	0.93679	48.80	41.34	38.72
0.94416	44.70	37.57	35.47	0.93655	48.90	41.43	38.80
0.94398	44.80	37.66	35.55	0.93636	49.00	41.52	38.88
0.94381	44.90	37.76	35.63	0.93617	49.10	41.61	38.96
0.94364	45.00	37.84	35.71	0.93598	49.20	41.71	39.04
0.94346	45.10	37.93	35.79	0.93578	49.30	41.80	39.12
0.94329	45.20	38.02	35.87	0.93559	49.40	41.90	39.20
0.94311	45.30	38.12	35.95	0.93540	49.50	41.99	39.28
0.94294	45.40	38.21	36.03	0.93521	49.60	42.08	39.36
0.94276	45.50	38.30	36.11	0.93502	49.70	42.18	39.44

ETHYL ALCOHOL (Continued)

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.93482	49.80	42.27	39.52	0.8773	75.00	....	....
0.93463	49.90	42.37	39.60	0.8747	76.00	....	....
0.9344	50.00	...*	....	0.8721	77.00	....	....
0.9325	51.00	....	....	0.8694	78.00	....	....
0.9305	52.00	....	....	0.8667	79.00	....	....
0.9285	53.00	....	....	0.8639	80.00	....	....
0.9264	54.00	....	....	0.8611	81.00	....	....
0.9244	55.00	....	....	0.8583	82.00	....	....
0.9222	56.00	....	....	0.8554	83.00	....	....
0.9201	57.00	....	....	0.8525	84.00	....	....
0.9180	58.00	....	....	0.8496	85.00	....	....
0.9158	59.00	....	....	0.8465	86.00	....	....
0.9136	60.00	....	....	0.8435	87.00	....	....
0.9113	61.00	....	....	0.8404	88.00	....	....
0.9091	62.00	....	....	0.8372	89.00	....	....
0.9068	63.00	....	....	0.8339	90.00	....	....
0.9044	64.00	....	....	0.8306	91.00	....	....
0.9021	65.00	....	....	0.8272	92.00	....	....
0.8997	66.00	....	....	0.8236	93.00	....	....
0.8974	67.00	....	....	0.8199	94.00	....	....
0.8949	68.00	....	....	0.8161	95.00	....	....
0.8925	69.00	....	....	0.8121	96.00	....	....
0.8900	70.00	....	....	0.8079	97.00	....	....
0.8876	71.00	....	....	0.8035	98.00	....	....
0.8850	72.00	....	....	0.7989	99.00	....	....
0.8825	73.00	....	....	0.7939	100.00	....	....
0.8799	74.00	....	....	......	......	....	....

* For specific gravity of mixtures by weight see following table.

ETHYL ALCOHOL

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Weight

The table gives the specific gravity at the temperature indicated referred to water at 4° C.

(U. S. Bureau of Standards.)

Per cent alcohol by weight.	15° C.	20° C.	25° C.	Per cent alcohol by weight.	15° C.	20° C.	25° C.
0	0.99913	0.99824	0.99708	51	0.91566	0.91164	0.90758
1	0.99725	0.99636	0.99521	52	0.91344	0.90940	0.90533
2	0.99543	0.99453	0.99338	53	0.91120	0.90715	0.90307
3	0.99366	0.99274	0.99159	54	0.90895	0.90488	0.90079
4	0.99197	0.99102	0.98984	55	0.90670	0.90262	0.89851
5	0.99033	0.98936	0.98815	56	0.90443	0.90034	0.89622
6	0.98877	0.98776	0.98651	57	0.90215	0.89805	0.89392
7	0.98726	0.98620	0.98491	58	0.89987	0.89576	0.89162
8	0.98581	0.98470	0.98336	59	0.89758	0.89346	0.88931
9	0.98442	0.98325	0.98185	60	0.89528	0.89115	0.88700
10	0.98307	0.98185	0.98038	61	0.89297	0.88883	0.88467
11	0.98176	0.98047	0.97893	62	0.89066	0.88651	0.88234
12	0.98049	0.97913	0.97752	63	0.88834	0.88418	0.88000
13	0.97925	0.97781	0.97612	64	0.88601	0.88185	0.87766
14	0.97803	0.97651	0.97474	65	0.88368	0.87950	0.87530
15	0.97683	0.97522	0.97336	66	0.88134	0.87716	0.87295
16	0.97563	0.97393	0.97199	67	0.87899	0.87480	0.87058
17	0.97444	0.97264	0.97061	68	0.87664	0.87244	0.86821
18	0.97324	0.97134	0.96922	69	0.87428	0.87008	0.86583
19	0.97203	0.97003	0.96782	70	0.87192	0.86770	0.86344
20	0.97080	0.96870	0.96640	71	0.86954	0.86532	0.86105
21	0.96956	0.96736	0.96497	72	0.86716	0.86292	0.85864
22	0.96829	0.96599	0.96352	73	0.86477	0.86052	0.85622
23	0.96699	0.96459	0.96203	74	0.86237	0.85812	0.85380
24	0.96566	0.96317	0.96052	75	0.85997	0.85570	0.85137
25	0.96430	0.96171	0.95897	76	0.85755	0.85328	0.84893
26	0.96289	0.96021	0.95739	77	0.85513	0.85084	0.84648
27	0.96145	0.95868	0.95577	78	0.85270	0.84840	0.84403
28	0.95997	0.95711	0.95412	79	0.85026	0.84595	0.84157
29	0.95845	0.95550	0.95244	80	0.84781	0.84349	0.83909
30	0.95688	0.95385	0.95071	81	0.84534	0.84101	0.83660
31	0.95526	0.95215	0.94894	82	0.84286	0.83852	0.83410
32	0.95360	0.95042	0.94713	83	0.84037	0.83602	0.83159
33	0.95191	0.94865	0.94529	84	0.83786	0.83350	0.82906
34	0.95017	0.94684	0.94342	85	0.83534	0.83097	0.82652
35	0.94839	0.94499	0.94152	86	0.83279	0.82842	0.82396
36	0.94657	0.94311	0.93957	87	0.83022	0.82583	0.82137
37	0.94471	0.94119	0.93760	88	0.82762	0.82323	0.81876
38	0.94282	0.93924	0.93560	89	0.82500	0.82060	0.81613
39	0.94089	0.93725	0.93356	90	0.82235	0.81795	0.81348
40	0.93893	0.93524	0.93151	91	0.81966	0.81527	0.81080
41	0.93694	0.93320	0.92943	92	0.81694	0.81255	0.80809
42	0.93491	0.93113	0.92732	93	0.81418	0.80979	0.80534
43	0.93286	0.92904	0.92519	94	0.81138	0.80700	0.80256
44	0.93078	0.92693	0.92305	95	0.80854	0.80417	0.79974
45	0.92868	0.92480	0.92088	96	0.80564	0.80129	0.79689
46	0.92655	0.92264	0.91870	97	0.80271	0.79838	0.79400
47	0.92441	0.92047	0.91650	98	0.79972	0.79541	0.79106
48	0.92225	0.91828	0.91429	99	0.79668	0.79240	0.78809
49	0.92006	0.91608	0.91207	100	0.79358	0.78933	0.78507
50	0.91787	0.91386	0.90983	.....	....	....	....

TABLES OF THE MANUFACTURING CHEMISTS' ASSOCIATION

SULPHURIC ACID

Authorities — W. C. FERGUSON; H. P. TALBOT

This table has been approved and adopted as a standard by the Manufacturing Chemists' Association of the United States.

Specific Gravity determinations were made at 60° F., compared with water at 60° F.

From the Specific Gravities the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = 145 - \frac{145}{\text{Sp. Gr.}}.$$

Baumé Hydrometers for use with this table must be graduated by the above formula, which formula should always be printed on the scale.

66° Baumé = Sp. Gr. 1.8354.

1 cu. ft. water at 60° F. weighs 62.37 lbs. av.

Atomic weights from F. W. Clarke's table of 1901. O = 16.

H_2SO_4 = 100 per cent.

	H_2SO_4	O. V.	60°
O. V.	93.19	100.00	119.98
60°	77.67	83.35	100.00
50°	62.18	66.72	80.06

Acids stronger than 66° Bé. should have their percentage compositions determined by chemical analysis.

Bé.°	Sp. gr.	Tw.°	Per cent H_2SO	Weight of 1 cu. ft. in lbs. av.	Per cent O. V.	Pounds O. V. in 1 cu. ft.	* Freezing (melting) point.
0	1.0000	0.0	0.00	62.37	0.00	0.00	32.0° F.
1	1.0069	1.4	1.02	62.80	1.09	.68	31.2 "
2	1.0140	2.8	2.08	63.24	2.23	1.41	30.5 "
3	1.0211	4.2	3.13	63.69	3.36	2.14	29.8 "
4	1.0284	5.7	4.21	64.14	4.52	2.90	28.9 "
5	1.0357	7.1	5.28	64.60	5.67	3.66	28.1 "
6	1.0432	8.6	6.37	65.06	6.84	4.45	27.2 "
7	1.0507	10.1	7.45	65.53	7.99	5.24	26.3 "
8	1.0584	11.7	8.55	66.01	9.17	6.06	25.1 "
9	1.0662	13.2	9.66	66.50	10.37	6.89	24.0 "
10	1.0741	14.8	10.77	66.99	11.56	7.74	22.8 "
11	1.0821	16.4	11.89	67.49	12.76	8.61	21.5 "
12	1.0902	18.0	13.01	68.00	13.96	9.49	20.0 "
13	1.0985	19.7	14.13	68.51	15.16	10.39	18.3 "
14	1.1069	21.4	15.25	69.04	16.36	11.30	16.6 "

* Calculated from Pickering's results, Journal of London Chemical Society, vol. 57, p. 363.

SULPHURIC ACID (Continued)

Bé.°	Sp. gr.	Tw.°	Per cent H_2SO_4	Weight of 1 cu. ft. in lbs. av.	Per cent O. V.	Pounds O. V. in 1 cu.ft.	* Freezing (melting) point.
15	1.1154	23.1	16.38	69.57	17.58	12.23	14.7 F.
16	1.1240	24.8	17.53	70.10	18.81	13.19	12.6 "
17	1.1328	26.6	18.71	70.65	20.08	14.18	10.2 "
18	1.1417	28.3	19.89	71.21	21.34	15.20	7.7 "
19	1.1508	30.2	21.07	71.78	22.61	16.23	4.8 "
20	1.1600	32.0	22.25	72.35	23.87	17.27	+ 1.6 "
21	1.1694	33.9	23.43	72.94	25.14	18.34	− 1.8 "
22	1.1789	35.8	24.61	73.53	26.41	19.42	− 6.0 "
23	1.1885	37.7	25.81	74.13	27.69	20.53	−11 "
24	1.1983	39.7	27.03	74.74	29.00	21.68	−16 "
25	1.2083	41.7	28.28	75.36	30.34	22.87	−23 "
26	1.2185	43.7	29.53	76.00	31.69	24.08	−30 "
27	1.2288	45.8	30.79	76.64	33.04	25.32	−39 "
28	1.2393	47.9	32.05	77.30	34.39	26.58	−49 "
29	1.2500	50.0	33.33	77.96	35.76	27.88	−61 "
30	1.2609	52.2	34.63	78.64	37.16	29.22	−74 "
31	1.2719	54.4	35.93	79.33	38.55	30.58	−82 "
32	1.2832	56.6	37.26	80.03	39.98	32.00	−96 "
33	1.2946	58.9	38.58	80.74	41.40	33.42	−97 "
34	1.3063	61.3	39.92	81.47	42.83	34.90	−91 "
35	1.3182	63.6	41.27	82.22	44.28	36.41	−81 "
36	1.3303	66.1	42.63	82.97	45.74	37.95	−70 "
37	1.3426	68.5	43.99	83.74	47.20	39.53	−60 "
38	1.3551	71.0	45.35	84.52	48.66	41.13	−53 "
39	1.3679	73.6	46.72	85.32	50.13	42.77	−47 "
40	1.3810	76.2	48.10	86.13	51.61	44.45	−41 "
41	1.3942	78.8	49.47	86.96	53.08	46.16	−35 "
42	1.4078	81.6	50.87	87.80	54.58	47.92	−31 "
43	1.4216	84.3	52.26	88.67	56.07	49.72	−27 "
44	1.4356	87.1	53.66	89.54	57.58	51.56	−23 "
45	1.4500	90.0	55.07	90.44	59.09	53.44	−20 "
46	1.4646	92.9	56.48	91.35	60.60	55.36	−14 "
47	1.4796	95.9	57.90	92.28	62.13	57.33	−15 "
48	1.4948	99.0	59.32	93.23	63.65	59.34	−18 "
49	1.5104	102.1	60.75	94.20	65.18	61.40	−22 "

* Calculated from Pickering's results, Journal of London Chemical Society, vol. 57, p. 363.

SULPHURIC ACID (Continued)

Bé.°	Sp. gr.	Tw.°	Per cent H_2SO_4	Weight of 1 cu. ft. in lbs. av.	Per cent O. V.	Pounds O. V. in 1 cu.ft.	*Freezing (melting) point.
50	1.5263	105.3	62.18	95.20	66.72	63.52	−27 F.
51	1.5426	108.5	63.66	96.21	68.31	65.72	−33 "
52	1.5591	111.8	65.13	97.24	69.89	67.96	−39 "
53	1.5761	115.2	66.63	98.30	71.50	70.28	−49 "
54	1.5934	118.7	68.13	99.38	73.11	72.66	−59 "
55	1.6111	122.2	69.65	100.48	74.74	75.10	..
56	1.6292	125.8	71.17	101.61	76.37	77.60	..
57	1.6477	129.5	72.75	102.77	78.07	80.23	.. Below −40
58	1.6667	133.3	74.36	103.95	79.79	82.95	..
59	1.6860	137.2	75.99	105.16	81.54	85.75	− 7
60	1.7059	141.2	77.67	106.40	83.35	88.68	+12.6 F.
61	1.7262	145.2	79.43	107.66	85.23	91.76	27.3 "
62	1.7470	149.4	81.30	108.96	87.24	95.06	39.1 "
63	1.7683	153.7	83.34	110.29	89.43	98.63	46.1 "
64	1.7901	158.0	85.66	111.65	91.92	102.63	46.4 "
64¼	1.7957	159.1	86.33	112.00	92.64	103.75	43.6 "
64½	1.8012	150.2	87.04	112.34	93.40	104.93	41.1 "
64¾	1.8068	161.4	87.81	112.69	94.23	106.19	37.9 "
65	1.8125	162.5	88.65	113.05	95.13	107.54	33.1 "
65¼	1.8182	163.6	89.55	113.40	96.10	108.97	24.6 "
65½	1.8239	164.8	90.60	113.76	97.22	110.60	13.4 "
65¾	1.8297	165.9	91.80	114.12	98.51	112.42	− 1 "
66	1.8354	167.1	93.19	114.47	10.00	114.47	−29 "

* Calculated from Pickering's results, Journal of London Chemical Society, vol. 57, p. 363.

APPROXIMATE BOILING POINTS

50°	Bé.	295 F.
60°	"	386 "
61°	"	400 "
62°	"	415 "
63°	"	432 "
64°	"	451 "
65°	"	485 "
66°	"	538 "

Per cent 60°	Pounds 60° in 1 cu. ft.	Per cent 50°	Pounds 50° in 1 cu. ft
61.93	53.34	77.36	66.63
63.69	55.39	79.56	69.19
65.50	57.50	81.81	71.83
67.28	59.66	84.05	74.53
69.09	61.86	86.30	77.27
70.90	64.12	88.56	80.10
72.72	66.43	90.83	82.98
74.55	68.79	93.12	85.93
76.37	71.20	95.40	88.94
78.22	73.68	97.70	92.03

SULPHURIC ACID (Continued)

FIXED POINTS

Sp. gr.	Per cent H_2SO_4	Sp. gr.	Per cent H_2SO_4
1.0000	.00	1.5281	62.34
1.0048	.71	1.5440	63.79
1.0347	5.14	1.5748	66.51
1.0649	9.48	1.6272	71.00
1.0992	14.22	1.6679	74.46
1.1353	19.04	1.7044	77.54
1.1736	23.94	1.7258	79.40
1.2105	28.55	1.7472	81.32
1.2513	33.49	1.7700	83.47
1.2951	38.64	1.7959	86.36
1.3441	44.15	1.8117	88.53
1.3947	49.52	1.8194	89.75
1.4307	53.17	1.8275	91.32
1.4667	56.68	1.8354	93.19
1.4822	58.14		

Per cent 60°	Pounds 60° in 1 cu. ft.	Per cent 50°	Pounds 50° in 1 cu. ft.
80.06	76.21	100.00	95.20
81.96	78.85	102.38	98.50
83.86	81.54	104.74	101.85
85.79	84.33	107.15	105.33
87.72	87.17	109.57	108.89
89.67	90.10	112.01	112.55
91.63	93.11	114.46	116.30
93.67	96.26	117.00	120.24
95.74	99.52	119.59	124.31
97.84	102.89	122.21	128.52
100.00	106.40	124.91	132.91
102.27	110.10	127.74	137.52
104.67	114.05	130.75	142.47
107.30	118.34	134.03	147.82
110.29	123.14	137.76	153.81
111.15	124.49	138.84	155.50
112.06	125.89	139.98	157.25
113.05	127.40	141.22	159.14
114.14	129.03	142.57	161.17
115.30	130.75	144.02	163.32
116.65	132.70	145.71	165.76
118.19	134.88	147.63	168.48
119.98	137.34	149.87	171.56

ALLOWANCE FOR TEMPERATURE

At 10° Bé. .029° Bé. or .00023 Sp. Gr. = 1° F.
At 20° Bé. .036° Bé. or .00034 Sp. Gr. = 1° F.
At 30° Bé. .035° Bé. or .00039 Sp. Gr. = 1° F.
At 40° Bé. .031° Bé. or .00041 Sp. Gr. = 1° F.
At 50° Bé. .028° Bé. or .00045 Sp. Gr. = 1° F.
At 60° Bé. .026° Bé. or .00053 Sp. Gr. = 1° F.
At 63° Bé. .026° Bé. or .00057 Sp. Gr. = 1° F.
At 66° Bé. .0235° Bé. or .00054 Sp. Gr. = 1° F.

NITRIC ACID

Authority — W. C. Ferguson

This table has been approved and adopted as a Standard by the Manufacturing Chemists' Association of the United States.

Specific Gravity determinations were made at 60° F., compared with water at 60° F.

From the Specific Gravities, the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = 145 - \frac{145}{\text{Sp. Gr.}}.$$

Baumé Hydrometers for use with this table must be graduated by the above formula, which formula should *always* be printed on the scale.

Atomic weights from F. W. Clarke's table of 1901. O = 16.

Allowance for Temperature

At 10°–20° Bé.	— 1/30° Bé. or .00029	Sp. Gr.	= 1° F.
20°–30° Bé.	— 1/23° Bé. or .00044	" "	= 1° F.
30°–40° Bé.	— 1/20° Bé. or .00060	" "	= 1° F.
40°–48.5° Bé.	— 1/17° Bé. or .00084	" "	= 1° F.

Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.	Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.
10.00	1.0741	14.82	12.86	15.25	1.1176	23.52	19.70
10.25	1.0761	15.22	13.18	15.50	1.1197	23.94	20.02
10.50	1.0781	15.62	13.49	15.75	1.1219	24.38	20.36
10.75	1.0801	16.02	13.81	16.00	1.1240	24.80	20.69
11.00	1.0821	16.42	14.13	16.25	1.1262	25.24	21.03
11.25	1.0841	16.82	14.44	16.50	1.1284	25.68	21.36
11.50	1.0861	17.22	14.76	16.75	1.1306	26.12	21.70
11.75	1.0881	17.62	15.07	17.00	1.1328	26.56	22.04
12.00	1.0902	18.04	15.41	17.25	1.1350	27.00	22.38
12.25	1.0922	18.44	15.72	17.50	1.1373	27.46	22.74
12.50	1.0943	18.86	16.05	17.75	1.1395	27.90	23.08
12.75	1.0964	19.28	16.39	18.00	1.1417	28.34	23.42
13.00	1.0985	19.70	16.72	18.25	1.1440	28.80	23.77
13.25	1.1006	20.12	17.05	18.50	1.1462	29.24	24.11
13.50	1.1027	20.54	17.38	18.75	1.1485	29.70	24.47
13.75	1.1048	20.96	17.71	19.00	1.1508	30.16	24.82
14.00	1.1069	21.38	18.04	19.25	1.1531	30.62	25.18
14.25	1.1090	21.80	18.37	19.50	1.1554	31.08	25.53
14.50	1.1111	22.22	18.70	19.75	1.1577	31.54	25.88
14.75	1.1132	22.64	19.02	20.00	1.1600	32.00	26.24
15.00	1.1154	23.08	19.36	20.25	1.1624	32.48	26.61

NITRIC ACID (Continued)

Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.	Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.
20.50	1.1647	32.94	26.96	31.50	1.2775	55.50	43.89
20.75	1.1671	33.42	27.33	31.75	1.2804	56.08	44.34
21.00	1.1694	33.88	27.67	32.00	1.2832	56.64	44.78
21.25	1.1718	34.36	28.02	32.25	1.2861	57.22	45.24
21.50	1.1741	34.82	28.36	32.50	1.2889	57.78	45.68
21.75	1.1765	35.30	28.72	32.75	1.2918	58.36	46.14
22.00	1.1789	35.78	29.07	33.00	1.2946	58.92	46.58
22.25	1.1813	36.26	29.43	33.25	1.2975	59.50	47.04
22.50	1.1837	36.74	29.78	33.50	1.3004	60.08	47.49
22.75	1.1861	37.22	30.14	33.75	1.3034	60.68	47.95
23.00	1.1885	37.70	30.49	34.00	1.3063	61.26	48.42
23.25	1.1910	38.20	30.86	34.25	1.3093	61.86	48.90
23.50	1.1934	38.68	31.21	34.50	1.3122	62.44	49.35
23.75	1.1959	39.18	31.58	34.75	1.3152	63.04	49.83
24.00	1.1983	39.66	31.94	35.00	1.3182	63.64	50.32
24.25	1.2008	40.16	32.31	35.25	1.3212	64.24	50.81
24.50	1.2033	40.66	32.68	35.50	1.3242	64.84	51.30
24.75	1.2058	41.16	33.05	35.75	1.3273	65.46	51.80
25.00	1.2083	41.66	33.42	36.00	1.3303	66.06	52.30
25.25	1.2109	42.18	33.80	36.25	1.3334	66.68	52.81
25.50	1.2134	42.68	34.17	36.50	1.3364	67.28	53.32
25.75	1.2160	43.20	34.56	36.75	1.3395	67.90	53.84
26.00	1.2185	43.70	34.94	37.00	1.3426	68.52	54.36
26.25	1.2211	44.22	35.33	37.25	1.3457	69.14	54.89
26.50	1.2236	44.72	35.70	37.50	1.3488	69.76	55.43
26.75	1.2262	45.24	36.09	37.75	1.3520	70.40	55.97
27.00	1.2288	45.76	36.48	38.00	1.3551	71.02	56.52
27.25	1.2314	46.28	36.87	38.25	1.3583	71.66	57.08
27.50	1.2340	46.80	37.26	38.50	1.3615	72.30	57.65
27.75	1.2367	47.34	37.67	38.75	1.3647	72.94	58.23
28.00	1.2393	47.86	38.06	39.00	1.3679	73.58	58.82
28.25	1.2420	48.40	38.46	39.25	1.3712	74.24	59.43
28.50	1.2446	48.92	38.85	39.50	1.3744	74.88	60.06
28.75	1.2473	49.46	39.25	39.75	1.3777	75.54	60.71
29.00	1.2500	50.00	39.66	40.00	1.3810	76.20	61.38
29.25	1.2527	50.54	40.06	40.25	1.3843	76.86	62.07
29.50	1.2554	51.08	40.47	40.50	1.3876	77.52	62.77
29.75	1.2582	51.64	40.89	40.75	1.3909	78.18	63.48
30.00	1.2609	52.18	41.30	41.00	1.3942	78.84	64.20
30.25	1.2637	52.74	41.72	41.25	1.3976	79.52	64.93
30.50	1.2664	53.28	42.14	41.50	1.4010	80.20	65.67
30.75	1.2692	53.84	42.58	41.75	1.4044	80.88	66.42
31.00	1.2719	54.38	43.00	42.00	1.4078	81.96	67.18
31.25	1.2747	54.94	43.44	42.25	1.4112	82.24	67.95

NITRIC ACID (Continued)

Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.	Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.
42.50	1.4146	82.92	68.73	45.50	1.4573	91.46	79.03
42.75	1.4181	83.62	69.52	45.75	1.4610	92.20	80.04
43.00	1.4216	84.32	70.33	46.00	1.4646	92.92	81.08
43.25	1.4251	85.02	71.15	46.25	1.4684	93.68	82.18
43.50	1.4286	85.72	71.98	46.50	1.4721	94.42	83.33
43.75	1.4321	86.42	72.82	46.75	1.4758	95.16	84.48
44.00	1.4356	87.12	73.67	47.00	1.4796	95.92	85.70
44.25	1.4392	87.84	74.53	47.25	1.4834	96.68	86.98
44.50	1.4428	88.56	75.40	47.50	1.4872	97.44	88.32
44.75	1.4464	89.28	76.28	47.75	1.4910	98.20	89.76
45.00	1.4500	90.00	77.17	48.00	1.4948	98.96	91.35
45.25	1.4536	90.72	78.07	48.25	1.4987	99.74	93.13
				48.50	1.5026	100.52	95.11

HYDROCHLORIC ACID

Authority — W. C. Ferguson

This table has been approved and adopted as a standard by the Manufacturing Chemists' Association of the United States.

Specific Gravity determinations were made at 60° F., compared with water at 60° F.

From the Specific Gravities, the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = 145 - \frac{\text{Sp. Gr.}}{145}.$$

Baumé Hydrometers for use with this table must be graduated by the above formula which formula should *always* be printed on the scale.

Atomic weights from F. W. Clarke's table of 1901. O = 16.

Allowance for Temperature

10° – 15° Bé. — 1/40° Bé. or .0002 Sp. Gr. for 1° F.
15° – 22° Bé. — 1/30° Bé. or .0003 " " " 1° F.
22° – 25° Bé. — 1/28° Bé. or .00035 " " " 1° F.

Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.	Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.
1.00	1.0069	1.38	1.40	10.25	1.0761	15.22	15.22
2.00	1.0140	2.80	2.82	10.50	1.0781	15.62	15.62
3.00	1.0211	4.22	4.25	10.75	1.0801	16.02	16.01
4.00	1.0284	5.68	5.69	11.00	1.0821	16.42	16.41
5.00	1.0357	7.14	7.15	11.25	1.0841	16.82	16.81
5.25	1.0375	7.50	7.52	11.50	1.0861	17.22	17.21
5.50	1.0394	7.88	7.89	11.75	1.0881	17.62	17.61
5.75	1.0413	8.26	8.26	12.00	1.0902	18.04	18.01
6.00	1.0432	8.64	8.64	12.25	1.0922	18.44	18.41
6.25	1.0450	9.00	9.02	12.50	1.0943	18.86	18.82
6.50	1.0469	9.38	9.40	12.75	1.0964	19.28	19.22
6.75	1.0488	9.76	9.78	13.00	1.0985	19.70	19.63
7.00	1.0507	10.14	10.17	13.25	1.1006	20.12	20.04
7.25	1.0526	10.52	10.55	13.50	1.1027	20.54	20.45
7.50	1.0545	10.90	10.94	13.75	1.1048	20.96	20.86
7.75	1.0564	11.28	11.32	14.00	1.1069	21.38	21.27
8.00	1.0584	11.68	11.71	14.25	1.1090	21.80	21.68
8.25	1.0603	12.06	12.09	14.50	1.1111	22.22	22.09
8.50	1.0623	12.46	12.48	14.75	1.1132	22.64	22.50
8.75	1.0642	12.84	12.87	15.00	1.1154	23.08	22.92
9.00	1.0662	13.24	13.26	15.25	1.1176	23.52	23.33
9.25	1.0681	13.62	13.65	15.50	1.1197	23.94	23.75
9.50	1.0701	14.02	14.04	15.75	1.1219	24.38	24.16
9.75	1.0721	14.42	14.43	16.0	1.1240	24.80	24.57
10.00	1.0741	14.82	14.83	16.1	1.1248	24.96	24.73

HYDROCHLORIC ACID (Continued)

Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.	Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.
16.2	1.1256	25.12	24.90	20.9	1.1684	33.68	33.12
16.3	1.1265	25.30	25.06	21.0	1.1694	33.88	33.31
16.4	1.1274	25.48	25.23	21.1	1.1703	34.06	33.50
16.5	1.1283	25.66	25.39	21.2	1.1713	34.26	33.69
16.6	1.1292	25.84	25.56	21.3	1.1722	34.44	33.88
16.7	1.1301	26.02	25.72	21.4	1.1732	34.64	34.07
16.8	1.1310	26.20	25.89	21.5	1.1741	34.82	34.26
16.9	1.1319	26.38	26.05	21.6	1.1751	35.02	34.45
17.0	1.1328	26.56	26.22	21.7	1.1760	35.20	34.64
17.1	1.1336	26.72	26.39	21.8	1.1770	35.40	34.83
17.2	1.1345	26.90	26.56	21.9	1.1779	35.58	35.02
17.3	1.1354	27.08	26.73	22.0	1.1789	35.78	35.21
17.4	1.1363	27.26	26.90	22.1	1.1798	35.96	35.40
17.5	1.1372	27.44	27.07	22.2	1.1808	36.16	35.59
17.6	1.1381	27.62	27.24	22.3	1.1817	36.34	35.78
17.7	1.1390	27.80	27.41	22.4	1.1827	36.54	35.97
17.8	1.1399	27.98	27.58	22.5	1.1836	36.72	36.16
17.9	1.1408	28.16	27.75	22.6	1.1846	36.92	36.35
18.0	1.1417	28.34	27.92	22.7	1.1856	37.12	36.54
18.1	1.1426	28.52	28.09	22.8	1.1866	37.32	36.73
18.2	1.1435	28.70	28.26	22.9	1.1875	37.50	36.93
18.3	1.1444	28.88	28.44	23.0	1.1885	37.70	37.14
18.4	1.1453	29.06	28.61	23.1	1.1895	37.90	37.36
18.5	1.1462	29.24	28.78	23.2	1.1904	38.08	37.58
18.6	1.1471	29.42	28.95	23.3	1.1914	38.28	37.80
18.7	1.1480	29.60	29.13	23.4	1.1924	38.48	38.03
18.8	1.1489	29.78	29.30	23.5	1.1934	38.68	38.26
18.9	1.1498	29.96	29.48	23.6	1.1944	38.88	38.49
19.0	1.1508	30.16	29.65	23.7	1.1953	39.06	38.72
19.1	1.1517	30.34	29.83	23.8	1.1963	39.26	38.95
19.2	1.1526	30.52	30.00	23.9	1.1973	39.46	39.18
19.3	1.1535	30.70	30.18	24.0	1.1983	39.66	39.41
19.4	1.1544	30.88	30.35	24.1	1.1993	39.86	39.64
19.5	1.1554	31.08	30.53	24.2	1.2003	40.06	39.86
19.6	1.1563	31.26	30.71	24.3	1.2013	40.26	40.09
19.7	1.1572	31.44	30.90	24.4	1.2023	40.46	40.32
19.8	1.1581	31.62	31.08	24.5	1.2033	40.66	40.55
19.9	1.1590	31.80	31.27	24.6	1.2043	40.86	40.78
10.0	1.1600	32.00	31.45	24.7	1.2053	41.06	41.01
20.1	1.1609	32.18	31.64	24.8	1.2063	41.26	41.24
20.2	1.1619	32.38	31.82	24.9	1.2073	41.46	41.48
20.3	1.1628	32.56	32.01	25.0	1.2083	41.66	41.72
20.4	1.1637	32.74	32.19	25.1	1.2093	41.86	41.99
20.5	1.1647	32.94	32.38	25.2	1.2103	42.06	42.30
20.6	1.1656	33.12	32.56	25.3	1.2114	42.28	42.64
20.7	1.1666	33.32	32.75	25.4	1.2124	42.48	43.01
20.8	1.1675	33.50	32.93	25.5	1.2134	42.68	43.40

AQUA AMMONIA

Authority — W. C. Ferguson

This table has been approved and adopted as a standard by the Manufacturing Chemists' Association of the United States.

Specific Gravity determinations were made at 60° F., compared with water at 60° F.

From the Specific Gravities, the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = \frac{140}{\text{Sp. Gr.}} - 130.$$

Baumé Hydrometers for use with this table must be graduated by the above formula, which formula should *always* be printed on the scale.

Atomic weights from F. W. Clarke's table of 1901. O = 16.

Allowance for Temperature

The coefficient of expansion for Ammonia Solutions varying with the temperature, correction must be applied according to the following table:

	Corrections to be added for each degree below 60° F.		Corrections to be subtracted for each degree above 60° F.			
Degrees Baumé	40° F.	50° F.	70° F.	80° F.	90° F.	100° F.
14	0.015 Bé.	0.017 Bé.	0.020 Bé.	0.022 Bé.	0.024 Bé.	0.026 Bé.
16	0.021 "	0.023 "	0.026 "	0.028 "	0.030 "	0.032 "
18	0.027 "	0.029 "	0.031 "	0.033 "	0.035 "	0.037 "
20	0.033 "	0.036 "	0.037 "	0.038 "	0.040 "	0.042 "
22	0.039 "	0.042 "	0.043 "	0.045 "	0.047 "	
26	0.053 "	0.057 "	0.057 "	0.059 "		

Bé.°	Sp. gr.	Per cent NH_3.	Bé.°	Sp. gr.	Per cent NH_3.
10.00	1.0000	0.00	12.25	0.9842	3.73
10.25	0.9982	0.40	12.50	0.9825	4.16
10.50	0.9964	0.80	12.75	0.9807	4.59
10.75	0.9947	1.21	13.00	0.9790	5.02
11.00	0.9929	1.62	13.25	0.9773	5.45
11.25	0.9912	2.04	13.50	0.9756	5.88
11.50	0.9894	2.46	13.75	0.9739	6.31
11.75	0.9876	2.88	14.00	0.9722	6.74
12.00	0.9859	3.30	14.25	0.9705	7.17

AQUA AMMONIA (Continued)

Be.°	Sp. Gr.	Per cent NH_3.	Be.°	Sp. gr.	Per cent NH_3.
14.50	0.9689	7.61	22.00	0.9211	21.60
14.75	0.9672	8.05	22.25	0.9195	22.08
15.00	0.9655	8.49	22.50	0.9180	22.56
15.25	0.9639	8.93	22.75	0.9165	23.04
15.50	0.9622	9.38	23.00	0.9150	23.52
15.75	0.9605	9.83	23.25	0.9135	24.01
16.00	0.9589	10.28	23.50	0.9121	24.50
16.25	0.9573	10.73	23.75	0.9106	24.99
16.50	0.9556	11.18	24.00	0.9091	25.48
16.75	0.9540	11.64	24.25	0.9076	25.97
17.00	0.9524	12.10	24.50	0.9061	26.46
17.25	0.9508	12.56	24.75	0.9047	26.95
17.50	0.9492	13.02	25.00	0.9032	27.44
17.75	0.9475	13.49	25.25	0.9018	27.93
18.00	0.9459	13.96	25.50	0.9003	28.42
18.25	0.9444	14.43	25.75	0.8989	28.91
18.50	0.9428	14.90	26.00	0.8974	29.40
18.75	0.9412	15.37	26.25	0.8960	29.89
19.00	0.9396	15.84	26.50	0.8946	30.38
19.25	0.9380	16.32	26.75	0.8931	30.87
19.50	0.9365	16.80	27.00	0.8917	31.36
19.75	0.9349	17.28	27.25	0.8903	31.85
20.00	0.9333	17.76	27.50	0.8889	32.34
20.25	0.9318	18.24	27.75	0.8875	32.83
20.50	0.9302	18.72	28.00	0.8861	33.32
20.75	0.9287	19.20	28.25	0.8847	33.81
21.00	0.9272	19.68	28.50	0.8833	34.30
21.25	0.9256	20.16	28.75	0.8819	34.79
21.50	0.9241	20.64	29.00	0.8805	35.28
21.75	0.9226	21.12			

SPECIFIC GRAVITY OF GASES AND VAPORS

Name	Formula	Mol. wt.	Mass of 1 liter in g. 760mm. 0° C.	Density, air = 1		Density, O = 1	
				Observed	Computed	Observed	Theoret.
Acetylene	C_2H_2	26.02	1.1708	0.9056	0.9056	0.8193	0.8133
Air	......	......	1.2928	......	1.0000	......	......
Ammonia	NH_3	17.03	0.7708	0.5962	0.5963	0.5394	0.5321
Argon	A	39.88	1.7828	1.379	1.378	1.248	1.247
Bromine	Br_2	159.84	7.1388	5.524	5.524	......	......
Butane	C_4H_{10}	58.08	2.5985	2.01	......	1.82	1.8155
Carbon dioxide	CO_2	44.	1.9768	1.5288	1.5289	1.3832	1.3766
monoxide	CO	28.	1.2501	0.9670	0.9670	0.8749	0.8752
oxychloride	$COCl_2$	98.92	4.5313	3.505	......	3.171	3.0914
oxysulphide	COS	60.07	2.7201	2.104	......	1.904	1.8786
Chlorine	Cl_2	70.92	3.2204	2.491	2.4906	2.254	2.2162
monoxide	Cl_2O	86.92	3.8874	3.007	......	2.72	2.716
Cyanogen	C_2N_2	52.02	2.3348	1.806	1.8353	1.634	1.6257
Ethane	C_2H_6	30.05	1.3567	1.0494	1.0496	0.9494	0.9392
Ethyl chloride	C_2H_5Cl	64.49	2.8700	2.22	2.257	2.01	2.0159
Ethylene	C_2H_4	28.03	1.2644	0.978	0.9753	0.885	0.8762
Fluorine	F_2	38.	1.6354	1.265	......	1.145	1.187
Helium	He	4.00	0.1769	0.1368	......	0.1238	0.125
Hydrochloric acid	HCl	36.47	1.6394	1.2681	1.2683	1.1473	1.1396
Hydrofluoric acid	HF	20.01	0.9218	0.713	......	0.645	0.625
Hydriodic acid	HI	127.93	5.7245	4.428	......	4.01	4.029
Hydrogen	H_2	2.016	0.08982	0.06948	0.06949	0.06286	0.06297
selenide	H_2Se	81.21	3.6134	2.795	2.850	2.529	2.538
sulphide	H_2S	34.08	1.5392	1.1895	1.1773	.....	....
telluride	H_2Te	129.52	5.8034	4.489	......	4.062	4.066
Krypton	Kr	82.92	3.6431	2.818	2.832	2.550	2.556
Methane	CH_4	16.03	0.7167	0.5544	0.5544	0.5016	0.5011
Methyl chloride	CH_3Cl	50.48	2.3044	1.7825	1.785	1.6127	1.578
Neon	Ne	20.20	0.8713	0.674	......	0.610	0.625
Nitric oxide	NO	30.01	1.3401	1.0366	1.0366	0.9297	0.9391
Nitrous oxide	N_2O	44.02	1.9781	1.5301	1.5303	1.3844	1.3754
Nitrosyl chloride	NOCl	65.47	2.9864	2.31	......	2.09	2.046
Oxygen	O_2	32.	1.4289	1.1053	1.1053	1.000	1.0000
Phosphine	PH_3	34.06	1.5293	1.1829	1.1830	1.0702	1.063
Silicon fluoride	SiF_4	104.30	4.6541	3.60	......	3.26	3.259
Sulphur dioxide	SO_2	64.07	2.9268	2.2639	2.2638	2.0482	2.0034
Xenon	X	130.2	5.7168	4.422	4.506	4.001	4.00

DEHYDRATION OF METALLIC SULPHATES

Metallic sulphates.	Temp. of beginning of decomposition, °C.	Products formed.	Color of products.
$CaSO_4.2H_2O$	38	$CaSO_4.H_2O$	White
$CaSO_4.H_2O$	80	$2CaSO_4.H_2O$	White
$2CaSO_4.H_2O$	149	$CaSO_4$	White
$MgSO_4.7H_2O$	19	$MgSO_4.6H_2O$	White
$MgSO_4.6H_2O$	38	$MgSO_4.2H_2O$	White
$MgSO_4.2H_2O$	112	$MgSO_4.H_2O$	White
$MgSO_4.H_2O$	203	$MgSO_4$	White
$CdSO_4.\frac{8}{3}H_2O$	30	$CdSO_4.2H_2O$	White
$CdSO_4.2H_2O$	41	$CdSO_4.H_2O$	White
$CdSO_4.H_2O$	170	$CdSO_4$	White
$CoSO_4.7H_2O$	14	$CoSO_4.4H_2O$	Rose
$CoSO_4.4H_2O$	58	$CoSO_4.H_2O$	Lilac
$CoSO_4.H_2O$	276	$CoSO_4$	Lilac
$NiSO_4.7H_2O$	40	$NiSO_4.4H_2O$	Green
$NiSO_4.4H_2O$	106	$NiSO_4.H_2O$	Yellow
$NiSO_4.H_2O$	279	$NiSO_4$	Orange
$ZnSO_4.7H_2O$	25	$ZnSO_4.6H_2O$	White
$ZnSO_4.6H_2O$	28	$ZnSO_4.2H_2O$	White
$ZnSO_4.2H_2O$	115	$ZnSO_4.H_2O$	White
$ZnSO_4.H_2O$	225	$ZnSO_4$	White
$MnSO_4.5H_2O$	25	$MnSO_4.2H_2O$	Pale peach blossom
$MnSO_4.2H_2O$	60	$MnSO_4.H_2O$	Paler than above
$MnSO_4.H_2O$	152	$MnSO_4$	Paler than above
$CuSO_4.5H_2O$	27	$CuSO_4.3H_2O$	Blue
$CuSO_4.3H_2O$	93	$CuSO_4.H_2O$	Pale blue
$CuSO_4.H_2O$	155	$CuSO_4$	White
$Al_2(SO_4)_3.16H_2O$	51	$Al_2(SO_4)_3.13H_2O$	White
$Al_2(SO_4)_3.13H_2O$	82	$Al_2(SO_4)_3.10H_2O$	White
$Al_2(SO_4)_3.10H_2O$	97	$Al_2(SO_4)_3.7H_2O$	White
$Al_2(SO_4)_3.7H_2O$	109	$Al_2(SO_4)_3.4H_2O$	White
$Al_2(SO_4)_3.4H_2O$	180	$Al_2(SO_4)_3.H_2O$	White
$Al_2(SO_4)_3.H_2O$	316	$Al_2(SO_4)_3$	White
$FeSO_4.7H_2O$	21	$FeSO_4.4H_2O$	Light apple green
$FeSO_4.4H_2O$	80	$FeSO_4.H_2O$	White
$FeSO_4.H_2O$	406	Fe_2O_3, SO_3	Yellowish green

DECOMPOSITION OF ANHYDROUS METALLIC SULPHATES

Metallic sulphate.	Temp. at beginning of decomposition, ° C.	Temp. of energetic decomposition, ° C.	Products of decomposition.	Color of product.
$FeSO_4$	167	480	Fe_2O_3, $2SO_4$	Yellow brown
Fe_2O_3, $2SO_3$	492	560	Fe_2O_3	Red
$Bi_2(SO_4)_3$	570	639	$5Bi_2O_3$, $4(SO_3)_3$	White
$Al_2(SO_4)_3$	590	639	Al_2O_3	White
$PbSO_4$	637	705	$6PbO$, $5SO_3$	White
$CuSO_4$	653	670	$2CuO$, SO_3	Orange
$MnSO_4$	699	790	Mn_3O_4	Dark red to black
$ZnSO_4$	702	720	$3ZnO$, $2SO_3$	White
$2CuO$, SO_3	702	736	CuO	Black
$NiSO_4$	703	764	NiO	Brownish green
$CoSO_4$	720	770	CoO	Brown to black
$3ZnO$, $2SO_3$	755	767	ZnO	White
$CdSO_4$	827	846	$5CdO$, SO_3	White
$5Bi_2O_3$, $4(SO_3)_3$	870	890	Bi_2O_3(?)	Yellow
$5CdO$, SO_3	878	890	CdO	Brown
$MgSO_4$	890	972	MgO	White
Ag_2SO_4	917	925	Ag	Silver white
$6PbO$, $5SO_3$	952	962	$2PbO$, SO_3(?)	White to yellow
$CaSO_4$	1200	....	CaO	White
$BaSO_4$	1510	....	BaO	White

DEGREE OF IONIZATION

In Normal Solution at 18° Unless Indicated

Acids

Nitric acid	0.82	† Permanganic acid	0.933
Hydrochloric acid	0.784	† Hydriodic acid	0.901
Sulfuric acid	0.510	† Hydrobromic acid	0.899
Hydrofluoric acid	0.070	† Perchloric acid	0.880
* Oxalic acid	0.500	† Chloric acid	0.878
* Tartaric acid	0.082	† Hydrochloric acid	0.876
* Acetic acid	0.004	† Phosphoric acid	0.170
* Carbonic acid	0.0017		
* Hydrogen sulfide	0.0007		
* Boric acid	0.0001		
* Hydrocyanic acid	0.0001		

* In 0.1 M. solution; primary ionization.
† In N/2 solution, at 25°.

Bases

Potassium hydroxide	0.77	‡ Strontium hydroxide	0.93
Sodium hydroxide	0.73	‡ Barium hydroxide	0.92
Barium hydroxide	0.69	‡ Calcium hydroxide	0.90
Lithium hydroxide	0.63		
Ammonium hydroxide	0.004		
Tetramethyl ammonium hydroxide	0.96		

‡ In N/64 solution, at 25°.

Salts

Approximate degree of ionization for active salts in N/10 solution:

Type R^+R^- (e.g. KCl)	0.86
Type $R^{+}\ (R^-)_2$ (e.g. $BaCl_2$)	0.72
Type $(R^+)_2R^{--}$ (e.g. K_2SO_4)	0.72
Type $R^{++}\ R^{--}$ (e.g. $BaSO_4$)	0.45

SOLUBILITY PRODUCT

The solubility product (or ion product constant) is the product of the concentrations of the ions in the saturated solution of a difficultly soluble salt. The concentrations are expressed as moles per liter of solution. The number of cations (or anions) resulting from the dissociation of one molecule of the salt, appears in the formula for calculations of the solubility product as the exponent of the concentration of the cation (or anion).

If two solutions, each containing one of the ions of a difficultly soluble salt, are mixed, no precipitation takes place unless the product of the ion concentrations in the mixture is greater than the solubility product.

In a solution containing two salts which yield a common ion the ratio of solubilities of the two salts is the ratio of the solubility products.

Substance	Solubility product at temperature noted	Substance	Solubility product at temperature noted
Barium carbonate	1.9×10^{-9} (16°)	Manganese sulfide	1.4×10^{-15} (18°)
Barium chromate	2.4×10^{-10} (28°)	Nickel sulfide	1.4×10^{-24} (18°)
Barium oxalate	1.2×10^{-7} (25°)	Lead carbonate	3.3×10^{-14} (18°)
Barium sulfate	1.0×10^{-10} (25°)	Lead chromate	1.77×10^{-14} (18°)
Calcium carbonate	2.8×10^{-9} (16°)	Lead oxalate	3.5×10^{-11} (25°)
Calcium oxalate	2.5×10^{-7} (25°)	Lead sulfate	1.0×10^{-8} (18°)
Calcium sulfate	6.0×10^{-5} (18°)	Lead sulfide	3.4×10^{-28} (18°)
Cadmium sulfide	3.6×10^{-29} (18°)	Silver chloride	1.5×10^{-10} (25°)
Cobalt sulfide	3.0×10^{-26} (18°)	Silver bromide	4.4×10^{-13} (25°)
Cupric sulfide	8.5×10^{-45} (18°)	Silver iodide	9.0×10^{-17} (25°)
Ferrous sulfide	3.7×10^{-19} (18°)	Silver bromate	5.77×10^{-5} (25°)
Mercurous chloride	3.5×10^{-18} (25°)	Silver chromate	2.6×10^{-12} (25°)
Mercurous bromide	1.3×10^{-21} (21°)	Silver iodate	3.4×10^{-8} (25°)
Mercurous iodide	1.2×10^{-28} (25°)	Silver sulfide	1.6×10^{-49} (18°)
Mercuric sulfide	4×10^{-54} (25°)	Silver thiocyanate	1.1×10^{-12} (25°)
Magnesium carbonate	2.6×10^{-5} (12°)	Strontium oxalate	5.6×10^{-8} (18°)
Magnesium oxalate	8.5×10^{-5} (18°)	Strontium sulfate	2.8×10^{-7} (18°)
Magnesium ammonium phosphate	2.5×10^{-13} (18°)	Zinc sulfide	1.2×10^{-23} (25°)

DISSOCIATION CONSTANTS OF ACIDS

Name	Formula	Constant for the first hydrogen	Temp. °C.	Constant for the second hydrogen	Temp. °C.
Acetic	CH_3COOH	1.8×10^{-5}	25		
Arsenious	H_3AsO_3	6×10^{-10}	25		
Arsenic	H_3AsO_4	5×10^{-3}	25		
Benzoic	C_6H_5COOH	6×10^{-5}	25		
Boric	H_3BO_3	5×10^{-10}	15		
Butyric	$CH_3(CH_2)_2COOH$	1.5×10^{-5}	25		
Carbonic	H_2CO_3	3×10^{-7}	18	3×10^{-11}	
Chromic	H_2CrO_4	....	.....	6×10^{-7}	
Dichlor acetic	$CHCl_2COOH$	5.1×10^{-2}			
Formic	$HCOOH$	2.14×10^{-4}			
Hydrocyanic	HCN	7×10^{-10}			
Hydro-sulfuric	H_2S	9×10^{-8}	18	1×10^{-15}	
Hypo-chlorous	$HClO$	3.7×10^{-8}	17		
Lactic	$CH_3CHOHCOOH$	1.4×10^{-4}	25		
Malonic	$CH_2(COOH)_2$	1.6×10^{-3}	25	2.1×10^{-6}	25
Monochlor acetic	$CH_2ClCOOH$	1.55×10^{-3}			
Nitrous	HNO_2	4×10^{-4}	25		
Oxalic	$(COOH)_2$	3.8×10^{-2}	25	4.9×10^{-5}	25
Phenol	C_6H_5OH	1.1×10^{-10}			
Phosphoric	H_3PO_4	1.1×10^{-2}	25	2×10^{-7}	
Propionic	CH_3CH_2COOH	1.4×10^{-5}	25		
Sulfuric	H_2SO_4	....	.....	3×10^{-2}	25
Sulfurous	H_2SO_3	1.7×10^{-2}	25	5×10^{-6}	25
Succinic	$C_2H_4(COOH)_2$				
Trichlor acetic	CCl_3COOH	3×10^{-1}	18		

DISSOCIATION CONSTANTS OF BASES

Name	Formula	Constant	Temp. °C
Ammonium hydroxide	NH_4OH	1.8×10^{-5}	25
Aniline	$C_6H_5NH_2$	3.5×10^{-10}	18
Dimethyl-aniline	$C_6H_5N(CH_3)_2$	2.4×10^{-10}	18
Ethylamine	$C_2H_5NH_2$	5.6×10^{-4}	25
Methylamine	CH_3NH_2	5×10^{-4}	25
Monomethyl-aniline	$C_6H_5NHCH_3$	7.4×10^{-9}	60
Silver hydroxide	$AgOH$	1.1×10^{-4}	25

ELECTROMOTIVE FORCE SERIES OF METALS

Alkali...Cs.Rb.K.Na.Li...		
Alkaline-earth..Ba.Sr.Ca..		
Magnesium	Mg	
Aluminum	Al	1.276
Manganese	Mn	1.075
Zinc	Zn	0.770
Chromium	Cr	
Cadmium	Cd	0.420
Iron	Fe	0.340
Cobalt	Co	0.232
Nickel	Ni	0.228
Tin	Sn	0.192
Lead	Pb	0.148
Hydrogen	(H)	0.000
Copper	Cu	0.336
Arsenic	As	
Bismuth	Bi	
Antimony	Sb	
Mercury	Hg	0.748
Silver	Ag	0.771
Palladium	Pd	
Platinum	Pt	0.863
Gold	Au	1.079

1. Any metal will replace any other metal, *below it* in the series, thus:

$Fe + CuSO_4$	$= FeSO_4 + Cu$	
$Zn + FeSO_4$	$= ZnSO_4 + Fe$	
$Fe + 2HCl$	$= FeCl_2 + H_2$	
$Zn + H_2SO_4$	$= ZnSO_4 + H_2$	
$Cu + HCl$	= No action.	Cu insoluble.
$Ag + HCl$	= No action.	Ag insoluble.
Cu + (dilute) H_2SO_4	= No action.	
$Ag + CuSO_4$	= No action.	Ag below Cu.

Note.—It is true that dilute and conc. HNO_3 and *hot conc.* H_2SO_4 will dissolve most of the metals. When they thus dissolve metals below hydrogen in the series, the action is an oxidizing one, and the acids are reduced to NO and SO_2 respectively. The metal is first oxidized to the oxide, the acid being thus at the same time reduced, and the oxide thus formed then reacts with the acid molecule present, and goes into solution as a salt.

(*a*) Cu + (dilute) $H_2\ SO_4$ = No action.
(*b*) Cu + 2 (hot conc.) $H_2SO_4 = CuSO_4 + SO_2 + 2H_2O$.

In (*b*), the Cu is first converted to CuO, thus

$$Cu + H_2SO_4 = CuO + H_2O + SO_2,$$

then the CuO reacts with another molecule of H_2SO_4, thus

$$CuO + H_2SO_4 = CuSO_4 + H_2O.$$
$$3Cu + 2HNO_3 = 3CuO + 2NO + H_2O$$
$$3CuO + 6HNO_3 = 3Cu(NO_3)_2 + 3H_2O$$

Added $$3Cu + 8HNO_3 = 3Cu(NO_3)_2 + 2NO + 4H_2O.$$

2. **In Regard to Ease of Reduction of Oxides.**—The metallic oxides down to and including Mn can not be completely reduced to the metal state, even in a current of hydrogen. The oxides of Cd and succeeding metals are easily reduced, and far down the list, the oxides of silver, platinum, mercury, and gold are reduced (decomposed into metal and oxygen) even by heat alone.

3. **In Regard to Ease of Rusting. (Oxidation in the Air.)**—The alkali and alkaline-earth metals rust very rapidly and with considerable evolution of heat. All the metals down to copper rust with comparative ease. The metals below copper do not rust. Assuming the electrolytic theory of the process of rusting to be true, these facts are just about what might have been predicted.

4. **In Regard to the Occurence of the Metals in the Free State in Nature.**—Natural waters are frequently dilute solutions of carbonic, nitric, humic, etc., acids. As such they contain displaceable hydrogen. Metals *above* hydrogen in the E.M.F. series scarcely, if ever, occur in the free state in nature, but are practically without exception found in the combined state, as sulphides, carbonates, etc. Metals *below* hydrogen are frequently found in the free state in nature. Thus gold is found in the form of nuggets of metallic gold. However, metals below hydrogen are also found in the combined state, as cinnabar, HgS, etc.

5. **In Regard to Action of the Metals on Water.**—The alkali and alkaline-earths metal displace hydrogen from water, even in the cold,

and with evolution of much heat. Mg and succeeding metals will displace hydrogen from steam. Metals at the bottom of the list will not displace hydrogen from steam.

6. **In Regard to the Solubility and Stability of Hydroxides.**—The alkali metal oxides have great avidity for water, forming hydroxides. The alkaline-earth metal oxides react with less readiness, forming hydroxides. MgO reacts slowly and incompletely with water, forming the hydroxide. All the other metallic oxides and hydroxides are insoluble in water and have no perceptible reaction therewith. When a solution of NaOH acts on solutions of salts of the metals, the alkali metal salts are not precipitated. The alkaline-earth metal salts are not precipitated unless in very concentrated solution. All the other metal solutions are acted upon, with precipitation of hydroxides, except in the case of copper which first gives copper hydroxide (blue), and which, on warming, changes to copper oxide (black). Also in the case of arsenic, no precipitate falls, sodium arsenite being formed. In the case of the last metals in the series, the *oxide* is precipitated, instead of the hydroxide, thus NaOH acting on salts of Sb, Hg, Ag, Pd, Pt, and Au, causes a precipitation of the *oxides* of these metals. Bismuth, as an exception, gives a normal hydroxide.

7. **In Regard to Carbonates.**—The alkali metals form normal stable, soluble carbonates, not easily decomposed on heating. The alkaline-earth metals form normal carbonates, which are insoluble in water, and which decompose upon heating, leaving the oxide, carbon dioxide being evolved. When sodium carbonate solution acts on solutions of all the other metals, as a rule, a basic carbonate is precipitated, being insoluble in water, and decomposed by heat into oxide and carbon dioxide. If the solution is cold, Ag, Hg, Cd, Fe, and Mn give normal carbonates. If the solution is warm, Sb, Hg, Ag, Pd, Pt, and Au give a precipitate of the *oxide*, instead of the carbonate, thus showing the instability of the carbonates of the lowest metals in the series.

8. **In Regard to Voltaic Cells.**—In choosing metals to acts as electrodes in voltaic cells, the farther apart the metals chosen, the greater the electromotive force of the voltaic cell. Thus the Al-Au couple gives a greater E.M.F. than the Zn-Cu couple.

For complete information, see Alex. Smith's Gen. Inorganic Chem., pages 361–363: 664–680. J. W. Mellor's Modern Inorg. Chem., pages 362–376.

TABLES SHOWING THE FUNCTIONS, USES AND COMPOSITIONS OF FOODS

Functions and Uses of Food in the Body.

Protein. — Builds and repairs tissue: Albumen (white of eggs) Casein (curd of milk) Lean meat Gluten of grains **Fats.** — Are stored as fat: Fat of meats, butter, olive oil, oils of corn, wheat and other grains. **Carbohydrates.** — Are transformed into fat: Sugar, starch, etc.	All serve as fuel to yield energy in the forms of heat and muscular power.

Mineral Matter of Ash. — Shares in forming bones and assist in processes of digestion.

Phosphates of lime potash, soda, etc.

Food is that which, taken into the body, builds tissue and yields energy.

TABLES SHOWING THE FUNCTIONS, USES AND COMPOSITIONS OF FOOD (Continued)

Dietary Standards

For a man in full vigor at moderate muscular work, per day

	Protein	Energy
	Grams	Large calories
Food eaten	100	3500
Food digested	95	3200

Mineral Matter (Required per Day)

	grams
Phosphoric acid, (P_2O_5)	3 to 4
Sulphuric acid, (SO_3)	2 to 3.5
Potassium oxide, (K_2O)	2 to 3
Sodium oxide, (Na_2O)	4 to 6
Calcium oxide, (CaO)	0.7 to 1.0
Magnesium oxide, (MgO)	0.3 to 0.5
Iron, (Fe)	0.006 to 0.012
Chlorine, (Cl)	6 to 8

These tables are compiled from charts of the United States Department of Agriculture, prepared by C. F. Langworthy, expert in charge of nutrition investigations.

Name of the food material	Protein.	Fat.	Carbo-hydrates.	Ash.	Water.	Fuel value in calories per lb.
Apple	0.4	0.5	14.2	0.3	84.6	290
Bacon	9.4	67.4	....	4.4	18.8	3030
Beef suet	4.7	81.8	....	0.3	13.2	3510
Butter	1.0	85.0	....	3.0	11.0	3410
Buckwheat	10.0	2.2	73.2	2.0	12.6	1600
Beefsteak	18.6	18.5	....	1.0	61.9	1130
Buttermilk	3.0	0.5	4.8	0.7	91.0	160
Bean, fresh shelled	9.4	0.6	29.1	2.0	58.9	740
Bean, green string	2.3	0.3	7.4	0.8	89.2	195
Bean, navy dry	22.5	1.8	59.6	3.5	12.6	1600
Banana	1.3	0.6	22.0	0.8	75.3	460
Codfish, fresh	12.8	0.4	....	1.2	82.6	325
Codfish, salt	21.5	0.3	....	24.7	53.5	410
Corn, dried	10.0	4.3	73.4	1.5	10.8	1800
Corn, green	3.1	1.1	19.7	0.7	75.4	500
Corn bread	7.9	4.7	46.3	2.2	38.9	1205
Cream cheese	25.9	33.7	2.4	3.8	34.2	1950
Cottage cheese	20.9	1.0	4.3	1.8	72.0	510
Cream	2.5	18.5	4.5	0.5	74.0	865

TABLES SHOWING THE FUNCTIONS, USES AND COMPOSITIONS OF FOODS—Continued

NAME OF THE FOOD MATERIAL	PROTEIN	FAT	CARBO-HYDRATES	ASH	WATER	FUEL VALUE IN CALORIES PER LB.
Candy stick			96.5	0.5	3.0	1785
Celery	1.1		3.4	1.0	94.5	85
Chestnut	10.7	7.0	74.2	2.2	5.9	1875
Cocoanut, dried	6.3	57.4	31.5	1.3	3.5	3125
Dried beef	30.0	6.6		9.1	54.3	840
Egg, whole	14.8	10.5		1.0	73.7	700
Egg, white	13.0	0.2		0.6	86.2	265
Egg, yolk	16.1	33.3		1.1	49.5	1608
Fig, dried	4.3	0.3	74.2	2.4	18.8	1475
Fruit, canned	1.1	0.1	21.1	0.5	77.2	415
Grapes	1.3	1.6	19.2	0.5	77.4	450
Grape juice, unfermented	0.2		7.4	0.2	92.2	150
Herring, smoked	36.4	15.8		13.2	34.6	1355
Honey	0.4		81.2	0.2	18.2	1520
Jelly, fruit			78.3	0.7	21.0	1455
Lard		100.0				4080
Lamb chop	17.6	28.3		1.0	53.1	1540
Mackerel	18.3	7.1		1.2	73.4	645
Macaroni	3.0	1.5	15.8	1.3	78.4	415
Milk, whole	3.3	4.0	5.0	0.7	87.0	310
Milk, skimmed	3.4	0.3	5.1	0.7	90.5	165
Molasses	2.4		69.3	3.2	25.1	1290
Oat	11.8	5.0	69.2	3.0	11.0	1720
Olive oil		100.0				4080
Oyster	6.2	1.2	3.7	2.0	86.9	235
Onion	1.6	0.3	9.9	0.6	87.6	225
Pork chop	16.9	30.1		1.0	52.0	1580
Parsnip	1.6	0.5	13.5	1.4	83.0	230
Potato	2.2	0.1	18.4	1.0	78.3	385
Peanut	25.8	38.6	22.4	2.0	9.2	2500
Peanut butter	29.3	46.5	17.1	5.0	2.1	2825
Rye	12.2	1.5	73.9	1.9	10.5	1750
Rice	8.0	2.0	77.0	1.0	12.0	1720
Rolled oats, cooked	2.8	0.5	11.5	0.7	84.5	285
Raisins	2.6	3.3	76.1	3.4	14.6	1605
Smoked ham	16.1	38.8		4.8	40.3	1940
Sugar granulated			100.0			1860
Sugar, maple			82.8	0.9	16.3	1540
Strawberry	1.0	0.6	7.4	0.6	90.4	180
Toasted bread	11.5	1.6	61.2	1.7	24.0	1420
Wheat	12.2	1.7	73.7	1.8	10.6	1750
White bread	9.2	1.3	53.1	1.1	35.3	1215
Whole wheat bread	9.7	0.9	49.7	1.3	38.4	1140
Walnut	16.6	63.4	16.1	1.4	2.5	3285

PROPERTIES OF MATTER

DENSITY OF VARIOUS SOLIDS

The approximate density of various solids at ordinary atmospheric temperature.

(Selected principally from the Smithsonian Tables.)

Substance.	Grams per cu. cm.	Pounds per cu. ft.	Substance.	Grams per cu. cm.	Pounds per cu. ft.
Agate	2.5–2.7	156–168	Glass, common	2.4–2.8	150–175
Alabaster, carbonate	2.69–2.78	168–173	flint	2.9–5.9	180–370
sulphate	2.26–2.32	141–245	Glue	1.27	80
Albite	2.62–2.65	163–165	Granite	2.64–2.76	165–172
Amber	1.06–1.11	66–69	Graphite	2.30–2.72	144–170
Amphoboles	2.9–3.2	180–200	Gum arabic	1.3–1.4	80–85
Anorthite	2.74–2.76	171–172	Gypsum	2.31–2.33	144–145
Asbestos	2.0–2.8	125–175	Hematite	4.9–5.3	306–330
Asphalt	1.1–1.5	69–94	Hornblende	3.0	187
Basalt	2.4–3.1	150–190	Ice	0.917	57.2
Beeswax	0.96–0.97	60–61	India rubber	0.91–0.93	57–58
Beryl	2.69–2.7	168	Ivory	1.83–1.92	114–120
Biotite	2.7–3.1	170–190	Leather, dry	0.86	54
Bone	1.7–2.0	106–125	Lime, slaked	1.3–1.4	81–87
Brick	1.4–2.2	87–137	Limestone	2.68–2.76	167–171
Butter	0.86–0.87	53–54	Magnetite	4.9–5.2	306–324
Calamine	4.1–4.5	255–280	Malachite	3.7–4.1	231–256
Calcspar	2.6–2.8	162–175	Marble	2.6–2.8	160–177
Caoutchouc	0.92–0.99	57–62	Meerschaum	0.99–1.28	62–80
Celluloid	1.4	87	Mica	2.6–3.2	165–200
Cement, set	2.7–3.0	170–190	Muscovite	2.76–3.00	172–225
Chalk	1.9–2.8	118–175	Ochre	3.5	218
Charcoal, oak	0.57	35	Opal	2.2	137
pine	0.28–0.44	18–28	Paper	0.7–1.15	44–72
Cinnabar	8.12	507	Paraffin	0.87–0.91	54–57
Clay	1.8–2.6	122–162	Peat	0.84	52
Coal, anthracite	1.4–1.8	87–112	Pitch	1.07	67
bituminous	1.2–1.5	75–94	Porcelain	2.3–2.5	143–156
Cocoa butter	0.89–0.91	56–57	Porphyry	2.6–2.9	162–181
Coke	1.0–1.7	62–105	Pyrite	4.95–5.1	309–318
Copal	1.04–1.14	65–71	Quartz	2.65	165
Cork	0.22–0.26	14–16	Resin	1.07	67
Corundum	3.9–4.0	245–250	Rock salt	2.18	136
Diamond	3.01–3.52	188–220	Sandstone	2.14–2.36	134–147
Dolomite	2.84	177	Serpentine	2.50–2.65	156–165
Ebonite	1.15	72	Silica, fused transparent	2.21	142
Emery	4.0	250	translucent	2.07	133
Epidote	3.25–3.50	203–218	Slag	2.0–3.9	125–240
Feldspar	2.55–2.75	159–172	Slate	2.6–3.3	162–205
Flint	2.63	164	Soapstone	2.6–2.8	162–175
Fluorite	3.18	198	Starch	1.53	95
Galena	7.3–7.6	460–470	Sugar	1.61	100
Gamboge	1.2	75	Talc	2.7–2.8	168–174
Garnet	3.15–4.3	197–268	Tallow	0.91–0.97	57–60
Gas carbon	1.88	117	Tar	1.02	66
Gelatine	1.27	80	Topaz	3.5–3.6	219–223

DENSITY OF VARIOUS SOLIDS (Continued)

Substance.	Grams per cu. cm.	Pounds per cu. ft.	Substance.	Grams per cu. cm.	Pounds per cu. ft.
Tourmaline	3.0–3.2	190–200	lignum vitæ....	1.17–1.33	73–83
Wax, sealing......	1.8	117	locust..........	0.67–0.71	42–44
Wood (seasoned)			logwood........	0.91	57
alder...........	0.42–0.68	26–42	mahogany		
apple...........	0.66–0.84	41–52	Honduras....	0.66	41
ash.............	0.65–0.85	40–53	Spanish......	0.85	53
bamboo........	0.31–0.40	19–25	maple..........	0.62–0.75	39–47
basswood......	0.32–0.59	20–37	oak............	0.60–0.90	37–56
beech..........	0.70–0.90	43–56	pear............	0.61–0.73	38–45
blue gum......	1.00	62	pine, pitch......	0.83–0.85	52–53
birch...........	0.51–0.77	32–48	white.........	0.35–0.50	22–31
box............	0.95–1.16	59–72	yellow.......	0.37–0.60	23–37
butternut......	0.38	24	plum...........	0.66–0.78	41–49
cedar...........	0.49–0.57	30–35	poplar..........	0.35–0.50	22–31
cherry..........	0.70–0.90	43–56	satinwood......	0.95	59
dogwood......	0.76	47	spruce..........	0.48–0.70	30–44
ebony..........	1.11–1.33	69–83	sycamore.......	0.40–0.60	24–37
elm............	0.54–0.60	34–37	teak, Indian....	0.66–0.88	41–55
hickory........	0.60–0.93	37–47	African.......	0.98	61
holly...........	0.76	47	walnut.........	0.64–0.70	40–43
juniper.........	0.56	35	water gum.....	1.00	62
larch...........	0.50–0.56	31–35	willow.........	0.40–0.60	24–37

For the specific gravity of *alloys* see Composition and Physical Properties of Alloys.

For the specific gravity of the *elements* see Physical Constants of the Elements.

For specific gravity of *inorganic compounds* see Physical Constants of Inorganic Compounds.

For specific gravity of *organic compounds* see Physical Constants of Organic Compounds.

DENSITY OF WATER

The temperature of maximum density for pure water, free from air = **3°.98** C.

The density at this temperature = **0.999973** (C. G. S.).

(International Bureau of Weights and Measures, 1910.)

DENSITY OF VARIOUS LIQUIDS

(Selected from Smithsonian Tables.)

Liquid.	Grams per cu.cm.	Pounds per cu.ft.	Temp. °C.
Acetone	0.792	49.4	0°
Alcohol, ethyl	0.791	49.4	0
methyl	0.810	50.5	0
Benzene	0.899	56.1	0
Carbolic acid	0.950–0.965	59.2–60.2	15
Chloroform	1.480	92.3	18
Ether	0.736	45.9	0
Gasoline	0.66–0.69	41.0–43.0	..
Glycerine	1.260	78.6	0
Milk	1.028–1.035	64.2–64.6	..
Naphtha, wood	0.848–0.810	52.9–50.5	0
Naphtha, petroleum ether	0.665	41.5	15
Oils:			
castor	0.969	60.5	15
cocoanut	0.925	57.7	15
cotton seed	0.926	60.2	16
creosote	1.040–1.100	64.9–68.6	15
linseed, boiled	0.942	58.8	15
olive	0.918	57.3	15
turpentine	0.873	54.2	16
Sea water	1.025	64.0	15

HYDROMETER CONVERSION TABLES

Showing the Relation between Density (C. G. S.) and Degrees Baumé for Densities less than Unity.

Density.	Degrees Baumé.				
	.00	.01	.02	.03	.04
0.60	103.33	99.51	95.81	92.22	88.75
.70	70.00	67.18	64.44	61.78	59.19
.80	45.00	42.84	40.73	38.68	36.67
.90	25.56	23.85	22.17	20.54	18.94
1.00	10.00	.....	.....	.....	.....

Density.	Degrees Baumé.				
	.05	.06	.07	.08	.09
0.60	85.38	82.12	78.95	75.88	72.90
.70	56.67	54.21	51.82	49.49	47.22
.80	34.71	32.79	30.92	29.09	27.30
.90	17.37	15.83	14.33	12.86	11.41
1.00	......	.....	.....	.....	.....

HYDROMETER CONVERSION TABLES
(Continued)

SHOWING THE RELATION BETWEEN DENSITY (C. G. S.) AND THE BAUMÉ AND TWADDELL SCALES FOR DENSITIES ABOVE UNITY.

Density.	Degrees Baumé.	Degrees Twaddell.	Density.	Degrees Baumé.	Degrees Twaddell.
1.00	0.00	0	1.41	42.16	82
1.01	1.44	2	1.42	42.89	84
1.02	2.84	4	1.43	43.60	86
1.03	4.22	6	1.44	44.31	88
1.04	5.58	8	1.45	45.00	90
1.05	6.91	10	1.46	45.68	92
1.06	8.21	12	1.47	46.36	94
1.07	9.49	14	1.48	47.03	96
1.08	10.74	16	1.49	47.68	98
1.09	11.97	18	1.50	48.33	100
1.10	13.18	20	1.51	48.97	102
1.11	14.37	22	1.52	49.60	104
1.12	15.54	24	1.53	50.23	106
1.13	16.68	26	1.54	50.84	108
1.14	17.81	28	1.55	51.45	110
1.15	18.91	30	1.56	52.05	112
1.16	20.00	32	1.57	52.64	114
1.17	21.07	34	1.58	53.23	116
1.18	22.12	36	1.59	53.80	118
1.19	23.15	38	1.60	54.38	120
1.20	24.17	40	1.61	54.94	122
1.21	25.16	42	1.62	55.49	124
1.22	26.15	44	1.63	56.04	126
1.23	27.11	46	1.64	56.58	128
1.24	28.06	48	1.65	57.12	130
1.25	29.00	50	1.66	57.65	132
1.26	29.92	52	1.67	58.17	134
1.27	30.83	54	1.68	58.69	136
1.28	31.72	56	1.69	59.20	138
1.29	32.60	58	1.70	59.71	140
1.30	33.46	60	1.71	60.20	142
1.31	34.31	62	1.72	60.70	144
1.32	35.15	64	1.73	61.18	146
1.33	35.98	66	1.74	61.67	148
1.34	36.79	68	1.75	62.14	150
1.35	37.59	70	1.76	62.61	152
1.36	38.38	72	1.77	63.08	154
1.37	39.16	74	1.78	63.54	156
1.38	39.93	76	1.79	63.99	158
1.39	40.68	78	1.80	64.44	160
1.40	41.43	80	....	.....	...

ABSOLUTE DENSITY OF WATER

DENSITY IN GRAMS PER CUBIC CENTIMETER, COMPUTED FROM THE RELATIVE VALUES BY THIESEN, SCHEEL AND DISSELHORST (1900), AND THE ABSOLUTE VALUE AT 3°.98 C. BY THE INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES (1910).

Degrees	0	1	2	3	4	5	6	7	8	9
0	0.999841	847	854	860	866	872	878	884	889	895
1	900	905	909	914	918	923	927	930	934	938
2	941	944	947	950	953	955	958	960	962	964
3	965	967	968	969	970	971	972	972	973	973
4	973	973	973	972	972	972	970	969	968	966
5	965	963	961	959	957	955	952	950	947	944
6	941	938	935	931	927	924	920	916	911	907
7	902	898	893	888	883	877	872	866	861	855
8	849	843	837	830	824	817	810	803	796	789
9	781	774	766	758	751	742	734	726	717	709
10	700	691	682	673	664	654	645	635	625	615
11	605	595	585	574	564	553	542	531	520	509
12	498	486	475	463	451	439	427	415	402	390
13	377	364	352	339	326	312	299	285	272	258
14	244	230	216	202	188	173	159	144	129	114
15	099	084	069	054	038	023	007	*991	*975	*959
16	0.998943	926	910	893	877	860	843	826	809	792
17	774	757	739	722	704	686	668	650	632	613
18	595	576	558	539	520	501	482	463	444	424
19	405	385	365	345	325	305	285	265	244	224
20	203	183	162	141	120	099	078	056	035	013
21	0.997992	970	948	926	904	882	860	837	815	792
22	770	747	724	701	678	655	632	608	585	561
23	538	514	490	466	442	418	394	369	345	320
24	296	271	246	221	196	171	146	120	095	069
25	044	018	*992	*967	*941	*914	*888	*862	*836	*809
26	0.996783	756	729	703	676	649	621	594	567	540
27	512	485	457	429	401	373	345	317	289	261
28	232	204	175	147	118	089	060	031	002	*973
29	0.995944	914	885	855	826	796	766	736	706	676
30	646	616	586	555	525	494	464	433	402	371

RELATIVE DENSITY AND VOLUME OF WATER

The mass of one cubic centimeter of water at 4° C is taken as unity. The absolute density in C. G. S. units is obtained by multiplying the relative density by 0.999973.

(Smithsonian Tables, compiled from Various Authors.)

Temp. ° C.	Density.	Volume.	Temp. ° C.	Density.	Volume
−10	0.99815	1.00186	+35	0.99406	1.00598
−9	843	157	36	371	633
−8	869	131	37	336	669
−7	892	108	38	299	706
−6	912	088	39	262	743
−5	0.99930	1.00070	40	0.99224	1.00782
−4	945	055	41	186	821
−3	958	042	42	147	861
−2	970	031	43	107	901
−1	979	021	44	066	943
+0	0.99987	1.00013	45	0.99025	1.00985
1	993	007	46	0.98982	1.01028
2	997	003	47	940	072
3	999	001	48	896	116
4	1.00000	1.00000	49	852	162
5	0.99999	1.00001	50	0.98807	1.01207
6	997	003	51	762	254
7	993	007	52	715	301
8	988	012	53	669	349
9	981	019	54	621	398
10	0.99973	1.00027	55	0.98573	1.01448
11	963	037	60	324	705
12	952	048	65	059	979
13	940	060	70	0.97781	1.02270
14	927	073	75	489	576
15	0.99913	1.00087	80	0.97183	1.02899
16	897	103	85	0.96865	1.03237
17	880	120	90	534	590
18	862	138	95	192	959
19	843	157	100	0.95838	1.04343
20	0.99823	1.00177	110	0.9510	1.0515
21	802	198	120	0.9434	1.0601
22	780	221	130	0.9352	1.0693
23	756	244	140	0.9264	1.0794
24	732	268	150	0.9173	1.0902
25	0.99707	1.00294	160	0.9075	1.1019
26	681	320	170	0.8973	1.1145
27	654	347	180	0.8866	1.1279
28	626	375	190	0.8750	1.1429
29	597	405	200	0.8628	1.1590
30	0.99567	1.00435	210	0.850	1.177
31	537	466	220	0.837	1.195
32	505	497	230	0.823	1.215
33	473	530	240	0.809	1.236
34	440	563	250	0.794	1.259

DENSITY AND VOLUME OF MERCURY

Based on the Density of Mercury at 0° C. by Thiesen and Scheel (1898)

(Selected from Smithsonian Tables.)

Temp. ° C.	Mass in gr. per cu.cm.	Vol. of 1 gr. in cu.cms.	Temp. ° C.	Mass in gr. per cu.cm.	Vol. in 1 gr. in cu.cms.
−10	13.6202	0.0734205	30°	13.5217	0.0739552
−9	6177	4338	31	5193	9686
−8	6152	4472	32	5168	9820
−7	6128	4606	33	5144	9953
−6	6103	4739	34	5119	40087
−5	13.6078	0.0734873	35	13.5095	0.0740221
−4	6053	5006	36	5070	0354
−3	6029	5140	37	5046	0488
−2	6004	5273	38	5021	0622
−1	5979	5407	39	4997	0756
0	13.5955	0.0735540	40	13.4973	0.0740891
1	5930	5674	50	4729	2229
2	5906	5808	60	4486	3569
3	5881	5941	70	4244	4910
4	5856	6075	80	4003	6252
5	13.5832	0.0736209	90	13.3762	0.0747594
6	5807	6342	100	3522	8939
7	5782	6476	110	3283	50285
8	5758	6610	120	3044	1633
9	5733	6744	130	2805	2982
10	13.5708	0.0736877	140	13.2567	0.0754334
11	5684	7011	150	2330	5688
12	5659	7145	160	2093	7044
13	5634	7278	170	1856	8402
14	5610	7412	180	1620	9764
15	13.5585	0.0737546	190	13.1384	0.0761128
16	5561	7680	200	1148	2495
17	5536	7813	210	0913	3865
18	5512	7947	220	0678	5239
19	5487	8081	230	0443	6616
20	13.5462	0.0738215	240	13.0209	0.0767996
21	5438	8348	250	12.9975	9381
22	5413	8482	260	9741	70769
23	5389	8616	270	9507	2161
24	5364	8750	280	9273	3558
25	13.5340	0.0738883	290	12.9039	0.0774958
26	5315	9017	300	8806	6364
27	5291	9151	310	8572	7774
28	5266	9285	320	8339	9189
29	5242	9419	330	8105	80609
30	13.5217	0.0739552	340	12.7872	0.0782033
			350	7638	3464
			360	7405	4900

DENSITY OF AQUEOUS SOLUTIONS

(Selected from Smithsonian Tables.)

Substance.	Density in grams per cubic centimeter.									Temp. °C.
	Parts of solute in 100 parts of solution by weight.									
	5	10	15	20	25	30	40	50	60	
Ammonium chloride..	1.015	1.030	1.044	1.058	1.072	...	...	...	...	15.
Barium chloride......	1.045	1.094	1.147	1.205	1.269	...	...	...	...	15.
Cadmium chloride....	1.043	1.087	1.138	1.193	1.254	1.319	1.469	1.653	1.887	19.5
Calcium chloride.....	1.041	1.086	1.132	1.181	1.232	1.286	1.402	...	...	15.
Cane sugar..........	1.019	1.039	1.060	1.082	1.129	1.178	1.289	...	...	17.5
Copper sulphate......	1.031	1.064	1.098	1.134	1.173	1.213	...	...	...	18.
Mercuric chloride.....	1.041	1.092	...	...	...	...	...	...	...	20.
Potassium bichromate.	1.035	1.071	1.108	...	...	...	...	...	...	19.5
hydroxide.........	1.040	1.082	1.027	1.076	1.229	1.286	1.410	1.538	1.666	15.
chloride..........	1.031	1.065	1.099	1.135	...	...	...	...	...	15.
bromide...........	1.035	1.073	1.114	1.157	1.205	1.254	1.364	...	...	19.5
iodide.............	1.036	1.076	1.118	1.164	1.216	1.269	1.394	1.544	1.732	19.5
nitrate............	1.031	1.064	1.099	1.135	...	...	...	...	...	15.
Sodium hydroxide....	1.058	1.114	1.169	1.224	1.279	1.331	1.436	1.539	1.642	15.
chloride...........	1.035	1.072	1.110	1.150	1.191	...	...	...	...	15.
Silver nitrate........	1.044	1.090	1.140	1.195	1.255	1.322	1.479	1.675	1.918	15.
Zinc chloride.........	1.043	1.089	1.135	1.184	1.236	1.289	1.417	1.563	1.737	19.5
sulphate...........	1.027	1.057	1.089	1.122	1.156	1.191	1.269	1.351	1.443	20.5

DENSITY OF ALCOHOL

DENSITY OF ETHYL ALCOHOL IN GRAMS PER CUBIC CENTIMETER, COMPUTED FROM MENDELEJEFF'S FORMULA

(Selected from Smithsonian Tables.)

Temp. °C.	0	1	2	3	4
0	.80625	.80541	.80457	.80374	.80290
10	.79788	.79704	.79620	.79535	.79451
20	.78945	.78860	.78775	.78691	.78606
30	.78097	.78012	.77927	.77841	.77756

Temp. °C.	5	6	7	8	9
0	.80207	.80123	.80039	.79956	.79872
10	.79367	.79283	.79198	.79114	.79029
20	.78522	.78437	.78352	.78267	.78182
30	.77671	.77585	.77500	.77414	.77329

DENSITY OF DRY AIR

AT THE TEMPERATURE t, AND UNDER THE PRESSURE H CM. OF MERCURY, THE DENSITY OF AIR

$$=\frac{0.001293}{1+0.00367\,t}\,\frac{H}{76}.$$

(From Miller's Laboratory Physics, Ginn & Co. publishers, by permission.)

t	Pressure H in Centimeters.					
	72.0	73.0	74.0	75.0	76.0	77.0
°						
10	0.001182	0.001198	0.001215	0.001231	0.001247	0.001264
11	178	193	210	227	243	259
12	173	190	206	222	239	255
13	169	186	202	218	234	251
14	165	181	198	214	230	246
15	0.001161	0.001177	0.001193	0.001210	0.001226	0.001242
16	157	173	189	205	221	238
17	153	169	185	201	217	233
18	149	165	181	197	213	229
19	145	161	177	193	209	225
20	0.001141	0.001157	0.001173	0.001189	0.001205	0.001221
21	137	153	169	185	201	216
22	134	149	165	181	197	212
23	130	145	161	177	193	208
24	126	142	157	173	189	204
25	0.001122	0.001138	0.001153	0.001169	0.001185	0.001200
26	118	134	149	165	181	196
27	115	130	146	161	177	192
28	111	126	142	157	173	188
29	107	123	138	153	169	184
30	0.001104	0.001119	0.001134	0.001150	0.001165	0.001180

Proportional Parts.

cm.	17	16	15
0.1	2	2	1
0.2	3	3	3
0.3	5	5	4
0.4	7	6	6
0.5	8	8	7
0.6	10	10	9
0.7	12	11	10
0.8	14	13	12
0.9	15	14	13

DENSITY OF SATURATED VAPORS AT THE TEMPERATURE OF NORMAL EBULLITION

Vapor.	Temp. ° C.	Density.
Acetic acid	118.5	0.00315
Benzene	80.2	0.00275
Chloroform	61.2	0.00443
Ether	34.6	0.00311
Ethyl alcohol	78.3	0.00164
Methyl alcohol	64.7	0.00121
Water	100.0	0.000596

DENSITY OF GASES IN LIQUID AND SOLID FORM

Temperatures marked * are the temperatures of normal ebullition.

Gas.	Liquid. Temp. °C.	Liquid. D g/cm³.	Solid. Temp. °C.	Solid. D g/cm³.	Observer.
Acetylene	− 23.5	0.52	.....	....	Mathias, 1909
	30.3	0.40	.....	....	
Air (20.9% oxygen)	−147.	0.92	.....	....	
Ammonia	− 10.7	0.65	.....	....	Andreeff, 1859
	+ 16.3	0.61	.....	....	Andreeff, 1859
Argon	−187.*	1.41	.....	....	Baly & Donnan, 1902
Carbon dioxide	− 60.	1.19	− 79.	1.53	Behn, 1910
	+ 20.	0.77	.....	....	Amagat
Carbon monoxide	−190.*	.79	.....	....	
	− 68.	.86	.....	....	Baly & Donnan
Chlorine	− 33.6*	1.56	.....	....	Knietsch, 1890
Chlorine	+ 20.	1.41	.....	....	Knietsch, 1890
Ethylene	− 21.	0.41	.....	....	Cailletet & Mathias, 1886
Ethylene	+ 10.	0.21			
Helium	−269.*	0.122	.....	....	Kamerling-Onnes & Perrier, 1910
Hydrogen	−253.*	0.07	−260.	.076	Dewar, 1904
Hydrogen sulphide	− 61.	0.86			
Nitrogen	−196.*	0.804	−253.	1.03	Dewar, 1904
Nitrous oxide	− 20.	1.0	.....	....	Cailletet & Mathias
Nitrous oxide	+ 17.	.80	.....	....	Villard, 1897
Oxygen	− 23.	0.89	.....	....	Cailletet & Hautefeuille, 1881
	−182.7*	1.14	−253.	−1.41	Kamerling-Onnes & Perrier, 1910
	−205.	1.25	.....	....	Baly & Donnan
Sulphur dioxide	− 10.*	1.46	.....	....	Pierre
	+ 20.	1.38	.....	....	Cailletet & Mathias

ELASTIC CONSTANTS FOR SOLIDS

YOUNG'S MODULUS AND MODULUS OF RIGIDITY

The values can be considered only as approximations. They are for ordinary atmospheric temperatures.

Material.	Young's Modulus. Dynes per sq.cm.	Young's Modulus. Pounds per sq.in.	Modulus of rigidity. Dynes per sq.cm.	Modulus of rigidity. Pounds per sq.in.
Aluminum	7×10^{11}	10.2×10^{6}	2.5×10^{11}	3.63×10^{6}
Bismuth	3.2	4.65	1.24	1.80
Brass	9.2	13.4	3.7	5.38
Bronze	10.6	15.4	4.06	5.91
phosphor	12.0	17.4	4.36	6.32
Cadmium	5.0	7.26	2.45	3.56
Copper	10.	14.5	4.2	6.10
German silver	10.8	15.7	4.5	6.54
Glass ordinary	4.7–7.8	6.83–11.3	1.8–3.2	2.62–4.65
crown	6.5–7.8	9.45–11.3	2.6–3.2	3.78–4.65
flint	5.0–6.0	7.26–8.52	2.0–2.5	2.91–3.63
Gold, pure	8.0	11.6	3.0	4.36
Granite	1.46	2.12		
Ice	.28	.407		
Iron, drawn	20.0	29.1	8.00	11.6
cast	11.5	16.8	5.10	7.41

ELASTIC CONSTANTS FOR SOLIDS (Continued)

Young's Modulus and Modulus of Rigidity (Continued)

Gas.	Young's Modulus.		Modulus of rigidity.	
	Dynes per sq.cm.	Pounds per sq.in.	Dynes per sq.cm.	Pounds per sq.in.
Ivory	$.9\times10^{11}$	1.31×10^{6}		
Lead	1.7	2.47	0.7×10^{11}	1.02×10^{6}
Magnesium	4.2	6.10	1.7	2.47
Manganin	12.4	18.0	4.65	6.70
Nickel	22.0	32.0	8.0	11.6
Platinum	17.0	24.7	6.5	9.45
Platinum-iridium	21.4	31.1		
Quartz, crystal:				
‖ to axis	10.30	15.0		
⊥ to axis	7.85	11.4		
fiber	5.6	8.14	3.0	4.36
Rhodium	28.0	40.7		
Silver, pure	7.5	10.9	2.7	3.94
Steel, ordinary mild	22.0	32.0	8.00	11.6
cast	19.5	28.3	7.50	10.9
drawn	18.8	27.3		
invar	14.1	20.3	5.63	8.18
Tantalum	18.6	27.0		
Tin	5.0	7.26	2.0	2.91
Wood	.03–1.0	.0436–1.45		
Zinc	9.0	13.1	3.4	4.94

Bulk Modulus, Limit of Elasticity and Breaking Strain

The values can be considered only as approximations. They are for ordinary atmospheric temperatures.

Material.	Limit of Elasticity.		Breaking Strain.		Bulk Modulus Dynes per sq.cm.
	Dynes per sq.cm.	Pounds per sq.in.	Dynes per sq.cm.	Pounds per sq.in.	
Aluminum	5.0×10^{8}	7.25×10^{3}	$10–25\times10^{8}$	$14.5–36.3\times10^{3}$	7.0×10^{11}
Bismuth	......	....	....	....	3.0
Brass	......	....	22.–48.	32.–70.	6.1
Bronze	5.0–12.	7.25–17.4	20.–40.	29.–58.	8.9
Cadmium	......	....	....	....	4.12
Copper	0.5–20.0	0.73–29.0	16.–45.	23.2–65.3	12.0
German silver	......	....	....	....	15.0
Glass:					
crown	......	....	....	....	4.0–5.9
flint	......	....	....	....	3.6–3.8
Gold	......	....	11.0	15.6	16.0
Iron:					
drawn	20.	29.	66.	96.	15.4
cast	17.	25.	33.	48.	9.6
Lead	......	....	3.	4.4	0.76
Manganin	......	....	....	....	12.1
Nickel	......	....	42.	61.	17.0
Platinum	......	....	36.	52.	24.0
Quartz	......	....	....	....	3.7
Silver	15.	22.	28.	41.	10.0
Steel, mild	20.–100.	29.–145.	35.–150.	51.–218.	16.0
Tin	......	....	8.	12.	5.0
Zinc	......	....	6.	8.7	3.5

COMPRESSIBILITY OF LIQUIDS

Contraction in unit volume per atmosphere.

Liquid.	Temp. °C.	Pressures in atmospheres.	Coefficient.	Observer.
Acetone......	0.	1–500	82×10^{-6}	Amagat, 1893
	0.	500–1000	59.	"
	0.	1000–1500	47.	"
	99.5	8.94–36.5	276.	"
Amyl alcohol..	17.7	8	90.5	Röntgen, 1891
Benzene C_6H_6.	12.9	0.4–18	87.	Suchodski, 1910
	34.9	2–18	100.	"
	99.9	4.5–19	190.	"
Butyl alcohol..	17.4	8	90.	Röntgen
Carbon disulphide......	0.	1–500	66.	Amagat, 1893
	49.2	1000–1500	51.	"
Carbon tetrachloride.....	20.	100–200	90.7	Richards, 1907
Chlorobenzene	13.	0.4–18	67.	Suchodski, 1910
	35.	0.4–18	77.	"
	100.	0.4–18	127.	"
Chloroform....	0.	....	101.	Grimaldi, 1887
	20.	....	128.	"
	40.	....	162.	"
	60.	....	204.	"
	100.	8–9	211.	Amagat
	100.	19–34	206.	"
	20.	1–98	94.	Richards&Stall, 1904
	20.	98.7–197.4	89.	Richards&Stall, 1904
	20.	197.4–296.1	80.	Richards&Stall, 1904
Ether.........	12.2	0.4–17.5	163.	Suchodski, 1910
	34.8	2–19	207.	"
	63.	8.6–34.3	293.	Amagat, 1893
	78.5	8.6–34.3	363.	"
	99.	8.6–36.5	523.	"
Ethyl acetate..	13.3	8.1–37.4	104.	"
Ethyl alcohol..	28.	150–400	81.	Barus, 1890
	65.	150–400	100.	"
	100.	150–400	132.	"
	185.	150–400	245.	"
	310.	150–400	1530.	"
	28.	150–200	86.	"
	100.	150–200	168.	"
	310.	150–200	4200.	"

COMPRESSIBILITY OF LIQUIDS (Continued)

Contraction in unit volume per atmosphere.

Liquid.	Temp. °C.	Pressures in atmospheres.	Coefficient.	Observer.
Ethyl alcohol:				
	0.	1–50	$96. \times 10^{-6}$	Amagat, 1893
	20.	1–50	112.	"
	40.	1–50	125.	"
	0.	100–200	85.	"
	0.	300–400	73.	"
	0.	500–600	64.	"
	0.	900–1000	52.	"
Ethyl bromide.	10.1	1–500	89.6	Amagat
	10.1	500–1000	63.4	"
	13.7	0.4–18.5	113.	Suchodski, 1910
	35.	2–19	138.	"
Ethyl chloride.	0.	1–500	103.	Amagat, 1893
	0.	500–1000	69.2	"
	11.	8.5–34.2	138.	"
	62.	12.7–32.8	255.	"
	99.	12.8–34.5	495.	"
Ethyl iodide...	10.6	1–500	73.8	Amagat
		500–1000	56.2	"
Fluor-benzene.	13.9	0.4–18	88.	Suchodski, 1910
	35.3	0.4–18	103.	"
	99.7	4.3–18.5	190.	"
Glycerine.....	14.9	1–10	22.	De Metz, 1890
Mercury......	0.	....	3.92	Amagat
	15.	100–200	3.76	Richards, 1907
Methyl acetate	14.3	8.1–37.5	97.	Amagat
	99.	8.3–37	250.	"
Methyl alcohol	0.	1–500	79.4	"
	0.	500–1000	58.3	"
	14.7	8.5–371	104.	"
	100.	8.7–37.3	221.	"
Nitric acid....	20.3	1–32	338.	....
Palmitic acid..	65.	20–100	88.	Barus, 1890
	100.	20–100	99.	"
Paraffine......	64.	20–100	84.	"
	100.	20–100	107.	"
Oil, almond...	17.	....	55.	Quincke
olive.......	20.5	....	63.	"
turpentine...	19.7	....	79.	"
Toluene.......	10.	1–5.25	79.	DeHeen, 1885
	100.	1–5.25	150.	" "
Xylene.......	10.	1–5.25	74.	" "
	100.	1–5.25	132.	" "

COMPRESSIBILITY OF LIQUIDS (Continued)

Contraction in unit volume per atmosphere.

Liquid.	Temp. °C.	Pressures in atmospheres.	Coefficient.	Observer.
Water........	0.	1–25	52.5×10^{-6}	Amagat, 1893
	10.	1–25	50.0	"
	20.	1–25	49.1	"
	0.	25–50	51.6	"
	10.	25–50	49.2	"
	20.	25–50	47.6	"
	0.	100–200	49.2	"
	10.	100–200	46.1	"
	20.	100–200	44.2	"
	50.	100–200	42.5	"
	100.	100–200	46.8	"
	0.	500–1000	41.6	"
	0.	1000–1500	35.8	"
	0.	1500–2000	32.4	"
	0.	2000–2500	29.2	"
	0.	2500–3000	26.1	"

ELASTIC CONSTANTS FOR GASES

For short ranges of pressure, at a constant temperature, the volume of a gas is inversely proportional to the pressure or pressure × volume = a constant. (Boyle's Law.)

For high pressures, the table below shows the relative volumes at various temperatures. The volume at 0° C. and 76 cm. pressure (1 atmosphere) being taken as 1,000,000.

(From Smithsonian Tables.)

Atm.	Oxygen.			Air.		
	0°	99°.5	199°.5	0°	99°.4	200°.4
100	9265	......	......	9730		
200	4570	7000	9095	5050	7360	9430
300	3208	4843	6283	3658	5170	6622
400	2629	3830	4900	3036	4170	5240
500	2312	3244	4100	2680	3565	4422
600	2115	2867	3570	2450	3180	3883
700	1979	2610	3202	2288	2904	3502
800	1879	2417	2929	2168	2699	3219
900	1800	2268	2718	2070	2544	3000
1000	1735	2151	......	1992	2415	2828

Atm.	Nitrogen.			Hydrogen.		
	0°	99°.5	199°.6	0°	99°.3	200°.5
100	9910					
200	5195	7445	9532	5690	7567	9420
300	3786	5301	6715	4030	5286	6520
400	3142	4265	5331	3207	4147	5075
500	2780	3655	4515	2713	3462	4210
600	2543	3258	3973	2387	3006	3627
700	2374	2980	3589	2149	2680	3212
800	2240	2775	3300	1972	2444	2900
900	2149	2616	3085	1832	2244	2657
1000	2068	......	......	1720	2093	

COEFFICIENT OF FRICTION

(From Rankine's Compilation, 1858; Smithsonian Tables.)

Materials.	Coefficient of friction.	Angle of repose in degrees.
Wood on wood, dry	.25–.50	14.0–26.5
Wood on wood, soapy	.20	11.5
Metals on oak, dry	.50–.60	26.5–31.0
Metals on oak, wet	.24–.26	13.5–14.5
Metals on oak, soapy	.20	11.5
Metals on elm, dry	.20–.25	11.5–14.0
Hemp on oak, dry	.53	28.0
Hemp on oak, wet	.33	18.5
Leather on oak	.27–.38	15.0–19.5
Leather on metals, dry	.56	29.5
Leather on metals, wet	.36	20.0
Leather on metals, greasy	.23	13.0
Leather on metals, oily	.15	8.5
Metals on metals, dry	.15–.20	8.5–11.5
Metals on metals, wet	.3	16.5
Smooth surfaces occasionally greased	.07–.08	4.0–4.5
Smooth surfaces continually greased	.05	3.0
Smooth surfaces, best results	.03–.036	1.75–2.0
Steel on agate, dry	.20	11.5
Steel on agate, oiled	.107	6.1
Iron on stone	.30–.70	16.7–35.0
Wood on stone	about .40	22.0
Masonry and brick work, dry	.60–.70	33.0–35.0
Masonry and brick work, damp mortar	.74	36.5
Masonry on dry clay	.51	27.0
Masonry on moist clay	.33	18.25
Earth on earth	.25–1.00	14.0–45.0
Earth on earth, dry sand, clay and mixed earth	.38–.75	21.0–37.0
Earth on earth, damp clay	1.00	45.0
Earth on earth, wet clay	.31	17.0
Earth on earth, shingle and gravel	.81–1.11	39.0–48.0

RESISTANCE TO CRUSHING FOR VARIOUS MATERIALS

Approximate values in pounds per square inch.

Material.	Resistance to crushing in lbs. per sq. in.	Material.	Resistance to crushing in lbs. per sq.in.
Brick:		Granite	9700–34000
soft burned	3000–6000	Limestone	6000–25000
hard burned	4500–6500	Marble	7600–20700
vitrified	8500–25000	Sandstone	2400–29300
Brownstone	7300–23600	Tufa	7700–11600
Concrete	800–3800		

TENSILE STRENGTH OF METALS

(Selected from Smithsonian Tables.)

Given in pounds per square inch. The values can be considered only as approximations.

Metal.	Tensile Strength in lbs. per sq.in.
Aluminum wire	30000–40000
Brass wire	50000–150000
Bronze wire, phosphor, hard drawn	110000–140000
Bronze wire, silicon, hard drawn	95000–115000
Bronze	60000–75000
Copper wire, hard drawn	60000–70000
Gold wire	20000
Iron, cast	13000–33000
Iron wire, hard drawn	80000–120000
Iron wire, annealed	50000–60000
Lead, cast or drawn	2600–3300
Palladium	39000
Platinum wire	50000
Silver wire	42000
Steel	80000–330000
Steel wire, maximum	460000
Steel, specially treated nickel steel	250000
Steel, piano wire, 0.033 in. diam	357000–390000
Steel, piano wire, 0.051 in. diam	325000–337000
Tin, cast or drawn	4000–5000
Zinc, cast	7000–13000
Zinc, drawn	22000–30000

MODULUS OF RUPTURE. TRANSVERSE TESTS FOR VARIOUS WOODS

(Smithsonian Tables.)

Material.	Modulus, lbs. per sq.in.	Material.	Modulus, lbs. per sq.in.
Ash, white	10,800	Maple, sugar	16,500
Basswood	8,340	Maple, white	14,640
Beech	16,200	Oak, red	11,400
Cedar, red	11,800	Oak, white	13,100
Cedar, white	6,300	Pine, white	7,900
Cypress, bald	7,900	Pine, red	9,100
Elm, white	10,300	Poplar	9,400
Fir, red	13,270	Spruce, pine	10,000
Hemlock	9,480	Walnut, black	11,900
Hickory, pignut	18,700		

HARDNESS

Scale of Hardness

1	Talc	4	Fluorite	8	Topaz
2	Rocksalt	5	Apatite	9	Corundum
3	Calcite	6	Feldspar	10	Diamond
		7	Quartz		

Hardness of Materials

The numbers give only the order of arrangement as to hardness.

(From Smithsonian Tables.)

Agate	7.	Hematite	6.
Alabaster	1.7	Hornblende	5.5
Alum	2–2.5	Iridium	6.
Aluminum	2.	Iridosmium	7.
Amber	2–2.5	Iron	4–5.
Andalusite	7.5	Kaolin	1.
Anthracite	2.2	Lead	1.5
Antimony	3.3	Loess (0°)	0.3
Apatite	5.	Magnetite	6.
Aragonite	3.5	Marble	3–4.
Arsenic	3.5	Meerschaum	2–3.
Asbestos	5.	Mica	2.8
Asphalt	1–2.	Opal	4–6.
Augite	6.	Orthoclase	6.
Barite	3.3	Palladium	4.8
Beryl	7.8	Phosphor bronze	4.
Bell-metal	4.	Platinum	4.3
Bismuth	2.5	Plat-iridium	6.5
Boric acid	3.	Pyrite	6.3
Brass	3–4.	Quartz	7.
Calanime	5.	Rock-salt	2.
Calcite	3.	Ross' metal	2.5–3.0
Copper	2.5–3.	Silver chloride	1.3
Corundum	9.	Sulphur	1.5–2.5
Diamond	10.	Stibnite	2.
Dolomite	3.5–4.	Serpentine	3–4.
Feldspar	6.	Silver	2.5–3.
Flint	7.	Steel	5–8.5
Fluorite	4.	Talc	1.
Galena	2.5	Tin	1.5
Garnet	7.	Topaz	8.
Glass	4.5–6.5	Tourmaline	7.3
Gold	2.5–3.	Wax (0°)	0.2
Graphite	0.5–1.	Wood's metal	3.
Gypsum	1.6–2.	Zinc	2.5

SURFACE TENSION OF VARIOUS LIQUIDS IN CONTACT WITH AIR

(Compiled from Various Sources.)

Liquid.	Temp. ° C.	Tension, dynes per cm.	Observer.
Acetic acid	20	23.5	Ramsay & Shields
Acetone	17.6	23.3	Jaeger
Alcohol, ethyl	20	21.7	Magie
Alcohol, methyl	20	23.0	Ramsay & Shields
Anilin	17.5	44.1	Volkmann
Benzol (C_6H_6)	22.5	29.4	Cantor
Bromine	−21	62.1	Quincke
Carbon disulphide	20	31.7	Magie
Chloroform	20	26.7	Magie
Ether	20	16.8	Brunner
Glycerine	18	65.2	Cantor
Hydrochloric acid	20	72.9	Quincke
Mercury	18	520.	
Oil, olive	20	33.5	Mean of various
Oil, turpentine	20	27.1	Mean of various
Petroleum	20	25.9	Magie

SURFACE TENSION OF AQUEOUS SOLUTIONS

Salt in solution.	Density of solution.	Temp. ° C.	Tension in dynes per cm. against air.
Barium chloride	1.282	15–16	81.8
Calcium chloride	1.351	19	95.0
Calcium chloride	1.277	19	90.2
Copper sulphate	1.178	15–16	78.6
Hydrochloric acid	1.119	20	73.6
Hydrochloric acid	1.089	20	74.5
Hydrochloric acid	1.024	20	75.3
Potassium chloride	1.170	15–16	82.8
Potassium chloride	1.101	15–16	80.1
Sodium chloride	1.193	20	85.8
Sodium chloride	1.107	20	80.5
Sodium nitrate	1.302	12	83.5
Sodium oleate	saturated	20	25.0
Sulphuric acid	1.445	15	79.7
Sulphuric acid	1.264	15	79.7
Zinc sulphate	1.398	15–16	83.3
Zinc sulphate	1.104	15–16	77.8

SURFACE TENSION OF FUSED SOLIDS

(With One Exception from Quincke, 1868.)

Substance.	Gas with which liquid is in contact.	Temp. ° C.	Surface tension, dynes per cm.
Antimony	CO_2	432.	245.
Borax	air	fusion	212.
Copper	air	fusion	581.
Gold *	air	1070	612.
Iron	air	fusion	950.
Lead	CO_2	330	448.
Phosphorus	CO_2	fusion	41.2
Platinum	air	2000	1658.
Potassium	....	58	371.
Potassium chloride	....	fusion	93.
Silver	air	1000	782.
Selenium	air	fusion	70.
Sodium	....	90	258.
Sodium chloride	....	fusion	115.
Sugar	air	160	66.9
Sulphur	air	111	42.
Tin	CO_2	fusion	352.
Zinc	....	360	877.

* Heydweiller.

SURFACE TENSION OF WATER AND ALCOHOL

SURFACE TENSION FOR WATER AND ALCOHOL (ETHYL) IN CONTACT WITH AIR IN DYNES PER CENTIMETER

(From Smithsonian Tables.)

Temp. ° C.	Surface tension, dynes per centimeter.		Temp. ° C.	Surface tension, dynes, per centimeter.	
	Water.	Ethyl alcohol.		Water.	Ethyl alcohol.
0	75.6	23.5	55	67.8	18.6
5	74.9	23.1	60	67.1	18.2
10	74.2	22.6	65	66.4	17.8
15	73.5	22.2	70	65.7	17.3
20	72.8	21.7	75	65.0	16.9
25	72.1	21.3	80	64.3	
30	71.4	20.8	85	63.6	
35	70.7	20.4	90	62.9	
40	70.0	20.0	95	62.2	
45	69.3	19.5	100	61.5	
50	68.6	19.1			

VISCOSITY OF WATER AND OTHER LIQUIDS

(1) Thorpe-Rodgers, 1894; (2) Gartenmeister, 1890.

Temp. ° C.	Coefficient of viscosity, C. G. S.							
	Water (1)	Alcohol, ethyl (1)	Chloroform (1)	Ether (2)	Benzol (1)	Acetic acid (2)	Carbon bisulphide (1)	Amyl acetate (2)
0	.01778	.01770	.00700	....	.00902	.....	.00429	
10	.01303	.01449	.00626	.0026	.00759	.0150	.00396	.0106
20	.01002	.01192	.00564	.0023	.00649	.0126	.00367	.0089
30	.00798	.00990	.00511	.0021	.00562	.0109	.00342	.0077
40	.00654	.00828	.00466	....	.00492	.0094	.00319	.0065
50	.00548	.00698	.00390	....	.00437	.0082	.....	.0058
60	.00468							
70	.00406	.00504	.....	....	.00351			
80	.00356							
90	.00316							

VISCOSITY OF LIQUIDS

Coefficient of Viscosity in C. G. S. Units

Liquid.	Temp. ° C.	Viscosity.	Observer.
Acetone	20.	.0033	Thorpe-Rodgers
Air, liquid	.....	0.0033	Forch
Bromine	16.	0.010	Thorpe-Rodgers
Carbon dioxide (liquid)	20.	0.00071	Warburg-Babo
Glycerine	2.8	42.2	Schottner
	20.3	8.3	Schottner
Mercury	0.	0.0170	Koch
	20.	0.0157	Koch
	300.	0.0093	Koch
Olive oil	15.	0.9890	Brodmann
Sulphuric acid	20.	0.22	Graham

VISCOSITY OF GASES

C. G. S. Units.

Gas.	Temp. ° C.	Viscosity.	Observer.
Air	0	0.000173	Breitenbach
Carbon dioxide	−20.	0.000129	Breitenbach
	15.	0.000145	Breitenbach
Chlorine	20.	0.000147	Graham
Hydrogen	0.	0.000086	Markowski
Nitrogen	10.9	0.000171	Obermayer
Oxygen	0.	0.000193	Markowski
Water vapor	0.	0.000090	Puluj
	100.	0.000132	Meyer-Schumann

DIFFUSION

Gases into Air

Gas or vapor.	Temp. C.	Coefficient of diffusion, sq.cm./sec.	Observer.
Alcohol, vapor	40.4	0.137	Winkelmann
Carbon dioxide	0.0	0.139	Mean of various
Carbon disulphide	19.9	0.102	Winkelmann
Ether, vapor	19.9	0.089	Winkelmann
Hydrogen	0.0	0.634	Obermayer
Oxygen	0.0	0.178	Obermayer
Water, vapor	8.0	0.239	Guglielmo

Aqueous Solutions into Pure Water

Concentration in gram-molecules per liter.

Substance.	Concentration.	Temp. ° C.	Diffusion sq.cm./day.	Observer.
Acetic acid	0.2	13.5	0.77	Scheffer
	1.0	12.	0.74	Arrhenius
	2.0	12.	0.69	Arrhenius
	3.0	12.	0.68	
	4.0	12.	0.66	Arrhenius
Ammonia	1.0	15.23	1.54	Abegg
Barium chloride	0.2	8.	0.66	Scheffer
Bromine	0.1	12.	0.8	Euler
Cadmium sulphate	2.0	19.04	0.246	Seitz
Calcium chloride	2.0	10.	0.68	Schuhmeister
Chlorine	0.1	12.	1.22	Euler
Copper sulphate	0.1	17.	0.39	Thovert
Formic acid	1.0	12.	0.97	Abegg
Glycerine	0.1	10.14	0.357	Heimbrodt
	0.2	10.1	3.55	Heimbrodt
	1.0	10.14	0.339	Heimbrodt
Hydrochloric acid	0.1	19.2	2.21	Thovert
	1.0	12.	2.09	Arrhenius
	2.0	12.	2.21	Arrhenius
Iodine	0.1	12.	(0.5)	Euler
Magnesium sulphate	1.0	7.	0.30	Scheffer
Nitric acid	0.1	19.5	2.07	Thovert
Potassium bromide	1.0	10.	1.13	Schuhmeister
carbonate	3.0	10.	0.60	Schuhmeister
chloride	0.1	17.5	1.38	Thovert
chloride	4.0	10.	1.27	Schuhmeister
hydrate	0.1	13.5	1.72	Thovert
	1.0	12.	1.72	Arrhenius
	3.0	12.	1.89	Arrhenius
Silver nitrate	0.1	12.	0.985	Thovert
Sodium acetate	0.2	12.	0.67	Kawalki
chloride	0.1	15.0	0.94	Thovert
	0.2	15.0	0.94	Thovert
	1.0	15.0	0.94	Thovert
	1.0	14.3	0.964	Heimbrodt
hydrate	1.0	12.	1.11	Thovert
iodide	1.0	10.	0.80	Schuhmeister
	2.0	10.	0.90	Schuhmeister
Sugar	1.0	12.	0.254	Arrhenius
Sulphuric acid	1.0	12.	1.12	Arrhenius
	2.0	12.	1.16	Arrhenius
Urea	0.1	14.8	0.97	Heimbrodt
	0.2	14.8	0.969	Heimbrodt
Zinc acetate	2.0	18.05	0.210	Seitz
	2.0	0.04	0.120	Seitz
sulphate	1.0	14.8	0.236	Seitz

OSMOTIC PRESSURE OF AQUEOUS SOLUTIONS

For a Membrane of Ferrocyanide of Copper

Dissolved Substance.	Gms. substance in 1 cm. sol.	Temp. ° C.	Pressure, cm. Hg.	Observer.
Glycerine..........	.00199	0	36.7	
Gum arabic.........	0.0099	15.5	7.0	Pfeffer
Gum arabic.........	0.164	15.6	119.3	Pfeffer
Phenol (carbolic acid)	.00127	0	23.3	Naccari
	Gm.-mol. substance per gm. sol.		**Pressure in atm.**	
Glucose............	.0001	10.2	2.39	Morse, 1911
	.0005	10.2	11.55	Morse, 1911
	.0010	10.0	23.80	Morse, 1911
Saccharose (cane sugar)............	.0001	10.0	2.50	Morse, 1911
	.0005	10.0	12.30	Morse, 1911
	.0010	10.0	25.69	Morse, 1911
	Gm.-mol. substance in 1 ccm. sol.			
Potassium carbonate	.00005	15	1.17	Adie, 1891
ferrocyanide......	.00005	15	3.44	Adie, 1891
nitrate...........	.00005	15	1.56	Adie, 1891
Sodium citrate (acid)	.00005	15	4.32	Adie, 1891

HEAT

CONVERSION OF THERMOMETER SCALES

Degrees C. $\times 1.8 + 32 =$ Degrees F. Degrees $\frac{(F.-32)4}{9} =$ Degrees R.

Degrees $\frac{F.-32}{1.8} =$ Degrees C. Degrees $\frac{R. \times 5}{4} =$ Degrees C.

Degrees $\frac{R. \times 9}{4} + 32 =$ Degrees F. Degrees $\frac{C. \times 4}{5} =$ Degrees R.

For Centigrade-Fahrenheit Conversion Tables see under Measures and Units.

REDUCTION OF MERCURY IN GLASS THERMOMETER READING TO THE HYDROGEN SCALE

JENA NORMAL GLASS, 16^{III}

(From Miller's Laboratory Physics, Ginn & Co., publishers, by permission.)

Reading	0°	10	20	30	40	50
Correction	0°.000	−0.055	−0.090	−0.109	−0.115	−0.109
Reading	50°	60	70	80	90	100
Correction	−0°.109	−0.096	−0.076	−0.053	−0.027	0.000

COEFFICIENT OF THERMAL EXPANSION

LINEAR

The coefficient given is the increase in length per unit length (measured at 0° C.) per degree Centigrade.

Substance	Temp. °C.	Coefficient	Observer
		$\times 10^{-4}$	
Aluminum	−191 to +16	0.1835	Henning, 1907
	20	0.255	Voigt, 1893
	40	0.2313	Fizeau, 1869
	600	0.3150	Chatelier
Aluminum-bronze	20	0.170	National Physical Laboratory
Antimony	−180 to +13	0.1023	Grüneisen, 1910
	20	0.12	Fizeau, 1869
	15–101	0.1088	Grüneisen, 1910
parallel to axis	10–90	0.1730	Fizeau, 1869
perpendicular to axis	10–90	0.0828	"
Arsenic	10–90	0.0386	"
Bismuth	−180 to +15	0.1298	
	19–101	0.1345	
parallel to axis	10–90	0.1537	
perpendicular to axis	10–90	0.1084	
Brass			
cast	0–100	0.1875	Smeaton
wire	0–100	0.1930	"
66Cu, 34Zn	20	0.189	National Physical Laboratory
Brick	....	0.095	National Physical Laboratory
Bronze			
3Cu, 1Sn	16.6–100	0.1844	Daniell
	16.6–350	0.2116	"
	16.6–957	0.1737	"
93.5Cu, 6.5Sn	16–100	0.365	Bein, 1912
90Cu, 10Sn	0–900	0.220	Le Chatelier, 1889
80Cu, 20Sn	0–800	0.270	"
70Cu, 30Sn	0–700	0.295	"
phosphor			
97.6Cu, 2Sn, 0.2P	0–85	0.168	Mean
Cadmium	−183 to +14	0.446	Grüneisen, 1901
	20	0.288	Matthiessen, 1866
	0–100	0.3159	"
	10–90	0.2939	Fizeau
	315	0.316	Vicentini & Omodei

COEFFICIENT OF THERMAL EXPANSION (Continued)

Linear

The coefficient given is the increase in length per unit length (measured at 0° C.) per degree Centigrade.

Substance	Temp. °C.	Coefficient	Observer
Calcite, parallel to axis	0–85	0.2514×10^{-4}	Benoit, 1888
perpendicular to axis	0–85	−0.0558	"
Caoutchouc	....	0.657–0.686	Various
	17–25	0.770	Kohlrausch
Carbon			
diamond	40	0.0118	Fizeau, 1869
gas carbon	40	0.0540	"
graphite	40	0.0786	"
Cement and concrete		0.10–0.14	"
Cobalt	40	0.1236	"
Constantan	4–29	0.1523	....
60Cu, 40Ni	20	0.170	National Physical Laboratory
	−191 to +16	0.1202	Henning, 1907
	0–38	0.1448	Guillaume, 1896
	0–500	0.1481	Holborn & Day, 1900
Copper	−191 to +16	0.1409	Henning, 1907
	10–90	0.1596	Fizeau, 1869
	0–625	0.1607	Dittenberger, 1902
Diamond, *see Carbon*			
Ebonite	25–35	0.842	Kohlrausch
Emerald, parallel to axis	0–85	−0.0135	Benoit
perpendicular to axis	0–85	+0.0100	
Fluor spar, CaF_2	0–100	0.195	Pfaff
Galena	....	0.199	....
German silver	0–100	0.1836	Pfaff
60Cu, 15Ni, 25Zn			
Glass			
tube	0–100	0.0833	Fizeau
soft	....	0.085	Schott
hard	....	0.097	"
plate	0–100	0.0891	Lavoisier & Laplace
crown	0–100	0.0897	" "
flint	50–60	0.0788	Pulfrich
Jena thermometer			
16III normal	0–100	0.081	Schott
59III	0–100	0.058	"
59III	−191 to +16	0.0424	Henning, 1907
Gold	−183 to +16	0.132	Grüneisen, 1910
	16–100	0.143	"
Gold-copper	0–100	0.1552	Matthiessen
2Au, 1Cu			
Gold-platinum	0–100	0.1523	"
2Au, 1Pt			
Granite	....	0.083	....
Gun metal	....	0.183	Nat. Phys. Lab.
Gutta percha	....	1.983	Russner, 1882
Ice	−20 to −1	0.510	....
	−10 to 0	0.507	Vincent, 1902
Indium	40	0.417	Fizeau, 1869
Invar, *see Nickel steel*			
Iodine	−188 to 16	0.837	Dewar, 1902
Iridium	−183 to +19	0.0571	Grüneisen, 1910
Iron	−190 to +17	0.0907	Henning, 1907
soft	40	0.1210	Fizeau, 1869
cast	40	0.1061	"
cast	−190 to +16	0.0850	Henning, 1907

COEFFICIENT OF THERMAL EXPANSION (Continued)

Linear

The coefficient given is the increase in length per unit length (measured at 0° C.) per degree Centigrade.

Substance	Temp. °C.	Coefficient	Observer
Iron, wrought	−18 to +100	0.1140×10^{-4}	Andrews
steel	40	0.1322	Fizeau, 1869
steel, annealed	40	0.1095	Fizeau, 1869
steel, 1.2% C.	0–100	0.105	Le Chatelier, 1899
"	100–200	0.115	"
"	200–300	0.13	"
"	300–400	0.15	"
"	400–500	0.14	"
"	500–600	0.16	"
"	600–700	0.16	"
"	above 900	0.29	"
Lead	−183 to +14	0.2708	Grüneisen, 1910
	18–100	0.2940	"
Lead-tin 2Pb, 1Sn	0–100	0.2508	Smeaton
Magnesium	−183 to +15	0.2140	Grüneisen, 1910
	18–100	0.2608	"
cast	20–100	0.2696	C. D. H., 1917
wrought	20–100	0.2673	"
Magnalium 96Al, 4Mg	0–13	0.22	Guillaume, 1902
86Al, 14Mg	12–39	0.238	Stadhagen, 1901
Marble	15–100	0.117	Fröhlich
Masonry	....	0.04–0.07	....
Mercury	−183 to −39	0.30	Dewar, 1902
	−78 to −38	0.41	Grunmach, 1901
Nickel	−191 to +16	0.1012	Henning, 1907
	40	0.1279	Fizeau
	16–250	0.1397	Holborn & Day, 1901
	375–1000	0.1346	Holborn & Day, 1901
Nickel steel			
10% Ni	20	0.130	Nat. Phys. Lab.
20	20	0.195	" " "
30	20	0.120	" " "
36 (Invar)	20	0.009	" " "
40	20	0.060	" " "
50	20	0.097	" " "
80	20	0.125	" " "
Osmium	40	0.0657	Fizeau
Palladium	40	0.1176	"
	0–100	0.1104	Matthiessen
Paraffine	0–16	1.066	Rodwell
	16–38	1.303	"
	38–49	4.771	"
Phosphorous	0–44	1.24	Laduc, 1891
Phosphor bronze, *see Bronze*			
Platinum	40	0.0899	Fizeau
Platinum iridium 10Pt, 1Ir	40	0.0884	Fizeau
Platinum silver 33Pt, 67Ag	0–100	0.1523	Matthiessen
Porcelain	20–790	0.0413	Braun
Berlin	0–100	0.031	Holborn & Grüneisen
Bayeux	0	0.025	Tutton, 1902
	1000–1400	0.0553	Deville & Troost

COEFFICIENT OF THERMAL EXPANSION (Continued)

Linear

The coefficient given is the increase in length per unit length (measured at 0° C.) per degree Centigrade.

Substance	Temp. °C.	Coefficient	Observer
Quartz (crystal)			
parallel to axis	−190 to +16	0.0521×10^{-4}	Scheel
	0–80	0.0797	Benoit, 1888
perpendicular to axis	0–80	0.1337	"
fused	−191 to +16	0.00256	Henning, 1907
	0–30	0.0042	Chappius, 1903
	0–100	0.0050	Scheel, 1907
	0–800	0.00546	Randall, 1910
	0–1200	0.00585	"
Rhodium	40	0.0850	Fizeau
Rock salt	40	0.4040	"
Rubidium	2–17	0.862	Elsa Deuss, 1911
Ruthenium	40	0.0963	Fizeau
Sandstone	20	0.07–0.12	....
Selenium	−180 to 0	0.372	Dorsey, 1908
	40	0.3680	Fizeau
Silicon	40	0.0763	"
Silver	−191 to +16	0.1704	Henning, 1907
	20	0.188	Voigt, 1893
Slate	20	0.06–0.10	....
Solder, *see Lead-tin*			
Speculum metal 68Cu, 32Sn	20	0.193	Smeaton
Sodium	−188 to +17	0.622	Dewar, 1902
Sulphur, crystal	40	0.6413	Fizeau, 1869
Tellurium	40	0.1675	"
Thallium	40	0.3021	"
Tin	−183 to +16	0.2257	Grüneisen, 1910
	18–100	0.2692	"
Topaz, axis a	0–100	0.0832	Pfaff
" b	0–100	0.0836	"
" c	0–100	0.0472	"
Tourmaline			
parallel to axis	0–100	0.0937	"
perpendicular to axis	0–100	0.0773	"
Tungsten	20–100	0.0336	Colin, 1910
Type metal	17–254	0.1952	Daniell
Vulcanite	0–18	0.6360	Mayer
Wood			
parallel to fiber			
ash	0–100	0.0951	Glatzel
beech	2–34	0.0257	Villari
chestnut	2–34	0.0649	"
elm	2–34	0.0565	"
mahogany	2–34	0.0361	"
maple	2–34	0.0638	"
oak	2–34	0.0492	"
pine	2–34	0.0541	"
walnut	2–34	0.0658	"
across fiber			
beech	2–34	0.614	"
chestnut	2–34	0.325	"
elm	2–34	0.443	"
mahogany	2–34	0.404	"
maple	2–34	0.484	"
oak	2–34	0.544	"
pine	2–34	0.341	"
walnut	2–34	0.484	"
Zinc	−180 to 0	0.264	Dorsey, 1908
	10–100	0.2628	Thiesen, Scheel & Sell, 1895

EQUATION FOR THE LINEAR EXPANSION OF SOLIDS

If l_0 is the length at 0° C. the length at t° C. is $l_t = l_0\,(1 + \alpha t + \beta t^2)$.

The table gives the values of these coefficients.

Substance.	Temp. limits. ° C.	α.	β.	Observer.
Aluminum...	10–90	$.2221 \times 10^{-4}$	$.114 \times 10^{-7}$	Fizeau
Brass.......	10–90	.1781	.098	Fizeau
Copper......	10–90	.1596	.102	Fizeau
Gold........	10–90	.1410	.042	Fizeau
Iron, pure...	0–38	.1145	.071	Guillaume
Lead........	10–90	.2829	.120	Fizeau
Nickel......	0–38	.1255	.057	Guillaume
Platinum....	0–1000	.0868	.013	Holborn and Valentine
Silver.......	10–90	.1862	.074	Fizeau
Tin..........	10–90	.2094	.175	Fizeau
Zinc........	10–90	.2969	–.0635	Fizeau

CUBICAL EXPANSION OF SOLIDS

The coefficient of cubical expansion for a solid is approximately three times the linear coefficient.

The experimental values for various solids are given in the following table. The coefficient is the increase in volume per unit volume per degree Centigrade.

Substance.	Temp. ° C.	Coefficient.	Observer.
Antimony.......	0–100	0.3167×10^{-4}	Matthieson
Bismuth........	......	0.4000	Kopp
Diamond........	40	0.0354	Fizeau
Fluor spar.......	14–47	0.6235	Kopp
Glass, white tube.	0–100	0.2648	Regnault
green tube.....	0–100	0.2299	Regnault
Jena..........	0–100	0.2533	Reichsanstalt
Ice.............	–20 to –1	1.1250	Brunner
Iceland spar.....	50–60	0.1447	Pulfrich
Iron............	0–100	0.3550	Dulong and Petit
Porcelain........	0–100	0.1080	Deville and Troost
Quartz..........	50–60	0.3530	Pulfrich
Rock salt........	50–60	1.2120	Pulfrich

CUBICAL EXPANSION OF LIQUIDS

The table gives the mean coefficient of cubical expansion for the range 0–100° C. and the values of the quantities α, β and γ in the equation $V_t = V_0 (1 + \alpha t + \beta t^2 + \gamma t^3)$.

(From Smithsonian Tables.)

Liquid.	Temp. Range ° C.	Mean coef. 0-100° C.	α	β	γ	Observer.
Acetic acid	16–107	.001433	1.0630×10^{-3}	0.1264×10^{-6}	1.0876×10^{-8}	Zander
Acetone	0–54	1616	1.3240	3.8090	0.8798	Zander
Alcohol:						
amyl	−15 to +80	.....	0.8900	0.6573	1.1846	Pierre
ethyl, sp.gr. .8095	0–80	.....	1.0414	0.7836	1.7168	Kopp
ethyl, 50% by volume	0–39	.....	0.7450	1.850	0.730	Recknagel
ethyl, 30% by volume	18–39	.....	0.2928	17.900	11.87	Recknagel
methyl	−38 to +70	1433	1.1856	1.5649	0.9111	Pierre
Benzene	11–81	1385	1.1763	1.2775	0.8065	Kopp
Bromine	− 7 to +60	1168	1.0382	1.7114	0.5447	Pierre
Calcium chloride:						
$CaCl_2$, 5.8% solution	18–25	0506	0.0788	4.2742	....	Decker
$CaCl_2$, 40.9% solution	17–24	0510	0.4238	0.8571	....	Decker
Carbon disulphide	−34 to +60	1468	1.1398	1.3706	1.9122	Pierre
Chloroform	0–63	1399	1.1071	4.6647	1.7433	Pierre
Ether	−15 to +38	2150	1.5132	2.3592	4.0051	Pierre
Glycerine	....	0534	0.4853	0.4895	....	Emo
Hydrochloric acid:						
$HCl + 6.25H_2O$	0–30	0489	0.4460	0.430	....	Marignac
$HCl + 50H_2O$	0–30	0933	0.0625	8.710	....	Marignac

CUBICAL EXPANSION OF LIQUIDS (Continued)

Liquid.	Temp. Range ° C.	Mean coef. 0-100° C.	α	β	γ	Observer.
Mercury..................	24–299	.....	0.18182×10^{-3}	0.00078×10^{-6}	....	Scheel
Olive oil..................	....	.000742	0.6821	1.1405	$-.539 \times 10^{-8}$	Spring
Potassium chloride:						
KCl, 2.5% solution.......	....	0572	....	....	....	Decker
KCl, 24.3% solution......	....	0477	....	....	....	Decker
Potassium nitrate:						
KNO_3, 5.3% solution.....	....	0539	....	....	....	Nicol
KNO_3, 21.9% solution....	....	0577	....	....	....	Nicol
Phenol, C_6H_6O.............	36–157	0899	0.8340	0.1073	0.4446	Pinette
Petroleum, sp.gr. 0.8467	24–120	1039	0.8994	1.396	....	Frankenheim
Sodium chloride, NaCl, 1.6% solution.............	....	1067	0.0213	10.462	....	Marignac
Sodium sulphate, Na_2SO_4, 24% solution..........	10–40	0611	0.3599	2.516	....	Marignac
Sodium nitrate, $NaNO_3$, 36.2% solution........	20–78	0627	0.5408	1.075	....	Nicol
Sulphuric acid:						
H_2SO_4..................	0–30	0489	0.5758	0.864	....	Marignac
$H_2SO_4+50H_2O$...........	0–30	0799	0.2835	5.160	....	Marignac
Turpentine................	−9 to +106	1051	0.9003	1.959	....	Kopp
Water.....................	0–33	.....	−.0643	8.505	6.790	Scheel

COEFFICIENTS OF EXPANSION OF GASES AT CONSTANT PRESSURE

Change in volume per unit volume per degree Centigrade.

(From Smithsonian Tables.)

Gas.	Temp. ° C.	Pressure in cm. of mercury.	Coeffi-cient.	Observer.
Acetylene	0	76.	.003772	Leduc, 1912
Acetylene	0–100	76.	3739	Leduc, 1912
Air	0–100	76.	3670	Regnault, 1842
Air	0–100	100.1	36728	Chappuis, 1903
Ammonia	0	76.	3860	Leduc, 1912
Ammonia	0–100	76.	3800	Leduc, 1912
Carbon dioxide	0	76.	3751	Leduc, 1912
Carbon dioxide	0–100	76.	3723	Leduc, 1912
Carbon dioxide	0–20	51.8	37128	Chappuis, 1903
Carbon dioxide	0–40	51.8	37100	Chappuis, 1903
Carbon dioxide	0–100	51.8	37073	Chappuis, 1903
Carbon dioxide	0–20	99.8	37602	Chappuis, 1903
Carbon dioxide	0–100	99.8	37410	Chappuis, 1903
Carbon dioxide	0–20	137.7	37972	Chappuis, 1903
Carbon dioxide	0–100	137.7	37703	Chappuis, 1903
Carbon dioxide	0–7.5	2621.	1097	Baly-Ramsay, 1894
Carbon dioxide	64–100	2621.	6574	Baly-Ramsay, 1894
Carbon monoxide	0–100	76.	3669	Regnault, 1842
Chlorine	0	76.	3900	Leduc, 1912
Chlorine	0–100	76.	3830	Leduc, 1912
Cyanogen	0	76.	396	Leduc, 1912
Cyanogen	0–100	76.	387	Leduc, 1912
Hydrochloric acid	0	76.	3770	Leduc, 1912
Hydrochloric acid	0–100	76.	3734	Leduc, 1912
Hydrogen	0–100	100.0	36600	Chappuis, 1903
Hydrogen	0–100	200. atm	332	Amagat, 1890
Hydrogen	0–100	400. atm	295	Amagat, 1890
Hydrogen	0–100	600. atm	261	Amagat, 1890
Hydrogen	0–100	800. atm	242	Amagat, 1890
Nitrogen	0	76.	3673	Leduc, 1912
Nitrogen	0–100	76.	3671	Leduc, 1912
Nitrous oxide	0–100	76.	3719	Regnault, 1842
Oxygen	0–100	100. atm	486	Amagat
Oxygen	0–100	200. atm	534	Amagat
Oxygen	0–100	400. atm	459	Amagat
Oxygen	0–100	600. atm	357	Amagat
Oxygen	0–100	800. atm	288	Amagat
Oxygen	0–100	1000. atm	241	Amagat
Sulphur dioxide	0–100	76.	3903	Regnault, 1842
Sulphur dioxide	....	98.	3980	Regnault, 1842
Water vapor	0–119	76.	4187	Hirn, 1862
Water vapor	0–141	76.	4189	Hirn, 1862
Water vapor	0–162	76.	4071	Hirn, 1862
Water vapor	0–200	76.	3938	Hirn, 1862
Water vapor	0–247	76.	3799	Hirn, 1862

COEFFICIENT OF EXPANSION OF GASES AT CONSTANT VOLUME

Change in pressure per unit pressure per degree Centigrade.

(From Smithsonian Tables.)

Gas.	Temp. ° C.	Pressure cm. of Hg.	Coefficient.	Observer.
Acetylene	0	76.	.003741	Leduc, 1912
Acetylene	0–100	76.	3726	Leduc, 1912
Air	.....	.6	37666	Meleander, 1890–92
Air	.....	1.3	37127	Meleander, 1890–92
Air	.....	10.0	36630	Meleander, 1890–92
Air	.....	25.4	36580	Meleander, 1890–92
Air	.....	75.2	36660	Meleander, 1890–92
Air	0–100	100.1	36744	Chappuis, 1903
Air	.....	76.0	36650	Regnault, 1842
Air	.....	200.0	36903	Regnault, 1842
Air	.....	2000.	38866	Regnault, 1842
Air	.....	10000.	4100	Regnault, 1842
Ammonia	0	76.	3800	Leduc, 1912
Ammonia	0–100	76.	3770	Leduc, 1912
Argon	.....	51.7	3668	Keunen-Randall, 1896
Carbon dioxide	0–20	51.8	36985	Chappuis, 1903
Carbon dioxide	0–40	51.8	36972	Chappuis, 1903
Carbon dioxide	0–100	51.8	36981	Chappuis, 1903
Carbon dioxide	0-20	99.8	37335	Chappuis, 1903
Carbon dioxide	0–100	99.8	37262	Chappuis, 1903
Carbon dioxide	0–100	100.0	37248	Chappuis, 1892
Carbon dioxide	0	76.	3724	Leduc, 1912
Carbon dioxide	0–100	76.	3714	Leduc, 1912
Carbon monoxide	.....	76.	36667	Regnault, 1842
Cyanogen	0	76.	3870	Leduc, 1912
Cyanogen	0–100	76.	3830	Leduc, 1912
Ethane	0	76.	3780	Leduc, 1912
Ethane	0-100	76.	3750	Leduc, 1912
Helium	.....	56.7	3665	Keunen-Randall, 1896
Hydrochloric acid	.....	76.	3740	Leduc, 1912
Hydrochloric acid	0–100	76.	3721	Leduc, 1912
Hydrogen	0	76.	3663	Leduc, 1912
Hydrogen	0–100	76.	3664	Leduc, 1912
Hydrogen	16–132	.0077	3328	Baly-Ramsay, 1894
Hydrogen	15–132	.025	3623	Baly-Ramsay, 1894
Hydrogen	12–105	.47	3656	Baly-Ramsay, 1894
Hydrogen	0–100	100.0	36626	Chappuis, 1903
Methane	0	76.	3680	Leduc, 1912
Methane	0–100	76.	3678	Leduc, 1912
Nitrogen	0	76.	3672	Leduc, 1912
Nitrogen	0–100	76.	3672	Leduc, 1912
Nitrogen	13–132	.06	3021	Baly-Ramsay, 1894
Nitrogen	9-133	.53	3290	Baly-Ramsay, 1894
Nitrogen	0–20	100.2	36754	Chappuis, 1903
Nitrogen	0-100	100.2	36744	Chappuis, 1903
Oxygen	0	76.	3673	Leduc, 1912
Oxygen	0–100	76.	3672	Leduc, 1912
Oxygen	11–132	.007	4161	Baly-Ramsay, 1894
Oxygen	9-132	.25	3984	Baly-Ramsay, 1894
Oxygen	11–132	.51	3831	Baly-Ramsay, 1894
Oxygen	.....	1.9	36683	Meleander, 1891
Oxygen	.....	18.5	36690	Meleander, 1891
Nitrous oxide	.....	76.	3676	Regnault, 1842
Sulphur dioxide, SO_2	.....	76.	3845	Regnault, 1842

REDUCTION OF GAS VOLUME

Values of (1+at) for Temperatures from 0 to 120° C.

T	0	1	2	3	4	5	6	7	8	9
00	1.0000	1.0037	1.0073	1.0110	1.0147	1.0183	1.0220	1.0257	1.0294	1.0330
10	1.0367	1.0404	1.0440	1.0477	1.0514	1.0550	1.0587	1.0624	1.0661	1.0697
20	1.0734	1.0771	1.0807	1.0844	1.0881	1.0917	1.0954	1.0991	1.1028	1.1064
30	1.1101	1.1138	1.1174	1.1211	1.1248	1.1284	1.1321	1.1358	1.1395	1.1431
40	1.1468	1.1505	1.1541	1.1578	1.1615	1.1651	1.1688	1.1725	1.1762	1.1798
50	1.1835	1.1872	1.1908	1.1945	1.1982	1.2018	1.2055	1.2092	1.2129	1.2165
60	1.2202	1.2239	1.2275	1.2312	1.2349	1.2385	1.2422	1.2459	1.2496	1.2532
70	1.2569	1.2606	1.2642	1.2679	1.2716	1.2752	1.2789	1.2826	1.2863	1.2899
80	1.2936	1.2973	1.3009	1.3046	1.3083	1.3119	1.3156	1.3193	1.3230	1.3266
90	1.3303	1.3340	1.3376	1.3413	1.3450	1.3486	1.3523	1.3560	1.3597	1.3633
100	1.3670	1.3707	1.3743	1.3780	1.3817	1.3853	1.3890	1.3927	1.3964	1.4000
110	1.4037	1.4074	1.4110	1.4147	1.4184	1.4220	1.4257	1.4294	1.4331	1.4367
120	1.4404									

Values of H/760 for Pressures from 700 to 780 mm. of Mercury.

H	0	1	2	3	4	5	6	7	8	9
700	0.9211	0.9224	0.9237	0.9250	0.9263	0.9276	0.9289	0.9303	0.9316	0.9329
710	0.9342	0.9355	0.9368	0.9382	0.9395	0.9408	0.9421	0.9434	0.9447	0.9461
720	0.9474	0.9487	0.9500	0.9513	0.9526	0.9539	0.9553	0.9566	0.9579	0.9592
730	0.9605	0.9618	0.9632	0.9645	0.9658	0.9671	0.9684	0.9697	0.9711	0.9724
740	0.9737	0.9750	0.9763	0.9776	0.9789	0.9803	0.9816	0.9829	0.9842	0.9855
750	0.9868	0.9882	0.9895	0.9908	0.9921	0.9934	0.9947	0.9961	0.9974	0.9987
760	1.0000	1.0013	1.0026	1.0039	1.0053	1.0066	1.0079	1.0092	1.0105	1.0118
770	1.0132	1.0145	1.0158	1.0171	1.0184	1.0197	1.0211	1.0224	1.0237	1.0250
780	1.0263									

SPECIFIC HEAT OF WATER AND MERCURY

Values for water from 0–100° C. are the mean of various determinations including Calendar and Blonsfield, 1912; above 100, Regnault's values recomputed by Guillaume, 1912.

Values for mercury 0–80° C. due to Barnes and Cooke; 90–140°, mean of Winkelmann, Naccari and Milthaler; above 140°, mean of Naccari and Milthaler.

Specific heat in normal calories (15° C.).

Temp. ° C.	Water.	Mercury.	Temp. ° C.	Water.	Mercury.
0	1.00874	.03346	80	1.00239	.03284
5	1.00477	.03340	85	1.00329	
10	1.00184	.03335	90	1.00433	.03277
15	1.00000	.03330	95	1.00534	
20	0.99859	.03325	100	1.00645	.03269
25	0.99765	.03320	110	1.0116	.03262
30	0.99745	.03316	120	1.0144	.03255
35	0.99743	.03312	130	1.0174	.03248
40	0.99761	.03308	140	1.0206	.03241
45	0.99790		150	1.0240	.0324
50	0.99829	.03300	160	1.0275	
55	0.99873		170	1.0313	.0322
60	0.99934	.03294	180	1.0353	
65	1.00001		190	1.0395	.0320
70	1.00077	.03289	200	1.0439	
75	1.00158				

SPECIFIC HEAT OF ELEMENTS

Element.	Temp. °C.	Specific heat, Cal./gm.	Observer.
Aluminum......	−240.6	0.0092	Nernst, 1911
	−233.	0.0165	"
	−190.	0.0889	"
	−190 to −82	0.1466	Koref, 1911
	−76 to −1	0.1962	"
	17–100	0.217	Schimpff, 1910
	15–435	0.236	Tilden, 1902
	500	0.274	Bontschew
Antimony......	−186 to −79	0.0462	Behn, 1900
	−188 to +20	0.0468	Richards & Jackson, 1910
	20	0.0503	Gaede, 1902
	100	0.0513	"
	200	0.0520	Naccari, 1887
	300	0.0537	"
Arsenic, gray, crystal.......	0–100	0.0822	Wigand, 1903
black amor....	0–100	0.0861	"
	−188 to +20	0.0704	Richards & Jackson, 1910
Barium........	−185 to +20	0.068	Nordmeyer-Bernouli, 1907
Beryllium......	0–100	0.425	Nilson & Pettersson, 1880
Bismuth.......	−188 to +20	0.0284	Richards & Jackson, 1910
	−79 to +17	0.0285	Schimpff, 1910
	17–100	0.0303	"
liquid	280–360	0.0363	Person
Boron, amor.....	−191 to −78	0.071	Koref, 1911
	−78–0	0.165	"
	0–100	0.307	Moissan & Gautier
	0–234	0.357	" "
Bromine, solid...	−191 to −81	0.070	Koref, 1911
	−78 to −20	0.084	Regnault, 1849
liquid........	1–32	0.107	Andrews, 1848
Cadmium......	−186 to −79	0.0498	Behn, 1910
	−79 to +18	0.0537	"
	20	0.0549	Gaede, 1902
	100	0.0566	"
	200	0.0594	Naccari, 1887
	300	0.0617	"
Caesium........	0–26	0.048	Eckardt & Graefe, 1900
Calcium........	−185 to +20	0.157	Nordmeyer & Bernouli, 1906
	0–20	0.145	Bernini, 1907

SPECIFIC HEAT OF ELEMENTS (Continued)

Element.	Temp. °C.	Specific heat, Cal./gm.	Observer.
Calcium	0–157	0.152	Bernini, 1907
Carbon:			
gas carbon....	24–68	0.204	Bettendorff & Wüllner
charcoal......	0–24	0.165	Weber, 1875
graphite......	−243	0.005	Nernst, 1911
	−203	0.0175	"
	−188 to −78	0.060	Dewar, 1905
	11	0.160	Weber, 1875
	138	0.254	"
	642	0.445	"
diamond.....	−233	0.0005	Nernst, 1911
	−185	0.0025	"
	−188 to −78	0.019	Dewar, 1905
	−78 to +18	0.079	"
	11	0.113	Weber, 1875
	140	0.222	"
	247	0.303	"
	606	0.441	"
Cerium.........	0–100	0.0448	Hillebrand, 1876
Chlorine, liquid..	0–24	0.226	Knietsch
Chromium......	−188 to +20	0.0793	Richards & Jackson, 1910
	−79 to +17	0.098	Schimpff, 1910
	17–100	0.110	"
	100	0.112	Adler, 1903
	400	0.133	"
Cobalt.........	−188 to +20	0.0827	Richards & Jackson, 1910
	15–100	0.1035	Tilden, 1900
	15–185	0.1047	" 1902
	300	0.121	Göbl, 1911
	*508	{0.145	"
		{0.125	"
	800	0.160	"
	1000	0.184	"
	*1112	{0.270	"
		{0.170	"
Copper........	−253	0.0031	Nernst, 1911
	−213	0.029	"
	−193	0.047	"
	−188 to +20	0.0788	Richards & Jackson, 1910
	−79 to +18	0.0883	Behn, 1900
	20	0.0912	Gaede, 1902
	15–100	0.09305	Bartoli & Stracciati

* Temperatures of Transformation.

SPECIFIC HEAT OF ELEMENTS (Continued)

Element.	Temp. °C.	Specific heat, Cal./gm.	Observer.
Copper:			
	100	0.0942	Gaede, 1900
	200	0.0963	Naccari, 1887
	900	0.1259	Richards, 1893
Didymium	0–100	0.046	Hillebrand, 1876
Gallium, liquid	13–110	0.080	Berthelot, 1878
solid	12–23	0.079	"
Germanium	0–100	0.074	Pettersson-Hedelius, 1881
Glucinium	0–46	0.397	Nilson & Pettersson, 1880
	0–300	0.505	Nilson & Pettersson, 1880
Gold	−188 to −20	0.0297	Richards & Jackson, 1910
	−79 to +17	0.0297	Schimpff, 1910
	0–100	0.0316	Voille, 1877
	17–100	0.031	Schimpff
	0–900	0.0345	Voille, 1879
Hydrogen, liq.	−253	6.0	Dewar, 1901
Indium	−186 to −79	0.0263	Behn, 1900
	−79 to +18	0.0303	"
	18–100	0.0323	"
Iodine	−243	0.031	Nernst, 1911
	−193	0.043	"
	−189 to −76	0.0467	" 1910
	−76–0	0.0516	"
	9–98	0.054	Regnault
liquid	107–180	0.108	Favre & Silbermann, 1863
Iridium	−186 to −79	0.0263	Behn, 1900
	−79 to +18	0.0302	"
	18–100	0.0323	"
	0–900	0.0371	Violle, 1879
Iron	−186 to −79	0.0721	Behn, 1900
	−79 to +18	0.1000	"
	18–100	0.113	"
	300	0.138	Naccari, 1887
	0–650	0.138	Weiss & Beck, 1908
	650	0.195	" "
	850	0.23	" "
cast	20–100	0.1189	Schmitz, 1903
wrought	15–100	0.1152	Nichol, 1881
hard drawn	20–100	0.1146	Hill, 1901
Lanthanum	0–100	0.0448	Hillebrand, 1876

SPECIFIC HEAT OF ELEMENTS (Continued)

Element.	Temp. °C.	Specific heat, Cal./gm.	Observer.
Lead	−253	0.0120	Nernst, 1911
	−233	0.0220	"
	−173	0.0275	"
	−192 to +20	0.0293	Schmitz, 1903
	−186 to −79	0.0291	Behn, 1910
	−79 to +18	0.0300	"
	20–100	0.0305	Schmitz, 1903
	100	0.0313	Gaede, 1902
	300	0.0338	Naccari, 1887
liquid	360	0.0410	Spring, 1886
Lithium	−191 to −80	0.52	Koref, 1911
	−100	0.5997	Laemmel, 1905
	0	0.7951	"
	50	0.9063	"
	100	1.0407	"
	190	1.3745	"
	0–100	1.09	Bernini, 1907
Magnesium	−185 to +20	0.222	Nordmeyer-Bernouli, 1907
	−186 to −79	0.189	Behn, 1900
	− 79 to +18	0.233	"
	17–100	0.248	Schimpff, 1910
	325	0.3235	Stücker, 1905
	625	0.4352	"
Manganese	−188 to +20	0.093	Richards & Jackson, 1910
	−100	0.0979	Laemmel, 1905
	0	0.1072	"
	100	0.1143	"
	325	....	Stücker, 1905
Mercury:			
solid	−213	0.0266	Pollitzer, 1911
"	−183	0.0285	"
"	−185 to +20	0.032	Nordmeyer-Bernouli, 1907
"	−78 to −40	0.0315	Regnault, 1849
liquid	0	0.03346	Barnes & Cooke, 1903
"	20	0.03326	" "
"	40	0.03309	" "
"	60	0.03295	" "
"	100	0.0328	Naccari, 1888
"	200	0.0323	"
"	250	0.0321	"
Molybdenum	−185 to +20	0.062	Nordmeyer-Bernouli, 1907

SPECIFIC HEAT OF ELEMENTS (Continued)

Element.	Temp. °C.	Specific heat, Cal./gm.	Observer.
Molybdenum:			
	15–93	0.072	Guichard & Defacqz, 1901
	60	0.0647	Stücker, 1905
	475	0.0750	"
Nickel.........	−185 to +20	0.092	Nordmeyer-Bernouli, 1907
	−186 to −79	0.0743	Behn, 1900
	−79 to +18	0.0983	"
	15–100	0.1089	Tilden, 1900
	100	0.1128	Pionchon, 1886
	0–200	0.1140	Weiss & Beck, 1908
	0–400	0.1256	" "
	0–800	0.131	" "
Nitrogen, liquid.	−208 to −196	0.0284	Alt, 1904
Osmium........	19–98	0.311	Regnault
Oxygen, liquid..	−200 to −183	0.35	Andrews
Palladium......	−186 to +18	0.0528	Behn, 1900
	−79 to +18	0.0567	"
	0–100	0.0592	Violle, 1878
	0–500	0.0632	"
	0–900	0.0672	"
Phosphorus, yellow........	−188 to +20	0.169	Richards & Jackson, 1910
	−186 to +20	0.17-	Nordmeyer-Bernouli, 1907
	7–30	0.190	Regnault
red..........	0–51	0.1829	Wiegand, 1906
Platinum.......	−180 to +18	0.0293	Behn, 1900
	15–100	0.03224	Bartoli & Stracciati, 1895
	0–500	0.0347	Violle, 1878
	100	0.0275	Tilden, 1903
	500	0.0356	White
	600	0.0344	"
	800	0.0369	"
	1000	0.0382	"
	1200	0.0398	"
	1500	0.0368	"
Potassium......	−185 to +20	0.170	Nordmeyer-Bernouli, 1907
	0–22	0.188	Bernini, 1906
	22–56	0.192	"
liquid........	78–100	0.217	"
	100–157	0.224	"

SPECIFIC HEAT OF ELEMENTS (Continued)

Element.	Temp. °C.	Specific heat, Cal./gm.	Observer.
Rhodium.......	10–97	0.0580	Regnault, 1861
Ruthenium.....	0–100	0.061	Bunsen, 1870
Selenium.......	−188 to +18	0.068	....
crystal.......	22–63	0.084	Bettendorf & Wüllner
Silicon.........	−185 to +20	0.123	Nordmeyer-Bernouli, 1907
amorphous ...	−190 to −80	0.091	Russell, 1912
	−79 to +17	0.147	Schimpff, 1910
	3–50	0.179	Russell, 1912
crystal.......	−40	0.136	Weber, 1875
	21	0.170	"
	129	0.196	"
Silver..........	−186 to −70	0.0496	Behn, 1900
	−79 to +18	0.0544	"
	−233	0.0175	Nernst, 1911
	−193	0.040	"
	15–100	0.05625	Bartoli & Stracciati, 1895
	500	0.0581	Tilden, 1900
	800	0.076	Pionchon, 1886
fluid.........	907–1100	0.0748	"
Sodium........	−185 to +20	0.253	Nordmeyer-Bernouli, 1907
	−80	0.266	Thum, 1906
	−40	0.279	"
	0	0.293	"
	100	0.323	"
Sulphur........	−188 to +18	0.137	....
rhombic......	0–54	0.1728	Wiegand, 1906
monocl.......	0–52	0.1809	"
liquid........	119–147	0.235	Naccari, 1887
Tantalum......	−185 to +20	0.033	Nordmeyer-Bernouli, 1907
	58	0.036	v. Bolton, 1905
	1400	0.043	....
Tellurium......	−188 to +18	0.047	....
crystal.......	15–100	0.0483	Kopp, 1865
	15–300	0.0490	Tilden, 1904
Thallium.......	−185 to +20	0.038	Nordmeyer-Bernouli, 1907
	20–100	0.0326	Schmitz, 1903
Thorium.......	0–100	0.0276	Nilson, 1883
Tin............	−186 to −79	0.0486	Behn, 1900
	−79 to +18	0.0518	"
	20	0.0541	Gaede, 1902

SPECIFIC HEAT OF ELEMENTS (Continued)

Element.	Temp. °C.	Specific heat, Cal./gm.	Observer.
Tin	100	0.0565	Gaede, 1902
liquid........	250–350	0.0608	Pionchon, 1887
"	1100	0.0758	"
gray.........	0–18	0.0589	Wigand, 1907
Titanium.......	−185 to +20	0.082	Nordmeyer-Bernouli, 1907
	20	0.142	Weiss, 1910
Tungsten.......	−185 to +20	0.036	Nordmeyer-Bernouli, 1907
	15–93	0.034	Guichard & Defacqz, 1901
	20–100	0.034	Gin, 1908
Uranium.......	0–98	0.028	Blümcke, 1885
	11–98	0.062	Regnault, 1840
Vanadium......	0–100	0.1153	Mache, 1897
Zinc...........	−192 to +20	0.0836	Schmitz, 1903
	−186 to −79	0.080	Behn, 1900
	−79 to +18	0.0895	"
	−233	0.0268	Nernst, 1911
	−193	0.063	"
	20	0.0924	Gaede, 1900
	100	0.0951	"
	300	0.1040	Naccari, 1887
Zirconium......	0–100	0.0660	Mixter-Dana, 1873
	0–100	0.068	Wedekind & Lewis, 1910

COLOR SCALE OF TEMPERATURE

This table is the result of an effort to interpret in terms of thermometric readings, the common expressions used in describing temperatures. It is obvious that the values are only approximations.

Color.	Temperature, °C.
Incipient red heat..................	500–550
Dark red heat......................	650–750
Bright red heat....................	850–950
Yellowish red heat	1050–1150
Incipient white heat...............	1250–1350
White heat.........................	1450–1550

SPECIFIC HEAT OF VARIOUS SOLIDS

Values given in calories per gram.

Substance.	Temp. ° C.	Sp. heat.	Observer.
Alloys, bell metal..	15–98	0.0858	Regnault
brass, red.......	0	.08991	Lorenz
brass, yellow....	0	.08831	Lorenz
German silver...	0–100	.09464	Tomlinson
Asbestos.........	20–98	.195	Ulrich
Basalt...........	20–100	.20	Mean
Calcspar.........	0–100	.2005	Lindner
Carborundum......	3–44	.162	
Cellulose, dry.....	....	.37	Mean
Cement, powder....	200–10	.20	
Chalk............	20–99	.214	Regnault
Charcoal.........	10	.16	Weber, 1875
Clay, dry.........	20–100	.22	Mean
Ebonite..........	20–100	.40	Louguinine, 1882
Glass, normal thermometer.....	19–100	.1988	Wachsmuth
crown..........	10–50	.161	KH. Meyer
flint...........	10–50	.117	H. Meyer
Granite..........	12–100	.192	Joly
Ice..............	−200	.168	Nernst, 1910
	−180	.199	Nernst, 1910
	−160	.230	Nernst, 1910
	−140	.262	Nernst, 1910
	−100	.325	Nernst, 1910
	− 60	.392	Nernst, 1910
	− 20	.480	Nernst, 1910
	− 10	.530	Nernst, 1910
India rubber (Para)	?–100	.481	Gee and Terry
Leather, dry......	....	.36	
Marble...........	0–100	.21	
Mica (Mg).......	20–98	.2061	Ulrich
Paraffin..........	0–20	.6939	R. W. Weber
Porcelain.........	15–950	.26	Harker, 1905
Quartz...........	12–100	.188	Joly
Rock-salt.........	13–45	.219	Kopp
Sugar............	20	.274	Hess, 1888
Vulcanite.........	20–100	.3312	A. M. Mayer
Wood............	......	.42	

SPECIFIC HEAT OF CHEMICAL ELEMENTS (Cont

Values given in calories per gram.

Element.	Temp. ° C.	Sp. heat.	Observer.
Phosphorus, red	0–51	0.1829	Wiegand, 1906
yellow	13–36	.202	Wiegand, 1906
Platinum	−186–+18	.0293	Behn, 1898–1900
Platinum	0–100	.0323	Violle, 1878
Platinum	500	.0356	White, 1909
Rhodium	10–97	.0580	Regnault, 1840–1861
Silver	0–100	.0559	Bunsen, 1870–1887
Silver	500	.0581	Tilden, 1900–1903
Sulphur, rhombic	0–54	.1728	Wiegand, 1906
monoclinic	0–52	.1809	Wiegand, 1906
Tin, cast	21–109	.0551	Spring, 1886–1895
Titanium	0–100	.1125	Nilson-Pettersson, 1887
Tungsten	0–100	.0336	Mache, 1897
Uranium	0–98	.028	Blümcke, 1885
Vanadium	0–100	.1153	Mache, 1897
Zinc	0–100	.0935	Bunsen, 1870–1887
Zinc	300	.1040	Naccari, 1887–88

SPECIFIC HEAT FOR AQUEOUS SOLUTIONS

Giving the specific heat referred to that of water at the same temperatures. Concentration of the solutions is stated as the number of molecules of water to each molecule of the solutes (anhydrous.)

Values from Marignac, Thomsen and others.

Substance	Temp. °C.	Concentration		
		25	50	100
Acetic acid	21–52	0.957	0.977	0.987
Aluminum sulphate	21–53	.....	.....	0.870
Ammonium acetate	17.5	0.911	0.951	0.976
chloride	18	0.881	0.937	0.966
hydroxide	18	.....	0.999	.....
nitrate	18	0.880	0.929	0.962
sulphate	19–51	0.803	0.879	0.933
Barium chloride	22–27	.....	0.780	0.875
Cadmium sulphate	12	0.696	0.813	0.893
Calcium acetate	22–52	.....	0.896	0.939
chloride	21–51	0.754	0.851	0.917
nitrate	21–51	0.760	0.846	0.911
Chromic acid	21–53	0.825	0.896	0.942
Copper chloride	19–51	0.779	0.864	0.920
nitrate	18–50	.....	0.826	0.899
sulphate	18–23	.....	0.841	0.908
Ferric chloride	0–98	0.666	0.750	0.854

SPECIFIC HEAT OF AQUEOUS SOLUTIONS
(Continued)

Giving the specific heat referred to that of water at the same temperatures. Concentration of the solutions is stated as the number of molecules of water to each molecule of the solutes (anhydrous).

Values from Marignac, Thomsen and others.

Substance.	Temp. °C.	Concentration.		
		25	50	100
Hydrochloric acid	18	.....	0.932	0.964
Lactic acid	16.5	0.947	0.970	0.982
Lead acetate	18–51	0.682	0.794	0.881
nitrate	18–51	.....	0.750	0.851
Lithium chloride	11	.....	0.941	0.973
hydroxide	13	.....	0.958	0.978
Magnesium chloride	22–52	0.772	0.866	0.923
nitrate	19–51	.....	0.832	0.903
Sulphate	18	.....	0.857	0.917
Manganese chloride	0–98	0.787	0.861	0.914
nitrate	19–51	.....	0.832	0.903
sulphate	19–51	.....	0.844	0.912
Nickel chloride	24–55	0.735	0.831	0.902
nitrate	24–55	0.717	0.823	0.895
sulphate	25–56	.....	0.837	0.910
Nitric acid	18	.....	0.930	0.963
Oxalic acid	20–52	.....	0.942	0.965
Potassium bromide	20–51	0.769	0.864	0.925
carbonate	21–52	0.760	0.851	0.916
chloride	18	0.828	0.904	0.948
chromate	20–51	.....	0.810	0.890
hydroxide	18	.....	0.916	0.954
iodide	20–51	0.715	0.830	0.906
nitrate	18–23	0.832	0.900	0.943
oxalate	21–52	.....	0.839	0.908
sulphate	19–52	.....	.....	0.902
Silver nitrate	25–52	0.750	0.849	0.913
Sodium acetate	18	.....	0.938	0.965
bromide	20–52	0.809	0.886	0.939
carbonate	21–52	0.865	0.907	0.943
chloride	18	0.880	0.931	0.962
chromate	21–52	0.781	0.856	0.913
hydroxide	18	0.908	0.942	0.968
iodide	20–51	0.749	0.850	0.917
nitrate	18	0.863	0.918	0.950
sulphate	21–52	0.819	0.878	0.960
Strontium chloride	21–26	.....	0.814	0.894
nitrate	19–51	.....	0.817	0.890
Sulphuric acid	21	0.854	0.915	0.956
Zinc chloride	19–51	0.796	0.884	0.933
nitrate	20–52	0.718	0.823	0.899
sulphate	20–52	.....	0.842	0.911

SPECIFIC HEAT OF GASES

Giving the specific heat of gases at constant pressure in calories per gram and the ratio of the specific heat at constant pressuie to that at constant volume.

Values are for atmospheric pressure.
(Selected from Smithsonian Tables.)

Gas or vapor.	Specific heat at constant pressure.			Ratio of specific heats.		
	Temp. °C.	Sp. ht.	Obs.*	Temp. °C.	Ratio Cp/Cv	Obs.*
Acetone	26–110	0.3468	W			
Air	0–100	0.2374	R			
Air	0–200	0.2375	R			
Air	20–630	0.2429	A			
Alcohol	108–220	0.4534	R	53	1.133	J
Ammonia	23–100	0.5202	W	0	1.3172	Wr
Argon	20–90	0.1233	D	0	1.667	N
Benzol	34–115	0.2990	W	20	1.403	P
Bromine	83–228	0.0555	R	20–388	1.293	S
Carbon dioxide	15–100	0.2025	R			
Carbon monoxide	23–99	0.2425	W	0	1.403	Wr
Carbon disluphide	86–190	0.1596	R	3.67	1.205	B
Chlorine	13–202	0.1241	R	20–340	1.323	S
Chloroform	27–118	0.1441	W	22–78	1.102	B
Ether	25–111	0.4280	W	12–20	1.024	L
Hydrochloric acid	13–100	0.1940	S	20	1.389	S
Hydrogen	12–198	3.4090	R			
Hydrogen sulphide	20–206	0.2451	R	10–40	1.276	Mr
Methane	18–208	0.5929	R	11–30	1.316	Mr
Nitrogen	0–200	0.2438	R	....	1.41	C
Nitric oxide	13–172	0.2317	R			
Nitrous oxide	16–207	0.2262	R	0	1.311	Wr
Oxygen	13–207	0.2175	R	5–14	1.3977	L–P
Sulphur dioxide	16–202	0.1544	R	16–34	1.256	Mr
Water vapor	0	0.4655	T	78	1.274	B
Water vapor	100	0.421	T	94	1.33	J
Water vapor	180	0.51	T			

*A Austin
B Beyme
C Cazin
D Dittenberger
J Jaeger
L Low
L–P Lummer & Pringsheim
Mr Muller
N Niemeyer
P Pagliani
R Regnault
S Strecker
T Thiesen
W Wiedemann
Wr Wüllner

BOILING–POINT OF WATER*

(Hydrogen Scale)

Pressure mm.	Tenths of millimeters									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
700	97.714	718	722	725	729	733	737	741	745	749
701	753	757	761	765	769	773	777	781	785	789
702	792	796	800	804	808	812	816	820	824	828
703	832	836	840	844	847	851	855	859	863	867
704	871	875	879	883	887	891	895	899	902	906
705	97.910	914	918	922	926	930	934	938	942	946
706	949	953	957	961	965	969	973	977	981	985
707	989	993	996	*000	*004	*008	*012	*016	*020	*024
708	98.028	032	036	040	043	047	051	055	059	063
709	067	071	075	079	082	086	090	094	098	102
710	98.106	110	114	118	121	125	129	133	137	141
711	145	149	153	157	160	164	168	172	176	180
712	184	188	192	195	199	203	207	211	215	219
713	223	227	230	234	238	242	246	250	254	258
714	261	265	269	273	277	281	285	289	292	296
715	98.300	304	308	312	316	320	323	327	331	335
716	339	343	347	351	355	358	362	366	370	374
717	378	382	385	389	393	397	401	405	409	412
718	416	420	424	428	432	436	440	443	447	451
719	455	459	463	467	470	474	478	482	486	490
720	98.493	497	501	505	509	513	517	520	524	528
721	532	536	540	544	547	551	555	559	563	567
722	570	574	578	582	586	590	593	597	601	605
723	609	613	617	620	624	628	632	636	640	643
724	647	651	655	659	662	666	670	674	678	682
725	98.686	689	693	697	701	705	709	712	716	720
726	724	728	732	735	739	743	747	751	755	758
727	762	766	770	774	777	781	785	789	793	797
728	800	804	808	812	816	819	823	827	831	835
729	838	842	846	850	854	858	861	865	869	873
730	98.877	880	884	888	892	896	899	903	907	911
731	915	918	922	926	930	934	937	941	945	949
732	953	956	960	964	968	972	975	979	983	987
733	991	994	998	*002	*006	*010	*013	*017	*021	*025
734	99.029	032	036	040	044	048	051	055	059	063
735	99.067	070	074	078	082	085	089	093	097	101
736	104	108	112	116	119	123	127	131	135	138
737	142	146	150	153	157	161	165	169	172	176
738	180	184	187	191	195	199	203	206	210	214
739	218	221	225	229	233	236	240	244	248	252
740	99.255	259	263	267	270	274	278	282	285	289
741	293	297	300	304	308	312	316	319	323	327
742	331	334	338	342	346	349	353	357	361	364
743	368	372	376	379	383	387	391	394	398	402
744	406	409	413	417	421	424	428	432	436	439
745	99.443	447	451	454	458	462	466	469	473	477
746	481	484	488	492	495	499	503	507	510	514
747	518	522	525	529	533	537	540	544	548	551
748	555	559	563	566	570	574	578	581	585	589
749	592	596	600	604	607	611	615	619	622	626

* See also under Vapor Tension.

BOILING-POINT OF WATER (Continued)

(Hydrogen Scale)

Pressure mm.	Tenths of millimeters .0	.1	.2	.3	.4	.5	.6	.7	.8	.9
750	99.630	633	637	641	645	648	652	656	659	663
751	667	671	674	678	682	686	689	693	697	700
752	704	708	712	715	719	723	726	730	734	738
753	741	745	749	752	756	760	764	767	771	775
754	778	782	786	790	793	797	801	804	808	812
755	99.815	819	823	827	830	834	838	841	845	849
756	852	856	860	863	867	871	875	878	882	886
757	889	893	897	900	904	908	911	915	919	923
758	926	930	934	937	941	945	948	952	956	959
759	963	967	970	974	978	982	985	989	993	996
760	100.000	004	007	011	015	018	022	026	029	033
761	037	040	044	048	052	055	059	063	066	070
762	074	077	081	085	088	092	096	099	103	107
763	110	114	118	121	125	129	132	136	140	143
764	147	151	154	158	162	165	169	173	176	180
765	100.184	187	191	195	198	202	206	209	213	216
766	220	224	227	231	235	238	242	246	249	253
767	257	260	264	268	271	275	279	283	286	290
768	293	297	300	304	308	311	315	319	322	326
769	330	333	337	341	344	348	352	355	359	363
770	100.366	370	373	377	381	384	388	392	395	399
771	403	406	410	414	417	421	424	428	432	435
772	439	442	446	450	453	457	461	464	468	472
773	475	479	483	486	490	493	497	501	504	508
774	511	515	519	522	526	530	533	537	540	544
775	100.548	551	555	559	562	566	569	573	577	580
776	584	588	591	595	598	602	606	609	613	616
777	620	624	627	631	634	638	642	645	649	653
778	656	660	663	667	671	674	678	681	685	689
779	692	696	689	703	707	710	714	718	721	725
780	100.728	732	735	739	743	746	750	753	757	761
781	764	768	772	775	779	782	786	789	793	797
782	800	804	807	811	815	818	822	825	829	833
783	836	840	843	847	851	854	858	861	865	869
784	872	876	879	883	886	890	894	897	901	904
785	100.908	912	915	919	922	926	929	933	937	940
786	944	947	951	954	958	962	965	969	972	976
787	979	983	987	990	994	997	*001	*005	*008	*012
788	101.015	019	022	026	029	033	037	040	044	047
789	051	054	058	062	065	069	072	076	079	083
790	101.087	090	094	097	101	104	108	112	115	119
791	.122	126	129	133	136	140	144	147	151	154
792	158	161	165	168	172	176	179	183	186	190
793	193	197	200	204	207	211	215	218	222	225
794	229	232	236	239	243	246	250	254	257	261
795	101.264	268	271	275	278	282	286	289	293	296
796	300	303	307	310	314	317	321	324	328	332
797	335	339	342	346	349	353	356	360	363	367
798	370	374	377	381	385	388	392	395	399	402
799	406	409	413	416	420	423	427	430	434	437
800	101.441	...	...	...	.....	...	...	...	...	...

MELTING AND BOILING TEMPERATURES

Temperature of Fusion for Various Substances for Atmospheric Pressure

For the melting- and boiling-points of the chemical elements and of inorganic compounds see under Physical Constants of the Elements, and Physical Constants of Inorganic Compounds.

Substance.	Temp. of fusion ° C.	Substance.	Temp. of fusion ° C.
Acetylene	−81	German silver	1000.
Alcohol, ethyl	−130.	Glass	1100.
Brass	900.	Glycerine	17.
Butter	31–31.5	Olive oil	2–6
Camphor	177.7	Paraffin	55.
Caoutchouc, pure gum	120.	Resin	135.
Chloroform	−63.2	Sea water	−2.5
Ether	−117.6	Sugar (cane)	160.

Boiling-point for Various Substances

Giving the boiling-point at atmospheric pressure and the variation per cm. pressure near 76 cm.

Substance.	Temp. ° C.	Variation.
Acetone	57.	0.39
Acetylene	−72.2	
Alcohol, ethyl	78.3	0.34
methyl	64.7	0.35
Amyl acetate	148.	
Benzene	80.	0.43
Camphor	205.	0.56
Chloroform	61.2	0.41
Ether	34.6	0.40
Gasoline	70–90.	
Glycerine	291.	
Turpentine	159.	

MELTING POINT OF ICE—VARIATION WITH PRESSURE

(From Tamann, 1900, by permission.)

Pressure in kg. per sq.cm.	Temp. ° C.	Pressure in kg. per sq.cm.	Temp. ° C.
1	0.0	1410	−12.5
336	− 2.5	1625	−15.0
615	− 5.0	1835	−17.5
890	− 7.5	2042	−20.0
1155	−10.0	2200	−22.1

BOILING POINTS OF WATER-ALCOHOL MIXTURES

(P. N. Evans, Journal of Industrial and Engineering Chemistry.)

Boiling point, ° C.	Weight per cent alcohol in		Boiling point, ° C.	Weight per cent alcohol in	
	Liquid.	Vapor.		Liquid.	Vapor.
78.2	91	92	86.5	18	71
78.4	85	89	87.0	17	70
78.6	82	88	87.5	16	69
78.8	80	87	88.0	15	68
79.0	78	86	88.5	13	67
79.2	76	85	89.0	12	65
79.4	74	85	89.5	11	63
79.6	72	84	90.0	10	61
79.8	69	84	90.5	10	59
80.0	67	83	91.0	9	57
80.2	64	83	91.5	8	55
80.4	62	82	92.0	8	53
80.6	59	82	92.5	7	51
80.8	56	81	93.0	6	49
81.0	53	81	93.5	6	46
81.2	50	80	94.0	5	44
81.4	47	80	94.5	5	42
81.6	45	80	95.0	4	39
81.8	43	79	95.5	4	36
82.0	41	79	96.0	3	33
82.5	36	78	96.5	3	30
83.0	33	78	97.0	2	27
83.5	30	77	97.5	2	23
84.0	27	76	98.0	1	19
84.5	25	75	98.5	1	15
85.0	23	74	99.0	0	10
85.5	21	73	99.5	0	5
86.0	20	72	100.0	0	0

MOLECULAR ELEVATION OF BOILING POINT

Showing the elevation of the boiling point due to the addition of one gram molecular weight of dissolved substance, for various solvents.

Solvent.	Constant for 1 gm. mol. wt. dissolved in 100 gms. solvent.	Constant for 1 gm. mol. wt. dissolved in 100 c.c. of solvent at its boiling point.
Acetone	16.7	22.2
Benzene	26.7	32.0
Chloroform	36.6	26.0
Ether	21.1	30.3
Ethyl alcohol	11.5	15.6
Water	5.2	5.4

MOLECULAR DEPRESSION OF FREEZING POINT

Showing the depression of the freezing point due to the addition of one gram molecular weight of dissolved substance, for various solvents.

Solvent.	Depression for 1 gm. mol. wt. dissolved in 100 gms. of solvent, °C.
Acetic acid	39.0
Benzene	49.0
Ethylene dibromide	118.0
Formic acid	27.7
Nitrobenzene	70.0
Phenol	74.0
Water	18.7

CRITICAL AND VAN DER WAALS' CONSTANTS FOR GASES

Name.	Critical.			Van der Waals'.	
	Temp., °C.	Pressure, atm.	Density, gms. per cm.³	*a*	*b*
Acetylene	36.5	61.6	0.2315	0.00880	0.00230
Air	−140	39	....	0.00257	0.00156
Ammonia	130	115.0	....	0.00798	0.00161
Aniline	425.6	52.3	....	0.05282	0.00611
Argon	−117.4	52.9	....	0.00259	0.00135
Benzene	288.5	47.9	0.3045	0.03726	0.00537
Bromine	302	131	....	0.01434	0.00202
Carbon bisulphide	273	72.9	0.4408	0.02316	0.00343
Carbon dioxide	31.1	73	0.464	0.00717	0.00191
Carbon monoxide	−141.1	35.9	0.328	0.00275	0.00168
Chlorine	146	93.5	0.547	0.01063	0.00205
Chloroform	260	54.9	....	0.0293	0.00445
Ethane	34	50.2	....	0.01060	0.0028
Ether	197	35.8	0.2622	0.03496	0.00602
Ethyl alcohol	243	62.7	0.2755	0.02407	0.00377
Ethylene	10	51.7	0.210	0.00877	0.00251
Helium	−268	2.3	....	0.0000615	0.0000995
Hydrochloric acid	52.3	86	....	0.00697	0.00173
Hydrogen	−234.5	20	0.03346	0.00042	0.00088
Hydrogen sulphide	100	88.7	....	0.00888	0.00193
Krypton	− 62.5	54.3	....	0.00462	0.00178
Methane	− 95.5	50	....	0.00357	0.00162
Neon	−205	....	....	....	....
Nitric oxide, NO	− 93.5	71.2	0.524	0.00257	0.00116
Nitrogen	−146	33	0.3269	0.00259	0.00165
Nitrogen tetroxide, NO_2	171.2	147	....	0.00756	0.00138
Nitrous oxide, N_2O	38.8	77.5	0.454	0.00710	0.00184
Oxygen	−118	50	0.4292	0.00273	0.00142
Sulphur dioxide	155.4	78.9	0.520	0.01316	0.00249
Water	365	194.6	0.329	0.0118	0.00150
Xenon	14.7	57.2	....	0.00818	0.00230

FREEZING MIXTURES

A is the proportion of the substance named in the first column to be added to the proportion of the substance given in column *B*. The table gives the temperature of the separate ingredients and the temperature attained by the mixture.

(From Smithsonian Tables.)

Substance.	*A*	*B*	Initial Temp. ° C.	Temp. ° C. attained by mixt.
$NaC_2H_3O_2$ (cryst.)	85	H_2O 100	10.7	− 4.7
NH_4Cl	30	H_2O 100	13.3	− 5.1
$NaNO_3$	75	H_2O 100	13.2	− 5.3
$Na_2S_2O_3$ (cryst.)	110	H_2O 100	10.7	− 8.0
KI	140	H_2O 100	10.8	−11.7
$CaCl_2$ (cryst.)	250	H_2O 100	10.8	−12.4
NH_4NO_3	60	H_2O 100	13.6	−13.6
$CaCl_2$	30	* Snow 100	− 1	−10.9
NH_4Cl	25	Snow 100	− 1	−15.4
NH_4NO_3	45	Snow 100	− 1	−16.75
$NaNO_3$	50	Snow 100	− 1	−17.75
NaCl	33	Snow 100	− 1	−21.3
$H_2SO_4+H_2O$ (66.1% H_2SO_4)	1	Snow 1.097	− 1	−37.0
	1	Snow 2.52	− 1	−30.0
	1	Snow 4.32	− 1	−25.0
	1	Snow 7.92	− 1	−20.0
	1	Snow 13.08	− 1	−16.0
$CaCl_2+6H_2O$	1	Snow .49	0	−19.7
	1	Snow .61	0	−39.0
	1	Snow .70	0	−54.9
	1	Snow .81	0	−40.3
	1	Snow 1.23	0	−21.5
	1	Snow 2.46	0	− 9.0
	1	Snow 4.92	0	− 4.0
Alcohol at 4°	77	Snow 73.	0	−30.0
	..	CO_2 solid	......	−72.0
Chloroform	....	CO_2 solid	......	−77.0
Ether	....	CO_2 solid	......	−77.0
Liquid SO_2	....	CO_2 solid	......	−82.0
NH_4NO_3	1	H_2O .94	20	− 4.0
	1	Snow .94	0	− 4.0
	1	H_2O 1.20	10	−14.0
	1	Snow 1.20	0	−14.0
	1	H_2O 1.31	10	−17.5
	1	Snow 1.31	0	−17.5

* Or finely pulverized ice.

HEAT EQUIVALENT OF FUSION

The table gives the heat equivalent in calories per gram at the temperature of fusion.

(From Smithsonian Tables.)

Substance.	Temp. ° C.	Heat cal/g.	Observer.
Aluminum	658.	76.8	Glaser
Ammonia	−75.	108.	Massol
Benzole	5.4	30.6	Mean
Bromine	−7.3	16.2	Regnault
Bismuth	268.	12.64	Person
Cadmium	320.7	13.66	Person
Calcium chloride	28.5	40.7	Person
Copper	1083	42.	Mean
Iron, gray cast	....	23.	Grumer
white cast	....	33.	Grumer
slag	....	50.	Grumer
Iodine	....	11.71	Favre & Silbermann
Ice	0	79.24	Regnault
Ice	0	80.02	Bunsen
Ice from sea water	−8.7	54.0	Petterson
Lead	327	5.86	Rudberg
Mercury	−39	2.82	Person
Naphthalene	79.87	35.62	Pickering
Nickel	1435	4.64	Pionchon
Palladium	1545	36.3	Violle
Phosphorus	44.2	4.97	Petterson
Platinum	1755	27.2	Violle
Potassium	62	15.7	Joannis
Potassium nitrate	333.5	48.9	Person
Phenol	25.37	24.93	Petterson
Paraffin	52.40	35.10	Batelli
Silver	961	21.07	Person
Sodium	97	31.7	Joannis
Sodium nitrate	305.8	64.87	Joannis
phosphate	36.1	66.8	Joannis
Spermaceti	43.9	36.98	Batelli
Sulphur	115	9.37	Person
Tin	232	14.0	Mean
Wax (Bees')	61.8	42.3	Mean
Zinc	419	28.13	Mean

HEAT EQUIVALENT OF VAPORIZATION

The table gives the heat equivalent (or latent heat) of vaporization in calories per gram, at the temperature of ebullition, and at the pressure of the vapor for that temperature.

(Principally from the Smithsonian Tables.)

Substance.	Temp. ° C.	Heat Cal/g.	Observer.
Acetic acid	118*	84.9	Ogier
Air	....	50.97	Fenner-Richtmyer
Alcohol: amyl	131*	120	Schall
ethyl	78.1*	205	Wirtz
ethyl	0	236	Regnault
methyl	64.5*	2.67	Wirtz
methyl	0	289	Ramsay & Young
Ammonia	7.8	294.2	Regnault
Ammonia	11	291.3	Regnault
Ammonia	16	297.4	Regnault
Ammonia	17	296.5	Regnault
Benzene	80.1*	92.9	Wirtz
Bromine	61*	45.6	Andrews
Carbon dioxide, liq	− 25	72.23	Cailletet & Mathias
Carbon dioxide, liq	0	57.48	Cailletet & Mathias
Carbon dioxide, liq	12.35	44.97	Mathias
Carbon dioxide, liq	22.04	31.8	Mathias
Carbon dioxide, liq	29.85	14.4	Mathias
Carbon dioxide, liq	30.82	3.72	Mathias
Carbon disulphide	46.1*	83.8	Wirtz
Carbon disulphide	0	90	Regnault
Chloroform	60.9*	58.5	Wirtz
Ether	34.5*	88.4	Wirtz
Ether	34.9	90.5	Andrews
Ether	0	94	Regnault
Iodine	184*	23.95	Favre & Silbermann
Mercury	357*	65	Mean
Nitrogen	−195.6*	47.65	Alt
Oxygen	−182.9*	50.97	Alt
Sulphur dioxide	0	91.2	Cailletet & Mathias
Sulphur dioxide	30	80.5	Cailletet & Mathias
Sulphur dioxide	65	68.4	Cailletet & Mathias
Turpentine	159.3	74.04	Brix
Water	100	535.9	Andrews
Water	0	596.8	Dieterici, 1889
Water	20	585.3	Smith, 1908
Water	40	574.0	Henning, 1909
Water	60	562.9	Henning, 1909
Water	80	551.1	Henning, 1909
Water	100*	538.7	Henning, 1909
Water	120	525.3	Henning, 1909
Water	140	510.9	Henning, 1909
Water	160	496.6	Henning, 1909
Water	180	482.2	Henning, 1909

Temperature values marked * are those of normal ebullition, at 76 cm. pressure.

CHANGE IN VOLUME DUE TO FUSION

The table gives the variation in volume expressed in c.cm. for one gram of the substance.

Substance.	Variation, cm.	Observer.
Aluminum	+0.019	Toepler, 1894
Bismuth	−0.0034	Toepler, 1894
Cadmium	+0.0064	Toepler, 1894
Iron	−0.0085	Wrightson, Roberts, 1881
Lead	+0.0034	Toepler, 1894
Tin	+0.0039	Toepler, 1894
Water	−0.083*	Toepler, 1894
Zinc	+0.0105	Toepler, 1894

*For one cubic centimeter.

FIXED POINTS FOR HIGH TEMPERATURES

Temperatures are for 76 cm. pressure.

Substance.	Boiling-point ° C.	Variation per cm. pressure, ° C.
Alcohol, ethyl	78.26	0.34
Aniline	184.	0.51
Benzene	80.	0.43
Chloro benzene	132.	0.50
Diphenylamine	302.	
Mercury	356.	
Naphthaline	218.	0.59
Sulphur	445.2	
Toluidine, *o*	199.7	0.58
Toulene	109.2	0.45
Water	100.	0.37
Xylene, *m*	138.8	0.50
Zinc	930.	

Substance.	Melting point ° C.	Substance.	Melting point ° C.
Aluminum	657	Platinum	1775
Copper	1084	Sodium chloride	800
Gold	1064	Tin	232
Nickel	1427	Zinc	419

VAPOR TENSION OF WATER

Tension of Aqueous Vapor, −30 to 0° C., Over Water

The tension is given in millimeters of mercury at 0° C.

(From International Bureau of Weights and Measures.)

Temp. ° C.	0.0	0.2	0.4	0.6	0.8
−30	0.3805				
−29	0.4185	0.4106	0.4028	0.3952	0.3878
−28	0.4598	0.4512	0.4428	0.4346	0.4265
−27	0.5047	0.4954	0.4862	0.4772	0.4684
−26	0.5535	0.5433	0.5333	0.5236	0.5141
−25	0.6064	0.5955	0.5847	0.5741	0.5637
−24	0.6637	0.6518	0.6402	0.6288	0.6175
−23	0.7258	0.7130	0.7003	0.6879	0.6757
−22	0.7930	0.7792	0.7655	0.7520	0.7388
−21	0.8656	0.8506	0.8359	0.8214	0.8071
−20	0.9441	0.9279	0.9120	0.8963	0.8808
−19	1.0288	1.0114	0.9941	0.9772	0.9605
−18	1.1202	1.1013	1.0828	1.0646	1.0465
−17	1.2187	1.1985	1.1785	1.1588	1.1394
−16	1.3248	1.3030	1.2814	1.2602	1.2393
−15	1.4390	1.4155	1.3924	1.3695	1.3470
−14	1.5618	1.5366	1.5117	1.4872	1.4629
−13	1.6939	1.6667	1.6399	1.6135	1.5874
−12	1.8357	1.8065	1.7776	1.7493	1.7214
−11	1.9880	1.9567	1.9258	1.8953	1.8653
−10	2.1514	2.1178	2.0847	2.0520	2.0198
− 9	2.3266	2.2905	2.2550	2.2199	2.1854
− 8	2.5143	2.4758	2.4378	2.4002	2.3632
− 7	2.7153	2.6740	2.6332	2.5930	2.5534
− 6	2.9304	2.8863	2.8427	2.7997	2.7572
− 5	3.1605	3.1132	3.0665	3.0205	2.9751
− 4	3.4065	3.3560	3.3062	3.2570	3.2084
− 3	3.6693	3.6153	3.5620	3.5095	3.4576
− 2	3.9499	3.8923	3.8355	3.7794	3.7240
− 1	4.2493	4.1878	4.1271	4.0672	4.0082
− 0	4.5687	4.5032	4.4385	4.3747	4.3116

VAPOR TENSION OF WATER

Tension of Aqueous Vapor. 40 to 0° C., Over Ice

The tension is given in millimeters of mercury.
(Juhlin and Marvin.)

Temp. ° C.	0.	1.	2.	3.	4.
−40	0.105	0.095	0.085	0.076	0.068
−30	0.292	0.264	0.238	0.215	0.193
−20	0.787	0.714	0.648	0.589	0.534
−10	1.974	1.806	1.650	1.506	1.375

Temp. ° C.	5.	6.	7.	8.	9.
−40	0.061	0.054	0.048	0.043	0.038
−30	0.173	0.156	0.141	0.127	0.115
−20	0.484	0.438	0.397	0.358	0.324
−10	1.257	1.148	1.048	0.955	0.868

Temp. ° C.	.0	.1	.2	3	.4
−10	1.974	1.956	1.939	1.922	1.905
− 9	2.154	2.136	2.118	2.100	2.082
− 8	2.347	2.327	2.307	2.287	2.268
− 7	2.557	2.535	2.514	2.492	2.470
− 6	2.785	2.761	2.738	2.715	2.692
− 5	3.032	3.006	2.981	2.956	2.931
− 4	3.299	3.271	3.244	3.217	3.190
− 3	3.586	3.556	3.527	3.498	3.469
− 2	3.894	3.862	3.831	3.799	3.768
− 1	4.223	4.189	4.155	4.122	4.089
− 0	4.579	4.543	4.507	4.470	4.434

Temp. ° C.	.5	.6	.7	.8	.9
−10	1.888	1.872	1.855	1.838	1.822
− 9	2.064	2.046	2.028	2.010	1.992
− 8	2.249	2.230	2.211	2.192	2.173
− 7	2.449	2.428	2.407	2.387	2.367
− 6	2.669	2.646	2.624	2.601	2.579
− 5	2.906	2.882	2.857	2.833	2.809
− 4	3.163	3.136	3.110	3.084	3.058
− 3	3.440	3.411	3.382	3.354	3.326
− 2	3.737	3.706	3.676	3.646	3.616
− 1	4.056	4.023	3.990	3.958	3.926
− 0	4.398	4.362	4.327	4.292	4.257

VAPOR TENSION OF WATER

TENSION OF AQUEOUS VAPOR, 0 TO 100° C.

The tension is given in millimeters of mercury at 0° C.
(International Bureau of Weights and Measures.)

Temp. ° C.	0.0	0.2	0.4	0.6	0.8
0	4.5687	4.6350	4.7022	4.7703	4.8393
1	4.9091	4.9798	5.0515	5.1240	5.1975
2	5.2719	5.3472	5.4235	5.5008	5.5790
3	5.6582	5.7383	5.8195	5.9017	5.9850
4	6.0693	6.1546	6.2410	6.3285	6.4171
5	6.5067	6.5974	6.6893	6.7824	6.8765
6	6.9718	7.0682	7.1658	7.2646	7.3647
7	7.4660	7.5685	7.6722	7.7772	7.8834
8	7.9909	8.0998	8.2099	8.3214	8.4342
9	8.5484	8.6641	8.7810	8.8993	9.0189
10	9.1398	9.2623	9.3863	9.5117	9.6387
11	9.7671	9.8969	10.028	10.161	10.296
12	10.432	10.570	10.709	10.850	10.993
13	11.137	11.283	11.430	11.580	11.731
14	11.884	12.038	12.194	12.352	12.512
15	12.674	12.837	13.003	13.170	13.339
16	13.510	13.683	13.858	14.035	14.214
17	14.395	14.578	14.763	14.950	15.139
18	15.330	15.524	15.719	15.917	16.117
19	16.319	16.523	16.730	16.939	17.150
20	17.363	17.579	17.997	18.018	18.241
21	18.466	18.694	18.924	19.157	19.392
22	19.630	19.870	20.113	20.359	20.607
23	20.858	21.111	21.367	21.626	21.888
24	22.152	22.420	22.690	22.963	23.239
25	23.517	23.799	24.084	24.371	24.662
26	24.956	25.252	25.552	25.855	26.161
27	26.471	26.783	27.099	27.418	27.740
28	28.065	28.394	28.727	29.062	29.401
29	29.744	30.090	30.440	30.793	31.149
30	31.510	31.873	32.341	32.612	32.988
31	33.366	33.749	34.136	34.526	34.920
32	35.318	35.720	36.126	36.536	36.951
33	37.369	37.791	38.218	38.649	39.084
34	39.523	39.966	40.414	40.866	41.323

VAPOR TENSION OF WATER (Continued)

Tension of Aqueous Vapor, 0 to 100° C.

In millimeters of mercury.

Temp. ° C.	0.0	0.2	0.4	0.6	0.8
35	41.784	42.250	42.720	43.195	43.674
36	44.158	44.646	45.139	45.637	46.140
37	46.648	47.160	47.677	48.200	48.727
38	49.259	49.796	50.339	50.886	51.439
39	51.997	52.560	53.128	53.702	54.281
40	54.865	55.455	56.051	56.652	57.258
41	57.870	58.488	59.111	59.741	60.376
42	61.017	61.664	62.316	62.975	63.640
43	64.310	64.987	65.670	56.359	67.055
44	67.757	68.465	69.180	69.901	70.628
45	71.362	72.102	72.850	73.603	74.364
46	75.131	75.906	76.687	77.475	78.270
47	79.071	79.880	80.696	81.520	82.350
48	83.188	84.034	84.886	85.746	86.614
49	87.488	88.371	89.261	90.159	91.064
50	91.978	92.900	93.829	94.766	95.711
51	96.664	97.626	98.595	99.573	100.56
52	101.55	102.56	103.57	104.59	105.62
53	106.65	107.70	108.76	109.82	110.89
54	111.97	113.06	114.16	115.27	116.39
55	117.52	118.65	119.80	120.95	122.12
56	123.29	124.48	125.67	126.87	128.09
57	129.31	130.54	131.79	133.04	134.30
58	135.58	136.86	138.15	139.46	140.77
59	142.10	143.43	144.78	146.14	147.51
60	148.88	150.27	151.68	153.09	154.51
61	155.95	157.39	158.85	160.32	161.80
62	163.29	164.79	166.31	167.83	169.37
63	170.92	172.49	174.06	175.65	177.25
64	178.86	180.48	182.12	183.77	185.43
65	187.10	188.79	190.49	192.20	193.93
66	195.67	197.42	199.18	200.96	202.75
67	204.56	206.38	208.21	210.06	211.92
68	213.79	215.68	217.58	219.50	221.43
69	223.37	225.33	227.30	229.29	231.29

VAPOR TENSION OF WATER (Continued)

Tension of Aqueous Vapor, 0 to 100° C.

In millimeters of mercury.

Temp. ° C.	0.0	0.2	0.4	0.6	0.8
70	233.31	235.34	237.39	239.45	241.52
71	243.62	245.72	247.85	249.98	252.14
72	254.30	256.49	258.69	260.91	263.14
73	265.38	267.65	269.93	272.23	274.54
74	276.87	279.21	281.58	283.96	286.35
75	288.76	291.19	293.64	296.11	298.59
76	301.09	303.60	306.14	308.69	311.26
77	313.85	316.45	319.07	321.72	324.38
78	327.05	329.75	332.47	335.20	337.95
79	340.73	343.52	346.33	349.16	352.01
80	354.87	357.76	360.67	363.59	366.54
81	369.51	372.49	375.50	378.53	381.58
82	384.64	387.73	390.84	393.97	397.12
83	400.29	403.49	406.70	409.94	413.19
84	416.47	419.77	423.09	426.44	429.81
85	433.19	436.60	440.04	443.49	446.97
86	450.47	454.00	457.54	461.11	464.71
87	468.32	471.96	475.63	479.32	483.03
88	486.76	490.52	494.31	498.12	501.95
89	505.81	509.69	513.60	517.53	521.48
90	525.47	529.48	533.51	537.57	541.65
91	545.77	549.90	554.07	558.26	562.47
92	566.71	570.98	575.28	579.61	583.96
93	588.33	592.74	597.17	601.64	606.13
94	610.64	615.19	619.76	624.37	629.00
95	633.66	638.35	643.06	647.81	652.59
96	657.40	662.23	667.10	672.00	676.92
97	681.88	686.87	691.89	696.93	702.02
98	707.13	712.27	717.44	722.65	727.89
99	733.16	738.46	743.80	749.17	754.57
100	760.00	765.47	770.97	776.50	782.07

VAPOR TENSION OF WATER

Tension of Aqueous Vapor, 100–230° C.

Giving the vapor tension in millimeters of mercury, in pounds per square inch and the corresponding temperature Fahrenheit.

(From Regnault—Smithsonian Tables.)

Temp.* ° C.	Pressure.		Temp.* ° F.	Temp.* ° C.	Pressure.		Temp.* ° F.
	mm.	Pounds per sq.in.			mm.	Pounds per sq.in.	
100	760.00	14.70	212.0	145	3125.55	60.44	293.0
101	787.59	15.23	213.8	146	3212.74	62.13	294.8
102	816.01	15.79	215.6	147	3301.87	63.86	296.6
103	845.28	16.35	217.4	148	3392.98	65.62	298.4
104	875.41	16.94	219.2	149	3486.09	67.41	300.2
105	906.41	17.53	221.0	150	3581.2	69.26	302.0
106	938.31	18.15	222.8	151	3678.4	71.14	303.8
107	971.14	18.78	224.6	152	3777.7	73.06	305.6
108	1004.91	19.44	226.4	153	3879.2	75.02	307.4
109	1039.65	20.11	228.2	154	3982.8	77.03	309.2
110	1075.37	20.80	230.0	155	4088.6	79.07	311.0
111	1112.09	21.51	231.8	156	4196.6	81.22	312.8
112	1149.83	22.24	233.6	157	4306.9	83.29	314.6
113	1188.61	22.99	235.4	158	4419.5	85.47	316.4
114	1228.47	23.76	237.2	159	4534.4	87.69	318.2
115	1269.41	24.55	239.0	160	4651.6	89.96	320.0
116	1311.47	25.37	240.8	161	4771.3	92.27	321.8
117	1354.66	26.20	242.6	162	4893.4	94.63	323.6
118	1399.02	27.06	244.4	163	5017.9	97.04	325.4
119	1444.55	27.94	246.2	164	5145.0	99.50	327.2
120	1491.28	28.85	248.0	165	5274.5	102.01	329.0
121	1539.25	29.78	249.8	166	5406.7	104.56	330.8
122	1588.47	30.73	251.6	167	5541.4	107.18	332.6
123	1638.96	31.70	253.4	168	5678.8	109.84	334.4
124	1690.76	32.70	255.2	169	5818.9	112.53	336.2
125	1743.88	33.72	257.0	170	5961.7	115.29	338.0
126	1798.35	34.78	258.8	171	6107.2	118.11	339.8
127	1854.20	35.86	260.6	172	6255.5	120.98	341.6
128	1911.47	36.97	262.4	173	6406.6	123.90	343.4
129	1970.15	38.11	264.2	174	6560.6	126.87	345.2
130	2030.28	39.26	266.0	175	6717.4	129.91	347.0
131	2091.94	40.47	267.8	176	6877.2	133.00	348.8
132	2155.03	41.68	269.6	177	7040.0	136.15	350.6
133	2219.69	42.93	271.4	178	7205.7	139.35	352.4
134	2285.92	44.21	273.2	179	7374.5	142.62	354.2
135	2353.73	45.52	275.0	180	7546.4	145.93	356.0
136	2423.16	46.87	276.8	181	7721.4	149.32	357.8
137	2494.23	48.24	278.6	182	7899.5	152.77	359.6
138	2567.00	49.65	280.4	183	8080.8	156.32	361.4
139	2641.44	51.06	282.2	184	8265.4	159.84	363.2
140	2717.63	52.55	284.0	185	8453.2	163.47	365.0
141	2795.57	54.07	285.8	186	8644.4	167.17	366.8
142	2875.30	55.60	287.6	187	8838.8	170.94	368.6
143	2956.86	57.16	289.4	188	9036.7	174.76	370.4
144	3040.26	58.79	291.2	189	9238.0	178.65	372.2

* These are the temperatures at which water boils under pressures shown.

VAPOR TENSION OF WATER (Continued)

Tension of Aqueous Vapor, 100–230° C.

Giving the vapor tension in millimeters of mercury, in pounds per square inch and the corresponding temperature Fahrenheit.)

(From Regnault—Smithsonian Tables.)

Temp. ° C.	Pressure. mm.	Pressure. Pounds per sq.in.	Temp. ° F.	Temp. ° C.	Pressure. mm.	Pressure. Pounds. per sq.in.	Temp. ° F.
190	9442.7	182.61	374.0	210	14324.8	277.01	410.0
191	9650.9	186.63	375.8	211	14611.3	282.58	411.8
192	9862.7	190.72	377.6	212	14902.2	288.21	413.6
193	10078.0	194.88	379.4	213	15197.5	293.92	415.4
194	10297.0	199.13	381.2	214	15497.2	299.72	417.2
195	10519.6	203.43	383.0	215	15801.3	305.57	419.0
196	10746.0	207.81	384.8	216	16109.9	311.57	420.8
197	10975.0	212.25	386.6	217	16423.2	317.62	422.6
198	11209.8	216.77	388.4	218	16740.9	323.78	424.4
199	11447.5	221.37	390.2	219	17063.3	330.01	426.2
200	11689.0	226.04	392.0	220	17390.4	336.30	428.0
201	11934.4	230.79	393.8	221	17722.1	342.70	429.8
202	12183.7	235.61	395.6	222	18058.6	349.21	431.6
203	12437.0	240.54	397.4	223	18399.9	355.81	433.4
204	12694.3	245.49	399.2	224	18746.1	362.50	435.2
205	12955.7	250.53	401.0	225	19097.0	369.29	437.0
206	13221.1	255.67	402.8	226	19452.9	376.17	438.8
207	13490.8	260.88	404.6	227	19813.8	383.15	440.6
208	13764.5	266.18	406.4	228	20179.6	390.22	442.4
209	14042.5	271.55	408.2	229	20550.5	397.40	444.2

VAPOR TENSION OF MERCURY

(From Gebhardt, Hertz, Regnault, Van der Plaats, and others.)

Temp. ° C.	Pressure, mm.	Temp. ° C.	Pressure, mm.
0	0.0004	200	18.3
20	0.0013	220	33.7
40	0.006	240	59.
60	0.03	260	98
80	0.09	280	156.
100	0.28	300	246.
120	0.8	320	371.
140	1.85	340	548.
160	4.4	360	790.
180	9.2		

LOWERING OF VAPOR PRESSURE BY SALTS IN AQUEOUS SOLUTIONS

The table gives the reduction of the vapor pressure in millimeters due to the presence of the number of grammolecules of salt per liter of water given at the head of the columns, at the temperature 100° C., at which temperature the vapor pressure of pure water is 76.0 centimeters.

(From Smithsonian Tables.)

Substance	0.5	1.0	2.0	3.0	4.0	5.0	6.0	8.0	10.0
Ammonium chloride.	12.0	23.7	45.1	69.3	94.2	118.5	138.2	179.0	213.8
Barium chloride.....	16.4	36.7	77.6						
Calcium chloride....	17.0	39.8	95.3	166.6	241.5	319.5			
Ferrous sulphate....	5.8	10.7	24.0	42.4					
Potassium hydroxide.	15.0	29.5	64.0	99.2	140.0	181.8	223.0	309.5	387.8
Potassium iodide....	12.5	25.3	52.2	82.6	112.2	141.5	171.8	225.5	278.5
Sodium chloride.....	12.3	25.2	52.1	80.0	111.0	143.0	176.5		
Sodium hydroxide...	11.8	22.8	48.2	77.3	107.5	139.1	172.5	243.3	314.0
Sulphuric acid......	12.9	26.5	62.8	104.0	148.0	198.4	247.0	343.2	
Zinc sulphate.......	4.9	10.4	21.5	42.1	66.2				

CONSTANTS OF THE KINETIC THEORY OF GASES

Giving the velocity, mean free path and diameter of molecules for various gases and vapors at 0° C. and 760 mm. pressure.

Gas.	Mean vel. cm./s.	Mean free path, cm.	Diam. cm.	Observer.
Ammonia.....	5.8×10^4	6.2×10^{-6}	3.9×10^{-8}	Graham, 1846
Argon........	3.81	8.84	3.23	Schultze, 1901
Benzene......	2.7	21	6.6	
Carbon dioxide	3.6	5.6	4.1	Breitenbach 1899
Chlorine......	2.86	4.07	4.76	Graham, 1846
Chloroform...	2.2	2.3	6.3	Puluj, 1878
Ether........	2.8	2.1	6.6	Puluj, 1878
Ethyl alcohol.	3.5	3.2	5.3	Puluj, 1878
Helium.......	12.02	25.1	1.9	Schultze, 1901
Hydrogen....	16.94	16.3	2.38	Puluj, 1878
Nitrogen.....	4.53	8.61	3.27	Markowski, 1904
Oxygen......	4.25	9.06	3.19	Markowski, 1904
Water vapor..	5.7	5.7	4.0	Puluj, 1878

NUMBER OF MOLECULES IN A MOLECULE-GRAM

Perrin, 1909–11.................................. 6.2×10^{23}
Perrin (Brownian movement)........................ 6.85
Millikan, 1910.................................... 6.2

MASS OF THE HYDROGEN ATOM

1.46×10^{-24} grams.

VAPOR PRESSURES OF

In centimeters

(Principally from

Temp. ° C.	Carbon bisulphide, CS_2.	Carbon dioxide, CO_2.	Carbon tetrachloride, CCl_4.	Chloroform, $CHCl_3$.	Ethyl Alcohol, C_2H_6O.	Ethyl Ether, $C_4H_{10}O$.	Acetic acid.	Acetone, C_3H_6O.	Ammonia, NH_3.
−30	....	.....	....	....	....	....	....	....	86.61
−25	....	1300.70	....	....	....	....	....	....	110.43
−20	4.73	1514.24	.98	....	.33	6.89	....	....	139.21
−15	6.16	1758.25	1.35	....	.51	8.93	....	....	173.65
−10	7.94	2034.02	1.85	....	.65	11.47	....	....	214.46
− 5	10.13	2344.13	2.48	....	.91	14.61	....	....	264.42
0	12.79	2690.66	3.29	5.97	1.27	18.44	0.35	....	318.33
5	16.00	3075.38	4.32	....	1.76	23.09	....	....	383.03
10	19.85	3499.86	5.60	10.05	2.42	28.68	0.64	....	457.40
15	24.41	3964.69	7.17	....	3.30	35.36	....	....	543.34
20	29.80	4471.66	9.10	16.05	4.45	43.28	1.18	17.96	638.78
25	36.11	5020.73	11.43	20.02	5.94	52.59	....	22.63	747.70
30	43.46	5611.90	14.23	24.75	7.85	63.48	2.01	28.10	870.10
35	51.97	6244.73	17.55	30.35	10.29	76.12	....	34.52	1007.02
40	61.75	6918.44	21.48	36.93	13.37	90.70	3.42	42.01	1159.53
45	72.95	7631.46	26.08	44.60	17.22	107.42	....	50.75	1328.73
50	85.71	.....	31.44	53.50	21.99	126.48	5.63	62.29	1515.83
55	100.16	.....	37.63	63.77	27.86	148.11	....	72.59	1721.98
60	116.45	.....	44.74	75.54	35.02	172.50	8.83	86.05	1948.21
65	134.75	.....	52.87	88.97	43.69	199.89	....	101.43	2196.51
70	155.21	.....	62.11	104.21	54.11	230.49	13.70	118.94	2467.55
75	177.99	.....	72.57	121.42	66.55	264.54	....	138.76	2763.00
80	203.25	.....	84.33	140.76	81.29	302.28	20.23	161.10	3084.31
85	231.17	.....	97.51	162.41	98.64	343.95	....	186.18	3433.09
90	261.91	.....	112.23	186.52	118.93	389.83	29.27	214.17	3810.92
95	296.63	.....	128.69	213.28	142.51	440.18	....	245.28	4219.57
100	332.51	.....	146.71	242.85	169.75	495.33	41.7	279.73	4660.82
105	372.72	.....	166.72	275.40	201.04	555.62	....	317.70	.....
110	416.41	.....	188.74	311.10	236.76	621.46	....	359.40	.....
115	463.74	.....	212.91	350.10	277.34	693.33	58.2	405.00	.....
120	514.88	.....	239.37	392.57	323.17	771.92	.... 79.4	454.69	.....
125	569.97	.....	268.24	438.66	374.69	....	....	508.62	.....
130	629.16	.....	299.69	488.51	432.30	....	106.7	566.97	.....
135	692.59	.....	333.86	542.25	496.42	....	....	629.87	.....
140	760.40	.....	370.90	600.02	567.46	....	140.4	697.44	.....
145	832.69	.....	411.00	661.92	645.80	....	....	....	.....
150	909.59	.....	454.31	728.06	731.84	....	184.7	....	.....
155	....	.....	501.02	798.53	825.92	....	....	....	.....
160	....	.....	551.31	873.42	....	....	....	....	.....
165	....	.....	605.38	952.78	....	....	....	....	.....

VARIOUS SUBSTANCES

of mercury.

Regnault.)

Temp. ° C.	Benzol, C_6H_6.	Camphor.	Methyl alcohol, CH_4O.	Naphthalene.	Nitrous oxide, N_2O.	Pictet's fluid, $64SO_2+44CO_2$ by weight.	Sulphur dioxide, SO_2.	Hydrogen sulphide, H_2S.	Terpentine, $C_{10}H_{16}$.
−30	....	....	....	....	.....	58.52	28.75		
−25	....	....	.41	....	1569.49	67.64	37.38	374.93	
−20	.58	....	.63	....	1758.66	74.48	47.95	443.85	
−15	.88	....	.93	....	1968.43	89.68	60.79	519.65	
−10	1.29	....	1.35	....	2200.80	101.84	76.25	608.46	
− 5	1.83	....	1.92	....	2457.92	121.60	94.69	706.60	
0	2.53	0.006	2.68	0.002	2742.10	139.08	116.51	820.63	.21
5	3.42	....	3.69	....	3055.86	167.20	142.11	949.08	
10	4.52	0.010	5.01	0.005	3401.91	193.80	171.95	1089.63	.29
15	5.89	....	6.71	0.005	3783.17	226.48	206.49	1244.79	
20	7.56	0.015	8.87	0.008	4202.79	258.40	246.20	1415.15	.44
25	9.59	....	11.60	....	4664.14	297.92	291.60	1601.24	
30	12.02	0.026	15.00	0.013	5170.85	338.20	343.18	1803.53	.69
35	14.93	....	19.20	....	6335.98	383.80	401.48	2002.43	
40	18.36	0.060	24.35	0.032	.....	434.72	467.02	2258.25	1.08
45	22.41	....	30.61	....	.....	478.80	540.35	2495.43	
50	27.14	0.130	38.17	0.081	.....	521.36	622.00	2781.48	1.70
55	32.64	....	47.22	....	.....	....	712.50	3069.07	
60	39.01	0.255	57.99	0.183	.....	....	812.38	3374.02	2.65
65	46.34	....	70.73	....	.....	....	922.14	3696.15	
70	54.74	0.460	85.71	0.395	.....	....	....	4035.32	4.06
75	64.32	....	103.21						
80	75.19	0.915	123.85	0.74	.....	....	....	.....	6.13
85	87.46	....	147.09						
90	101.27	....	174.17	1.26	.....	....	....	.....	9.06
95	116.75	....	205.17						
100	134.01	....	240.51	1.85	.....	....	....	.....	13.11
105	153.18	....	280.63						
110	174.44	....	325.96	2.73	.....	....	....	.....	18.60
115	197.82	....	376.98						
120	223.54	....	434.18	4.02	.....	....	....	.....	25.70
125	251.71	....	498.05						
130	282.43	....	569.13	6.19	.....	....	....	.....	34.90
135	315.85	....	647.93						
140	352.07	....	733.71	....	.....	....	....	.....	46.40
145	391.21	....	830.89	....					
150	433.37	....	936.13						
155	478.65	....	....	....	.....	....	....	.....	60.50
160	527.14	....	....	....	.....	....	....	.....	68.60
165	568.30	....	....	....	.....	....	....	.....	77.50

HEAT CONDUCTIVITY

Giving the quantity of heat in calories which is transmitted per second through a plate one centimeter thick across an area of one square centimeter when the temperature difference is one degree Centigrade.

Metals

Substance	Temp. °C.	Conductivity	Observer
Aluminum	−160	0.514	Lees, 1908
	18	0.480	Jaeger & Diesselhorst, 1900
	18	0.504	Lees, 1908
	100	0.492	Jaeger & Diesselhorst, 1900
	100	0.49	Angell, 1911
	200	0.55	"
	300	0.64	"
	400	0.76	"
	600	1.01	"
Antimony	0	0.0442	Lorenz, 1881
	100	0.040	"
	0–30	0.042	Berget, 1890
Bismuth	−186	0.025	Macchia, 1907
	0	0.0177	Lorenz
	18	0.0194	Jaeger & Diesselhorst, 1900
	100	0.0161	Jaeger & Diesselhorst, 1900
Brass (70Cu+30Zn)	−160	0.181	Lees, 1908
(70Cu+30Zn)	17	0.260	" "
yellow	0	0.204	Lorenz
red	0	0.246	"
Bronze, aluminum (90Cu, 10Al)	....	0.18	Van Aubel
Cadmium	−160	0.239	Lees, 1908
	0	0.220	Lorenz
	18	0.222	Jaeger & Diesselhorst, 1900
	100	0.216	Jaeger & Diesselhorst, 1900
Constantan	18	0.054	Jaeger & Diesselhorst, 1900
(60Cu, 40Ni)	100	0.064	Jaeger & Diesselhorst, 1900
Copper, pure	−160	1.097	Lees, 1908
	13	1.00	Angström, 1863
	18	0.918	Jaeger & Diesselhorst, 1900

HEAT CONDUCTIVITY (Continued)

Metals

Substance	Temp. °C.	Conductivity	Observer
Copper, pure	100	0.908	Jaeger & Diesselhorst, 1900
	100–197	1.043	Hering, 1910
	100–268	0.969	"
	100–370	0.931	"
	100–541	0.902	"
	100–837	0.858	"
German silver	0	0.070	Lorenz, 1881
	100	0.089	"
(52Cu, 26Zn, 22Ni)	....	0.10	Glage, 1905
Gold	17	0.705	Barratt, 1914
	18	0.700	Jaeger & Diesselhorst, 1900
	100	0.703	Jaeger & Diesselhorst, 1900
Iridium	17	0.141	Barratt, 1914
Iron, pure	18	0.161	Jaeger & Diesselhorst
	100	0.151	" "
	100–727	0.202	Hering, 1910
	100–1245	0.191	"
wrought	−160	0.152	Lees, 1908
	18	0.144	Jaeger & Diesselhorst
	100	0.143	" "
cast	18	0.109	" "
	100	0.108	" "
	54	0.114	Callendar
	102	0.111	"
Steel	−160	0.113	Lees, 1908
	18	0.115	" "
	18	0.108	Jaeger & Diesselhorst
	100	0.107	" "
Lead	−160	0.092	Lees, 1908
	18	0.083	Jaeger & Diesselhorst
	100	0.082	" "
Magnesium	0–100	0.376	Lorenz, 1881
Manganin	18	0.15186	Jaeger & Diesselhorst
(84Cu, 4Ni, 12Mn)	100	0.06310	" "
	−160	0.035	Lees, 1908
Mercury	0	0.0148	H. F. Weber, 1880
	50	0.0189	" "
	17	0.0197	R. Weber, 1902
Molybdenum	17	0.346	Barratt, 1914
Nickel	−160	0.129	Lees, 1908

HEAT CONDUCTIVITY (Continued)

Metals

Substance	Temp. ° C.	Conductivity	Observer
Nickel	18	0.142	Jaeger & Diesselhorst, 1900
	100	0.138	Jaeger & Diesselhorst, 1900
	300	0.126	Angell, 1911
	600	0.088	"
	800	0.068	"
	1200	0.058	"
Palladium..........	18	0.1683	Jaeger & Diesselhorst, 1900
	100	0.182	
Platinum...........	18	0.1664	Jaeger & Diesselhorst, 1900
	100	0.1733	Jaeger & Diesselhorst, 1900
Platinum-iridium.... 10% Ir	17	0.074	Barratt, 1914
Platinum-rhodium... 10% Rh	17	0.072	Barratt, 1914
Platinoid...........	18	0.060	Lees, 1908
Rhodium...........	17	0.210	Barratt, 1914
Silver, pure.........	−160	0.998	Lees, 1908
	18	0.974	"
	18	1.006	Jaeger & Diesselhorst, 1900
	100	0.992	Jaeger & Diesselhorst, 1900
Tin................	−160	0.192	Lees, 1908
	0	0.1528	Lorenz, 1881
	18	0.155	Jaeger & Diesselhorst, 1900
	100	0.145	Jaeger & Diesselhorst, 1900
	100	0.1423	Lorenz, 1881
Tantalum..........	17	0.130	Barratt, 1914
Tungsten...........	17	0.476	"
	18	0.35	Coolidge
Wood's alloy........	....	0.0319	H. F. Weber
Zinc...............	−160	0.278	Lees, 1908
	18	0.2653	Jaeger & Diesselhorst
	100	0.2619	" "

HEAT CONDUCTIVITY (Continued)

Various Solids

Approximate values at ordinary temperatures.

Substance	Conductivity	Observer
Asbestos fiber, 500° C..	0.00019	Randolph, 1912
paper..............	0.0006	....
	0.0004	Lees-Chorlton, 1896
Basalt................	0.0052	Hecht, 1903
Brick, common red....	0.0015	Herschel-Lebour & Dunn, 1879
Blotting paper........	0.00015	Lees-Charlton, 1896
Carbon..............	0.01	
Carborundum........	0.0005	Lorenz
brick, 150°–1200°...	0.0032–0.0027	Wologdine
Cardboard...........	0.0005	....
Cement, Portland.....	0.00071	Lees-Chorlton, 1896
Chalk...............	0.0020	Herschel-Lebour & Dunn, 1879
Concrete, cinder......	0.00081	....
stone.............	0.0022	Norton
Cork...............	0.00072	G. Forbes, 1875
	0.00013	Lees, 1892–8
Cotton wool..........	0.000043	G. Forbes
felted.............	0.000033	"
Diatomic earth.......	0.00013	Hutton-Blard
Earth's crust, ave.....	0.004	....
Ebonite..............	0.00042	Lees
	0.00014	Barratt, 1914
Eiderdown...........	0.000011	Peclet, 1878
Felt................	0.000087	....
Fiber, red...........	0.0011	Barratt, 1914
Fire brick...........	0.00028	Hutton-Blard
	0.0011	Barratt, 1914
Flannel..............	0.00023	
Gas carbon, 20°.......	0.0085	Barratt, 1914
100°..............	0.0095	"
Glass		
crown (window)....	0.0025	Lees, 1892–8
flint.............	0.002	"
Jena..............	0.001–0.002	"
soda, 20°.........	0.0017	Barratt, 1914
100°........	0.0018	"
Granite, 100°.........	0.0045–0.0050	Poole, 1912
500°........	0.0040	"
Graphite.............	0.012	....
Graphite brick, 300° to 700°..............	0.24	Wologdine, 1909

HEAT CONDUCTIVITY (Continued)

Various Solids (Continued)

Approximate values at ordinary temperatures.

Substance	Conductivity	Observer
Gutta percha	0.00048	Péclet, 1878
Gypsum	0.0031	R. Weber, 1878
Haircloth, felt	0.000042	G. Forbes
Ice	0.005	....
	0.0039	....
	0.0022	Forbes, 1875
Infusorial earth, 100°	0.00034	Skinner
300°	0.00040	"
pressed bricks, 100°	0.00030	"
Lamp black, 100	0.00007	Randolph, 1912
Leather, cowhide	0.00042	Lees-Chorlton, 1896
chamois	0.00015	" "
Lime	0.00029	Hutton-Blard
Linen	0.00021	Lees-Chorlton, 1896
Magnesia, MgO	0.00016–0.00045	Hutton-Blard
brick, 50°–1130°	0.0027–0.0072	Wologdine, 1909
Magnesium carbonate, 100°	0.00023	Skinner
300°	0.00025	"
Marble	0.0071	Lees, 1892–8
Mica, perpendicular to cleavage plane	0.0018	Lees
Paper	0.0003	"
Paraffine	0.0006	"
0°	0.00023	R. Weber, 1878
Plaster of Paris	0.00070	Lees-Chorlton, 1896
Porcelain	0.0025	Lees, 1892–8
165°–1055°	0.0039–0.0047	Wologdine, 1909
Quartz, parallel to axis	0.030	Lees, 1892–8
perpendicular to axis	0.16	"
Rubber, para	0.00045	"
Sand, dry	0.00093	Herschel-Lebour & Dunn, 1879
Sandstone	0.0055	Herschel-Lebour & Dunn, 1879
Sawdust	0.00012	G. Forbes, 1875
Silica, fused, 20°	0.00237	Barratt, 1914
100°	0.00255	"
Silica brick, 100° to 1000° C	0.002–0.003	Wologdine, 1909
Silk	0.000095	Lees-Chorlton, 1896
Slate	0.004700	Lees, 1892–8

HEAT CONDUCTIVITY (Continued)

Various Solids (Continued)

Approximate values at ordinary temperatures.

Substance	Conductivity	Observer
Snow, compact.......	0.00051	Hjeltström
Soil, dry.............	0.00033	Lees-Chorlton, 1896
Wax, bees'...........	0.00009	G. Forbes
Wood, fir || to axis.....	0.00030	....
perpendicular to axis.	0.00009	....
Liquids		
Acetic acid...........	0.00047	H. F. Weber
Amyl alcohol.........	0.000328	"
Aniline, 12°..........	0.00041	....
Benzole, 5°...........	0.000333	H. F. Weber
Carbon disulphide, 9° to 15°..........	0.000343	"
Chloroform, 9°–15°...	0.000288	"
Ether, 9°–15°.........	0.000303	"
Ethyl alcohol.........	0.000423	"
Glycerine, 9°–15°.....	0.000637	Graetz
Methyl alcohol.......	0.000495	H. F. Weber
Oils: olive	0.000395	Wachsmuth
castor.............	0.000425	"
petroleum, 13°......	0.000355	Graetz
turpentine.........	0.000325	"
Vaseline, 25°.........	0.00044	Lees
Water, 4°............	0.00138	H. F. Weber
0°............	0.00120	"
17°............	0.00131	R. Weber
20°............	0.00143	Milner & Chattock
Gases		
Air, 0°...............	0.0000568	Winklemann
Argon, 0°............	0.0000389	Schwarze
Ammonia gas, 0°......	0.0000458	Winklemann
Carbon dioxide, 0°....	0.0000307	"
monoxide..........	0.0000499	"
Ethylene............	0.0000395	"
Helium, 0°...........	0.000339	Schwarze
Hydrogen, 0°.........	0.000327	Winklemann
100°.......	0.000369	Graetz
Methane, 7°–8°.......	0.0000647	Winklemann
Nitric oxide, NO, 8°...	0.0000460	"
Nitrogen, 7°–8°.......	0.0000524	"
Nitrous oxide, N_2O ...	0.0000350	
Oxygen, 7°–8°........	0.0000563	

PROPERTIES OF

METRIC AND

The heat units used are the large calorie, 15° to 16° C. and the B.T.U., 62° to 63° F. The heat of the liquid, q, is the heat required to raise unit mass of water from 0° C. (32° F.) to the temperature indicated. The heat of vaporization, r, is the heat required to vaporize unit mass of water at the indicated temperature and pressure. Total heat involved, $H = r + q$.

The heat of vaporization overcomes external pressure and changes the state from liquid to vapor at constant temperature and pressure. If u is the change

Temperature degrees Centigrade.	Pressure. Millimeters of mercury.	Pressure. Kilograms per square centimeter.	Pressure. Pounds per square inch.	Heat of the liquid. Calories per kilogram.	Heat of the liquid. B.T.U. per pound.	Heat of vaporization. Calories per kilogram.	Heat of vaporization. B.T.U. per pound.	Heat equivalent of internal work. Calories per kilogram.	Heat equivalent of internal work. B.T.U. per pound.	Temperature, degrees Fahrenheit.
t	p	p	p	q	q	r	r	ρ	ρ	t
0	4.579	0.00623	0.0886	0.00	0.0	595.4	1071.7	565.3	1017.5	**32**
1	4.924	0.00670	0.0952	1.01	1.8	594.9	1070.8	564.7	1016.4	**33.8**
2	5.290	0.00719	0.1023	2.02	3.6	594.4	1069.9	564.0	1015.3	**35.6**
3	5.681	0.00772	0.1099	3.03	5.5	593.9	1069.0	563.4	1014.2	**37.4**
4	6.097	0.00829	0.1179	4.03	7.3	593.3	1068.0	562.8	1013.1	**39.2**
5	6.541	0.00889	0.1265	5.04	9.1	592.8	1067.1	562.2	1011.9	**41**
6	7.011	0.00953	0.1356	6.04	10.9	592.3	1066.1	561.5	1010.7	**42.8**
7	7.511	0.01021	0.1453	7.05	12.7	591.8	1065.2	560.9	1009.6	**44.6**
8	8.042	0.01093	0.1555	8.05	14.5	591.2	1064.2	560.2	1008.5	**46.4**
9	8.606	0.01170	0.1664	9.05	16.3	590.7	1063.3	559.6	1007.4	**48.2**
10	9.205	0.01252	0.1780	10.06	18.1	590.2	1062.3	559.0	1006.2	**50**
11	9.840	0.01338	0.1903	11.06	19.9	589.6	1061.3	558.3	1005.0	**51.8**
12	10.513	0.01429	0.2033	12.06	21.7	589.1	1060.4	557.7	1003.9	**53.6**
13	11.226	0.01526	0.2171	13.06	23.5	588.6	1059.4	557.1	1002.7	**55.4**
14	11.980	0.01629	0.2317	14.06	25.3	588.1	1058.5	556.5	1001.6	**57.2**
15	12.779	0.01737	0.2471	15.06	27.1	587.6	1057.6	555.9	1000.5	**59**
16	13.624	0.01852	0.2635	16.06	28.9	587.0	1056.6	555.2	999.4	**60.8**
17	14.517	0.01974	0.2807	17.06	30.7	586.5	1055.7	554.6	998.3	**62.6**
18	15.460	0.02102	0.2990	18.06	32.5	585.9	1054.7	553.9	997.1	**64.4**
19	16.456	0.02237	0.3182	19.06	34.3	585.4	1053.8	553.3	996.0	**66.2**
20	17.51	0.02381	0.3386	20.06	36.1	584.9	1052.8	552.7	994.8	**68**
21	18.62	0.02532	0.3601	21.06	37.9	584.4	1051.9	552.1	993.7	**69.8**
22	19.79	0.02691	0.3827	22.06	39.7	583.9	1051.0	551.5	992.6	**71.6**
23	21.02	0.02858	0.4065	23.06	41.5	583.3	1050.0	550.8	991.4	**73.4**
24	22.32	0.03035	0.4316	24.06	43.3	582.8	1049.1	550.2	990.3	**75.2**
25	23.69	0.03221	0.4581	25.05	45.1	582.3	1048.1	549.5	989.1	**77**
26	25.13	0.03417	0.4860	26.05	46.9	581.8	1047.2	548.9	988.0	**78.8**
27	26.65	0.03623	0.5154	27.05	48.7	581.2	1046.2	548.2	986.9	**80.6**
28	28.25	0.03841	0.5463	28.05	50.5	580.7	1045.2	547.6	985.7	**82.4**
29	29.94	0.04071	0.5790	29.04	52.3	580.2	1044.3	547.0	984.6	**84.2**
30	31.71	0.04311	0.6132	30.04	54.1	579.6	1043.3	546.3	983.4	**86**

SATURATED STEAM

English Units

in volume the external work is pu and the corresponding amount of heat is Apu where A is the reciprocal of the mechanical equivalent of heat. The part of the heat of vaporization not used in external work is considered used in changing the state from liquid to vapor. The heat required for this work may be represented by $\rho = r - Apu$.

(From Peabody, Steam and Entropy Tables, John Wiley and Sons, Inc., publishers, by permission.)

Temperature, degrees Centigrade.	Heat equivalent of external work. Calories per kilogram.	Heat equivalent of external work. B.T.U. per pound.	Entropy of the liquid.	Entropy of vaporization.	Specific volume. Cubic meters per kilo.	Specific volume. Cubic feet per pound.	Density. Kilos per cubic meter.	Density. Pounds per cubic foot.	Temperature, degrees Fahrenheit.
t	Apu	Apu	θ	$\frac{r}{T}$	s	s	$\frac{1}{s}$	$\frac{1}{s}$	t
0	30.1	54.2	0.0000	2.1804	206.3	3304	0.00485	0.000303	**32**
1	30.2	54.4	0.0037	2.1706	192.7	3087	0.00519	0.000324	**33.8**
2	30.4	54.6	0.0074	2.1609	180.0	2884	0.00556	0.000347	**35.6**
3	30.5	54.8	0.0110	2.1513	168.2	2694	0.00595	0.000371	**37.4**
4	30.5	54.9	0.0146	2.1416	157.2	2518	0.00636	0.000397	**39.2**
5	30.6	55.2	0.0183	2.1320	147.1	2356	0.00680	0.000424	**41**
6	30.8	55.4	0.0219	2.1225	137.7	2206	0.00726	0.000453	**42.8**
7	30.9	55.6	0.0256	2.1130	129.0	2067	0.00775	0.000484	**44.6**
8	31.0	55.7	0.0290	2.1036	120.9	1937	0.00827	0.000516	**46.4**
9	31.1	55.9	0.0326	2.0943	113.4	1816	0.00882	0.000551	**48.2**
10	31.2	56.1	0.0361	2.0850	106.3	1703	0.00941	0.000587	**50**
11	31.3	56.3	0.0397	2.0758	99.8	1599	0.01002	0.000625	**51.8**
12	31.4	56.5	0.0433	2.0667	93.7	1502	0.01067	0.000666	**53.6**
13	31.5	56.7	0.0467	2.0576	88.1	1411	0.01135	0.000709	**55.4**
14	31.6	56.9	0.0502	2.0486	82.9	1327	0.01206	0.000754	**57.2**
15	31.7	57.1	0.0537	2.0396	77.9	1248	0.01283	0.000801	**59**
16	31.8	57.3	0.0571	2.0308	73.3	1174	0.01364	0.000852	**60.8**
17	31.9	57.4	0.0607	2.0220	69.1	1105	0.01447	0.000905	**62.6**
18	32.0	57.6	0.0641	2.0132	65.1	1041	0.01536	0.000961	**64.4**
19	32.1	57.8	0.0675	2.0045	61.3	982	0.01631	0.001018	**66.2**
20	32.2	58.0	0.0709	1.9959	57.8	926	0.01730	0.001080	**68**
21	32.3	58.2	0.0743	1.9873	54.5	873	0.01835	0.001145	**69.8**
22	32.4	58.4	0.0776	1.9788	51.5	824	0.01942	0.001214	**71.6**
23	32.5	58.6	0.0811	1.9703	48.60	778	0.02058	0.001286	**73.4**
24	32.6	58.8	0.0845	1.9620	45.92	735	0.02178	0.001361	**75.2**
25	32.8	59.0	0.0878	1.9536	43.40	695	0.02304	0.001439	**77**
26	32.9	59.2	0.0911	1.9453	41.05	657	0.02436	0.001522	**78.8**
27	33.0	59.3	0.0945	1.9370	38.83	622	0.02575	0.001608	**80.6**
28	33.1	59.5	0.0978	1.9288	36.74	589	0.02722	0.001698	**82.4**
29	33.2	59.7	0.1011	1.9207	34.78	557	0.02875	0.001795	**84.2**
30	33.3	59.9	0.1044	1.9126	32.95	528	0.03035	0.001894	**86**

PROPERTIES OF

Temperature, degrees Centigrade.	Pressure. Millimeters of mercury.	Pressure. Kilograms per square centimeter.	Pressure. Pounds per square inch.	Heat of the liquid. Calories per kilogram.	Heat of the liquid. B.T.U. per pound.	Heat of vaporization. Calories per kilogram.	Heat of vaporization. B.T.U. per pound.	Heat equivalent of internal work. Calories per kilogram.	Heat equivalent of internal work. B.T.U. per pound.	Temperature, degrees Fahrenheit.
t	p	p	p	q	q	r	r	ρ	ρ	t
31	33.57	0.04564	0.6492	31.04	55.9	579.1	1042.4	545.7	982.2	**87.8**
32	35.53	0.04830	0.6871	32.04	57.7	578.6	1041.4	545.1	981.0	**89.6**
33	37.59	0.05111	0.7269	33.04	59.5	578.0	1040.4	544.4	979.9	**91.4**
34	39.75	0.05404	0.7687	34.03	61.3	577.4	1039.4	543.7	978.7	**93.2**
35	42.02	0.05713	0.8126	35.03	63.1	576.9	1038.5	543.1	977.6	**95**
36	44.40	0.06037	0.8586	36.03	64.9	576.4	1037.5	542.5	976.4	**96.8**
37	46.90	0.06376	0.9068	37.02	66.6	575.8	1036.5	541.8	975.2	**98.6**
38	49.51	0.06731	0.9574	38.02	68.4	575.3	1035.5	541.2	974.0	**100.4**
39	52.26	0.07105	1.0105	39.02	70.2	574.7	1034.5	540.5	972.8	**102.2**
40	55.13	0.07495	1.0661	40.02	72.0	574.2	1033.5	539.9	971.7	**104**
41	58.14	0.07905	1.1243	41.01	73.8	573.6	1032.5	539.2	970.5	**105.8**
42	61.30	0.08334	1.1854	42.01	75.6	573.1	1031.5	538.6	969.3	**107.6**
43	64.59	0.08782	1.2492	43.01	77.4	572.5	1030.5	537.9	968.2	**109.4**
44	68.05	0.09252	1.3159	44.01	79.2	571.9	1029.4	537.2	966.9	**111.2**
45	71.66	0.09743	1.3858	45.00	81.0	571.3	1028.4	536.5	965.7	**113**
46	75.43	0.10256	1.4587	46.00	82.8	570.8	1027.4	535.8	964.5	**114.8**
47	79.38	0.10792	1.5350	47.00	84.6	570.2	1026.4	535.1	963.3	**116.6**
48	83.50	0.11353	1.6147	48.00	86.4	569.6	1025.3	534.4	962.0	**118.4**
49	87.80	0.11937	1.6979	48.99	88.2	569.0	1024.3	533.7	960.8	**120.2**
50	92.30	0.12549	1.7849	49.99	90.0	568.4	1023.2	533.0	959.6	**122**
51	96.99	0.13187	1.8756	50.99	91.8	567.8	1022.2	532.3	958.4	**123.8**
52	101.88	0.13852	1.9701	51.99	93.6	567.3	1021.2	531.7	957.2	**125.6**
53	106.99	0.14546	2.0689	52.99	95.4	566.8	1020.2	531.1	956.0	**127.4**
54	112.30	0.15268	2.172	53.98	97.2	566.2	1019.1	530.4	954.7	**129.2**
55	117.85	0.16023	2.279	54.98	99.0	565.6	1018.1	529.7	953.5	**131**
56	123.61	0.16806	2.390	55.98	100.8	565.1	1017.1	529.1	952.3	**132.8**
57	129.63	0.17624	2.506	56.98	102.6	564.5	1016.1	528.4	951.1	**134.6**
58	135.89	0.18475	2.627	57.98	104.4	563.9	1015.1	527.7	949.9	**136.4**
59	142.41	0.19362	2.754	58.97	106.2	563.4	1014.1	527.1	948.7	**138.2**
60	149.19	0.20284	2.885	59.97	108.0	562.8	1013.1	526.4	947.5	**140**
61	156.24	0.21242	3.021	60.97	109.8	562.2	1012.0	525.7	946.3	**141.8**
62	163.58	0.2224	3.163	61.97	111.6	561.7	1011.0	525.1	945.1	**143.6**
63	171.20	0.2328	3.310	62.97	113.4	561.1	1009.9	524.4	943.8	**145.4**
64	179.13	0.2435	3.464	63.98	115.2	560.5	1008.9	523.7	942.6	**147.2**
65	187.36	0.2547	3.623	64.98	117.0	559.9	1007.8	523.0	941.3	**149**
66	195.92	0.2664	3.789	65.98	118.8	559.3	1006.8	522.3	940.1	**150.8**
67	204.80	0.2784	3.960	66.98	120.6	558.8	1005.8	521.7	938.9	**152.6**
68	214.02	0.2910	4.139	67.98	122.4	558.2	1004.7	521.0	937.6	**154.4**
69	223.58	0.3040	4.324	68.98	124.2	557.6	1003.6	520.3	936.3	**156.2**
70	233.53	0.3175	4.516	69.98	126.0	556.9	1002.5	519.5	935.0	**158**

SATURATED STEAM (Continued)

Temperature, degrees Centigrade. t	Heat equivalent of external work. Calories per kilogram. Apu	Heat equivalent of external work. B.T.U. per pound. Apu	Entropy of the liquid. θ	Entropy of vaporization. $\frac{r}{T}$	Specific volume. Cubic meters per kilo. s	Specific volume. Cubic feet per pound. s	Density. Kilos per cubic meter. $\frac{1}{s}$	Density. Pounds per cubic foot. $\frac{1}{s}$	Temperature, degrees Fahrenheit. t
31	33.4	60.2	0.1077	1.9046	31.24	501	0.03201	0.001996	**87.8**
32	33.5	60.4	0.1110	1.8966	29.62	474.7	0.03376	0.002107	**89.6**
33	33.6	60.5	0.1142	1.8886	28.08	449.7	0.03561	0.002224	**91.4**
34	33.7	60.7	0.1175	1.8806	26.62	426.5	0.03757	0.002345	**93.2**
35	33.8	60.9	0.1207	1.8728	25.25	404.7	0.03960	0.002471	**95**
36	33.9	61.1	0.1239	1.8650	23.98	384.2	0.04170	0.002603	**96.8**
37	34.0	61.3	0.1272	1.8572	22.78	364.9	0.04390	0.002740	**98.6**
38	34.1	61.5	0.1304	1.8494	21.65	346.8	0.04619	0.002884	**100.4**
39	34.2	61.7	0.1336	1.8417	20.58	329.7	0.04859	0.003033	**102.2**
40	34.3	61.8	0.1368	1.8341	19.57	313.5	0.0511	0.003190	**104**
41	34.4	62.0	0.1399	1.8265	18.61	298.0	0.0537	0.003356	**105.8**
42	34.5	62.2	0.1431	1.8189	17.69	283.3	0.0565	0.003530	**107.6**
43	34.6	62.3	0.1463	1.8113	16.82	269.5	0.0595	0.003711	**109.4**
44	34.7	62.5	0.1494	1.8038	16.01	256.5	0.0625	0.003899	**111.2**
45	34.8	62.7	0.1526	1.7693	15.25	244.4	0.0656	0.004092	**113**
46	35.0	62.9	0.1557	1.7889	14.54	233.0	0.0688	0.004292	**114.8**
47	35.1	63.1	0.1588	1.7815	13.86	222.1	0.0722	0.004502	**116.6**
48	35.2	63.3	0.1619	1.7742	13.21	211.7	0.0757	0.004724	**118.4**
49	35.3	63.5	0.1650	1.7669	12.60	201.9	0.0794	0.00495	**120.2**
50	35.4	63.6	0.1682	1.7597	12.02	192.6	0.0832	0.00519	**122**
51	35.5	63.8	0.1713	1.7525	11.47	183.8	0.0872	0.00544	**123.8**
52	35.6	64.0	0.1743	1.7454	10.96	175.5	0.0912	0.00570	**125.6**
53	35.7	64.2	0.1774	1.7383	10.47	167.7	0.0955	0.00596	**127.4**
54	35.8	64.4	0.1804	1.7312	10.00	160.3	0.1000	0.00624	**129.2**
55	35.9	64.6	0.1835	1.7242	9.56	153.2	0.1046	0.00653	**131**
56	36.0	64.8	0.1865	1.7173	9.14	146.5	0.1094	0.00683	**132.8**
57	36.1	65.0	0.1895	1.7104	8.74	140.1	0.1144	0.00713	**134.6**
58	36.2	65.2	0.1925	1.7035	8.36	134.0	0.1196	0.00746	**136.4**
59	36.3	65.4	0.1955	1.6967	8.00	128.3	0.1250	0.00779	**138.2**
60	36.4	65.6	0.1986	1.6899	7.66	122.8	0.1305	0.00814	**140**
61	36.5	65.7	0.2016	1.6831	7.34	117.6	0.1362	0.00850	**141.8**
62	36.6	65.9	0.2046	1.6764	7.03	112.7	0.1422	0.00887	**143.6**
63	36.7	66.1	0.2075	1.6696	6.74	108.0	0.1484	0.00926	**145.4**
64	36.8	66.3	0.2105	1.6629	6.46	103.5	0.1548	0.00966	**147.2**
65	36.9	66.5	0.2135	1.6563	6.19	99.2	0.1615	0.01008	**149**
66	37.0	66.7	0.2164	1.6497	5.94	95.1	0.1684	0.01051	**150.8**
67	37.1	66.9	0.2194	1.6431	5.70	91.3	0.1754	0.01095	**152.6**
68	37.2	67.1	0.2223	1.6366	5.47	87.6	0.1828	0.01142	**154.4**
69	37.3	67.3	0.2253	1.6300	5.25	84.1	0.1905	0.01189	**156.2**
70	37.4	67.4	0.2282	1.6235	5.04	80.7	0.1984	0.01239	**158**

PROPERTIES OF

Temperature, degrees Centigrade.	Pressure.			Heat of the liquid.		Heat of vaporization.		Heat equivalent of internal work.		Temperature, degrees Fahrenheit.
	Millimeters of mercury.	Kilograms per square centimeter.	Pounds per square inch.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	
t	p	p	p	q	q	r	r	ρ	ρ	t
71	243.8	0.3315	4.715	70.98	127.8	556.4	1001.5	518.8	933.9	**159.8**
72	254.5	0.3460	4.921	71.99	129.6	555.8	1000.4	518.1	932.6	**161.6**
73	265.6	0.3611	5.136	72.99	131.4	555.2	999.4	517.4	931.4	**163.4**
74	277.1	0.3767	5.358	73.99	133.2	554.6	998.3	516.7	930.1	**165.2**
75	289.0	0.3929	5.589	74.99	135.0	554.0	997.3	516.0	928.8	**167**
76	301.3	0.4096	5.826	76.00	136.8	553.4	996.2	515.3	927.6	**168.8**
77	314.0	0.4269	6.072	77.00	138.6	552.9	995.2	514.7	926.4	**170.6**
78	327.2	0.4449	6.327	78.00	140.4	552.3	994.1	514.0	925.2	**172.4**
79	340.9	0.4635	6.592	79.01	142.2	551.7	993.0	513.3	923.9	**174.2**
80	355.1	0.4828	6.867	80.01	144.0	551.1	991.9	512.6	922.6	**176**
81	369.7	0.5026	7.150	81.02	145.8	550.5	990.8	511.9	921.3	**177.8**
82	384.9	0.5233	7.443	82.02	147.6	549.9	989.8	511.2	920.1	**179.6**
83	400.5	0.5445	7.745	83.03	149.4	549.3	988.7	510.5	918.8	**181.4**
84	416.7	0.5665	8.058	84.03	151.2	548.7	987.6	509.8	917.6	**183.2**
85	433.5	0.5894	8.383	85.04	153.1	548.1	986.5	509.1	916.3	**185**
86	450.8	0.6129	8.717	86.04	154.9	547.4	985.4	508.3	915.0	**186.8**
87	468.6	0.6371	9.062	87.05	156.7	546.8	984.3	507.6	913.7	**188.6**
88	487.1	0.6623	9.419	88.06	158.5	546.2	983.2	506.9	912.5	**190.4**
89	506.1	0.6881	9.787	89.06	160.3	545.6	982.1	506.2	911.2	**192.2**
90	525.8	0.7149	10.167	90.07	162.1	544.9	980.9	505.4	909.9	**194**
91	546.1	0.7425	10.560	91.08	163.9	544.3	979.8	504.7	908.5	**195.8**
92	567.1	0.7710	10.966	92.08	165.7	543.7	978.7	504.0	907.2	**197.6**
93	588.7	0.8004	11.384	93.09	167.5	543.1	977.6	503.3	906.0	**199.4**
94	611.0	0.8307	11.815	94.10	169.3	542.5	976.5	502.6	904.7	**201.2**
95	634.0	0.8620	12.260	95.11	171.2	541.9	975.4	501.9	903.4	**203**
96	657.7	0.8942	12.718	96.12	173.0	541.2	974.2	501.1	902.1	**204.8**
97	682.1	0.9274	13.190	97.12	174.8	540.6	973.1	500.4	900.8	**206.6**
98	707.3	0.9616	13.678	98.13	176.6	539.9	971.9	499.6	899.4	**208.4**
99	733.3	0.9970	14.180	99.14	178.5	539.3	970.8	498.9	898.2	**210.2**
100	760.0	1.0333	14.697	100.2	180.3	538.7	969.7	498.2	896.9	**212**
101	787.5	1.0707	15.229	101.2	182.1	538.1	968.5	497.5	895.5	**213.8**
102	815.9	1.1093	15.778	102.2	183.9	537.4	967.3	496.8	894.1	**215.6**
103	845.1	1.1490	16.342	103.2	185.7	536.8	966.2	496.1	892.9	**217.4**
104	875.1	1.1898	16.923	104.2	187.6	536.2	965.1	495.4	891.6	**219.2**
105	906.1	1.2319	17.522	105.2	189.4	535.6	964.0	494.7	890.3	**221**
106	937.9	1.2752	18.137	106.2	191.2	534.9	962.8	493.9	889.0	**222.8**
107	970.6	1.3196	18.769	107.2	193.0	534.2	961.6	493.1	887.6	**224.6**
108	1004.3	1.3653	19.420	108.2	194.8	533.6	960.5	492.4	886.3	**226.4**
109	1038.8	1.4123	20.089	109.3	196.7	532.9	959.3	491.6	885.0	**228.2**
110	1074.5	1.4608	20.777	110.3	198.5	532.3	958.1	490.9	883.6	**230**

SATURATED STEAM (Continued)

Temperature, degrees, Centigrade.	Heat equivalent of external work. Calories per kilogram.	Heat equivalent of external work. B.T.U. per pound.	Entropy of the liquid.	Entropy of vaporization.	Specific volume. Cubic meters per kilo.	Specific volume. Cubic feet per pound.	Density. Kilos per cubic meter.	Density. Pounds per cubic foot.	Temperature, degrees Fahrenheit.
t	Apu	Apu	θ	$\frac{r}{T}$	s	s	$\frac{1}{s}$	$\frac{1}{s}$	t
71	37.6	67.6	0.2311	1.6171	4.838	77.5	0.2067	0.01290	**159.8**
72	37.7	67.8	0.2340	1.6107	4.647	74.4	0.2152	0.01344	**161.6**
73	37.8	68.0	0.2639	1.6044	4.466	71.5	0.2239	0.01398	**163.4**
74	37.9	68.2	0.2398	1.5981	4.294	68.8	0.2329	0.01453	**165.2**
75	38.0	68.5	0.2427	1.5918	4.130	66.2	0.2421	0.01510	**167**
76	38.1	68.6	0.2456	1.5856	3.973	63.7	0.2517	0.01570	**168.8**
77	38.2	68.8	0.2484	1.5793	3.822	61.2	0.2616	0.01634	**170.6**
78	38.3	68.9	0.2513	1.5731	3.676	58.8	0.2720	0.01700	**172.4**
79	38.4	69.1	0.2541	1.5670	3.537	56.6	0.2827	0.01767	**174.2**
80	38.5	69.3	0.2570	1.5609	3.404	54.5	0.2938	0.01835	**176**
81	38.6	69.5	0.2598	1.5548	3.277	52.5	0.3052	0.01905	**177.8**
82	38.7	69.7	0.2626	1.5487	3.156	50.6	0.3168	0.01976	**179.6**
83	38.8	69.9	0.2654	1.5426	3.040	48.71	0.3289	0.02053	**181.4**
84	33.9	70.0	0.2682	1.5366	2.929	46.92	0.3414	0.02131	**183.2**
85	39.0	70.2	0.2711	1.5307	2.824	45.23	0.3541	0.02211	**185**
86	39.1	70.4	0.2739	1.5247	2.723	43.62	0.3672	0.02293	**186.8**
87	39.2	70.6	0.2767	1.5187	2.627	42.08	0.3807	0.02376	**188.6**
88	39.3	70.7	0.2795	1.5128	2.534	40.59	0.3946	0.02463	**190.4**
89	39.4	70.9	0.2823	1.5069	2.444	39.15	0.4091	0.02554	**192.2**
90	39.5	71.0	0.2851	1.5010	2.358	37.77	0.4241	0.02648	**194**
91	39.6	71.3	0.2879	1.4952	2.275	36.45	0.4395	0.02743	**195.8**
92	39.7	71.5	0.2906	1.4894	2.197	35.19	0.4552	0.02842	**197.6**
93	39.8	71.6	0.2934	1.4836	2.122	34.00	0.4713	0.02941	**199.4**
94	39.9	71.8	0.2961	1.4779	2.050	32.86	0.4878	0.03043	**201.2**
95	40.0	72.0	0.2989	1.4723	1.980	31.75	0.505	0.03149	**203**
96	40.1	72.1	0.3016	1.4666	1.913	30.67	0.523	0.03260	**204.8**
97	40.2	72.3	0.3043	1.4609	1.849	29.63	0.541	0.03375	**206.6**
98	40.3	72.5	0.3070	1.4552	1.787	28.64	0.560	0.03492	**208.4**
99	40.4	72.6	0.3097	1.4496	1.728	27.69	0.579	0.03611	**210.2**
100	40.5	72.8	0.3125	1.4441	1.671	26.78	0.598	0.03734	**212**
101	40.6	73.0	0.3152	1.4386	1.617	25.90	0.618	0.03861	**213.8**
102	40.6	73.2	0.3179	1.4330	1.564	25.06	0.639	0.03990	**215.6**
103	40.7	73.3	0.3205	1.4275	1.514	24.25	0.661	0.04124	**217.4**
104	40.8	73.5	0.3232	1.4220	1.465	23.47	0.683	0.04261	**219.2**
105	40.9	73.7	0.3259	1.4165	1.419	22.73	0.705	0.04400	**221**
106	41.0	73.8	0.3286	1.4111	1.374	22.01	0.728	0.04543	**222.8**
107	41.1	74.0	0.3312	1.4057	1.331	21.31	0.751	0.04692	**224.6**
108	41.2	74.2	0.3339	1.4003	1.289	20.64	0.776	0.04845	**226.4**
109	41.3	74.3	0.3365	1.3949	1.248	19.99	0.801	0.0500	**228.2**
110	41.4	74.5	0.3392	1.3895	1.209	19.37	0.827	0.0516	**230**

PROPERTIES OF

Temperature, degrees Centigrade.	Pressure.			Heat of the liquid.		Heat of vaporization.		Heat equivalent of internal work.		Temperature, degrees Fahrenheit.
	Millimeters of mercury.	Kilograms per square centimeter.	Pounds per square inch.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	
t	p	p	p	q	q	r	r	ρ	ρ	t
111	1111.1	1.5106	21.486	111.3	200.3	531.6	956.9	490.2	882.3	**231.8**
112	1148.7	1.5617	22.214	112.3	202.1	530.9	955.7	489.4	880.9	**233.6**
113	1187.4	1.6144	22.962	113.3	203.9	530.3	954.5	488.7	879.5	**235.4**
114	1227.1	1.6684	23.729	114.3	205.8	529.6	953.3	487.9	878.2	**237.2**
115	1267.9	1.7238	24.518	115.3	207.6	528.9	952.1	487.1	876.8	**239**
116	1309.8	1.7808	25.328	116.4	209.4	528.2	950.8	486.3	875.4	**240.8**
117	1352.8	1.8393	26.160	117.4	211.2	527.5	949.5	485.5	873.9	**242.6**
118	1397.0	1.8993	27.015	118.4	213.0	526.9	948.4	484.8	872.6	**244.4**
119	1442.4	1.9611	27.893	119.4	214.9	526.2	947.2	484.0	871.3	**246.2**
120	1488.9	2.0243	28.792	120.4	216.7	525.6	946.0	483.4	870.0	**248**
121	1536.6	2.0891	29.715	121.4	218.5	524.9	944.8	482.6	868.6	**249.8**
122	1585.7	2.1556	30.664	122.5	220.4	524.2	943.5	481.8	867.1	**251.6**
123	1636.0	2.2241	31.637	123.5	222.2	523.5	942.3	481.0	865.8	**253.4**
124	1687.5	2.2943	32.64	124.5	224.1	522.8	941.0	480.2	864.3	**255.2**
125	1740.5	2.3663	33.66	125.5	225.9	522.1	939.8	479.4	863.0	**257**
126	1794.7	2.4401	34.71	126.5	227.7	521.4	938.6	478.6	861.6	**258.8**
127	1850.3	2.5156	35.78	127.5	229.5	520.7	937.3	477.8	860.2	**260.6**
128	1907.3	2.5931	36.88	128.6	231.4	520.0	936.1	477.0	858.8	**262.4**
129	1965.8	2.6726	38.01	129.6	233.3	519.3	934.8	476.3	857.4	**264.2**
130	2025.6	2.7540	39.17	130.6	235.1	518.6	933.6	475.5	856.0	**266**
131	2086.9	2.8373	40.36	131.6	236.9	517.9	932.3	474.7	854.6	**267.8**
132	2149.8	2.9227	41.57	132.6	238.7	517.3	931.1	474.0	853.2	**269.6**
133	2214.0	3.0101	42.81	133.7	240.6	516.6	929.8	473.3	851.8	**271.4**
134	2280.0	3.0999	44.09	134.7	242.4	515.9	928.5	472.5	850.4	**273.2**
135	2347.5	3.1916	45.39	135.7	244.2	515.1	927.2	471.6	848.9	**275**
136	2416.5	3.2854	46.73	136.7	246.0	514.4	925.9	470.8	847.5	**276.8**
137	2487.3	3.3816	48.10	137.7	247.9	513.7	924.6	470.1	846.1	**278.6**
138	2559.7	3.4801	49.50	138.8	249.7	513.0	923.3	469.3	844.6	**280.4**
139	2633.8	3.581	50.93	139.8	251.6	512.3	922.1	468.5	843.3	**282.2**
140	2709.5	3.684	52.39	140.8	253.4	511.5	920.7	467.6	841.8	**284**
141	2787.1	3.789	53.89	141.8	255.3	510.7	919.3	466.8	840.2	**285.8**
142	2866.4	3.897	55.43	142.8	257.1	510.1	918.1	466.1	838.9	**287.6**
143	2947.7	4.008	57.00	143.9	259.0	509.3	916.7	465.3	837.4	**289.4**
144	3030.5	4.121	58.60	144.9	260.8	508.6	915.4	464.4	835.9	**291.2**
145	3115.3	4.236	60.24	145.9	262.7	507.8	914.1	463.6	834.5	**293**
146	3202.1	4.354	61.92	146.9	264.5	507.1	912.8	462.8	833.1	**294.8**
147	3290.8	4.474	63.64	148.0	266.4	506.4	911.5	462.0	831.6	**296.6**
148	3381.3	4.597	65.39	149.0	268.2	505.6	910.1	461.2	830.1	**298.4**
149	3474.0	4.723	67.18	150.0	270.1	504.9	908.8	460.4	828.7	**300.2**
150	3568.7	4.852	69.01	151.0	271.9	504.1	907.4	459.5	827.2	**302**

SATURATED STEAM (Continued)

Temperature, degrees Centigrade. t	Heat equivalent of external work. Calories per kilogram. Apu	Heat equivalent of external work. B.T.U. per pound. Apu	Entropy of the liquid. θ	Entropy of vaporization. $\frac{r}{T}$	Specific volume. Cubic meters per kilo. s	Specific volume. Cubic feet per pound. s	Density. Kilos per cubic meter. $\frac{1}{s}$	Density. Pounds per cubic foot. $\frac{1}{s}$	Temperature, degrees Fahrenheit. t
111	41.4	74.6	0.3418	1.3842	1.172	18.77	0.853	0.0533	**231.8**
112	41.5	74.8	0.3445	1.3789	1.136	18.20	0.880	0.0550	**233.6**
113	41.6	75.0	0.3471	1.3736	1.101	17.64	0.908	0.0567	**235.4**
114	41.7	75.1	0.3498	1.3683	1.068	17.10	0.936	0.0585	**237.2**
115	41.8	75.3	0.3524	1.3631	1.036	16.59	0.965	0.0603	**239**
116	41.9	75.4	0.3550	1.3579	1.005	16.09	0.995	0.0622	**240.8**
117	42.0	75.6	0.3576	1.3527	0.9746	15.61	1.026	0.0641	**242.6**
118	42.1	75.8	0.3602	1.3475	0.9460	15.16	1.057	0.0659	**244.4**
119	42.2	75.9	0.3628	1.3423	0.9183	14.72	1.089	0.0679	**246.2**
120	42.2	76.0	0.3654	1.3372	0.8914	14.28	1.122	0.0700	**248**
121	42.3	76.2	0.3680	1.3321	0.8653	13.86	1.156	0.0721	**249.8**
122	42.4	76.4	0.3705	1.3269	0.8401	13.46	1.190	0.0743	**251.6**
123	42.5	76.5	0.3731	1.3218	0.8158	13.07	1.226	0.0765	**253.4**
124	42.6	76.7	0.3756	1.3167	0.7924	12.69	1.262	0.0788	**255.2**
125	42.7	76.8	0.3782	1.3117	0.7698	12.33	1.299	0.0811	**257**
126	42.8	77.0	0.3807	1.3067	0.7479	11.98	1.337	0.0835	**258.8**
127	42.9	77.1	0.3833	1.3017	0.7267	11.64	1.376	0.0859	**260.6**
128	43.0	77.3	0.3858	1.2967	0.7063	11.32	1.416	0.0883	**262.4**
129	43.0	77.4	0.3884	1.2917	0.6867	11.00	1.456	0.0909	**264.2**
130	43.1	77.6	0.3909	1.2868	0.6677	10.70	1.498	0.0935	**266**
131	43.2	77.7	0.3934	1.2818	0.6493	10.40	1.540	0.0961	**267.8**
132	43.3	77.9	0.3959	1.2769	0.6315	10.12	1.583	0.0988	**269.6**
133	43.3	78.0	0.3985	1.2720	0.6142	9.839	1.628	0.1016	**271.4**
134	43.4	78.1	0.4010	1.2672	0.5974	9.569	1.674	0.1045	**273.2**
135	43.5	78.3	0.4035	1.2623	0.5812	9.309	1.721	0.1074	**275**
136	43.6	78.4	0.4060	1.2574	0.5656	9.060	1.768	0.1104	**276.8**
137	43.6	78.5	0.4085	1.2526	0.5506	8.820	1.816	0.1134	**278.6**
138	43.7	78.7	0.4110	1.2479	0.5361	8.587	1.865	0.1165	**280.4**
139	43.8	78.8	0.4135	1.2431	0.5219	8.360	1.916	0.1196	**282.2**
140	43.9	78.9	0.4160	1.2383	0.5081	8.140	1.968	0.1229	**284**
141	43.9	79.1	0.4185	1.2335	0.4948	7.926	2.021	0.1262	**285.8**
142	44.0	79.2	0.4209	1.2288	0.4819	7.719	2.075	0.1296	**287.6**
143	44.0	79.3	0.4234	1.2241	0.4694	7.519	2.130	0.1330	**289.4**
144	44.2	79.5	0.4259	1.2194	0.4574	7.326	2.186	0.1365	**291.2**
145	44.2	79.6	0.4283	1.2147	0.4457	7.139	2.244	0.1401	**293**
146	44.3	79.7	0.4307	1.2100	0.4343	6.957	2.303	0.1437	**294.8**
147	44.4	79.9	0.4332	1.2054	0.4232	6.780	2.363	0.1475	**296.6**
148	44.4	80.0	0.4356	1.2008	0.4125	6.609	2.424	0.1513	**298.4**
149	44.5	80.1	0.4380	1.1962	0.4022	6.443	2.486	0.1552	**300.2**
150	44.6	80.2	0.4405	1.1916	0.3921	6.282	2.550	0.1592	**302**

PROPERTIES OF

Temperature, degrees Centigrade.	Pressure.			Heat of the liquid.		Heat of vaporization.		Heat equivalent of internal work.		Temperature, degrees Fahrenheit.
	Millimeters of mercury.	Kilograms per square centimeter.	Pounds per square inch.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	
t	*p*	*p*	*p*	*q*	*q*	*r*	*r*	*ρ*	*ρ*	*t*
151	3665.3	4.984	70.88	152.1	273.8	503.4	906.1	458.7	825.7	**303.8**
152	3761.1	5.118	72.79	153.1	275.6	502.6	904.7	457.9	824.2	**305.6**
153	3861.9	5.255	74.74	154.1	277.4	501.9	903.3	457.1	822.7	**307.4**
154	3968	5.395	76.73	155.1	279.2	501.1	901.9	456.3	821.2	**309.2**
155	4073	5.538	78.76	156.2	281.1	500.3	900.5	455.4	819.6	**311**
156	4181	5.684	80.84	157.2	283.0	499.6	899.2	454.6	818.2	**312.8**
157	4290	5.833	82.96	158.2	284.8	498.8	897.8	453.8	816.7	**314.6**
158	4402	5.985	85.12	159.3	286.7	498.1	896.5	453.0	815.3	**316.4**
159	4517	6.141	87.33	160.3	288.5	497.3	895.1	452.1	813.7	**318.2**
160	4633	6.300	89.59	161.3	290.4	496.5	893.7	451.2	812.2	**320**
161	4752	6.462	91.89	162.3	292.2	495.7	892.3	450.4	810.7	**321.8**
162	4874	6.628	94.25	163.4	294.1	494.9	890.9	449.5	809.2	**323.6**
163	4998	6.796	96.65	164.4	295.9	494.2	889.5	448.7	807.7	**325.4**
164	5124	6.967	99.09	165.4	297.7	493.4	888.1	447.9	806.2	**327.2**
165	5253	7.142	101.58	166.5	299.6	492.6	886.7	447.0	804.7	**329**
166	5384	7.320	104.11	167.5	301.5	491.9	885.4	446.3	803.3	**330.8**
167	5518	7.502	106.71	168.5	303.3	491.1	883.9	445.4	801.7	**332.6**
168	5655	7.688	109.35	169.5	305.1	490.3	882.5	444.6	800.1	**334.4**
169	5794	7.877	112.04	170.6	307.0	489.5	881.0	443.7	798.5	**336.2**
170	5937	8.071	114.79	171.6	308.9	488.7	879.6	442.8	797.0	**338**
171	6081	8.268	117.59	172.6	310.7	487.9	878.3	441.9	795.6	**339.8**
172	6229	8.469	120.45	173.7	312.6	487.1	876.9	441.1	794.1	**341.6**
173	6379	8.673	123.36	174.7	314.5	486.3	875.4	440.2	792.5	**343.4**
174	6533	8.882	126.33	175.7	316.3	485.5	873.9	439.4	790.9	**345.2**
175	6689	9.094	129.35	176.8	318.2	484.7	872.4	438.5	789.3	**347**
176	6848	9.310	132.43	177.8	320.0	483.9	871.0	437.7	787.8	**348.8**
177	7010	9.531	135.56	178.8	321.8	483.1	869.5	436.8	786.2	**350.6**
178	7175	9.755	138.75	179.9	323.7	482.3	868.1	436.0	784.7	**352.4**
179	7343	9.983	142.00	180.9	325.6	481.4	866.6	435.0	783.1	**354.2**
180	7514	10.216	145.30	181.9	327.5	480.6	865.1	434.2	781.5	**356**
181	7688	10.453	148.67	183.0	329.3	479.8	863.6	433.3	779.9	**357.8**
182	7866	10.695	152.11	184.0	331.2	479.0	862.2	432.5	778.4	**359.6**
183	8046	10.940	155.60	185.0	333.0	478.2	860.7	431.6	776.9	**361.4**
184	8230	11.189	159.15	186.1	334.9	477.4	859.2	430.8	775.3	**363.2**
185	8417	11.444	162.77	187.1	336.8	476.6	857.7	429.9	773.7	**365**
186	8608	11.703	166.46	188.1	338.6	475.7	856.3	429.0	772.2	**366.8**
187	8802	11.967	170.21	189.2	340.5	474.8	854.7	428.0	770.5	**368.6**
188	8999	12.235	174.02	190.2	342.4	474.0	853.2	427.2	768.9	**370.4**
189	9200	12.508	177.90	191.2	344.2	473.2	851.7	426.3	767.4	**372.2**
190	9404	12.786	181.85	192.3	346.1	472.3	850.2	425.4	765.8	**374**

SATURATED STEAM (Continued)

Temperature, degrees Centigrade.	Heat equivalent of external work.		Entropy of the liquid.	Entropy of vaporization.	Specific volume.		Density.		Temperature, degrees Fahrenheit.
	Calories per kilogram.	B.T.U. per pound.			Cubic meters per kilo.	Cubic feet per pound.	Kilos per cubic meter.	Pounds per cubic foot.	
t	Apu	Apu	θ	$\frac{r}{T}$	s	s	$\frac{1}{s}$	$\frac{1}{s}$	t
151	44.6	80.4	0.4429	1.1870	0.3824	6.126	2.615	0.1632	**303.8**
152	44.7	80.5	0.4453	1.1824	0.3729	5.974	2.682	0.1674	**305.6**
153	44.8	80.6	0.4477	1.1778	0.3637	5.826	2.750	0.1716	**307.4**
154	44.8	80.7	0.4501	1.1733	0.3548	5.683	2.818	0.1759	**309.2**
155	44.9	80.9	0.4525	1.1688	0.3463	5.546	2.888	0.1803	**311**
156	45.0	81.0	0.4549	1.1644	0.3380	5.413	2.959	0.1847	**312.8**
157	45.0	81.1	0.4573	1.1599	0.3298	5.282	3.032	0.1893	**314.6**
158	45.1	81.2	0.4596	1.1554	0.3218	5.154	3.108	0.1940	**316.4**
159	45.2	81.4	0.4620	1.1509	0.3140	5.029	3.185	0.1988	**318.2**
160	45.3	81.5	0.4644	1.1465	0.3063	4.906	3.265	0.2038	**320**
161	45.3	81.6	0.4668	1.1421	0.2989	4.789	3.345	0.2088	**321.8**
162	45.4	81.7	0.4692	1.1377	0.2920	4.677	3.425	0.2138	**323.6**
163	45.5	81.8	0.4715	1.1333	0.2855	4.571	3.503	0.2188	**325.4**
164	45.5	81.9	0.4739	1.1289	0.2792	4.469	3.582	0.2238	**327.2**
165	45.6	82.0	0.4763	1.1245	0.2729	4.368	3.664	0.2289	**329**
166	45.6	82.1	0.4786	1.1202	0.2666	4.268	3.751	0.2343	**330.8**
167	45.7	82.2	0.4810	1.1159	0.2603	4.168	3.842	0.2399	**332.6**
168	45.7	82.4	0.4833	1.1115	0.2540	4.070	3.937	0.2457	**334.4**
169	45.8	82.5	0.4857	1.1072	0.2480	3.975	4.032	0.2516	**336.2**
170	45.9	82.6	0.4880	1.1029	0.2423	3.883	4.127	0.2575	**338**
171	46.0	82.7	0.4903	1.0987	0.2368	3.794	4.223	0.2636	**339.8**
172	46.0	82.8	0.4926	1.0944	0.2314	3.709	4.322	0.2696	**341.6**
173	46.1	82.9	0.4949	1.0901	0.2262	3.626	4.421	0.2758	**343.4**
174	46.1	83.0	0.4972	1.0859	0.2212	3.545	4.521	0.2821	**345.2**
175	46.2	83.1	0.4995	1.0817	0.2164	3.467	4.621	0.2884	**347**
176	46.2	83.2	0.5018	1.0775	0.2117	3.391	4.724	0.2949	**348.8**
177	46.3	83.3	0.5041	1.0733	0.2072	3.318	4.826	0.3014	**350.6**
178	46.3	83.4	0.5064	1.0691	0.2027	3.247	4.933	0.3080	**352.4**
179	46.4	83.5	0.5087	1.0649	0.1983	3.177	5.04	0.3148	**354.2**
180	46.4	83.6	0.5110	1.0608	0.1941	3.109	5.15	0.3217	**356**
181	46.5	83.7	0.5133	1.0567	0.1899	3.041	5.27	0.3288	**357.8**
182	46.5	83.8	0.5156	1.0525	0.1857	2.974	5.38	0.3362	**359.6**
183	46.6	83.8	0.5178	1.0484	0.1817	2.911	5.50	0.3435	**361.4**
184	46.6	83.9	0.5201	1.0443	0.1778	2.849	5.62	0.3510	**363.2**
185	46.7	84.0	0.5224	1.0403	0.1740	2.787	5.75	0.3588	**365**
186	46.7	84.1	0.5246	1.0362	0.1702	2.727	5.88	0.3667	**366.8**
187	46.8	84.2	0.5269	1.0321	0.1666	2.669	6.00	0.3746	**368.6**
188	46.8	84.3	0.5291	1.0280	0.1632	2.614	6.13	0.3826	**370.4**
189	46.9	84.3	0.5314	1.0240	0.1598	2.560	6.26	0.3906	**372.2**
190	46.9	84.4	0.5336	1.0200	0.1565	2.507	6.39	0.3989	**374**

PROPERTIES OF

Temperature, degrees Centigrade.	Pressure.			Heat of the liquid.		Heat of vaporization.		Heat equivalent of internal work.		Temperature, degrees Fahrenheit.
	Millimeters of mercury.	Kilograms per square centimeter.	Pounds per square inch.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	
t	*p*	*p*	*p*	*q*	*q*	*r*	*r*	*ρ*	*ρ*	*t*
191	9612	13.068	185.87	193.3	347.9	471.5	848.7	424.5	764.2	**375.8**
192	9823	13.355	189.96	194.4	349.8	470.6	847.1	423.6	762.5	**377.6**
193	10038	13.647	194.11	195.4	351.7	469.8	845.6	422.8	761.0	**379.4**
194	10256	13.944	198.33	196.4	353.5	468.9	844.1	421.9	759.4	**381.2**
195	10479	14.247	202.64	197.5	355.4	468.1	842.5	421.0	757.7	**383**
196	10705	14.554	207.01	198.5	357.3	467.2	841.0	420.1	756.1	**384.8**
197	10934	14.866	211.45	199.5	359.2	466.4	839.5	419.2	754.6	**386.6**
198	11168	15.184	215.96	200.6	361.1	465.6	838.0	418.4	753.0	**388.4**
199	11406	15.507	220.56	201.6	362.9	464.7	836.4	417.4	751.3	**390.2**
200	11647	15.835	225.23	202.7	364.8	463.8	834.8	416.5	749.7	**392**
201	11893	16.169	229.98	203.7	366.7	462.9	833.3	415.6	748.1	**393.8**
202	12142	16.508	234.80	204.7	368.5	462.1	831.8	414.8	746.6	**395.6**
203	12395	16.852	239.71	205.8	370.4	461.2	830.2	413.8	744.9	**397.4**
204	12653	17.202	244.69	206.8	372.3	460.3	828.6	412.9	743.3	**399.2**
205	12915	17.558	249.75	207.9	374.1	459.4	827.0	412.0	741.6	**401**
206	13181	17.921	254.89	208.9	376.0	458.6	825.4	411.1	740.0	**402.8**
207	13452	18.289	260.13	210.0	377.9	457.7	823.8	410.2	738.3	**404.6**
208	13727	18.663	265.45	211.0	379.8	456.8	822.2	409.3	736.7	**406.4**
209	14006	19.042	270.85	212.0	381.6	455.9	820.6	408.4	735.1	**408.2**
210	14290	19.428	276.34	213.1	383.5	455.0	819.1	407.5	733.6	**410**
211	14578	19.820	281.91	214.1	385.4	454.1	817.4	406.6	731.9	**411.8**
212	14871	20.218	287.57	215.2	387.3	453.2	815.8	405.7	730.2	**413.6**
213	15168	20.622	293.31	216.2	389.2	452.4	814.3	404.9	728.7	**415.4**
214	15470	21.033	299.16	217.3	391.1	451.5	812.7	404.0	727.1	**417.2**
215	15778	21.452	305.10	218.3	392.9	450.6	811.0	403.1	725.4	**419**
216	16090	21.876	311.14	219.3	394.8	449.6	809.3	402.1	723.7	**420.8**
217	16406	22.306	317.26	220.4	396.7	448.7	807.7	401.2	722.1	**422.6**
218	16728	22.743	323.48	221.4	398.5	447.8	806.1	400.3	720.5	**424.4**
219	17055	23.188	329.81	222.5	400.4	446.9	804.5	399.4	718.9	**426.2**
220	17387	23.639	336.24	223.5	402.3	446.0	802.9	398.5	717.3	**428**

SATURATED STEAM (Concluded)

Temperature, degrees Centigrade.	Heat equivalent of external work.		Entropy of the liquid.	Entropy of vaporization.	Specific volume.		Density.		Temperature, degrees Fahrenheit.
	Calories per kilogram.	B.T.U. per pound.			Cubic meters per kilo.	Cubic feet per pound.	Kilos per cubic meter.	Pounds per cubic foot.	
t	Apu	Apu	θ	$\frac{r}{T}$	s	s	$\frac{1}{s}$	$\frac{1}{s}$	t
191	47.0	84.5	0.5358	1.0160	0.1533	2.456	6.52	0.4072	**375.8**
192	47.0	84.6	0.5381	1.0120	0.1501	2.405	6.66	0.4158	**377.6**
193	47.0	84.6	0.5403	1.0080	0.1470	2.355	6.80	0.4246	**379.4**
194	47.0	84.7	0.5426	1.0040	0.1440	2.306	6.94	0.4336	**381.2**
195	47.1	84.8	0.5448	1.0000	0.1411	2.259	7.09	0.4426	**383**
196	47.1	84.9	0.5470	0.9961	0.1382	2.214	7.23	0.4516	**384.8**
197	47.2	84.9	0.5492	0.9922	0.1354	2.169	7.38	0.4610	**386.6**
198	47.2	85.0	0.5514	0.9882	0.1327	2.126	7.53	0.4704	**388.4**
199	47.3	85.1	0.5536	0.9843	0.1300	2.083	7.69	0.4801	**390.2**
200	47.3	85.1	0.5558	0.9804	0.1274	2.041	7.84	0.4900	**392**
201	47.3	85.2	0.5580	0.9765	0.1249	2.001	8.00	0.4998	**393.8**
202	47.3	85.2	0.5602	0.9727	0.1225	1.962	8.16	0.510	**395.6**
203	47.4	85.3	0.5624	0.9688	0.1201	1.923	8.33	0.520	**397.4**
204	47.4	85.3	0.5646	0.9650	0.1177	1.885	8.50	0.531	**399.2**
205	47.4	85.4	0.5668	0.9611	0.1153	1.847	8.67	0.541	**401**
206	47.5	85.4	0.5690	0.9572	0.1130	1.810	8.85	0.552	**402.8**
207	47.5	85.5	0.5712	0.9534	0.1108	1.774	9.03	0.564	**404.6**
208	47.5	85.5	0.5733	0.9496	0.1086	1.739	9.21	0.575	**406.4**
209	47.5	85.5	0.5755	0.9458	0.1065	1.705	9.39	0.587	**408.2**
210	47.5	85.5	0.5777	0.9420	0 1044	1.673	9.58	0.598	**410**
211	47.5	85.5	0.5799	0.9382	0.1024	1.640	9.77	0.610	**411.8**
212	47.5	85.6	0.5820	0.9344	0.1004	1.608	9.96	0.622	**413.6**
213	47.5	85.6	0.5842	0.9307	0.0984	1.577	10.16	0.634	**415.4**
214	47.5	85.6	0.5863	0.9269	0.0965	1.546	10.36	0.647	**417.2**
215	47.5	85.6	0.5885	0.9232	0.0947	1.516	10.56	0.660	**419**
216	47.5	85.6	0.5906	0.9195	0.0928	1.486	10.78	0.673	**420.8**
217	47.5	85.6	0.5927	0.9157	0.0910	1.458	10.99	0.686	**422.6**
218	47.5	85.6	0.5948	0.9120	0.0893	1.430	11.20	0.699	**424.4**
219	47.5	85.6	0.5969	0.9084	0.0876	1.403	11.41	0.713	**426.2**
220	47.5	85.6	0.5991	0.9047	0.0860	1.376	11.62	0.727	**428**

HIGH AND LOW TEMPERATURES OBTAINED BY VARIOUS MEANS

Absolute zero, −273° C.

Freezing-point of helium	−272° C.
Freezing-point of hydrogen	−259
Boiling-point of hydrogen	−252
Boiling-point of liquid air at atmospheric pressure	−192
Freezing-point of carbon dioxide	− 57

Industrial furnaces	+1700 to 1800°
Bunsen burner	1870
Oxy-coal gas flame	2000
Oxy-hydrogen flame	2800
Oxy-acetylene flame	3500
Electric arc (furnace)	3500

(Sun's Temperature, 5000° C.)

HEAT VALUES OF FUEL

(From Smithsonian Tables.)

Fuel.	Calories per gm.	B.T.U. per lb.
Coal:		
Lignite		
low grade	3247	5845
high grade	6764	12175
Sub-bituminous		
low grade	5115	9207
high grade	5865	10557
Bituminous		
low grade	6088	10958
high grade	7852	14134
Semi-bituminous		
Low grade	7845	14121
high grade	8166	14699
Semi-anthracite	7612	13702
Anthracite		
low grade	6987	12577
high grade	7417	13351
Peats (air dried):		
From Franklin Co., N. Y.	5726	10307
From Sawyer Co., Wis.	4867	8761
Liquid fuel:		
Petroleum ether	12215	21987
Gasoline	11250	20250
Kerosene	11100	19980
Fuel oils, heavy petroelum or refinery residue	10350	18630
Alcohol, fuel or denatured with 7–9 per cent water and denaturing material	6455	11619

HYGROMETRIC AND BAROMETRIC TABLES

CONVERSION TABLE FOR BAROMETRIC READINGS

U. S. inches to cm.

Inches.	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
27.0	68.580	.606	.631	.656	.682	.707	.733	.758	.783	.809
27.1	.834	.860	.885	.910	.936	.961	.987	*.012	*.037	*.063
27.2	69.088	.114	.139	.164	.190	.215	.241	.266	.291	.317
27.3	.342	.368	.393	.418	.444	.469	.495	.520	.545	.571
27.4	.596	.622	.647	.672	.698	.723	.749	.774	.799	.825
27.5	.850	.876	.901	.926	.952	.977	*.002	*.028	*.053	*.079
27.6	70.104	.130	.155	.180	.206	.231	.257	.282	.307	.333
27.7	.358	.384	.409	.434	.460	.485	.511	.536	.561	.587
27.8	.612	.638	.663	.688	.714	.739	.765	.790	.815	.841
27.9	.866	.892	.917	.942	.968	.993	*.018	*.044	*.069	*.095
28.0	71.120	.146	.171	.196	.222	.247	.273	.298	.323	.349
28.1	.374	.400	.425	.450	.476	.501	.527	.552	.577	.603
28.2	.628	.654	.679	.704	.730	.755	.781	.806	.831	.857
28.3	.882	.908	.933	.958	.984	*.009	*.035	*.060	*.085	*.111
28.4	72.136	.162	.187	.212	.238	.263	.289	.314	.339	.365
28.5	.390	.416	.441	.466	.492	.517	.543	.568	.593	.619
28.6	.644	.670	.695	.720	.746	.771	.797	.822	.847	.873
28.7	.898	.924	.949	.974	*.000	*.025	*.051	*.076	*.101	*.127
28.8	73.152	.178	.203	.228	.254	.279	.305	.330	.355	.381
28.9	.406	.432	.457	.482	.508	.533	.559	.584	.609	.635
29.0	.660	.686	.711	.736	.762	.787	.813	.838	.863	.889
29.1	.914	.940	.965	.990	*.016	*.041	*.067	*.092	*.117	*.143
29.2	74.168	.194	.219	.244	.270	.295	.321	.346	.371	.397
29.3	.422	.448	.473	.498	.524	.549	.575	.600	.625	.651
29.4	.676	.702	.727	.752	.778	.803	.829	.854	.879	.905
29.5	.930	.956	.981	*.006	*.032	*.057	*.083	*.108	*.133	*.159
29.6	75.184	.210	.235	.260	.286	.311	.337	.362	.387	.413
29.7	.438	.464	.489	.514	.540	.565	.591	.616	.341	.667
29.8	.692	.718	.743	.768	.794	.819	.845	.870	.895	.921
29.9	.946	.972	.997	*.022	*.048	*.073	*.099	*.124	*.149	*.175
30.0	76.200	.226	.251	.277	.302	.327	.353	.378	.404	.429
30.1	.454	.480	.505	.531	.556	.581	.607	.632	.658	.683
30.2	.708	.734	.759	.785	.810	.835	.861	.886	.912	.937
30.3	.962	.988	*.013	*.039	*.064	*.089	*.115	*.140	*.166	*.191
30.4	77.216	.242	.267	.293	.318	.343	.369	.394	.420	.445
30.5	.470	.496	.521	.547	.572	.597	.623	.648	.674	.699
30.6	.724	.750	.775	.801	.826	.851	.877	.902	.928	.953
30.7	.978	*.004	*.029	*.055	*.080	*.105	*.131	*.156	*.182	*.207
30.8	78.232	.258	.283	.309	.334	.359	.385	.410	.436	.461
30.9	.486	.512	.537	.563	.588	.613	.639	.664	.690	.715

TEMPERATURE CORRECTION, BRASS SCALE

Metric

To reduce readings of a mercurial barometer with a brass scale to 0° C. subtract the appropriate quantity as found in the table.

Temp. ° C.	Observed height in centimeters.								
	70 cm.	71 cm.	72 cm.	73 cm.	74 cm.	75 cm.	76 cm.	77 cm.	78 cm.
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	.011	.011	.012	.012	.012	.012	.012	.012	.013
2	.023	.023	.023	.024	.024	.024	.024	.025	.025
3	.034	.034	.035	.035	.036	.036	.037	.037	.038
4	.045	.046	.046	.047	.048	.048	.049	.050	.050
5	0.056	0.057	0.058	0.059	0.060	0.060	0.061	0.062	0.063
6	.068	.069	.069	.071	.072	.072	.073	.074	.075
7	.079	.080	.081	.082	.083	.085	.086	.087	.088
8	.090	.092	.093	.094	.095	.097	.098	.099	.101
9	.102	.103	.104	.106	.107	.109	.110	.112	.113
10	0.113	0.114	0.116	0.118	0.119	0.121	0.122	0.124	0.126
11	.124	.126	.128	.129	.131	.133	.135	.137	.138
12	.135	.137	.139	.141	.143	.145	.147	.149	.151
13	.147	.149	.151	.153	.155	.157	.159	.161	.164
14	.158	.160	.163	.165	.167	.169	.172	.174	.176
15	0.169	0.172	0.174	0.177	0.179	0.181	0.184	0.186	0.189
16	.181	.183	.186	.188	.191	.194	.196	.199	.201
17	.192	.195	.197	.200	.203	.206	.208	.211	.214
18	.203	.206	.209	.212	.215	.218	.221	.224	.227
19	.215	.218	.221	.224	.227	.230	.233	.236	.239
20	0.226	0.229	0.232	0.236	0.239	0.242	0.245	0.248	0.252
21	.237	.241	.244	.247	.251	.254	.258	.261	.264
22	.249	.252	.256	.259	.263	.266	.270	.273	.277
23	.260	.264	.267	.271	.275	.278	.282	.286	.290
24	.271	.275	.279	.283	.287	.291	.294	.298	.302
25	0.283	0.287	0.291	0.295	0.299	0.303	0.307	0.311	0.315
26	.294	.298	.302	.306	.311	.315	.319	.323	.327
27	.305	.310	.314	.318	.323	.327	.331	.336	.340
28	.317	.321	.326	.330	.335	.339	.344	.348	.353
29	.328	.333	.337	.342	.347	.351	.356	.361	.365
30	0.339	0.344	0.349	0.354	0.359	0.363	0.368	0.373	0.378

CONVERSION TABLE FOR PRESSURE UNITS

Correct for mercury at 0° C.

Cms. of Hg.	Grams per sq.cm.	Dynes per sq.cm. (g = 980).	Lbs. per sq.in.
1	13.5956	13,323.7	0.193376
2	27.1912	26,647.4	0.386752
3	40.7868	39,971.1	0.580123
4	54.3824	53,294.8	0.773504
5	67.9780	66,618.4	0.966880
6	81.5736	79,942.1	1.160256
7	95.1692	93,265.8	1.353632
8	108.7648	106,589.5	1.547008
9	122.3604	119,913.2	1.740384

TEMPERATURE CORRECTION, GLASS SCALE

Metric

To reduce readings of a mercurial barometer with a glass scale to 0° C. subtract the appropriate quantity as found in table.

Temp. ° C.	Observed height in centimeters.								
	70 cm.	71 cm.	72 cm.	73 cm.	74 cm.	75 cm.	76 cm.	77 cm.	78 cm.
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	.012	.012	.013	.013	.013	.013	.013	.013	.014
2	.025	.025	.025	.026	.026	.026	.026	.027	.027
3	.036	.036	.037	.037	.038	.038	.039	.039	.040
4	.048	.049	.049	.050	.051	.051	.052	.053	.053
5	0.060	0.061	0.062	0.063	0.064	0.064	0.065	0.066	0.067
6	.073	.074	.074	.076	.077	.077	.078	.079	.080
7	.085	.086	.087	.088	.089	.091	.092	.093	.094
8	.096	.098	.099	.100	.101	.103	.104	.105	.107
9	.109	.110	.111	.113	.114	.116	.117	.119	.120
10	0.121	0.122	0.124	0.126	0.127	0.129	0.130	0.132	0.134
11	.133	.135	.137	.138	.140	.142	.144	.146	.147
12	.144	.146	.148	.150	.152	.154	.156	.158	.160
13	.157	.159	.161	.163	.165	.167	.169	.171	.174
14	.169	.171	.174	.176	.178	.180	.183	.185	.187
15	0.181	0.184	0.186	0.189	0.191	0.193	0.196	0.198	0.201
16	.194	.196	.199	.201	.204	.207	.209	.212	.214
17	.205	.208	.210	.213	.216	.219	.221	.224	.227
18	.217	.220	.223	.226	.229	.232	.235	.238	.241
19	.230	.233	.236	.239	.242	.245	.248	.251	.254
20	0.242	0.245	0.248	0.252	0.255	0.258	0.261	0.264	0.268
21	.254	.258	.261	.264	.268	.271	.275	.278	.281
22	.266	.269	.273	.276	.280	.283	.287	.290	.294
23	.278	.282	.285	.289	.293	.296	.300	.304	.308
24	.290	.294	.298	.302	.306	.310	.313	.317	.321
25	0.303	0.307	0.311	0.315	0.319	0.323	0.327	0.331	0.335
26	.315	.319	.323	.327	.332	.336	.340	.344	.348
27	.326	.331	.335	.339	.344	.348	.352	.357	.361
28	.339	.343	.348	.352	.357	.361	.366	.370	.375
29	.351	.356	.360	.365	.370	.374	.379	.384	.388
30	0.363	0.368	0.373	0.378	0.383	0.387	0.392	0.397	0.402

MASS OF WATER VAPOR IN SATURATED AIR

Mass in grams per cubic meter.

(From Smithsonian Tables.)

Temp. ° C.	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
−20	0.892	0.810	0.737	0.673	0.613	0.557	0.505	0.457	0.413	0.373
−10	2.154	1.978	1.811	1.658	1.519	1.395	1.282	1.177	1.079	0.982
− 0	4.835	4.468	4.130	3.813	3.518	3.244	2.988	2.752	2.537	2.340
+ 0	4.835	5.176	5.538	5.922	6.330	6.761	7.219	7.703	8.215	8.757
10	9.330	9.935	10.574	11.249	11.961	12.712	13.505	14.339	15.218	16.144
20	17.118	18.143	19.222	20.355	21.546	22.796	24.109	25.487	26.933	28.450
30	30.039	31.704	33.449	35.275	37.187	39.187	41.279	43.465	45.751	48.138

REDUCTION OF BAROMETER READINGS TO STANDARD TEMPERATURE

Brass Scale, British Units.

The table gives the corrections for the barometer reading in inches and the temperature in degrees Fahrenheit for a brass scale graduated to be correct at 62° F. The correction is to be subtracted.

Temp. ° F.	Observed height in inches.								
	27.0	27.5	28.0	28.5	29.0	29.5	30.0	30.5	31.0
32	0.009	0.009	0.009	0.009	0.009	0.009	0.010	0.010	0.010
34	.013	.014	.014	.014	.014	.015	.015	.015	.015
36	.018	.019	.019	.019	.020	.020	.020	.021	.021
38	.023	.024	.024	.025	.025	.025	.026	.026	.027
40	.028	.029	.029	.030	.030	.031	.031	.032	.032
42	.033	.034	.034	.035	.036	.036	.038	.037	.038
44	.038	.039	.039	.040	.041	.041	.042	.043	.044
46	.043	.044	.044	.045	.046	.047	.048	.048	.049
48	.048	.049	.050	.050	.051	.052	.053	.054	.055
50	.053	.054	.055	.055	.057	.058	.058	.059	.060
52	.058	.059	.060	.060	.062	.063	.064	.065	.066
54	.062	.063	.065	.066	.067	.068	.069	.071	.072
56	.067	.068	.070	.071	.072	.074	.075	.076	.077
58	.072	.073	.075	.076	.078	.079	.080	.082	.083
60	.077	.078	.080	.081	.083	.084	.086	.087	.089
62	.082	.083	.085	.086	.088	.090	.091	.093	.094
64	.087	.088	.090	.092	.093	.095	.097	.098	.100
66	.092	.093	.095	.097	.099	.100	.102	.104	.105
68	.097	.098	.100	.102	.104	.106	.107	.109	.111
70	.102	.103	.105	.107	.109	.111	.113	.115	.117
72	.107	.108	.110	.112	.114	.116	.118	.120	.122
74	.111	.113	.116	.117	.120	.122	.124	.126	.128
76	.116	.118	.121	.123	.125	.127	.129	.131	.133
78	.121	.123	.126	.128	.130	.132	.135	.137	.139
80	.126	.128	.131	.133	.135	.138	.140	.142	.145
82	.131	.133	.136	.138	.141	.143	.146	.148	.150
84	.136	.138	.141	.143	.146	.148	.151	.153	.156
86	.141	.143	.146	.148	.151	.154	.156	.159	.162
88	.146	.148	.151	.154	.156	.159	.162	.165	.167
90	.151	.153	.156	.159	.162	.165	.167	.170	.173
92	.156	.158	.161	.164	.167	.170	.173	.176	.178
94	.160	.163	.166	.170	.172	.175	.178	.181	.184
96	.165	.168	.171	.174	.178	.181	.184	.187	.190
98	.170	.173	.177	.179	.183	.186	.189	.192	.195

CORRECTION FOR CAPILLARY DEPRESSION OF MERCURY IN A GLASS TUBE

Correction to be added.

Diam. of tube.	Height of meniscus in centimeters.							
	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18
cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.
0.4	0.083	0.122	0.154	0.198	0.237			
0.5	.047	.065	.086	.119	.145	0.180		
0.6	.027	.041	.056	.078	.098	.121	0.143	
0.7	.018	.028	.040	.053	.067	.082	.097	.113
0.8	....	.020	.029	.038	.046	.056	.065	0.077
0.9	....	0.015	0.021	0.028	0.033	0.040	0.046	0.052
1.0	....	.....	.015	.020	.025	.029	.033	.037
1.1	....	.....	.010	.014	.018	.021	.024	.027
1.2	....	.....	.007	.010	.013	.015	.018	.019
1.3	....	.....	.004	.007	.010	.012	.013	.014

REDUCTION OF BAROMETER TO SEA LEVEL

Metric Units

Correction to be added (in cm.)
(From Smithsonian Tables.)

Height above sea level in meters.	Observed Height in Centimeters.					
	55	60	65	70	75	80
100	......	....	....	.0014	.0015	.0016
200	......	....	....	.0028	.0030	.0032
300	......	....	....	.0041	.0044	.0047
400	......	....	....	.0055	.0059	.0063
500	......	....	.0064	.0068	.0073	.0078
600	......	....	.0077	.0082	.0088	
700	......	....	.0090	.0096	.0102	
800	......	....	.0103	.0109	.0117	
900	......	....	.0115	.0123	.0131	
1000	.0108	.0118	.0128	.0137	.0146	
1100	.0118	.0130	.0141	.0150		
1200	.0129	.0142	.0154	.0164		
1300	.0140	.0153	.0166	.0178		
1400	.0151	.0165	.0179	.0191		
1500	.0162	.0176	.0191	.0205		
1600	.0172	.0188	.0204			
1700	.0183	.0200	.0217			
1800	.0194	.0212	.0230			
1900	.0204	.0224	.0242			
2000	.0215	.0235	.0255			
2100	.0226	.0247				
2200	.0237	.0259				
2300	.0248	.0271				
2400	.0259	.0283				
2500	.0270	.0295				

English Units

Height above sea level in feet.	Observed Height in Inches.						
	20	22	24	26	28	30	32
500	......	.....	.....	.078	.084	.090	.096
1000	......	.....	.....	.155	.167	.179	.192
1500	......	.....	.215	.233	.251	.269	
2000	......	.....	.287	.311	.335	.359	
2500	......	.....	.359	.389	.419		
3000	......	.395	.431	.467	.503		
3500	......	.461	.503	.545			
4000	......	.526	.574	.623			
4500	......	.592	.646	.701			
5000	.598	.658	.718	.779			
5500	.658	.724	.790				
6000	.718	.789	.862				
6500	.777	.655	.934				
7000	.837	.721	1.005				
7500	.897	.787	1.077				
8000	.957	.853					
8500	1.016	.918					
9000	1.076	.984					
9500	1.136	1.050					

REDUCTION OF BAROMETER TO LATITUDE 45°

Metric Scale

For latitudes below 45°, subtract the correction; for latitudes greater than 45° it is to be added. Corrections in cm.

(From Smithsonian Meteorological Tables.)

Latitude.		Observed Height of Barometer in Centimeters.					
		68	70	72	74	76	78
25°	65°	0.116	0.120	0.123	0.127	0.130	0.133
26	64	.111	.115	.118	.121	.125	.128
27	63	.106	.110	.113	.116	.119	.122
28	62	.101	.104	.107	.110	.113	.116
29	61	.096	.099	.102	.104	.107	.110
30	60	0.091	0.094	0.096	0.098	0.101	0.104
31	59	.085	.087	.090	.092	.095	.097
32	58	.079	.082	.084	.086	.089	.091
33	57	.074	.076	.078	.080	.082	.084
34	56	.068	.070	.072	.074	.076	.078
35	55	0.062	0.064	0.066	0.067	0.069	0.071
36	54	.056	.058	.059	.061	.063	.064
37	53	.050	.051	.053	.054	.056	.057
38	52	.044	.045	.046	.048	.049	.050
39	51	.038	.039	.040	.041	.042	.043
40	50	0.031	0.032	0.033	0.034	0.035	0.036
41	49	.025	.026	.027	.027	.028	.029
42	48	.019	.019	.020	.021	.021	.022
43	47	.013	.013	.013	.014	.014	.014
44	46	.006	.007	.007	.007	.007	.007

English Scale

Corrections in inches.

Latitude.		Observed Height in Inches.					
		25	26	27	28	29	30
25°	65°	0.043	0.044	0.046	0.048	0.050	0.051
26	64	.041	.043	.044	.046	.048	.049
27	63	.039	.041	.042	.044	.045	.047
28	62	.037	.039	.040	.042	.043	.045
29	61	.035	.037	.038	.039	.041	.042
30	60	0.033	0.035	0.036	0.037	0.039	0.040
31	59	.031	.032	.034	.035	.036	.037
32	58	.029	.030	.032	.033	.034	.035
33	57	.027	.028	.029	.030	.031	.032
34	56	.025	.026	.027	.028	.029	.030
35	55	0.023	0.024	0.025	0.025	0.026	0.027
36	54	.021	.021	.022	.023	.024	.025
37	53	.018	.019	.020	.021	.021	.022
38	52	.016	.017	.017	.018	.019	.019
39	51	.014	.014	.015	.015	.016	.017
40	50	0.012	0.012	0.012	0.013	0.013	0.014
41	49	.009	.010	.010	.010	.011	.011
42	48	.007	.007	.008	.008	.008	.008
43	47	.005	.005	.005	.005	.005	.006
44	46	.002	.002	.003	.003	.003	.003

RELATIVE HUMIDITY—DEW-POINT

The table gives the relative humidity of the air for temperature *t* and dew-point *d*.

(From Smithsonian Meteorological Tables.)

Depression of dew-point *t–d* ° C.	Dew-point (*d*).				
	−10	0	+10	+20	+30
0.0	100%	100%	100%	100%	100%
0.2	98	99	99	99	99
0.4	97	97	97	98	98
0.6	95	96	96	96	97
0.8	94	94	95	95	96
1.0	92	93	94	94	94
1.2	91	92	92	93	93
1.4	90	90	91	92	92
1.6	88	89	90	91	91
1.8	87	88	89	90	90
2.0	86	87	88	88	89
2.2	84	85	86	87	88
2.4	83	84	85	86	87
2.6	82	83	84	85	86
2.8	80	82	83	84	85
3.0	79	81	82	83	84
3.2	78	80	81	82	83
3.4	77	79	80	81	82
3.6	76	77	79	80	82
3.8	75	76	78	79	81
4.0	73	75	77	78	80
4.2	72	74	76	77	79
4.4	71	73	75	77	78
4.6	70	72	74	76	77
4.8	69	71	73	75	76
5.0	68	70	72	74	75
5.2	67	69	71	73	75
5.4	66	68	70	72	74
5.6	65	67	69	71	73
5.8	64	66	69	70	72
6.0	63	66	68	70	71
6.2	62	65	67	69	71
6.4	61	64	66	68	70
6.6	60	63	65	67	69
6.8	60	62	64	66	68
7.0	59	61	63	66	68
7.2	58	60	63	65	67
7.4	57	60	62	64	66
7.6	56	59	61	63	65
7.8	55	58	60	63	65

RELATIVE HUMIDITY—DEW-POINT (Continued)

Depression of dew-point $t-d$ ° C.	Dew-point (d).				
	−10	0	+10	+20	+30
8.0	54	57	60	62	64
8.2	54	56	59	61	63
8.4	53	56	58	60	63
8.6	52	55	57	60	62
8.8	51	54	57	59	61
9.0	51	53	56	58	61
9.2	50	53	55	58	60
9.4	49	52	55	57	59
9.6	48	51	54	56	59
9.8	48	51	53	56	58
10.0	47	50	53	55	57
10.5	45	48	51	54	
11.0	44	47	49	52	
11.5	42	45	48	51	
12.0	41	44	47	49	
12.5	39	42	45	48	
13.0	38	41	44	46	
13.5	37	40	43	45	
14.0	35	38	41	44	
14.5	34	37	40	43	
15.0	33	36	39	42	
15.5	32	35	38	40	
16.0	31	34	37	39	
16.5	30	33	36	38	
17.0	29	32	35	37	
17.5	28	31	34	36	
18.0	27	30	33	35	
18.5	26	29	32	34	
19.0	25	28	31	33	
19.5	24	27	30	33	
20.0	24	26	29	32	
21.0	22	25	27		
22.0	21	23	26		
23.0	19	22	24		
24.0	18	21	23		
25.0	17	19	22		
26.0	16	18	21		
27.0	15	17	20		
28.0	14	16	19		
29.0	13	15	18		
30.0	12	14	17		

REDUCTION OF PSYCHROMETRIC OBSERVATION

For the reduction of observations with the wet and dry bulb thermometer. Assuming the relative velocity of the air to the thermometer bulbs is at least three meters per second; if t is the temperature of the air as indicated by the dry bulb, t_w, the temperature of the wet bulb, B, the barometric pressure, and E_w, the vapor tension of water corresponding to t_w, then the actual vapor tension is

$$E = E_w - 0.00066B(t - t_w)[1 + 0.00115(t - t_w)].$$

The value of the term

$$0.00066B(t - t_w)[1 + 0.00115(t - t_w)]$$

is given in the following table.

(From Miller's Laboratory Physics, Ginn & Co., publishers, by permission.)

$t - t_w$	Barometric Pressure B in Centimeters.							
	70.0	71.0	72.0	73.0	74.0	75.0	76.0	77.0
°	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.
1	0.047	0.048	0.048	0.049	0.050	0.050	0.051	0.052
2	.093	.094	.096	.097	.098	.100	.101	.103
3	.139	.141	.143	.145	.147	.149	.152	.154
4	.186	.189	.191	.194	.197	.199	.202	.204
5	0.232	0.236	0.239	0.243	0.246	0.249	0.252	0.256
6	.279	.283	.287	.291	.295	.299	.303	.307
7	.326	.331	.336	.340	.345	.350	.354	.359
8	.373	.379	.384	.389	.395	.400	.405	.411
9	.421	.427	.432	.438	.444	.450	.456	.462
10	0.468	0.474	0.481	0.488	0.494	0.501	0.508	0.515
11	.515	.522	.530	.537	.544	.551	.559	.566
12	.562	.570	.578	.586	.594	.602	.611	.619
13	.610	.618	.627	.636	.645	.653	.662	.671
14	.658	.667	.676	.686	.695	.705	.714	.723
15	0.706	0.716	0.726	0.736	0.746	0.756	0.766	0.776
16	.754	.764	.775	.786	.796	.807	.818	.829
17	.802	.813	.824	.836	.847	.859	.870	.882
18	.850	.862	.874	.886	.898	.910	.922	.935
19	.898	.911	.923	.936	.949	.962	.975	.987
20	0.946	0.960	0.973	0.987	1.000	1.014	1.027	1.041

VELOCITY OF SOUND

Solids

Approximate values.
(From Smithsonian Tables.)

Substance.	Temp. ° C.	Veloc., meters per sec.	Veloc., feet per sec.	Observer.
Metals:				
Aluminum	....	5104	16740	Masson
Brass	....	3500	11480	Various
Cadmium	....	2307	7570	Masson
Cobalt	....	4724	15500	Masson
Copper	20	3560	11670	Wertheim
Copper	100	3290	10800	Wertheim
Copper	200	2950	9690	Wertheim
Gold, soft	20	1743	5717	Wertheim
Gold, hard	....	2100	6890	Various
Iron and soft steel	....	5000	16410	Various
Iron	20	5130	16820	Wertheim
Iron	100	5300	17390	Wertheim
Iron	200	4720	15480	Wertheim
Iron cast steel	20	4990	16360	Wertheim
Iron cast steel	200	4790	15710	Wertheim
Lead	20	1227	4026	Wertheim
Magnesium	....	4602	15100	Melde
Nickel	....	4973	16320	Masson
Palladium	....	3150	10340	Various
Platinum	20	2690	8815	Wertheim
Platinum	100	2570	8437	Wertheim
Platinum	200	2460	8079	Wertheim
Silver	20	2610	8553	Wertheim
Silver	100	2640	8658	Wertheim
Tin	....	2500	8200	Various
Zinc	....	3700	12140	Various
Various:				
Brick	....	3652	11980	Chladni
Clay rock	....	3480	11420	Gray and Milne
Cork	....	500	1640	Stefan
Granite	....	3950	12960	Gray and Milne
Marble	....	3810	12500	Gray and Milne
Paraffin	15	1304	4280	Warburg
Slate	....	4510	14800	Gray and Milne
Tallow	16	390	1280	Warburg
Glass, from	....	5000	16410	Various
Glass, to	....	6000	19690	Various
Ivory	....	3013	9886	Ciccone & Campanile
Vulcanized rubber	0	54	177	Exner
Wax	17	880	2890	Stefan
Woods:				
Ash, along the fiber	....	4670	15310	Wertheim
Ash, across the rings	....	1390	4570	Wertheim
Ash, along the rings	....	1260	4140	Wertheim
Beech, along the fiber	....	3340	10960	Wertheim
Elm, along the fiber	....	4120	13516	Wertheim
Fir, along the fiber	....	4640	15220	Wertheim
Maple, along the fiber	....	4110	13470	Wertheim
Oak, along the fiber	....	3850	12620	Wertheim
Pine, along the fiber	....	3320	10900	Wertheim
Poplar, along the fiber	....	4280	14050	Wertheim
Sycamore, along fiber	....	4460	14640	Wertheim

VELOCITY OF SOUND (Continued)

Liquids and Gases

(From Smithsonian Tables.)

Substance.	Temp. ° C.	Veloc., meters per sec.	Veloc., feet per sec.	Observer.
Liquids:				
Alcohol, 95%	12.5	1241.	4072.	Dorsing, 1908
Alcohol	20.5	1213.	3890.	Dorsing, 1908
Ammonia, conc	16.	1663.	5456.	Dorsing, 1908
Benzine	17.	1166.	3826.	Dorsing, 1908
Carbon bisulphide	15.	1161.	3809.	Dorsing, 1908
Chloroform	15.	983.	3225.	Dorsing, 1908
Ether	15.	1032.	3386.	Dorsing, 1908
NaCl, 10% sol	15.	1470.	4823.	Dorsing, 1908
NaCl, 15% sol	15.	1530.	5020.	Dorsing, 1908
NaCl, 20% sol	15.	1650.	5414.	Dorsing, 1908
Turpentine oil	15.	1326.	4351.	Dorsing, 1908
Water, air-free	13.	1441.	4728.	Dorsing, 1908
Water, air-free	19.	1461.	4794.	Dorsing, 1908
Water, air-free	31.	1505.	4938.	Dorsing, 1908
Water, Lake Geneva	9.	1435.	4708.	Colladon-Sturm
Water, Seine River	15.	1437.	4714.	Wertheim
Water, Seine River	30.	1528.	5013.	Wertheim
Water, Seine River	60.	1724.	5657.	Wertheim
Gases:				
Air, dry, CO_2-free	0.	331.78	1088.5	Rowland
Air, dry,	0.	331.36	1087.1	Violle, 1900
Air, dry, CO_2-free	0.	331.92	1089.0	Thiesen, 1908
Air 1 atmosphere	0.	331.7	1088.	Mean
Air 25 atmospheres	0.	332.0	1089.	Mean (Witkowski)
Air 50 atmospheres	0.	334.7	1098.	Mean (Witkowski)
Air 100 atmospheres	0.	350.6	1150.	Mean (Witkowski)
Air	20.	344.	1129.	
Air	100.	386.	1266.	Stevens
Air	500.	553.	1814.	Stevens
Air	1000.	700.	2297.	Stevens
Ammonia	0.	415.	1361.	Masson
Carbon monoxide	0.	337.1	1106.	Wullner
Carbon dioxide	0.	258.0	846.	Bückendahl, 1906
Carbon disulphide	0.	189.	606.	Masson
Chlorine	0.	205.3	674.	Strecker
Ethylene	0.	314.	1030.	Dulong
Hydrogen	0.	1269.5	4165.	Dulong
Illuminating gas	0.	490.4	1609.	Zoch
Methane	0.	432.	1417.	Masson
Nitric oxide	0.	325.	1066.	Masson
Nitrous oxide	0.	261.8	859.	Dulong
Oxygen	0.	317.2	1041.	Dulong
Vapors:				
Alcohol	0.	230.6	756.	Masson
Ether	0.	179.2	588.	Masson
Water	0.	401.	1315.	Masson
Water	100.	404.8	1328.	Treitz, 1903
Water	130.	424.4	1392.	Treitz, 1903

MUSICAL SCALES

(From Miller's Laboratory Physics, Ginn & Co., publishers, by permission

VIBRATION FREQUENCY OF TONES IN THE MUSICAL SCALE FOR HIGHER OR LOWER OCTAVES ARE OBTAINED BY MULTIPLYING BY SOME POWER OF 2

Scientific diatonic scale. $C_3 = 256$.		Musical equal-tempered chromatic scale. $A_3 = 435$.			
C_3	**256.**	C_3	258.65	G_3	387.54
D_3	288.	$C\#_3$	274.03	$G\#_3$	410.58
E_3	320.	D_3	290.33	A_3	**435.**
F_3	341.33	$D\#_3$	307.59	$A\#_3$	460.87
G_3	384.	E_3	325.88	B_3	488.27
A_3	426.66	F_3	345.26	C_4	517.30
B_3	480.	$F\#_3$	365.79		
C_4	512.				

ELECTRICITY AND MAGNETISM

SPARKING POTENTIAL OR DIELECTRIC STRENGTH

AIR

Potential in volts necessary to produce a spark in air at atmospheric pressure and ordinary temperatures, the potential required depends on the shape and size of the electrodes and increases with the pressure of the air.

(From Smithsonian Tables.)

Spark length, cm.	Point electrodes, steady potential.	Ball electrodes, 1 cm. diam.	
		Steady potential.	Alternating potential.
.02	....	1530	
.04	....	2430	
.06	....	3240	
.08	....	3990	3770
.10	3720	4560	4400
.2	4680	8490	7510
.3	5310	11340	10480
.4	5970	14340	13360
.5	6300	17220	16140
.6	6840	20070	18700
.8	8070	24780	23820
1.0	8670	27810	28380
2.0	10140	45480	42950
3.0	11250	46710	
4.0	12210	49100	
5.0	13050	50310	
6.0			
8.0	....	52400	
10.0	....	74300	

SPECIFIC INDUCTIVE CAPACITY

SOLIDS

Atmospheric temperatures except where noted.

(From Smithsonian Tables.)

Substance.	Wave length.	Specific inductive capacity.	Observer.
Asphalt	∞	2.68	v. Pirani, 1903
Caoutchouc	∞	2.22	Gordon, 1879
Calcspar:			
⊥ to axis	∞	8.49	Fallinger, 1902
‖ to axis	∞	7.56	Fallinger, 1902
Diamond	∞	16.5	v. Pirani, 1903
Ebonite	∞	2.72	Winklemann, 1889
Glass flint, extra heavy	∞	9.90	Hopkinson, 1891
hard crown	∞	6.96	Hopkinson, 1891
lead (Powell)	∞	5.4–8.0	Gray-Dobbie, 1898
Jena, barium	∞	7.8–8.5	Löwe, 1898
Gutta percha	.....	3.3–4.9	(submarine-data)
Ice −5° C	1200	2.85	Thwing, 1894
−18°	5000	3.16	Abegg, 1897
−190°	75	1.76–1.88	Behn-Kiebitz, 1904
Iodine, cryst	75	4.00	Schmidt, 1903
Marble, Carrara	75	8.3	Schmidt, 1903
Mica	∞	5.66–5.97	Elsas, 1891
Mica, Canadian amber	∞	3.0	E. Wilson
Paraffin	∞	2.10	Zietkowski, 1900
Phosphorus, yellow	75	3.60	Schmidt, 1903
Porcelain, hard (Royal Berlin)	∞	5.73	Starke, 1897
Quartz:			
⊥ to axis	∞	4.69	Fallinger, 1902
‖ to axis	∞	5.06	Fallinger, 1902
Selenium	∞	6.13	Vonwiller-Mason, 1907
Shellac	∞	3.10	Winkelmann, 1889
Sulphur, amorphous	∞	3.98	v. Pirani, 1903
Sulphur, cast, fresh	∞	4.22	v. Pirani, 1903
Wood, dry:			
red beech	∞	4.83–2.51	
red beech	∞	7.73–3.63	
oak	∞	4.22–2.46	
oak	∞	6.84–3.64	

SPECIFIC INDUCTIVE CAPACITY (Continued)

Gases

The specific inductive capacity of a vacuum is taken as unity. Wave-lengths of the measuring current greater than 10,000 cm.

(Dielectric constant.)

Gas.	Temp. ° C.	Pressure in atmospheres.	Specific inductive capacity.	Observer.
Air	0	1	1.000590	Boltzmann, 1875
Air	19	20	1.0108	Tangl, 1907
Air	....	40	1.0218	Tangl, 1907
Air	....	60	1.0330	Tangl, 1907
Air	....	80	1.0439	Tangl, 1907
Air	....	100	1.0548	Tangl, 1907
Ammonia	20	1	1.00718	Bädeker, 1901
Carbon bisulphide	0	1	1.00290	Klemenčič
Carbon bisulphide	100	1	1.00239	Bädeker
Carbon dioxide	0	1	1.000985	Klemenčič
Carbon dioxide	15	10	1.008	Linde, 1895
Carbon dioxide	....	20	1.020	Linde, 1895
Carbon dioxide	....	40	1.060	Linde, 1895
Carbon monoxide	0	1	1.000690	Boltzmann
Ethylene	0	1	1.00131	Boltzmann
Hydrochloric acid	100	1	1.00258	Bädeker
Hydrogen	0	1	1.000264	Boltzmann
Methane	0	1	1.000944	Boltzmann
Nitrous oxide (N_2O)	0	1	1.00116	Boltzmann
Nitrous oxide (N_2O)	15	10	1.010	Linde, 1895
Nitrous oxide (N_2O)	....	20	1.025	Linde, 1895
Nitrous oxide (N_2O)	....	40	1.070	Linde, 1895
Sulphur dioxide	0	1	1.00993	Bädeker
Sulphur dioxide	0	1	1.00905	Klemenčič
Water vapor	145	4	1.00705	Bädeker

Liquids

Where the wave-length is not specified it is greater than 10,000 cm.

Liquid.	Temp. ° C.	Wave length.	Specific inductive capacity.	Observer.
Acetic acid	18	∞	9.7	Francke, 1893
Acetone	0	∞	26.6	Abegg, 1897
Air	−191	∞	1.43	v. Pirani, 1903
Alcohol:				
amyl	0	∞	17.4	Abegg-Seitz, 1899
amyl	+20	∞	16.0	Abegg-Seitz, 1899
ethyl	frozen	∞	2.7	Abegg-Seitz, 1899
ethyl	−120	∞	54.6	Abegg-Seitz, 1899

SPECIFIC INDUCTIVE CAPACITY (Continued)

Liquids (Continued)

Liquid.	Temp. ° C.	Wave length.	Specific inductive capacity.	Observer.
Alcohol:				
ethyl	−80	∞	44.3	Abegg-Seitz, 1899
ethyl	−40	∞	35.3	Abegg-Seitz, 1899
ethyl	0	∞	28.4	Abegg-Seitz, 1899
ethyl	+20	∞	25.8	Abegg-Seitz, 1899
ethyl	17	200	24.4	Drude, 1896
ethyl	17	75	23.0	Drude, 1896
ethyl	17	53	20.6	Marx, 1898
ethyl	17	4	8.8	Marx, 1898
ethyl	17	0.4	5.0	Lampa, 1896
methyl	0	∞	35.0	Abegg-Seitz, 1899
methyl	+20	∞	31.2	Abegg-Seitz, 1899
propyl	0	∞	24.8	Abegg-Seitz, 1899
propyl	+20	∞	22.2	Abegg-Seitz, 1899
Ammonia	−34	75	21–23	Goodwin-Thompson, 1899
Amyl acetate	19	∞	4.81	Löwe, 1898
Anilin	18	∞	7.316	Turner, 1900
Benzol (Benzene)	18	∞	2.288	Turner, 1900
Bromine	23	84	3.18	Schlundt
Carbon bisulphide	20	∞	2.626	Tangl, 1903
Carbon dioxide	−5	∞	1.60	Linde, 1895
Chlorine	−60	∞	2.15	Linde, 1895
Chloroform	18	∞	5.2	Turner, 1900
Ethyl ether	0	∞	4.68	Abegg, 1897
Ethyl ether	20	∞	4.30	Tangl, 1903
Glycerine	15	1200	56.2	Thwing, 1894
Hydrogen peroxide 46% in H_2O	18	75	84.7	Calvert, 1900
Hydrogen sulphide	10	∞	5.93	Eversheim, 1904
Nitrous oxide, N_2O	−88	∞	1.93	Hasenhörl, 1900
Oils:				
castor	11	∞	4.67	Arons-Rubens, 1892
cottonseed	14	∞	3.10	Salvioni, 1888
linseed	13	∞	3.35	Salvioni, 1888
olive	20	∞	3.11	Heinke, 1896
petroleum	....	2000	2.13	Marx
sperm	20	∞	3.17	Hopkinson, 1881
turpentine	20	∞	2.23	Hopkinson, 1881
Oxygen	−182	∞	1.49	Fleming-Dewar, 1896
Phenol	48	73	9.68	Drude, 1896
Sulphur dioxide	20	∞	14.0	Eversheim, 1904
Water	18	∞	81.07	Turner, 1900

SPARKING POTENTIAL OR DIELECTRIC STRENGTH

VARIOUS INSULATORS.

Potential to puncture in kilovolts per centimeter. 1 kilovolt = 1000 volts.

Substance.	Thickness used mm.	Kilovolts per cm.
Air, liquid	....	40–90
Ebonite	....	300–1100
Fiber	....	20
Glass	....	300–1500
Guttapercha	....	80–200
Kerosene	1.0	164
Linen, varnished	....	100–200
Mica	0.1	1500–2200
Mica	1.0	300–700
Oils:		
castor	0.2	190
castor	1.0	130
cottonseed	....	70
lard	0.2	140
lard	1.0	40
linseed, raw	0.2	185
raw	1.0	90
boiled	0.2	190
boiled	1.0	80
lubricating	....	50
olive	0.2	170
olive	1.0	75
paraffin	0.2	215
paraffin	1.0	160
sperm, mineral	0.2	180
mineral	1.0	85
natural	0.2	195
natural	1.0	90
turpentine	0.2	160
turpentine	1.0	110
Papers:		
beeswaxed	....	770
blotting	....	150
Manilla	....	25
paraffined	....	500
varnished	....	100–250
Paraffin:		
melted	....	75
solid, melt. point 43°	....	350
solid, melt. point 70°	....	450
Rubber	....	160–500
Vaseline	....	90–130
Xylol	0.2	140
Xylol	1.0	80

ELECTROMOTIVE FORCE AND COMPOSITION OF VOLTAIC CELLS

Standard Cells

(From Smithsonian Tables.)

Name of cell.	Negative pole.	Solution.	Positive pole.	Depolarizer.	E.M.F. in volts.
Weston normal..	Cadmium amalgam...	Saturated solution of $CdSO_4$.....	Mercury. .	Paste of Hg_2SO_4 and $CdSO_4$	1.0183 at 20° C.
Clark standard. .	Zinc amalgam.......	Saturated solution of $ZnSO_4$.....	Mercury. .	Paste of Hg_2SO_4 and $ZnSO_4$.	1.4328 at 15° C.

Temperature equations:

Clark cell: $E_t = 1.4328[1 - 0.00119(t - 15) - 0.000007(t - 15)^2]$ volt

Weston cell: $E_t = 1.0183[1 - 0.0000406(t - 20) - 0.00000095(t - 20)^2 + 0.00000001(t - 20)^3]$ volt

Double Fluid Cells

Name of cell.	Negative pole.	Solution.	Positive pole.	Solution.	E.M.F. in volts.
Bunsen.........	Amal. zinc..........	1 part H_2SO_4 to 12 parts H_2O....	Carbon...	Fuming nitric acid........	1.94
Bunsen.........	Amal. zinc..........	1 part H_2SO_4 to 12 parts H_2O....	Carbon...	HNO_3, density, 1.38.......	1.86
Bichromate.....	Amal. zinc..........	12 parts $K_2Cr_2O_7$ to 25 parts H_2SO_4 and 100 parts H_2O.	Carbon...	1 part H_2SO_4 to 12 parts H_2O	2.00
Bichromate.....	Amal. zinc..........	1 part H_2SO_4 to 12 parts H_2O....	Carbon...	12 parts $K_2Cr_2O_7$ to 100 parts H_2O..............	2.03
Daniell.........	Amal. zinc..........	1 part H_2SO_4 to 4 parts H_2O.....	Copper...	Saturated solution of $CuSO_4 + 5H_2O$...........	1.06
Daniell.........	Amal. zinc..........	5% solution of $ZnSO_4 + 6H_2O$....	Copper...	Saturated solution of $CuSO_4 + 5H_2O$...........	1.08
Daniell	Amal. zinc..........	1 part NaCl to 4 parts H_2O.....	Copper...	Saturated solution of $CuSO_4 + 5H_2O$...........	1.05
Grove..........	Amal. zinc..........	1 part H_2SO_4 to 12 parts H_2O....	Platinum .	Fuming nitric acid........	1.93
Grove..........	Amal. zinc..........	Solution of $ZnSO_4$.............	Platinum .	HNO_3 density 1.33........	1.66

ELECTROMOTIVE FORCE AND COMPOSITION OF VOLTAIC CELLS (Continued)

Double Fluid Cells (Continued)

Name of cell.	Negative pole.	Solution.	Positive pole.	Solution.	E.M.F. in volts.
Grove	Amal. zinc	H_2SO_4 solution, density 1.136	Platinum	HNO_3 density 1.33	1.79
Grove	Amal. zinc	H_2SO_4 solution, density 1.14	Platinum	HNO_3 density 1.19	1.66
Grove	Amal. zinc	NaCl solution	Platinum	HNO_3 density, 1.33	1.88

Single Fluid Cells

Name of cell.	Negative pole.	Solution.	Positive pole.	E.M.F.
Leclanché	Amal. zinc	Solution of sal-ammoniac	Carbon, depolarizer: manganese peroxide with powd. carbon	1.46
Edison-Lalande	Amal. zinc	Solution of caustic potash	Copper, depolarizer, CuO	0.70
Chloride of silver	Zinc	23% sol. of sal-ammoniac	Silver, depolarizer: silver chloride	1.02

Storage Cells

Name of cell.	Negative pole.	Solution.	Positive pole.	E.M.F.
Lead accumulator	Lead	H_2SO_4 solution of density 1.1	PbO_2	2.2
Regnier (1)	Copper	$CuSO_4+H_2SO_4$	PbO_2	1.68 to 0.85, average, 1.3
Regnier (2)	Amal. zinc	$ZnSO_4$ solution	PbO_2 in H_2SO_4	2.36
Main	Amal. zinc	H_2SO_4, density about 1.1	PbO_2	2.50
Edison	Iron	KOH, 20% solution	A nickel oxide	1.1, mean of full discharge

CONTACT DIFFERENCE OF POTENTIAL

Metals

The values in the table give the potential in volts of the metal at the top of the column with respect to the metal named at the left.

(Tabulated from results by Pellat, 1881.)

	Antimony.	Bismuth.	Brass.	Copper.	Gold.	Iron.
Antimony	0	−.08	−.06	−.30	−.48	−.15
Bismuth	+.08	0	−.07	−.22	−.40	−.07
Brass	+.06	+.07	0	+.15	−.33	0
Copper	+.30	+.22	−.15	0	−.18	+.15
Gold	+.48	+.40	+.33	+.18	0	+.33
Iron	+.15	+.07	0	−.15	−.33	0
Lead	−.26	−.34	−.41	−.56	−.74	−.41
Nickel	+.06	−.02	−.09	−.24	−.42	−.09
Platinum	+.46	+.39	+.32	+.17	−.01	+.32
Silver	+.50	+.42	+.35	+.20	+.02	+.35
Tin	−.16	−.24	−.31	−.46	−.64	−.31
Zinc	−.41	−.49	−.56	−.71	−.89	−.56
Carbon*	.....	.....	+.41	+.37	.....	+.48
Mercury	.....	.....	.....	+.31	.....	+.50

	Lead.	Nickel.	Platinum.	Silver.	Tin.	Zinc.	Carbon.
Antimony	+.26	−.06	−.46	−.50	+.16	+.41	
Bismuth	+.34	+.02	−.39	−.42	+.24	+.49	
Brass	+.41	+.09	−.32	−.35	+.31	+.56	−.41
Copper	+.56	+.24	−.17	−.20	+.46	+.71	−.37
Gold	+.74	+.42	+.01	−.02	+.64	+.89	
Iron	+.41	+.09	−.32	−.35	+.31	+.56	−.48
Lead	0	−.32	−.73	−.76	−.10	+.15	−.85
Nickel	+.32	0	−.41	−.44	+.22	+.47	
Platinum	+.73	+.41	0	−.03	+.63	+.88	−.11
Silver	+.76	+.44	+.03	0	+.66	+.91	
Tin	+.10	−.22	−.63	−.66	0	+.25	−.79
Zinc	−.15	−.47	−.88	−.91	−.25	0	−1.10
Carbon*	+.85	.....	+.11	.....	+.79	+1.10	0
Mercury	....	.....	+.16	....	....	....	+.09

* Ayrton and Perry.

DIFFERENCE OF POTENTIAL BETWEEN METALS IN SOLUTIONS OF SALTS

The table gives the difference in potential in hundredths of a volt between zinc in a normal solution of sulphuric acid and the metal named at the head of the columns in the solution named at the side. The signs given refer to the external difference of potential.

(Magnanini.)

Strength of the solution in gramme molecules per liter.	Difference of potential in centivolts.					
	Zinc	Cadmium.	Lead.	Tin.	Copper.	Silver.
0.5 Sulphuric acid	0.0	36.6	51.3	51.3	100.7	121.3
1.0 Sodium hydroxide	−32.1	19.5	31.8	0.2	80.2	95.8
1.0 Potassium hydroxide	−42.5	15.5	32.0	−1.2	77.0	104.0
0.5 Sodium sulphate	1.4	35.6	50.8	51.4	101.3	120.9
1.0 Potassium nitrate	11.8	31.9	42.6	31.1	81.2	105.7
1.0 Sodium nitrate	11.5	32.3	51.0	40.9	95.7	114.8
0.5 Potassium bichromate	72.8	61.1	78.4	68.1	123.6	132.4
0.5 Potassium sulphate	1.8	34.7	51.0	40.9	95.7	114.8
0.2 Potassium chlorate	15.−10.	39.9	53.8	57.7	105.3	120.9
1.0 Ammonium chloride	2.9	32.4	51.3	50.9	81.2	101.7
1.0 Sodium chloride	......	31.9	51.2	50.3	80.9	101.3
1.0 Potassium chloride	......	32.1	51.6	52.6	81.6	107.6

SPECIFIC RESISTANCE AND TEMPERATURE COEFFICIENT

FOR METALS

Resistance in ohms of unit length and unit cross-section at 0° C.

Metal.	Specific resistance.	Variation of resistance per ohm per dgeree C., at 20° C.
Aluminum	$2.6–3.0 \times 10^{-6}$	.0039
Antimony	35.4–45.8	.0039
Arsenic	33.3	.0042
Bismuth	108.0	.0045
Brass	8.5	.0040
Cadmium	6.2–7.0	.0042
Cobalt	9.8	.0033
Constantin	49.	–.00001
Copper, annealed	1.55–1.63	
hard drawn	1.61–1.68	
pure	1.54	.0041
Gas carbon	5000.	–.0005
German silver	30.	.00036
Gold	2.04–2.09	.0037
Iron, commercial	9.7–12.0	.0055
cast hard	97.8	
Lead	18.4–19.6	.0042
Magnesium	4.1–5.0	.0039
Manganin	42.	.00003
Mercury	94.	.0009
Nickel	10.7–12.4	.0060
Platinum	9.0–15.5	.0038
Platinum iridium	24.	.0012
Silver	1.5–1.7	.0040
Steel, hard	45.7	.0016
soft	15.9	.0042
Tantalum	14.5	.0027
Tin	9.53–11.4	.0043
Tungsten	7.0	.0039
Zinc	5.56–6.04	.0040

RESISTANCE OF ELECTROLYTES

Resistance of aqueous solutions of various salts and acids in ohms per centimeter cube for a temperature of 18° C.

(From observations by Kohlrausch.)

Salt.	Number of grams of salt in 100 grams solution.							
	5	10	15	20	25	30	40	50
Acetic acid	...	654.	616.	622.5	658.	714.	925.	1351.
Ammonium chloride	10.89	5.63	3.86	2.97	2.48			
Copper nitrate	27.4	15.7	11.7	9.82	9.17			
sulphate	52.9	31.2	23.7					
Hydrochloric acid	2.54	1.59	1.34	1.31	1.38	1.51	1.94	
Potassium iodide	29.5	14.7	.....	6.88	....	4.34	3.16	2.55
Silver nitrate	39.0	21.0	14.64	11.46	9.45	8.07	6.39	5.39
Sodium carbonate	22.2	14.2	12.0					
chloride	14.94	8.33	6.10	5.11	4.69			
hydroxide	5.08	3.20	2.89	3.06	3.68	4.95	8.61	
Sulphuric acid	4.79	2.55	1.84	1.53	1.39	1.35	1.47	1.85
Zinc chloride	20.70	13.75	....	10.96	....	10.80	11.83	15.87
sulphate	52.3	31.2	24.1	21.4	20.8	22.5		
(Concentration)	6.2	12.4	18.6	24.8	31.	37.2	43.4	
Nitric acid	3.2	1.84	1.45	1.30	1.28	1.32	1.43	
(Concentration)	8.4	12.6	16.8	21.	25.2	29.4	33.6	
Potassium hydroxide	3.67	2.66	2.19	1.96	1.85	1.84	1.91	

SAFE CARRYING CAPACITY OF COPPER WIRE

(From Collins' Design and Construction of Induction Coils, by permission.)

Brown & Sharpe gauge.	Diameter in mils.	Area in circular mils.	Number of amperes, exposed work.	Number of amperes, confined spaces.
18	40	1.624	5	3
17	45	2.048	6	4
16	51	2.583	8	6
15	57	3.257	10	8
14	64	4.106	16	12
13	72	5.178	19	14
12	81	6.530	23	17
11	91	8.234	27	21
10	102	10.380	32	25
9	114	13.090	39	29
8	128	16.510	46	33
7	144	20.820	56	39
6	162	26.250	65	45
5	182	33.100	77	53
4	204	41.740	92	63
3	229	52.630	110	75
2	258	66.370	131	88
1	289	83.690	156	105
0	325	105.500	185	125
00	365	133.100	220	150

CONDUCTIVITY OF STANDARD SOLUTIONS

Giving the conductivity in reciprocal ohms (mho) per cm. for NaCl, KCl, H_2SO_4 and $MgSO_4$ for various temperatures. Solutions are as follows: —

H_2SO_4, — maximum conductivity (18° C.); dissolve 378 g. of 97% acid in pure water and dilute to 1 liter. Density at 18° C., 1.223.

$MgSO_4$, — maximum conductivity (18° C.); dissolve in 1 liter of distilled water 552 g. of $MgSO_4 7H_2O$. Density at 18° C., 1.190.

NaCl, — solution saturated at all temperatures given. An excess of NaCl in distilled water, about 450 g. per liter. D = 1.2014 (18° C.).

KCl, — normal solution, 74.59 grams per liter of solution at 18° C. Dissolve 74.555 grams (weighed in air) of KCl and dilute to 1 liter. Density, 1.04492.

Solution.	0° C.	5°	10°	15°
H_2SO_4	0.5184	0.7952	0.6408	0.7028
$MgSO_4$	0.02877	0.03402	0.03963	0.04555
NaCl	0.1345	0.1555	0.1779	0.2014
KCl, normal	0.06541	0.07414	0.08319	0.09252
KCl, 1/10 normal	0.00715	0.00822	0.00933	0.01048
KCl, 1/100 normal	0.000776	0.000896	0.001020	0.001147

	16°	17°	18°	19°	20°
H_2SO_4	0.7151	0.7275	0.7398	0.7522	0.7645
$MgSO_4$	0.04676	0.04799	0.04922	0.05046	0.05171
NaCl	0.2062	0.2111	0.2160	0.2209	0.2259
KCl, n.	0.09441	0.09631	0.09822	0.10014	0.10207
KCl, 1/10 n.	0.01072	0.01095	0.01119	0.01143	0.01167
KCl, 1/100 n.	0.001173	0.001199	0.001225	0.001251	0.001278

	21°	22°	23°	24°	25°
H_2SO_4	0.7768	0.7890	0.8013	0.8135	0.8257
$MgSO_4$	0.05297	0.05424	0.05551	0.05679	0.05808
NaCl	0.2309	0.2360	0.2411	0.2462	0.2513
KCl, n.	0.10400	0.10594	0.10789	0.10984	0.11180
KCl, 1/10, n.	0.01191	0.01215	0.01239	0.01264	0.01288
KCl, 1/100 n.	0.001305	0.001332	0.001359	0.001386	0.001413

	26°	27°	28°	29°	30°
H_2SO_4	0.8378	0.8499	0.8620	0.8740	0.8860
$MgSO_4$	0.05937	0.06067	0.06197	0.06328	0.06459
NaCl	0.2565	0.2616	0.2669	0.2721	0.2774
KCl, n.	0.11377	0.11574	....	....	....
KCl, 1/10 n.	0.01313	0.01337	0.01362	0.01387	0.01412
KCl, 1/100 n.	0.002819	0.002873	0.002927	0.002981	0.003036

EQUIVALENT CONDUCTIVITY OF AQUEOUS SOLUTIONS

The conductivity is given in reciprocal ohms per centimeter cube. Concentration is given in milli-equivalents of solute per liter of solution. Corrected for conductance of water except in case of the strong acids.

Substance.	Concentration milli-equivalents per liter.	18° C.	100° C.
Acetic acid	0.	347.	773.
	10.	14.50	25.1
	30.	8.50	14.7
	80.	5.22	9.05
	100.	4.67	8.10
*Ammonium acetate	0.	99.8	338.
	10.	91.7	300.
	25.	88.2	286.
*Ammonium chloride	0.	131.1	415.
	2.	126.5	399.
	10.	122.5	382.
	30.	118.1	......
Ammonium hydroxide	0.	238.	647.
	10.	9.66	23.2
	30.	5.66	13.6
	100.	3.10	7.47
Barium ferrocyanide	0.	91.	521.
	2.	46.9	202.3
	12.5	30.4	129.8
Barium hydroxide	0.	222.	645.
	2.	215.	591.
	10.	207.	548.
	50.	191.1	478.
	100.	180.1	443.
Barium nitrate	0.	116.9	385.
	2.	109.7	352.
	10.	101.	322.
	40.	88.7	280.
	80.	81.6	258.
	100.	79.1	249.
Calcium ferrocyanide	0.	88.	512.
	100.	21.9	84.3
	200.	20.6	77.5
	400.	202.	76.2
Calcium nitrate	0.	70.4	369.
	2.	66.5	346.5
	50.	55.6	276.8
	100.	51.9	255.5
	200.	48.3	234.4

* Values have been corrected for hydrolysis.

EQUIVALENT CONDUCTIVITY OF AQUEOUS SOLUTIONS (Continued)

Substance.	Concentration milli-equivalents per liter.	18° C.	100° C.
Hydrochloric acid	0.	379.	850.
	2.	373.6	826.
	10.	368.1	807.
	80.	353.	762.
	100.	350.6	754.
Lanthanum nitrate	0.	75.4	413.
	2.	68.9	363.5
	12.5	61.4	311.2
	50.	54.	261.4
	100.	49.9	236.7
	200.	46.	210.8
Magnesium sulphate	0.	114.1	426.
	2.	94.3	302.
	10.	76.1	234.
	20.	67.5	190.
	40.	59.3	160.
	80.	52.	136.
	100.	49.8	130.
	200.	43.1	110.
Nitric acid	0.	377.	826.
	2.	371.2	806.
	10.	365.	786.
	50.	353.7	750.
	100.	346.4	728.
Phosphoric acid	0.	338.3	730.
	2.	283.1	498.
	10.	203.	308.
	50.	122.7	168.
	100.	95.7	128.
Potassium chloride	0.	130.1	414.
	2.	126.3	393.
	10.	122.4	377.
	80.	113.5	342.
	100.	112.	336.
Potassium citrate	0.	76.4	420.
	2.	71.	381.2
	5.	67.6	357.2
	50.	54.4	273.
	100.	50.2	247.5
	300.	43.5	209.5
Potassium nitrate	0.	80.8	384.
	2.	78.6	370.3
	12.5	75.3	351.5

EQUIVALENT CONDUCTIVITY OF AQUEOUS SOLUTIONS (Continued)

Substance.	Concentration milli-equivalents per liter.	18° C.	100° C.
Potassium nitrate	50.	70.7	326.1
	100.	67.2	308.5
Potassium ferrocyanide	0.	98.4	527.
	2.	84.8	427.6
	50.	58.2	272.4
	100.	53.	245.
	206.	48.8	222.3
	400.	45.4	203.1
Potassium oxalate	0.	79.4	419.
	2.	74.9	389.3
	50.	63.	312.2
	100.	59.3	288.9
	200.	55.8	265.1
Potassium sulphate	0.	132.8	455.
	2.	124.8	402.
	10.	115.7	365.
	40.	104.2	320.
	80.	97.2	294.
	100	95.	286.
Silver nitrate	0.	115.8	367.
	2.	112.2	353.
	10.	108.	337.
	20.	105.1	326.
	40.	101.3	312.
	80.	96.5	294.
	100.	94.6	289.
Sodium acetate	0.	78.1	285.
	2.	74.5	268.
	10.	71.2	253.
	80.	63.4	221.
Sodium chloride	0.	109.	362.
	2.	105.6	349.
	10.	102.	336.
	80.	93.5	301.
	100.	92.0	296.
Sodium hydroxide	0.	216.5	594.
	2.	212.1	582.
	20.	205.8	559.
	50.	200.6	540.
Sulphuric acid	0.	383.	891.
	2.	353.9	571.
	10.	309.	446.
	50.	253.5	384.
	100.	233.3	369.

THE EQUIVALENT CONDUCTANCE OF THE SEPARATE IONS

(From Smithsonian Physical Tables.)

Ion.	0°	18°	25°	50°	75°	100°	128°	156°
K	40.4	64.6	74.5	115	159	206	263	317
Na	26.	43.5	50.9	82	116	155	203	249
NH_4	40.2	64.5	74.5	115	159	207	264	319
Ag	32.9	54.3	63.5	101	143	188	245	299
$\frac{1}{2}$Ba	33.	55	65.	104	149	200	262	322
$\frac{1}{2}$Ca	30.	51	60.	98	142	191	252	312
$\frac{1}{3}$La	35.	61.	72.	119	173	235	312	388
Cl	41.1	65.5	75.5	116	160	207	264	318
NO_3	40.4	61.7	70.6	104	140	178	222	263
$C_2H_3O_2$	20.3	34.6	40.8	67	96	130	171	211
$\frac{1}{2}SO_4$	41.	68	79.	125	177	234	303	370
$\frac{1}{2}C_2O_4$	39.	63	73.	115	163	213	275	336
$\frac{1}{3}C_6H_5O_7$	36.	60.	70.	113	161	214		
$\frac{1}{4}Fe(CN)_6$	58.	95.	111.	173	244	321		
H	240.	314.	350.	465	565	644	722	777
OH	105.	172.	192.	284	360	439	525	592

RESISTANCE OF VARIOUS SUBSTANCES

Solids

Resistance in ohms per centimeter cube.

Substance.	Temp. ° C.	Resistance, ohms.
Celluloid	16	$2\text{–}80 \times 10^{9}$
Ebonite	....	$2\text{–}30 \times 10^{15}$
Fiber	....	$2\text{–}10 \times 10^{7}$
Glass	20	9×10^{13}
Ice	−1	5×10^{9}
Mica	....	$5\text{–}10 \times 10^{13}$
Paper variable with dryness	....	$1\text{–}1000 \times 10^{9}$
Paraffin	....	$3\text{–}300 \times 10^{16}$
Paraffin paper	....	$1\text{–}20 \times 10^{16}$
Porcelain	50	2×10^{15}
enameled	210	6×10^{9}
porous	20	2×10^{6}
Quartz crystal	20	1×10^{14}
fused	101	4×10^{11}
Rock salt	20	9×10^{16}
Slate	....	$2\text{–}4 \times 10^{8}$
Sulphur, prismatic	....	$70\text{–}390 \times 10^{13}$
octahedral	....	(resistance too high for measurement.)
Varnish	16	2×10^{12}
Wood dry	....	$.5\text{–}10 \times 10^{8}$
green	....	$5\text{–}10 \times 10^{3}$
Zirconium oxide	1200	1.2×10^{3}

Liquids

Resistance in ohms per centimeter cube.

Substance.	Temp. ° C.	Resistance, ohms.
Alcohol, ethyl	15	$.3 \times 10^{6}$
methyl	....	$.14 \times 10^{6}$
Oils, olive	....	5×10^{12}
paraffin	....	1×10^{16}
Petroleum	....	2×10^{16}
Water distilled	18	0.5×10^{6}

Fused Salts

(Poincaré.)

Substance.	Temp. ° C.	Resistance, ohms.
Calcium chloride	750	.862
Potassium bromide	750	.714
chlorate fused	355	2.20
Silver nitrate	350	.820
Sodium chloride fused	750	.294

THERMOELECTRIC POWER

The table gives the electromotive force in microvolts per degree difference in temperature between the two junctions, for various metals with lead. The temperature given is the mean temperature of the two junctions. A is the thermo-electric power at 0 ° C. and B the coefficient in the equation for the thermoelectric power at any temperature,

$$Q = A + Bt,$$

where t is the mean temperature of the two junctions. The thermoelectric power of any two metals in the table may be found by subtracting the value for the first from that of the second, a positive difference indicating that the current will flow from the cold to the hot junction in the second metal.

The sign of the values given is so chosen that if A is positive the current flows in the metal listed from the cold to the hot junction. When B is positive Q increases with the temperature.

(Principally from the Smithsonian Physical Tables.)

Metal.	A micro-volts.	B micro-volts per ° C.	Temp. ° C.	Thermo-electric power, micro-volts.	Neutral point.
Aluminum[1]	0.76	−0.0039	20	0.68	195
Antimony comm'l.-pressed wire[2]	.....	......	20	−6.0	
pure[3]	.....	−0.018	−100–+100	−1.49	
Argentan[1]	11.94	0.0506	20	12.95	−236
Arsenic[2]	.....	......	20	13.56	
Bismuth comm'l.-pressed wire[2]	.....	......	20	97.0	
pure pressed wire[2]	.....	......	20	89.0	
commercial[4]	.....	......	50	39.9	
Brass[5]	.....	−0.0026	0.260	−0.65	
Cadmium[1]	−2.63	−0.0424	20	−3.48	−62
Cobalt[2]	.....	......	20	22.	
Constantin	.....	......	50	+19.3	
Copper[1]	−1.34	−0.0094	20	−1.52	−143
commercial[2]	.....	......	20	−0.10	
German silver[3]	.....	+0.019	−100–+100	+10.7	
Gold[1]	−2.80	−0.0101	20	−3.0	−277
Iron[1]	−17.15	0.0482	20	−16.2	356
pianoforte wire[2]	.....	......	20	−17.5	
Magnesium[1]	−2.22	0.0094	20	−2.03	236
Manganin[3]	.....	0.003	−100–+100	1.12	
Mercury[2]	.....	......	20	0.413	
Nickel[4]	.....	......	50	15.50	
Paladium[1]	6.18	0.0355	20	6.9	−174
Platinum, pure[6]	.....	+0.011	0–200	+3.04	
Platinum-iridium alloys:					
85%Pt+15%Ir[1]	−7.90	−0.0062	20	−8.03	−1274
90%Pt+10%Ir[1]	−5.90	0.0133	20	−5.63	444
Selenium[2]	.....	......	20	−807.	
Silver[1]	−2.12	−0.0147	20	−2.41	−144
pure hard[2]	.....	......	20	−3.00	
Steel[1]	−11.27	0.0325	20	−10.62	347
Tellurium[2]	.....	......	20	−502.	
Tin, commercial[4]	.....	......	50	−0.33	
Tin[1]	0.43	−0.0055	20	0.33	78
Zinc[1]	−2.32	−0.0238	20	−2.79	−98

OBSERVERS: [1] Tait. [2] Matthiesen. [3] Dewar & Fleming, 1895. [4] Ed. Becquerel. [5] Steinmann. [6] Noll, 1894.

MAGNETIC CONSTANTS OF IRON

Permeability of Transformer Iron

Giving *M*, the total magneto motive force applied. *M/l*, the magneto motive force per unit length of iron circuit. *B* the total induction, *B/a* the induction per unit cross-section of iron, *M/B*, the magnetic reluctance of the iron circuit and *Bl/Ma*, the permeability; showing the typical relations of the magnetic constants for varying field.

(From Smithsonian Tables.)

M.	*M/l*.	*B*.	*B/a*.	Reluctance $M/B = K$.	Permeability $Bl/Ma = \mu$.
20	0.597	218×10^3	1406	0.917×10^{-4}	2360
40	1.194	587	3790	0.681	3120
60	1.791	878	5660	0.683	3180
80	2.338	1091	7040	0.734	2960
100	2.985	1219	7860	0.819	2640
120	3.582	1330	8580	0.903	2410
140	4.179	1405	9060	0.994	2186
160	4.776	1475	9510	1.090	2000
180	5.373	1532	9880	1.180	1850
200	5.970	1581	10200	1.270	1720
220	6.567	1618	10430	1.360	1590
260	7.761	1692	10910	1.540	1410

MAGNETIC PROPERTIES OF IRON AND STEEL

(From Gumlich, 1909.)

Sample.	Coercive force.	Residual *B*.	Maximum permeability.	*B* for H = 150.	$4\pi I$ for saturation.
Electrolytic iron	2.83	11400	1850	19200	21620
The same annealed	0.36	10800	14400	18900	21630
Cast steel	1.51	10600	3550	18800	21420
The same annealed	0.37	11000	14800	19100	21420
Steel hardened	52.4	7500	110	11700	18000
Cast iron	11.4	5100	240	10400	16400
The same annealed	4.6	5350	600	11000	16800
Electrical iron in sheets annealed	1.30	9400	3270	18200	20500

SATURATION CONSTANTS FOR MAGNETIC SUBSTANCES

Substance.	Field intensity. (For saturation.)	Induced magnetization. (For saturation.)	Substance.	Field intensity. (For saturation.)	Induced magnetization. (For saturation.)
Cobalt	9000	1300	Nickel, hard	8000	400
Iron, wrought	2000	1700	annealed	7000	515
cast	4000	1200	Vicker's steel	15000	1600
Manganese steel	7000	200			

MAGNETIC SUSCEPTIBILITY OF VARIOUS SUBSTANCES

Metals

Magnetic susceptibility or the ratio of the magnetic moment per unit volume to the magnetizing field is given for various substances. The value is negative for diamagnetic bodies, positive for paramagnetic bodies.

(C. G. S. Electromagnetic units.)

Substance.	Temp. °C.	Susceptibility (vacuum =0).	Observer.
Aluminum	.....	-1.8×10^{-6}	
Antimony	.....	-4.6	Curie, 1895
Bismuth	.....	-13.3	Curie, 1895
Copper	.....	-1.33	Becquerel, 1855
Gold	.....	-4.5	Hanriot & Raoult, 1911
Lead	.....	-1.21	Becquerel
Mercury	15	-2.1	St. Mayer
Platinum	.....	$+29.0$	J. Königsberger, 1898
Selenium	20	-1.54	Curie, 1895
Silver	.....	-1.8	Becquerel, 1855
Tellurium	20	-1.94	Curie, 1895
Zinc	.....	-1.16	Owen, 1912
Iron annealed	.....	$+37.4\times10^{1}$	For weak fields
Nickel	.....	$+4.\times10^{1}$	For H =100 C. G. S.
Steel tempered	.....	$+3.4\times10^{1}$	For weak fields

Inorganic Compounds

Substance.	Temp. °C.	Susceptibility (vacuum =0).	Observer.
Boric acid	.....	-0.88×10^{-6}	Meslin, 1906
Cobalt sulphate ($7H_2O$)	.....	$+76.3$	Meslin, 1906
Copper sulphate ($5H_2O$)	.....	$+13.4$	Mlle. Feytis, 1911
Ferric chloride	.....	$+287.$	Meslin, 1906
Ferrous sulphate ($7H_2O$)	.....	$+95.3$	Meslin, 1906
Glass	.....	-0.15	Faraday, 1853
Nickel sulphate ($7H_2O$)	.....	$+37.$	Meslin, 1906
Potassium bichromate	.....	$+0.36$	Meslin, 1906
Potassium chloride	18	-1.09	Curie, 1895
Potassium ferrocyanide	.....	$+16.0$	Meslin, 1906
Quartz	20	-1.20	J. Königsberger
Sodium chloride	22	-1.02	Meslin, 1906

Liquids

Substance.	Temp. °C.	Susceptibility (vacuum =0).	Observer.
Acetic acid	.....	-0.61	Meslin, 1906
Alcohol, ethyl	.....	-0.65	Meslin, 1906
Benzene	.....	-0.69	Meslin, 1906
Chloroform	.....	-0.86	Meslin, 1906
Ether	.....	-0.61	Meslin, 1906
Glycerine	.....	-0.81	Meslin, 1906
Sulphuric acid	.....	-0.77	Quincke, 1885
Water	20	-0.72	Piccard, 1912

VARIATION OF RESISTANCE DUE TO A MAGNETIC FIELD

Bismuth

The table shows the proportional values of the resistance for values of the magnetic field from 0 to 35,000 and for different temperatures. The resistance at 0° C. and H =0 is taken as 1.

Proportional values of resistance.
(From Smithsonian Tables.)

H. Gauss.	−192°	−135°	−100°	−37°	0°	+18°	+60°	+100°	+183°
0	0.40	0.60	0.70	0.88	1.00	1.08	1.25	1.42	1.79
2000	1.16	0.87	0.86	0.96	1.08	1.11	1.26	1.43	1.80
4000	2.32	1.35	1.20	1.10	1.18	1.21	1.31	1.46	1.82
6000	4.00	2.06	1.60	1.29	1.30	1.32	1.39	1.51	1.85
8000	5.90	2.88	2.00	1.50	1.43	1.42	1.46	1.57	1.87
10000	8.60	3.80	2.43	1.72	1.57	1.54	1.54	1.62	1.89
12000	10.8	4.76	2.93	1.94	1.71	1.67	1.62	1.67	1.92
14000	12.9	5.82	3.50	2.16	1.87	1.80	1.70	1.73	1.94
16000	15.2	6.95	4.11	2.38	2.02	1.93	1.79	1.80	1.96
18000	17.5	8.15	4.76	2.60	2.18	2.06	1.88	1.87	1.99
20000	19.8	9.50	5.40	2.81	2.33	2.20	1.97	1.95	2.03
25000	25.5	13.3	7.30	3.50	2.73	2.52	2.22	2.10	2.09
30000	30.7	18.2	9.8	4.20	3.17	2.86	2.46	2.28	2.17
35000	35.5	20.35	12.2	4.95	3.62	3.25	2.69	2.45	2.25

Various Metals

The table gives the per cent. change in the resistance due to a field of 10,000 gauss with respect to the value at 0° C. and H =0.

(Grumach.)

Metal.	Per cent. change.	Metal	Per cent. change.
Cadmium	+0.03	Palladium	+0.001
Cobalt	−0.53	Platinum	+0.0005
Copper	+0.004	Silver	+0.004
Gold	+0.003	Tantalum	+0.0003
Lead	+0.0004	Tin	+0.002
Nickel	−1.4	Zinc	+0.01

INTERNAL RESISTANCE OF VARIOUS VOLTAIC CELLS

The internal resistance is subject to large variations; the values given can be considered only approximate.

Cell.	Resistance, ohms.	Cell.	Resistance, ohms.
Edison-Lalande	0.03	Grove	0.1–0.2
Daniell	0.85	Bunsen	0.1–0.2
Gravity	1–5	Bichromate	0.08–0.40
Silver chloride	4.	Storage	0.004–0.02
Dry cell	0.2–1.0	Clark standard	20–50
Leclanché	0.4–0.2	Weston standard	20–50

HALL EFFECT

If a strip of metal of thickness t, in which a current i is flowing (longitudinally) is subjected to a transverse magnetic field H, a difference of potential E is produced at opposite points at the side of the strip. $E = R \times Hi/t$ where R is a constant specific with different metals and E, H, i and t in C. G. S. units. The table gives values obtained at ordinary room temperatures, 18-24° C. If the value of R is independent of the field, or nearly so, the field intensity is not given. The positive sign indicates that if a strip of metal were considered to be in the plane of this page with its long axis horizontal, the primary current flowing from left to right and the magnetic field directed away from the observer, normal to the plane of the strip, the upper edge of the strip would be at a higher potential than the lower.

Substance.	Field strength, gausses.	*R.*	Observer.
Aluminum	......	−.00038	Von Ettinghausen & Nernst, 1886
Antimony	1750	+0.219	Barlow, 1903
Bismuth	1650	−10.27	Von Ettinghausen & Nernst, 1886
Bismuth	11100	−4.95	Von Ettinghausen & Nernst, 1886
Cadmium	......	+.00055	Von Ettinghausen & Nernst, 1886
Carbon	......	−.17	Von Ettinghausen & Nernst, 1886
Cobalt	3463	+.24	Hall, 1885
Copper	......	−.00052	Hall, 1885
Gold	......	−.00066	Hall, 1885
Iron	6290	+.0108	Zahn, 1904
Lead	......	.00009	Von Ettinghausen & Nernst, 1886
Magnesium	......	−.00094	Von Ettinghausen & Nernst, 1886
Nickel	10620	−.0047	Zahn, 1904
Platinum	......	−.00024	Von Ettinghausen & Nernst, 1886
Silver	......	−.00083	Von Ettinghausen & Nernst, 1886
Tellurium	......	+530.	Von Ettinghausen & Nernst, 1886
Tin	......	−.00004	Von Ettinghausen & Nernst, 1886
Zinc	......	+.00033	Barlow, 1903

ELECTROCHEMICAL EQUIVALENTS

Grams per coulomb.

Element.	Valence.	Equiv.	Element.	Valence.	Equiv.
Aluminum	3	$.0936 \times 10^{-3}$	Iron	3	$.1929 \times 10^{-3}$
Antimony	3	.4153	Lead	2	1.0731
Antimony	5	.2492	Magnesium	2	.1260
Bismuth	3	.7185	Mercury	1	2.0788
Cadmium	2	.5824	Mercury	2	1.0394
Chromium	3	.1796	Nickel	2	.3040
Cobalt	2	.3055	Oxygen	2	.0829
Copper	1	.6588	Platinum	2	1.0104
Copper	2	.3294	Silver	1	1.1180
Gold	3	.6812	Tin	2	.6166
Hydrogen	1	.0105	Tin	4	.3083
Iron	2	.2893	Zinc	2	.3387

MAGNETIC INCLINATION OR DIP AND HORIZONTAL INTENSITY

The mean or limiting values are given for the territory covered by the State named. The horizontal intensity is given in gausses. The table is compiled from the results of the U. S. Coast and Geodetic Survey for 1911 and 1912.

State.	Dip, degrees.	Horizontal intensity.
Alabama	62. to 66.	.23 to .26
Alaska	67. 74.	.16 .21
Arizona	59.	.27
Arkansas	63. 65.	.24 .25
California	58. 62.	.25 .27
Colorado	67. 68.	.22 .23
Connecticut	72. 73.	17 .18
Delaware	70. 71.5	19 .20
Florida	57. 58.	27 .29
Georgia	62. 66.	.23 .26
Hawaii	39.	.29
Idaho	69.	.21
Indiana	69. 72.	.18 .21
Iowa	71. 73.	.18 .20
Kansas	67. 69.	.21 .23
Kentucky	68. 70.	.20 .22
Maine	74. 76.	.14 .16
Maryland	70.5	.20
Massachusetts	73.	.17
Michigan	73. 76.	.15 .18
Mississippi	61. 66.	.24 .26
Missouri	67. 71.	.20 .22
Montana	70. 72.	.18 .20
Nebraska	70. 71.	.20
New Hampshire	73. 74.	.16 .17
New Jersey	71.	.19
New Mexico	63. 65.	.24 .25
New York	74.	.16 .17
North Carolina	66. 68.	.21 .23
North Dakota	74. 77.	.15 .16
Ohio	71. 73.	.18 .20
Oklahoma	63. 67.	.23 .25
Oregon	68. 69.	.21
Pennsylvania	71. 72.	.18 .19
Philippines	0. 23.	.37 .39
Porto Rico	49. 50.	.29 .30
South Carolina	66. 67.	.23
South Dakota	71. 74.	.17 .19
Tennessee	66. 68.	.22 .23
Texas	57. 63.	.25 .29
Utah	66. 67.	.22 .23
Vermont	73. 75.	.16 .17
Virginia	68. 70.	.20 .21
Washington	71.	.19
West Virginia	70.5	.20
Wisconsin	74. 76.	.15 .17
Wyoming	68. 72.	.19 .22

MAGNETIC DECLINATION

An annual decrease in declination is indicated by the negative sign, an increase by the positive.

(From U. S. Coast and Geodetic Survey)

State.	Station.	Magnetic declination in degrees and tenths.					Ann. Chge. (1910).
		1870	1880	1890	1900	1910	
Ala.	Montgomery	4.5 E	3.9 E	3.2 E	2.8 E	2.9 E	−.012
Alaska	Sitka	29.0 E	29.3 E	29.5 E	29.7 E	30.2 E	
	Kodiak	25.6 E	25.1 E	24.7 E	24.4 E	24.1 E	
	Unalaska	20.1 E	19.6 E	19.0 E	18.3 E	17.5 E	
	St. Michael	....	24.7 E	23.1 E	22.1 E	21.4 E	
Ariz.	Holbrook	13.8 E	13.7 E	13.4 E	13.5 E	13.9 E	+.072
	Prescott	13.7 E	13.6 E	13.5 E	13.7 E	14.3 E	+.077
Ark.	Little Rock	8.2 E	7.6 E	7.0 E	6.6 E	6.9 E	+.023
Cal.	Los Angeles	14.4 E	14.6 E	14.6 E	14.9 E	15.5 E	+.083
	San José	17.3 E	17.5 E	17.5 E	17.8 E	18.5 E	+.075
Cal.	Redding	18.1 E	18.2 E	18.3 E	18.6 E	19.3 E	+.075
Colo.	Pueblo	13.8 E	13.5 E	13.0 E	12.9 E	13.3 E	+.050
	Glenwood Sp.	16.3 E	16.1 E	15.7 E	15.6 E	16.1 E	+.062
Conn.	Hartford	8.7 W	9.4 W	9.8 W	10.4 W	11.0 W	+.097
Del.	Dover	4.7 W	5.3 W	5.9 W	6.4 W	7.0 W	+.080
D. C.	Washington	2.4 W	3.0 W	3.6 W	4.2 W	4.7 W	+.075
Fla.	Jacksonville	3.1 E	2.4 E	1.8 E	1.3 E	1.2 E	−.033
	Tampa	3.9 E	3.3 E	2.8 E	2.3 E	2.0 E	−.013
Ga.	Macon	3.9 E	3.2 E	2.6 E	2.1 E	2.0 E	−.033
Hawaii	Honolulu	9.5 E	9.8 E	10.1 E	10.4 E	10.6 E	
Idaho	Pocatello	17.8 E	17.9 E	17.7 E	17.8 E	18.4 E	+.067
	Boise	18.6 E	18.7 E	18.6 E	18.8 E	19.4 E	+.075
Ill.	Bloomington	5.4 E	4.7 E	4.1 E	3.6 E	3.4 E	−.013
Ind.	Indianapolis	3.2 E	2.6 E	2.0 E	1.4 E	1.1 E	−.030
Ia.	Des Moines	9.7 E	9.1 E	8.4 E	7.9 E	8.1 E	+.017
Kans.	Emporia	11.2 E	10.7 E	10.1 E	9.8 E	10.1 E	+.030
	Ness City	12.2 E	11.9 E	11.4 E	11.1 E	11.4 E	+.040
Ky.	Lexington	2.5 E	1.9 E	1.2 E	0.7 E	0.5 E	−.033
	Princeton	5.6 E	5.0 E	4.3 E	3.8 E	3.7 E	−.017
La.	Alexandria	8.0 E	7.4 E	6.9 E	6.6 E	6.8 E	+.030
Me.	Eastport	18.2 W	18.6 W	18.7 W	19.0 W	19.4 W	+.100
	Portland	12.8 W	13.4 W	13.9 W	14.4 W	14.8 W	+.100
Md.	Baltimore	3.8 W	4.4 W	5.0 W	5.6 W	6.1 W	+.075
Mass.	Boston	11.0 W	11.5 W	12.0 W	12.6 W	13.1 W	+.100
	Pittsfield	9.3 W	10.0 W	10.4 W	11.0 W	11.5 W	+.097
Mich.	Marquette	4.6 E	3.8 E	3.0 E	2.3 E	2.0 E	−.027
	Lansing	2.1 E	1.3 E	0.5 E	0.0 E	0.4 E	+.040
Minn.	Northome	10.0 E	9.3 E	8.6 E	8.0 E	8.1 E	+.017
	Mankato	10.9 E	10.4 E	9.5 E	9.0 E	9.1 E	+.020
Miss.	Jackson	7.5 E	6.9 E	6.4 E	6.0 E	6.2 E	+.017
Mo.	Sedalia	9.4 E	8.7 E	8.0 E	7.6 E	7.9 E	+.020
Mont.	Forsyth	18.6 E	18.4 E	17.9 E	17.8 E	18.3 E	+.050
	Helena	19.8 E	19.6 E	19.4 E	19.5 E	20.0 E	+.062
Nebr.	Hastings	11.7 E	11.2 E	10.5 E	10.2 E	10.5 E	+.033
	Alliance	15.3 E	14.8 E	14.3 E	14.2 E	14.5 E	+.043

MAGNETIC DECLINATION (Continued)

An annual decrease in declination is indicated by the negative sign and an increase by the positive.

(From U. S. Coast and Geodetic Survey.)

State.	Station.	Magnetic declination in degrees and tenths.					Ann. Chge. (1910)
		1870	1880	1890	1900	1910	
Nevada...	Elko..........	17.7 E	17.7 E	17.6 E	17.8 E	18.3 E	+.077
	Hawthorne......	16.9 E	17.0 E	17.0 E	17.3 E	17.8 E	+.083
N. H......	Hanover........	11.1 W	11.6 W	12.0 W	12.5 W	13.0 W	+.100
N. J......	Trenton........	6.0 W	6.7 W	7.2 W	7.8 W	8.4 W	+.082
N. Mex...	Santa Rosa.....	12.7 E	12.5 E	12.1 E	12.0 E	12.4 E	+.060
N. Mex...	Laguna.........	13.6 E	13.4 E	13.0 E	13.0 E	13.5 E	+.062
N. Y......	Albany.........	9.1 W	9.8 W	10.2 W	10.8 W	11.4 W	+.093
	Elmira.........	5.4 W	6.3 W	7.0 W	7.6 W	8.1 W	+.075
N. C......	Newbern........	1.0 W	1.6 W	2.2 W	2.8 W	3.3 W	+.057
	Salisbury.......	1.5 E	0.8 E	0.2 E	0.4 W	0.7 W	+.047
N. Dak...	Jamestown......	14.0 E	13.5 E	12.7 E	12.4 E	12.8 E	+.030
	Dickinson.......	17.4 E	17.0 E	16.4 E	16.2 E	16.6 E	+.040
Ohio......	Columbus.......	1.2 E	0.6 E	0.0 E	0.7 W	1.1 W	+.047
Okla......	Okmulgee.......	9.8 E	9.4 E	8.8 E	8.5 E	8.9E	+.033
	Enid...........	10.9 E	10.5 E	9.9 E	9.7 E	10.1 E	+.043
Oregon....	Sumpter........	20.0 E	20.2 E	20.2 E	20.4 E	21.0 E	+.077
	Detroit.........	20.1 E	20.4 E	20.5 E	20.8 E	21.5 E	+.080
Penn......	Philadelphia.....	5.5 W	6.3 W	6.8 W	7.4 W	8.0 W	+.083
	Altoona.........	3.1 W	3.8 W	4.5 W	5.1 W	5.6 W	+.067
P. R......	San Juan.......	....	....	....	1.0 W	2.0 W	
R. I......	Newport........	10.3 W	10.8 W	11.3 W	11.9 W	12.4 W	+.100
S. C......	Columbia.......	2.1 E	1.4 E	0.8 E	0.2 E	0.1 W	+.043
S. D......	Huron..........	12.6 E	12.1 E	11.4 E	11.1 E	11.4 E	+.030
	Rapid City......	16.3 E	15.8 E	15.3 E	15.1 E	15.4 E	+.042
Tenn.....	Chattanooga....	3.3 E	2.6 E	2.0 E	1.5 E	1.3 E	−.033
Tenn.....	Huntington.....	6.1 E	5.5 E	4.9 E	4.4 E	4.3 E	−.008
Texas.....	Houston........	8.9 E	8.5 E	7.9 E	7.7 E	8.1 E	+.042
	San Antonio.....	9.6 E	9.3 E	8.9 E	8.7 E	9.1 E	+.050
	Pecos..........	11.0 E	10.8 E	10.4 E	10.3 E	10.7 E	+.060
	Floydada.......	11.2 E	10.9 E	10.4 E	10.3 E	10.7 E	+.052
Utah......	Salt Lake City ..	16.7 E	16.5 E	16.3 E	16.5 E	17.0 E	+.070
Vermont ..	Rutland........	10.6 W	11.2 W	11.6 W	12.1 W	12.7 W	+.100
Va........	Richmond......	1.8 W	2.5 W	3.1 W	3.7 W	4.2 W	+.067
	Lynchburg......	0.5 W	1.2 W	1.8 W	2.4 W	2.8 W	+.057
Wash.....	Wilson Creek....	21.9 E	21.9 E	22.1 E	22.4 E	22.9 E	+.075
Wash.....	Seattle.........	22.1 E	22.3 E	22.6 E	23.0 E	23.5 E	+.083
W. Va....	Charleston......	0.2 W	0.9 W	1.5 W	2.1 W	2.6 W	+.057
Wis.......	Madison........	7.2 E	6.4 E	5.6 E	5.0 E	4.9 E	−.017
Wyo......	Douglas........	16.0 E	15.8 E	15.4 E	15.3 E	15.7 E	+.053
	Green River.....	17.0 E	16.9 E	16.6 E	16.6 E	17.0 E	+.060

LIGHT

PHOTOMETRIC STANDARDS

VALUE OF VARIOUS STANDARDS IN INTERNATIONAL CANDLES

Standard Pentane Lamp, burning pentane...... 10.0 candles.
Standard Hefner Lamp, burning amyl acetate.... 0.9 "
Standard Carcel Lamp, burning colza oil......... 9.6 "
Standard English Sperm Candle, about.......... 1.0 "

The *Carcel unit* is the horizontal intensity of the carcel lamp, burning 42 grams of colza oil per hour. For a consumption between 38 and 46 grams per hour the intensity may be considered proportional to the consumption.

The *Hefner unit* is the horizontal intensity of the Hefner lamp burning amyl acetate, with a flame 4 cm. high. If the flame is l mm. high, the intensity $I = 1 + 0.027(l - 40)$.

STANDARD CANDLES

The horizontal intensity may be considered proportional to the rate of consumption of material if the variation is small.

	French.	English.	German.
Material.......	2 pts. stearic acid 1 pt. palmitic acid	Spermaceti	Paraffin
Temp. of fusion.	54° C.	44.4–46°.1 C.	55° C.
Wick (cotton)...	81 threads	54 to 63 threads	24 to 25 threads
Height of flame..	5.24 cm.	4.5 cm.	5 cm.
Rate of consumption of material	10 g. per hr.	7.78 g. per hr.	7.7 g. per hr.
Horizontal intensity in Internat. candles	1.34	1.05	1.11

MEAN HORIZONTAL CANDLE POWER OF VARIOUS LIGHT SOURCES

GIVEN IN INTERNATIONAL CANDLES.

(Lux, 1907.)

Source.	Total power consumed in watts.	Mean horizontal candle power.	Efficiency in watts per candle (spherical)
Acetylene flame	96	6.9	17.7
Electric arcs:			
Carbon, open air, continuous current	435	171	0.92
alternating current	181	98	2.27
Flaming arc, yellow	350	816	0.34
Mercury arc, uviol tube	199	393	0.64
quartz tube	691	3060	0.25
Incandescent electric, carbon filament	98	28.3	4.54
tantalum filament	44	31.1	1.83
tungsten filament	38	32.7	1.59
tungsten filament, gas filled	1000	1670	0.66
Incandescent gas mantle, vertical	717	96.3	8.9
inverted	571	96.3	7.7
Nernst lamp	181	108	2.12

PRIMARY COLOR SENSATIONS PRODUCED BY VARIOUS LIGHT SOURCES

The relative values of the excitation of the three primary sensations are given.

(Ives, 1911.)

Source.	Red.	Green.	Blue.
Black body at 5000° absolute	33	33	33
Blue sky	29	30	41
Clouded sky	35	34	31
Sun	38	37	25
Hefner lamp	54	40	6
Acetylene flame	49	40	11
Incandescent carbon filament	51	41	8
Tungsten filament	48	41	11
Nernst filament	49	40	11
Electric arc, carbon	41	36	23
Mercury arc	29	30	41
Flaming arc	52	37.5	10.5
Incandescent gas mantle, thorium with 0.25 part in 100 of cerium	42	41	17

INTRINSIC BRILLIANCY OF SURFACE INTENSITY OF LIGHT SOURCES

GIVEN IN INTERNATIONAL CANDLES PER SQUARE CENTIMETER.

Sources.	Surface intensity.	Observer.
Electric arc:		
current of 10 amperes	16000	Blondel, 1897
current of 25 amperes	19500	Blondel, 1897
current of 250 amperes	30000	Rey & Blondel, 1902
Flaming arc	4000	
Flames, candle	0.4–0.6	
petroleum lamp, round wick	3.3	Stockhausen, 1910
petroleum lamp, flat wick	.67	Stockhausen, 1910
gas, argand burner	1.14	Stockhausen, 1910
acetylene, flat flame	5.6	Stockhausen, 1910
Incandescent electric:		
filament of carbon (3.3 watts per candle)	75.	Blondel, 1911
filament of tungsten (1.2 watts per candle)	150.	Blondel, 1911
Nernst	350–470	Ives & Luckiesch, '11
Gas mantle	4.8–6.7	Ives & Luckiesch
Mercury arc	2.5	Ives & Luckiesch
Moon	0.4	Pickering, 1908
Star (Algol)	840000	Nordmann, 1910
Sun at zenith	160000	Palaz, 1893

WAVE LENGTHS OF VARIOUS RADIATIONS

	Microns
Röntgen (X) rays	0.0001
Shortest ultra-violet radiation	0.051
Shortest ultra-violet radiation in the solar spectrum (limited by atmospheric absorption)	0.292
Limit of the visible spectrum	0.390
Violet, wave length best representing the color	0.410
Wave lengths included	0.390–0.422
Blue, representative	0.470
Includes	0.422–0.492
Green, representative	0.520
Includes	0.492–0.535
Maximum visual intensity, about	0.535
Yellow, representative	0.580
Includes	0.535–0.586
Orange, representative	0.600
Includes	0.586–0.647
Red, representative	0.650
Includes	0.647–0.810
Limit of the visible spectrum	0.810
Limit of the solar spectrum	5.300
Infra-red (heat waves)	
Includes	0.810–314.00
Shortest measured Hertzian wave	4000.
Used for wireless telegraphy	100–5000 meters

VARIATION IN THE SENSITIVENESS OF THE EYE WITH THE WAVE LENGTH

FOR LOW INTENSITIES

(König.)

Wave length...	.410	.430	.450	.470	.490	.510	.530	.550	.570	.590	.610
Mean sensitiveness........	0.02	0.06	0.23	0.49	0.81	1.00	0.81	0.49	0.22	0.077	0.026

WAVE LENGTHS OF THE FRAUNHOFER LINES

SUN'S SPECTRUM

At 15° C. and 76 cm. pressure. Wave length in microns (Fabry and Buisson system).

Line.	Due to	Wave length in Microns.	Line.	Due to	Wave length in microns.
U	Fe	2947.9	*h*	H	4101.9
t	Fe	2994.4	*g*	Ca	4226.7
T	Fe	3020.7	*G*	{ Ca	{ 4307.7
s	Fe	3047.6		{ Fe	{ 4307.9
	{ Fe	{ 3099.9	*G*	H	4340.5
S	{ Fe	{ 3100.0	*F*	H	4861.4
	{ Fe, Mn	{ 3100 3	b_4	Mg	5167.3
	{ Fe, Ti	{ 3100.7	b_2	Mg	5172.7
R	Ca	3179.3	b_1	Mg	5183.6
Q	Fe	3286.8	*E*	Fe	5269.6
P	Ti	3361.2	D_2	Na	5890.0
O	{ Fe	{ 3440.6	D_1	Na	5895.9
	{ Fe	{ 3441.0	*C*	H	6562.8
N	Fe	3581.2	*B*	O	6867.2
M	Fe	3719.9	*A*	O	7593.8
L	Fe, C	3820.4	*Z*	.....	8228.5
K	Ca	3933.7	*Y*	.....	8990.0
H	Ca	3968.5			

WAVE LENGTHS FOR SPECTROSCOPE CALIBRATION

Source.	Wave length.	Source.	Wave length.
Potassium flame..........	0.7699μ	*E*, solar.................	0.5270μ
Potassium flame..........	0.7666	b_1, solar or magnesium flame	0.5184
B, solar.................	0.6867	b_2, solar or magnesium flame	0.5173
Lithium flame............	0.6708	*F*, solar or hydrogen tube...	0.4867
C, solar or hydrogen tube..	0.6563	Strontium flame..........	0.4608
D_1, solar or sodium flame..	0.5896	*G*, solar or hydrogen tube...	0.4308
D_2, solar or sodium flame..	0.5893	H_1, solar................	0.3969
Thallium flame..........	0.5351	H_2, solar................	0.3934

WAVE LENGTH OF PRINCIPAL LINES OF VARIOUS ELEMENTS

Solids

Wave lengths of the most prominent lines in microns. The letters a, s and f after a wave length indicate its occurrence as a strong line in the arc, spark of flame spectrum respectively.

Aluminum	.3082	a, s	Caesium	.4555	a, f
	.3092	a, s		.4593	a, f
	.3587	s		.6723	a
	.3944	a, s		.6974	a
	.3961	a, s	Calcium	.3934	a, s
	.5697	s		.3969	a, s
	.5723	s		.4227	a, s, f
Antimony	.3268	s	Calcium chloride in the Bunsen flame also gives lines not due to calcium	.5517	
	.6005	s		.5543	
	.6079	s		.6181	
	.6130	s		.6202	
Arsenic	.2745	s		.6265	
	.2861	s	Cerium	.4012	s
	.3923	s		.4134	s
	.4037	s		.4150	s
Barium	.3891	s		.4165	s
	.4131	s		.4187	s
	.4554	a, s		.4297	s
	.4934	a, s		.4527	s
	.5535	a, s, f		.4628	s
	.5853	a, s		.5274	s
	.6141	a, s		.5353	s
	.6497	a, s	Chromium*	.4255	a, s
Barium chloride in the Bunsen flame gives other lines not due to barium	.5136			.4275	a, s
	.5242			.4290	a, s
	.5313			.4559	s
Bismuth	.3596	s		.4588	s
	.4723	a, s		.5205	a, s
	.4994	s		.5206	a, s
Cadmium	.3611	a, s		.5209	a, s
	.4678	a, s		.5410	a
	.4800	a, s	Cobalt†	.3846	a, s
	.5086	a, s		.3873	a, s
	.5338	s		.3894	a, s
	.5378	s		.4531	a
	.6439	a, s			

* More than twenty fairly prominent lines occur in the spark spectrum of chromium having wave lengths from .2763 to .3606μ.

† A large number of lines occur in the arc and spark spectrum of cobalt having wave lengths less than .3600 (ultraviolet).

WAVE LENGTH OF PRINCIPAL LINES OF VARIOUS ELEMENTS (Continued)

Solids (Continued)

Cobalt (Cont.)...	.4581	a
	.4780	a, s
	.4793	a, s
	.4814	a, s
	.4840	a, s
	.4868	a, s
Copper..........	.3248	a
	.3274	a
	.4023	a
	.4063	a
	.5106	a, s
	.5153	a, s
	.5218	a, s
	.5700	a
	.5782	a, s
Gold............	.2428	a, s
	.2676	a, s
	.2802	s
	.3898	s
	.4065	s
	.4315	s
	.6278	s
Iodine (spark) ...	.5159	
	.5244	
	.5339	
	.5349	
	.5408	
	.5448	
	.5471	
	.5631	
	.5686	
	.5716	
	.5741	
	.5766	
	.5781	
	.5961	
Iridium.........	.3606	s
	.3653	s
	.3675	s
	.3800	s
	.3903	s
	.4400	a, s
Iron*...........	.4046	a, s
	.4064	a, s
	.4071	a, s
	.4118	a
	.4132	a, s
	.4134	a
	.4143	a
	.4144	a, s
	.4187	a, s
	.4188	a, s
	.4191	a
	.4198	a, s
	.4199	a, s
	.4202	a, s
	.4227	a, s
	.4234	a, s
	.4236	a, s
	.4250	a, s
	.4251	a, s
	.4261	a, s
	.4272	a, s
	.4282	a, s
	.4294	a, s
	.4299	a, s
	.4308	a, s
	.4315	a
	.4326	a, s
	.4337	a
	.4384	a, s
	.4405	a, s
	.4415	a, s
	.4476	a
	.4528	a, s
	.4655	a, s
	.4736	a
	.4892	a
	.4921	a, s
	.4957	a, s
	.5139	a, s
	.5167	a, s
	.5192	a, s
	.5227	a, s
	.5233	a, s
	.5267	a, s
	.5270	a, s

* The ultraviolet spectrum of iron shows over 100 lines of intensity comparable with those listed above.

WAVE LENGTH OF PRINCIPAL LINES OF VARIOUS ELEMENTS (Continued)

Solids (Continued)

Iron (Cont.).....	.5284	a, s	Lithium (Cont.)..	.4602	a, s
	.5302	a, s		.6104	a
	.5324	a		.6708	a, s, f
	.5328	a	Mercury........	.2537	a
	.5372	a		.2967	a, s
	.5397	a		.3022	a
	.5406	a		.3023	s
	.5447	a		.3126	a, s
	.5455	a		.3132	a, s
	.5570	a		.3341	a, s
	.5573	a		.3650	a, s
	.5587	a		.3654	a, s
	.5616	a		.3663	a, s
	.5659	a		.3984	s
	.5763	a		.4046	a, s
	.5862	a		.4078	a, s
	.5930	a		.4358	a, s
	.6065	a		.5426	s
	.6137	a		.5461	a, s
	.6138	a		.5770	a, s
	.6192	a		.5791	a, s
	.6231	a		.5804	s
	.6253	a	Magnesium......	.2796	a, s
	.6302	a		.2803	a, s
	.6318	a		.2852	a, s, f
	.6337	a		.3097	a, f
	.6400	a		.3829	a, s, f
	.6495	a		.3832	a, s, f
	.6546	a		.3838	a, s, f
	.6593	a		.4481	s
Lead*..........	.3640	a, s		.5173	a, s
	.3684	a, s		.5183	a, s
	.3740	a, s	Manganese......	.3807	a, s
	.3786	s		.4031	a, s
	.3854	s		.4033	a
	.4058	a, s		.4035	a
	.4245	s		.4042	a
	.4387	s		.4754	a
	.5374	s		.4784	a
	.5547	s		.4824	a, s
	.5608	s		.6014	a, s
	.6657	s		.6017	a, s
Lithium.........	.4132	a		.6022	a, s

* The arc and spark spectra of lead include a large number of lines in the ultraviolet not given above.

WAVE LENGTH OF PRINCIPAL LINES OF VARIOUS ELEMENTS (Continued)

Solids (Continued)

Molybdenum	.3635	s
	.3688	s
	.3798	a, s
	.3864	a, s
	.3903	a, s
	.3961	s
	.5506	a, s
	.5533	a, s
	.5570	a, s
	.6030	s
Nickel	.4714	a, s
	.4855	a, s
	.4866	a, s
	.4873	s
	.5035	a, s
	.5081	a
	.5477	a
	.5893	s
Osmium	.3753	s
	.4067	s
	.4136	s
	.4212	s
	.4261	s
	.4294	s
	.4421	s
Platinum	.3687	s
	.3923	s
	.4552	s
	.5228	a, s
	.5301	s
	.5369	s
Potassium	.3447	a, s, f
	.4044	a, s, f
	.6911	a
	.6939	a
	.7665	a, s, f
	.7699	a, s, f
Radium	.3650	s
	.3815	s
	.4341	s
	.4436	s
	.4533	s
	.4683	s
Radium (Cont.)	.4826	s, f
	.5661	s
	.5814	s
band .6130–	.6330	f
	.6349	f
band .6530–	.6700	f
Rubidium	.4202	a, s, f
	.4215	a, s, f
	.6207	a, f
	.6298	a, s, f
	.7806	a, f
	.7811	a
	.7950	a, f
Selenium	.4606	s
	.4840	s
	.4842	s
	.4972	s
	.4993	s
	.5094	s
	.5142	s
	.5176	s
	.5225	s
	.5270	s
	.5305	s
Silicon	.2516	a, s
	.2881	a, s
Silver	.3281	a, s
	.3383	a, s
	.4055	a
	.4212	a
	.5209	a, s
	.5466	a, s
Sodium	.3302	a, s, f
	.3303	a, s, f
	.5683	a
	.5688	a
	.5890	a, s, f
	.5896	a, s, f
	.6154	a
	.6161	a
Strontium	.4078	a, s
	.4216	a, s
	.4607	a, s, f

WAVE LENGTH OF PRINCIPAL LINES OF VARIOUS ELEMENTS (Continued)

Solids (Continued)

Strontium compounds, chloride, nitrate, etc., give other bands not due to strontium	.6032		Tin	.3801	s
	.6060			.4525	a, s
	.6351			.5564	s
	.6464			.5589	s
	.6597			.5632	a, s
	.6664			.5799	s
	.6694			.6453	s
Sulphur	.4465	s	Tungsten	.4843	s
	.4486	s		.5059	s
	.4525	s		.5224	s
	.4552	s		.5514	s
	.5021	s	Uranium	.5478	s
	.5033	s		.5480	s
	.5201	s		.5482	s
	.5215	s		.5494	s
	.5320	s		.5528	s
	.5343	s	Zinc	.3345	a, s
	.5605	s		.4680	a, s
	.5640	s		.4722	a, s
	.6290	s		.4811	a, s
Tantalum	.3906	s		.4912	s
	.4059	s		.4925	s
	.4080	s		.6103	s
	.4101	s		.6362	a, s
	.4124	s	Zirconium	.3958	a, s
Thallium	.2918	a		.3982	a
	.3230	a		.3991	a, s
	.3519	a, s		.3999	s
	.3529	a		.4049	a, s
	.3776	a, s, f		.4073	a
	.4737	s		.4081	a
	.5351	a, s, f		.4149	a, s
Thorium	.3221	s		.4156	a, s
	.3272	s		.4161	a, s
	.3291	s		.4360	a, s
	.3301	s		.4371	a, s
	.3314	s		.4380	a, s
	.3508	s		.4443	s
	.3539	s		.4494	s
	.4019	s		.4497	a, s
	.4382	s		.4688	s
	.4391	s		.4710	s
	.4555	s		.4739	s
				.4772	s
				.4816	s
				.6128	s
				.6142	s

WAVE LENGTH OF PRINCIPAL LINES OF VARIOUS ELEMENTS (Continued)

Gases

Air (spark) line due to	N .3995	Bromine..........	.4785
	N .4447		.5332
	N .4631		.6150
	O .4642		.6351
	N .4643	Chlorine, Plücker tube.............	
	.5001		.3851
	N .5005		.3861
	N .5679		.4133
Argon, Plücker tube (blue spectrum)...			.4253
	.3491		.4344
	.3560		.4794
	.3589		.4810
	.3638		.4819
	.3729		.5423
	.3850		
	.4072	Helium...........	.3188
	.4104		.3888
	.4228		.4026
	.4331		.4471
	.4348		.5016
	.4426		.5876
	.4430		.6678
	.4806	Hydrogen.........	.4102
(red spectrum)...	.4158		.4341
	.4191		.4861
	.4198		.6563
	.4200	Nitrogen..........	See air
	.4259		
	.4511	Oxygen...........	See air
	.6965		
	.7067		

RELATIVE STIMULATION OF THE THREE PRIMARY COLOR SENSATIONS BY DIFFERENT WAVE LENGTHS

Wave length...	0.36μ	0.38	0.40	0.42	0.44	0.46	0.48	0.50	0.52	0.54
Red......	0.0	0.0	2.0	1.0	1.0	1.0	3.0	9.0	23.0	39.0
Green....	0.0	0.0	0.0	0.0	0.0	2.0	7.0	23.0	61.0	87.0
Blue......	0.0	10.5	29.0	52.0	76.0	78.0	68.0	46.0	16.0	7.0

Wave length...	0.56μ	0.58	0.60	0.62	0.64	0.66	0.68	0.70	0.72	0.74
Red......	56.0	69.0	71.5	59.0	30.0	12.0	5.0	2.0	1.0	0.0
Green....	86 0	67.0	37.0	10.0	2.5	1.0	0.0	0.0	0.0	0.0
Blue......	4.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

INDEX OF REFRACTION OF OPTICALLY ISOTROPIC SOLIDS

(From Smithsonian Tables.)

Substance.	Line of spectrum.	Index of refraction.	Observer.
Agate (light color)	red	1.537	De Senarmont
Ammonium chloride	*D*	1.642	Grailich
Arsenite	*D*	1.755	DesCloiseaux
Barium nitrate	*D*	1.572	Fock
Bell metal	*D*	1.005	Beer
Blende	*Li*	2.342	Ramsay
Blende	*Na*	2.369	Ramsay
Blende	*Tl*	2.401	Ramsay
Boric acid	*C*	1.462	Bedson & C. Williams
Boric acid	*D*	1.463	Bedson & C. Williams
Boric acid	*F*	1.470	Bedson & C. Williams
Borax (vitrified)	*C*	1.512	Bedson & C. Williams
Borax (vitrified)	*D*	1.515	Bedson & C. Williams
Borax (vitrified)	*F*	1.521	Bedson & C. Williams
Camphor	*D*	1.532	Kohlrausch
Camphor	*D*	1.546	Mülheims
Diamond (colorless)	red	2.414	DesCloiseaux
Diamond (colorless)	green	2.428	DesCloiseaux
Diamond (brown)	*B*	2.461	Schrauf
Diamond (brown)	*D*	2.470	Schrauf
Diamond (brown)	*E*	2.479	Schrauf
Ebonite	*D*	1.6	Ayrton & Perry
Fuchsin	*A*	2.03	Means
Fuchsin	*B*	2.19	Means
Fuchsin	*C*	2.33	Means
Fuchsin	*G*	1.97	Means
Fuchsin	*H*	1.32	Means
Garnet (different varieties)	*D*	1.74–1.90	Various
Gum arabic	red	1.480	Jamin
Gum arabic	red	1.514	Wollaston
Hanyne	*D*	1.496	Tschichatscheff
Helvine	*D*	1.739	Levy & Lecroix
Obsidian	*D*	1.482–1.496	Various
Opal	*D*	1.406	Various
Opal	*D*	1.450	Various
Pitch	red	1.531	Wollaston
Potassium bromide	*D*	1.559	Topsöe and Christiansen
chlorstannate	*D*	1.657	Topsöe and Christiansen
iodide	*D*	1.667	Topsöe and Christiansen
Phosphorus	*D*	2.144	Gladstone & Dale

INDEX OF REFRACTION OF OPTICALLY ISOTROPIC SOLIDS (Continued)

Substance.	Line of spectrum.	Index of refraction.	Observer.
Resins: aloes	red	1.619	Jamin
Canada balsam	red	1.528	Wollaston
colophony	red	1.548	Jamin
copal	red	1.528	Jamin
mastic	red	1.535	Wollaston
Peru balsam	*D*	1.593	Baden Powell
Selenium, vitreous	*A*	2.612	Wood
Selenium, vitreous	*B*	2.680	Wood
Selenium, vitreous	*C*	2.729	Wood
Selenium, vitreous	*D*	2.93	Wood
Silver bromide	*D*	2.253	Wernicke
chloride	*D*	2.061	Wernicke
iodide	*D*	2.182	Wernicke
Sodalite, blue	*D*	1.483	Feusner
Sodalite, clear like water	*D*	1.483	Feusner
Sodium chlorate	*D*	1.515	Dussaud
Spinel	*D*	1.716	DesCloiseaux
Strontium nitrate	*D*	1.567	Fock

INDEX OF REFRACTION OF UNIAXIAL CRYSTALS

Substance.		Index of refraction.			
		Line of spectrum.	Ordinary ray.	Extra-ordinary ray.	Observer.
Alunite (alum stone)		*D*	1.573	1.592	Levy & Lacroix
Apatite		*D*	1.639	1.635	Schrauf
Beryl	from	*D*	1.589	1.582	Various
	to	*D*	1.570	1.566	Various
Calomel		red	1.96	2.60	De Senarmont
Cinnabar		red	2.854	3.199	DesCloiseaux
Corundum (ruby, sapphire, etc.)	from	red	1.767	1.759	DesCloiseaux
	to	red	1.769	1.762	DesCloiseaux
Emerald (pure)		green	1.584	1.578	DesCloiseaux
Ice at −8° C.		*D*	1.309	1.313	Meyer
Ivory		*D*	1.539	1.541	Kohlrausch
Sodium nitrate		*D*	1.587	1.336	Schrauf
Tourmaline (colorless)		*D*	1.637	1.619	Heusser
Tourmaline (differ- ferent colors)	from	*D*	1.633	1.616	Jeroféjew
	to	*D*	1.650	1.625	Jeroféjew

INDEX OF REFRACTION OF BIAXIAL CRYSTALS

Substances.	Index of refraction.				
	Line of spectrum.	Minimum.	Intermediate.	Maximum.	Observer.
Borax	*D*	1.447	1.469	1.472	Dufet
Copper sulphate	*D*	1.514	1.537	1.543	Kohlrausch
Gypsum	*D*	1.521	1.523	1.530	Mülheims
Mica (muscovite)	*D*	1.560	1.594	1.598	Pulfrich
Potassium bichromate	*D*	1.720	1.738	1.820	Dufet
nitrate	*D*	1.335	1.506	1.506	Schrauf
sulphate	*D*	1.493	1.495	1.498	Topsöe & Christiansen
Sugar (cane)	*D*	1.540	1.567	1.572	Calderon
Sulphur (rhombic)	*D*	1.951	2.038	2.241	Schrauf
Topaz (Brazilian)	*D*	1.629	1.631	1.638	Mülheims

INDEX OF REFRACTION OF GLASS

RELATIVE TO AIR

Variety.	Wave length in microns.							
	.361	.434	.486	.589 (Na)	.656	.768	1.20	2.00
Zinc crown	1.539	1.528	1.523	1.517	1.514	1.511	1.505	1.497
Higher dispersion crown	1.546	1.533	1.527	1.520	1.517	1.514	1.507	1.497
Light flint	1.614	1.594	1.585	1.575	1.571	1.567	1.559	1.549
Heavy flint	1.705	1.675	1.664	1.650	1.644	1.638	1.628	1.617
Heaviest flint	....	1.945	1.919	1.890	1.879	1.867	1.848	1.832

INDEX OF REFRACTION OF ROCK SALT, SILVINE, CALCITE, FLUORITE AND QUARTZ

(Compiled from data of Martens, Paschen, and others.)

Wave length.	Rock salt.	Silvine, KCl.	Fluorite.	Calcspar, ordinary ray.	Calcspar, extraordinary ray.	Quartz, ordinary ray.	Quartz, extraordinary ray.
0.185	1.893	1.827	......	......	......	1.676	1.690
0.198	.....	......	1.496	......	1.578	1.651	1.664
0.340	.....	......	......	1.701	1.506	1.567	1.577
0.589	1.544	1.490	1.434	1.658	1.486	1.544	1.553
0.760	.....	......	1.431	1.650	1.483	1.539	1.548
0.884	1.534	1.481	1.430				
1.179	1.530	1.478	1.428				
1.229	.....	......	......	1.639	1.479		
2.324	.....	......	......	......	1.474	1.516	
2.357	1.526	1.475	1.421				
3.536	1.523	1.473	1.414				
5.893	1.516	1.469	1.387				
8.840	1.502	1.461	1.331				

INDEX OF REFRACTION, LIQUIDS

(From Smithsonian Tables.)

Substance.	Temp. °C.	Index of refraction for spectrum lines.				Observer.
		C	*D*	*F*	*H*	
Acetone	10.	1.363	1.365	1.369	...	Korten
Almond oil	0	1.476	1.478	1.485	...	Olds
Anilin	20.	1.599	1.586	1.604	...	Weegman
Aniseed oil	21.4	1.541	1.548	1.565	...	Willigen
Aniseed oil	15.1	1.551	1.557	1.574	1.608	Baden Powell
Benzene	10	1.498	1.503	1.515	1.536	Gladstone
Benzene	21.5	1.493	1.498	1.510	1.530	Gladstone
Bitter almond oil	20	1.539	...	1.562	...	Landolt
Bromnaphthalin	20	1.650	1.658	1.682	1.729	Walter
Carbon disulphide	0	1.634	1.643	1.669	1.718	Ketteler
Carbon disulphide	20	1.618	1.628	1.652	1.699	Ketteler
Carbon disulphide	10	1.625	1.634	1.659	1.708	Gladstone
Carbon disulphide	19	1.619	1.628	1.635	1.701	Dufet
Cassia oil	10	1.601	1.610	1.639	1.704	Baden Powell
Cassia oil	22.5	1.593	1.603	1.631	1.699	Baden Powell
Cedar oil	22	...	1.515	...	...	Texier
Chinolin	20	1.609	1.617	1.636	...	Gladstone
Chloroform	10	1.447	1.449	1.456	1.461	Gladstone & Dale
Chloroform	30	...	1.440	...	1.456	Gladstone & Dale
Chloroform	20	1.444	1.446	1.453	...	Lorenz
Cinnamon oil	23.5	1.608	1.619	1.651	...	Willigen
Ether	15	1.355	1.357	1.361	1.368	Gladstone & Dale
Ether	15	1.357	1.359	1.364	1.371	Kundt
Ethyl alcohol	0	1.368	1.369	1.374	...	Korten
Ethyl alcohol	10	1.364	1.365	1.370	...	Korten
Ethyl alcohol	20	1.360	1.361	1.366	...	Korten
Ethyl alcohol	15	1.362	1.364	1.368	1.375	Gladstone & Dale
Glycerine	20	1.471	...	1.478	...	Landolt
Methyl alcohol	15	1.331	1.333	1.336	1.342	Baden Powell
Olive oil	0	1.474	1.476	1.483	...	Olds
Rock oil	0	1.435	1.457	1.464	...	Olds
Turpentine oil	10.6	1.472	1.474	1.481	1.494	Frauenhofer
Turpentine oil	20.7	1.469	1.472	1.479	1.491	Willigen
Toluene	20	1.491	1.496	1.507	...	Bruhl
Water	20	1.331	1.333	1.337	1.344	Means

DISPERSION

The dispersion for various types of optical glass is shown in the following table. n_D = index of refraction for the *D* line (of the solar spectrum) and n_F and n_C the index for the *F* and *C* lines respectively $(n_F - n_D)$ shows the dispersion for these two wave lengths.

Glass.	n_D	$(n_F - n_C)$
Light phosphate crown	1.5159	.00737
Barium-silicate crown	1.5399	.00909
High-dispersion crown	1.5262	.01026
Borate flint	1.5686	.01102
Extra light flint	1.5398	.01142
Heavy flint	1.7174	.02434
Heaviest flint	1.9626	.04882

INDEX OF REFRACTION, AQUEOUS SOLUTIONS

Substance.	Density.	Temp. °C.	Index for λ = .5893 (Na)	Observer.
Ammonium chloride	1.067	27.05	1.379	Willigen
Ammonium chloride	1.025	29.75	1.351	Willigen
Calcium chloride	1.398	25.65	1.443	Willigen
Calcium chloride	1.215	22.9	1.397	Willigen
Calcium chloride	1.143	25.8	1.374	Willigen
Hydrochloric acid	1.166	20.75	1.411	Willigen
Nitric acid	1.359	18.75	1.402	Willigen
Potash (caustic)	1.416	11.0	1.403	Frauenhofer
Potassium chloride	Normal	solution	1.343	Bender
Potassium chloride	Double	normal	1.352	Bender
Potassium chloride	Triple	normal	1.360	Bender
Soda (caustic)	1.376	21.6	1.413	Willigen
Sodium chloride	1.189	18.07	1.378	Schutt
Sodium chloride	1.109	18.07	1.360	Schutt
Sodium chloride	1.035	18.07	1.342	Schutt
Sodium nitrate	1.358	22.8	1.385	Willigen
Sulphuric acid	1.811	18.3	1.437	Willigen
Sulphuric acid	1.632	18.3	1.425	Willigen
Sulphuric acid	1.221	18.3	1.370	Willigen
Sulphuric acid	1.028	18.3	1.339	Willigen
Zinc chloride	1.359	26.6	1.402	Willigen
Zinc chloride	1.209	26.4	1.375	Willigen

INDEX OF REFRACTION OF METALS

For Sodium Light

(Drude.)

Metal.	Index of refraction.	Metal.	Index of refraction.
Aluminum	1.44	Mercury	1.73
Antimony	3.04	Nickel	1.79
Bismuth	1.90	Platinum	2.06
Cadmium	1.13	Silver	0.181
Copper	0.641	Steel	2.41
Gold	0.366	Tin, solid	1.48
Iron	2.36	Tin, fluid	2.10
Lead	2.01	Zinc	2.12
Magnesium	0.37		

DIFFUSED REFLECTION (ALBEDO)

Ratio of total quantity of light reflected by a surface to the total incident light.

White pinewood	0.40	Blotting paper, white	0.70–.80
Paper, ordinary white	.60–.70	blue	.25
Black velvet	.004	yellow	.40
Snow	.78	Earth, moist	.08

INDEX OF REFRACTION, GASES

Values are relative to a vacuum and for a temp. of 0° C. and 760 mm. pressure.

(From Smithsonian Tables.)

Substance.	Kind of light.	Indices of refraction.	Observer.
Acetone	*D*	1.001079–1.001100	
Air	*D*	1.0002926	Perreau
Ammonia	white	1.000381–1.000385	
Ammonia	*D*	1.000373–1.000379	
Argon	*D*	1.000281	Rayleigh
Benzene	*D*	1.001700–1.001823	
Bromine	*D*	1.001132	Mascart
Carbon dioxide	white	1.000449–1.000450	
dioxide	*D*	1.000448–1.000454	
disulphide	white	1.001500	Dulong
disulphide	*D*	1.001478–1.001485	
monoxide	white	1.000340	Dulong
monoxide	white	1.000335	Mascart
Chlorine	white	1.000772	Dulong
Chlorine	*D*	1.000773	Mascart
Chloroform	*D*	1.001436–1.001464	
Cyanogen	white	1.000834	Dulong
Cyanogen	*D*	1.000784–1.000825	
Ethyl alcohol	*D*	1.000871–1.000885	
ether	*D*	1.001521–1.001544	
Helium	*D*	1.000036	Ramsay
Hydrochloric acid	white	1.000449	Mascart
Hydrochloric acid	*D*	1.000447	Mascart
Hydrogen	white	1.000138–1.000143	
Hydrogen	*D*	1.000132	Burton
sulphide	*D*	1.000644	Dulong
sulphide	*D*	1.000623	Mascart
Methane	white	1.000443	Dulong
Methane	*D*	1.000444	Mascart
Methyl alcohol	*D*	1.000549–1.000623	
Methyl ether	*D*	1.000891	Mascart
Nitric oxide	white	1.000303	Dulong
Nitric oxide	*D*	1.000297	Mascart
Nitrogen	white	1.000295–1.000300	
Nitrogen	*D*	1.000296–1.000298	
Nitrous oxide	white	1.000503–1.000507	
Nitrous oxide	*D*	1.000516	Mascart
Oxygen	white	1.000272–1.000280	
Oxygen	*D*	1.000271–1.000272	
Pentane	*D*	1.001711	Mascart
Sulphur dioxide	white	1.000665	Dulong
Sulphur dioxide	*D*	1.000686	Ketteler
Water	white	1.000261	Jamin
Water	*D*	1.000249–1.000259	

COEFFICIENT OF TRANSPARENCY OF UVIOL GLASS FOR THE ULTRA-VIOLET

For a thickness of 1 mm.

Wave length, microns	0.280	0.309	0.325	0.346	0.361	0.383	0.397
Uviol crown	0.56	0.95	0.990	0.996	0.999	1.000	1.000

REFLECTION OF LIGHT BY GLASS IN AIR

The table gives the per cent of the incident light which is reflected from the surface of glass in air assuming an index of refraction of 1.55; *i* represents the angle of incidence and *R* the per cent of light reflected.

(Computed according to Fresnel's formula, see page 223.)

i	*R*	*i*	*R*	*i*	*R*
0°	4.65				
5	4.65	35°	4.98	65°	12.91
10	4.66	40	5.26	70	18.00
15	4.66	45	5.73	75	26.19
20	4.68	50	6.50	80	39.54
25	4.73	55	7.74	85	61.77
30	4.82	60	9.73	90	100.

REFLECTION BY TRANSPARENT MEDIA IN AIR

For Normal Incidence

The table gives the per cent of the normally incident light which is reflected by transparent media of various indices of refraction. n = index of refraction, R = reflected light, i = angle of incidence = 0.

(Computed from Fresnel's formula.)

n	*R*	*n*	*R*	*n*	*R*
1.0	0.00	1.7	6.72	2.4	17.0
1.1	0.23	1.8	8.16	2.5	18.4
1.2	0.83	1.9	9.63	2.6	19.8
1.3	1.70	2.0	11.11	2.7	21.1
1.4	2.78	2.1	12.6	2.8	22.5
1.5	4.00	2.2	14.1	2.9	23.8
1.6	5.33	2.3	15.5	3.0	25.0

COEFFICIENT OF TRANSPARENCY OF GLASS FOR THE INFRA-RED

Normal incidence. thickness 1 cm.

Wave length, microns....	0.7	1.1	1.7	2.3	2.7	3.1
Crown, borate..........	1.00	.55	.21	.025	.04	
borosilicate...........	...	.74	.61	.33	.034	.021
Flint, light............	1.00	.91	.82	.45	.083	.019
heavy..............	1.00	1.00	1.00	1.00	.45	.019

REFLECTION OF LIGHT BY METALS

The table gives the per cent of normally incident light which is reflected by the polished surface of various metals.

Wave length.	Antimony.	Bronze (68Cu, 68Sn).	Copper, commercial.	Gold, electrolytic.	Iron.	Magnalium, Mach's.	Magnesium.	Mercury, backed glass.
.251	....	.30	25.9	38.8	....	67.0		
.288	....	....	24.3	34.0	....	70.6		
.305	....	....	25.3	31.8	....	72.2		
.326	....	....	24.9	28.6	....	75.5		
.357	....	....	27.3	27.9	....	81.2		
.385	....	.53	28.6	27.1	....	83.9		
.420	....	....	32.7	29.3	....	83.3		
.450	....	....	37.0	33.1	....	83.4	....	72.8
.500	....	.63	43.7	47.0	.55	83.3	.72	70.9
.550	....	....	47.7	74.0	....	82.7	....	71.2
.600	.53	.64	71.8	84.4	.57	83.0	.73	69.9
.650	....	....	80.0	88.9	....	82.7	....	71.5
.700	....	....	83.1	92.3	.59	83.3	....	72.8
.800	....	....	88.6	94.9	....	84.3		
1.00	.55	.70	90.1	......	.65	84.1	.74	
2.0	.60	.80	95.5	96.8	.78	86.7	.77	
3.0	.65	.86	97.1	......	.84	87.4	.80	
4.0	.68	.88	97.3	96.9	.89	88.7	.83	
9.0	.72	.93	98.4	98.0	.94	90.6	.93	

Wave length.	Nickel, electrolytic.	Platinum, electrolytic.	Silver, chemically deposited.	Silver-backed glass.	Speculum metal.	Steel.	Tungsten.
.251	37.8	33.8	34.1	......	29.9	32.9	
.288	42.7	38.8	21.2	......	37.7	35.0	
.305	44.2	39.8	9.1	......	41.7	37.2	
.326	45.2	41.4	14.6	......	......	40.3	
.357	48.8	43.4	74.5	......	51.0	45.0	
.385	49.6	45.4	81.4	......	53.1	47.8	
.420	56.6	51.8	86.6	......	56.4	51.9	
.450	59.4	54.7	90.5	85.7	60.0	54.4	
.500	60.8	58.4	91.3	86.6	63.2	54.8	.49
.550	62.6	61.1	92.7	88.2	64.0	54.9	
.600	64.9	64.2	92.6	88.1	64.3	55.4	.51
.650	66.6	66.5	94.7	89.1	65.4	56.4	
.700	68.8	69.0	95.4	89.6	66.8	57.6	.54
.800	69.6	70.3	96.8	......	......	58.0	
1.00	72.0	72.9	97.0	......	70.5	63.1	.62
2.0	83.5	80.6	97.8	......	80.4	76.7	.85
3.0	88.7	88.8	98.1	......	86.2	83.0	.90
4.0	91.1	91.5	98.5	......	88.5	87.8	.93
9.0	95.6	95.4	98.7	......	92.2	92.9	.95

TRANSMISSIBILITY FOR RADIATIONS

Ratio of the transmitted light to the incident light for a definite thickness of the substance, usually 1 cm.

GLASS.

Glass in general is opaque to the ultra-violet and infra-red. Uviol glass is transparent to the longer radiations of the ultra-violet.

Coefficient of transparency of glass for visible and ultra-violet radiations.

	Normal incidence, thickness 1 cm.								
Wave length microns.......	0.309	0.330	0.347	0.357	0.361	0.375	0.384	0.388	0.396
Crown, ordinary..	...	...	...	...	...	.947			
Crown, borosilicate..........	0.08	0.65	0.88	...	0.95	...	0.972	0.975	0.986
Flint, ordinary...	...	...	...	0.72	...	...	...	0.904	
Flint, heavy.....	...	...	0.01	...	0.16	...	0.58		

	Normal incidence, thickness 1 cm.								
Wave length, microns.......	0.400	0.415	0.419	0.425	0.434	0.455	0.500	0.580	0.677
Crown, ordinary..	0.964	...	0.952	...	0.960	0.981	...	0.986	0.990
Crown, borosilicate..........	...	0.985	...	0.993	...	...	0.993		
Flint, ordinary...	...	0.959	...	...	...	...	1.00		
Flint, heavy.....	...	...	...	0.905					

See also pp. 175 and 176.

QUARTZ

Quartz is very transparent to the ultra-violet and to the visible spectrum, but opaque for the infra-red beyond 7.0μ.

(Pflüger.)

Wave length, microns...........	0.19	0.20	0.21	0.22
Transmission for 1 mm..........	.67	.84	.92	.94

FLUORITE

Fluorite is very transparent to the ultra-violet, nearly to 0.10μ. Coefficient of transparency at $\lambda = 186$ is found by Pflüger to be 0.80.

For the infra-red the values are given in a table below.

TRANSMISSIBILITY FOR RADIATIONS (Continued)

Rock Salt and Sylvine and Fluorite

Transparency for the Infra-red.

Thickness 1 cm.

Wave length, microns.	Rock salt.	Sylvine KCl.	Fluorite.
8.	....	....	.844
9.	0.995	1.000	.543
10.	.995	.988	.164
12.	.993	.995	.010
14.	.931	.975	.000
16.	.661	.936	
18.	.275	.862	
19.	.096	.758	
20.7	.006	.585	
23.7	.000	.155	

PHOSPHORESENCE BY CATHODE RAYS

Substances Luminous under Excitation by Cathode Rays.

Substance (with calcium oxide).	Wave lengths of principal bands in microns. (Urbain, 1909.)
Dysprosium oxide........	0.480, 0.489, 0.585, 0.675
Europium oxide.........	0.416–0.426, 0.469
Europium oxide.........	0.589–0.593, 0.613, 0.625
Neodymium oxide........	0.392, 0.419–0.429, 0.458
Praesodymium oxide.....	0.488, 0.604, 0.606, 0.626, 0.634

One part.	100 parts.	Wave length.	Color.	Observer.
Antimony oxide..	calcium oxide	0.560	yellow	Bruninghaus, 1910
Antimony trisulphide.........	calcium sulphide	0.569	yellow	Bruninghaus, 1910
Bismuth oxide...	calcium oxide	0.522	blue	Bruninghaus, 1910
Bismuth sulphate.	calcium sulphate	0.640	red	Bruninghaus, 1910
Manganous carbonate........	magnesium carbonate	0.620	red	Bruninghaus, 1910
oxide.........	calcium oxide	0.589	yellow	Lecoq & Boisbaudran, 1886
phosphate.....	calcium phosphate $Ca_3(PO_4)_2$	0.633	red	Bruninghaus, 1910
sulphate.......	calcium sulphate	0.540	green	Lecoq & Boisbaudran, 1886
sulphide.......	calcium sulphide	0.589	yellow	Bruninghaus, 1910

FLUORESCENCE OF ORGANIC SUBSTANCES IN SOLUTION

Excitation by White Light.

Substance.	Solvent.	Wave length microns.	Observer.
Anthracene......	alcohol	0.400 0.430 0.436	Stark & Meyer, 1907
Eosine..........	alcohol or water	0.589	Nichols & Merritt, 1907
Esculine.........	alcohol	0.460	Nichols & Merritt, 1907
Fluorescein......	water (alkaline)	0.542	Nichols & Merritt, 1907
Naphthalin, red..	alcohol	0.632	Nichols & Merritt, 1907
Quinine sulphate.	water	0.437	Nichols & Merritt, 1907
Resorcin blue....	water	0.65	Nichols & Merritt, 1907
Rhodamin.......	water	0.554	Nichols & Merritt, 1907

FLUORESCENCE

Gases and Vapors.

Gas or vapor.	Condition.	Excitation.	Color or wave length of emitted light.	Observer.
Iodine...	Vapor at ordinary temperature.	Mercury arc $\lambda = .546\mu$	Strongest bands $\lambda = .5460\mu$, $.5774\mu$ .5730, .5796	Wood, 1911
Mercury .	Vapor at ordinary temperature	Spark between aluminum electrodes	Broad band $\lambda = .5900-.3000$	Wood, 1909
Oxygen ..	....	Mercury arc in quartz tube	Strongest lines $\lambda = .1849$, .1851 (ultra-violet)	Streubing, 1910
Potassium	Vapor, 300°–400° C.	White light	Many strong lines from .6416–.6768, strongest .6544 and .6584	Wood & Carter, 1908
Rubidium	Vapor, at 270° C.	White light (elec. arc)	Strong red band $\lambda = .6900-.6620$.	Dunoyer, 1912
Sodium ..	Vapor at 350° C.	White light (elec. arc)	D, $\lambda = .5893$ (mean)	Dunoyer, 1912

SPECIFIC ROTATION

The tables give the specific rotation in degrees for one decimeter; + signifies right-handed rotation, − left. Rotation is for sodium light.

Liquids

Liquid.	Temp. ° C.	Specific Rotation. Degrees.	Observer.
Amyl alcohol.....	....	−5.7	Le Bel
Camphor..........	204	+70.33	Gernez
Cedar oil..........	15	−30 to −40	
Citron oil..........	15	+62	
Menthol..........	35.2	−49.7	Paterson & Taylor
Nicotine..........	22.7	+150.0	Molby
Oil of turpentine...	15	−20 to −40	

Solutions

Giving the rotation for one decimeter, for one gram of active substance in one cubic centimeter of solution.

Active substance.	Solvent.	Temp. ° C.	Spec. rot.	Observer.
Albumen, egg...	water	....	−25 to −38	
Camphor.......	ether	....	+57.	Darmois, 1910
Dextrose (β)....	water	15	+52.5	Tanret, 1896
Glucose (β).....	water	20	+51.4	
Lactose........	water	15	56.	
Maltose........	water	20	+136.9	
Quinine sulphate	alcohol	17	−57.5	Oudemans, 1876
Sugar cane.....	water	20	66.5	
Tartaric acid....	water	20	+13.44	Wendel, 1898

Solids

(Rotation per millimeter.)

Substance.	Rotation.	Substance.	Rotation.
Cinnabar (HgS).....	32.5	Quartz..............	21.7
Lead hyposulphate.	5.5	Sodium bromate...	2.8
Potassium " .	8.4	Sodium chlorate...	3.13

MAGNETO OPTIC ROTATION

$$\text{Verdet's Constant: } \rho = \frac{\alpha}{tH \cos \theta}$$

The specific power of magnetic rotation ρ, is expressed in the above formula, where α is the total angle of rotation in minutes, t the thickness of the substance in centimeters, H the magnetic field intensity in gausses and θ the angle between the direction of the magnetic field and the path of light.

Solids

For sodium light.
(Values from the Smithsonian Tables.)

Substance.	Temp. ° C.	Verdet's Constant, Minutes.	Observer.
Amber	18–20	0.0095	Quincke
Blende	15	0.2234	Becquerel
Diamond	15	0.0127	Becquerel
Fluorspar	15	0.0087	Becquerel
Glass, crown	15	0.0203	Becquerel
flint	18–20	0.0420	Quincke
flint, dense	15	0.0647	Becquerel
Quartz (⊥ to axis)	18–20	0.0172	Quincke
Rock salt	15	0.0355	Becquerel
Selenium	15	0.4625	Becquerel
Sylvine	15	0.0283	Becquerel

Liquids

For sodium light.

Substance.	Density $g/cm.^3$	Temp. ° C.	Verdet's Constant, minutes.	Observer.
Acetone	0.7947	20	0.0113	Jahn
Acids: (see also solutions in water) acetic	1.0561	21	0.0105	Perkin
hydrochloric	1.2072	15	0.0224	Perkin
hydrobromic	1.7859	15	0.0343	Perkin
nitric	1.5190	13	0.0070	Perkin
sulphuric	......	15	0.0121	Becquerel
sulphurous	......	15	0.0153	Becquerel
Alcohols: amyl	......	15	0.0131	Becquerel
ethyl	0.7929	18–20	0.0107	Quincke
methyl	0.7915	18–20	0.0094	Quincke
Benzine	0.8796	20	0.0297	Jahn
Carbon disulphide	1.2644	18–20	0.0441	Quincke
Chloroform	1.4	20	0.0164	Jahn
Phosphorus (melted)	....	33	0.1316	Becquerel
Sulphur (melted)	....	114	0.0803	Becquerel
Toluene	....	28.4	0.0269	Becquerel
Water	....	18–20	0.0130	Schönrock
Xylene	....	15	0.0221	Becquerel
Zinc bichloride	....	15	0.0437	Becquerel

MAGNETO OPTIC ROTATION (Continued)

Aqueous Solutions

For sodium light.

Salt.	Density, g/cm³.	Temp. ° C.	Verdet's constant, minutes.	Observer.
Acids: hydrochloric	1.1856	15	0.0219	Perkin
hydrochloric	1.1279	15	0.0193	Perkin
hydrochloric	1.0323	20	0.0150	Jahn
nitric	1.3560	20	0.0105	Perkin
Ammonia	0.8918	15	0.0153	Perkin
Bromides: barium	1.5399	20	0.0215	Jahn
potassium	1.1424	20	0.0163	Jahn
sodium	1.1351	20	0.0165	Jahn
Carbonate of potassium	1.1960	20	0.0140	Jahn
Carbonate of sodium	1.1006	20	0.0140	Jahn
Chlorides: barium	1.2897	20	0.0168	Jahn
cadmium	1.3179	20	0.0185	Jahn
calcium	1.1504	20	0.0165	Jahn
iron (ferrous)	1.4331	15	0.0025	Becquerel
iron (ferric)	1.6933	15	−0.2026	Becquerel
lithium	1.0619	20	0.0145	Jahn
mercury	1.0381	16	0.0137	Schönrock
potassium	1.6000	15	0.0163	Becquerel
sodium	1.2051	15	0.0180	Becquerel
zinc	1.2851	15	0.0196	Verdet
Bichromate of potassium	1.0786	15	0.0126	Verdet
Iodides: potassium	1.6743	15	0.0338	Becquerel
Sulphates: barium	1.1788	20	0.0134	Jahn
potassium	1.0475	20	0.0133	Jahn
sodium	1.0661	20	0.0135	Jahn

Gases

For sodium light.

Substance.	Pressure.	Temp. ° C	Verdet's constant, minutes.	Observer.
Atmospheric air	atmos.	ordinary	6.83×10^{-6}	Becquerel
Carbon dioxide	atmos.	ordinary	13.00	Becquerel
Carbon disulphide	74 cms.	70°	23.49	Bichat
Ethylene	atmos.	ordinary	34.48	Becquerel
Nitrogen	atmos.	ordinary	6.92	Becquerel
Nitrous oxide	atmos.	ordinary	16.90	Becquerel
Oxygen	atmos.	ordinary	6.28	Becquerel
Sulphur dioxide	atmos.	ordinary	31.39	Becquerel
Sulphur dioxide	246 cms	20°	38.40	Bichat

MISCELLANEOUS TABLES

α RAYS

The α rays are thought to be positively charged particles, moving with a high velocity. They are only slightly deviable by a strong magnetic or electric field and have small penetrating power. The initial velocity has been found to be about 2×10^9 cms./s. The mass of each particle is 6.2×10^{-24} g. (Rutherford and Geiger, 1910.) The charge carried by each, as measured by the same authors, is 9.3×10^{-10} electro static units.

β RAYS

The β rays are similar to the cathode rays produced by an electric discharge in a vacuum tube. They are judged to be negatively charged particles moving with high velocity. They are much more penetrating than the α rays, and are strongly deviated by a magnetic or electric field. The velocity of the moving particle is in the neighborhood of that of light, about 2×10^{10} cm./s. The charge on each particle is approximately 4.7×10^{-10} electro static units.

γ RAYS

The γ rays are similar to the X rays and are not deviable by magnetic or electric fields. They are more penetrating than either the α or β rays, and are considered to be of the nature of wave pulses in the ether.

RÖNTGEN RAYS

Scale of Hardness

The "radiochrometer" of Benoist consists of a disk of silver 0.11 mm. thick, which is surrounded by 12 sectors of aluminum ranging in thickness from 1 to 12 millimeters. The sector which shows the same absorption as the central disk gives the degree of hardness according to Benoist. The relation of this to other scales is shown below.

Benoist	2	3	4	5	6	7	8
Wehnelt	1.8–2	5	6.5	7.5	8	9	10–11
Walter	2.0–3	4–5	5–6	6	6–7	7	7–8

The absorption of rays is very nearly proportional to the mass of substance penetrated.

IONIZATION DUE TO RÖNTGEN RAYS IN VARIOUS GASES

From Smithsonian Physical Tables

Gas	Relative ionization		Density
	Soft rays, Strutt	Hard rays, Eve	
Hydrogen	0.11	0.42	0.069
Air	1.00	1.00	1.00
Oxygen	1.39	......	1.11
Carbon dioxide	1.60	......	1.53
Cyanogen	1.05	......	1.86
Sulphur dioxide	7.97	2.3	2.19
Chloroform	31.9	4.6	4.32
Methyl iodide	72.0	13.5	5.05
Carbon tetrachloride	45.3	4.9	5.31
Hydrogen sulphide	......	0.9	1.18

MEAN ABSORPTION COEFFICIENTS

(From Smithsonian Physical Tables)

If I_0 be the intensity of a parallel beam of homogeneous radiation incident normally on a plate of absorbing material of thickness t, then $I = I_0 e^{-\lambda x}$ gives the intensity I at the depth x. Because of the great homogeneity of the secondary X-rays they were used in the determination of the following coefficients. The coefficients λ have been divided by the density d.

	Absorber										
Radiator	C.	Mg.	Al.	Fe.	Ni.	Cu.	Zn.	Ag.	Sn.	Pt.	Au.
Cr.	15.3	126.	136.	104.	129.	143.	170.	580.	714.	(517.)	(507.)
Fe.	10.1	80.	88.	66.	84.	95.	112.	381.	472.	340.	367.
Co.	80.0	64.	72.	67.	67.	75.	92.	314.	392.	281.	306.
Ni.	6.6	52.	59.	314.	56.	62.	74.	262.	328.	236.	253.
Cu.	5.2	41.	48.	268.	63.	53.	61.	214.	272.	194.	210.
Zn.	4.3	35.	39.	221.	265.	56.	50.	175.	225.	162.	178.
As.	2.5	19.	22.	134.	166.	176.	204.	105.	132.	106.	106.
Se.	2.0	16.	19.	116.	141.	150.	175.	88.	112.	93.	100.
Ag.	.4	2.2	2.5	17.	23.	24.	27.	13.	16.	56.	61.

X-RAY SPECTRA AND ATOMIC NUMBERS

(From Smithsonian Physical Tables)

Kaye has shown that an element excited by sufficiently rapid cathode rays emits characteristic Röntgen radiations. These have been analyzed and the wave lengths obtained by Moseley (Phil. Mag. 27, p. 703, 1914) using a crystal of potassium ferrocyanide as a grating. The "K" series of elements shows 2 lines *α* and *β*, the "L" series several. The wave lengths of the *α* and *β* lines of each series are given in the following table. $Q_K = (v/\frac{3}{4}\, v_0)^{\frac{1}{2}}$; $Q_L = (v/\frac{5}{36}\, v_0)^{\frac{1}{2}}$ where v is the frequency of the *α* line and v_0 the fundamental Rydberg frequency. The atomic number for the K series = $Q_K + 1$; for the L series = $Q_L + 7.4$ approximately. $v_0 = 3.29 \times 10^{15}$.

Element	α line $\lambda \times 10^8$ cm.	Q_K	Atomic number N	β line $\lambda \times 10^8$ cm.	Element	α line $\lambda \times 10^8$ cm.	Q_L	Atomic number N	β line $\lambda \times 10^8$ cm.
Al............	8.364	12.0	13	7.912	Zr............	6.091	32.8	40	
Si............	7.142	13.0	14	6.729	Cb............	5.749	33.8	41	5.507
Cl............	4.750	16.0	17		Mo............	5.423	34.8	42	5.187
K............	3.759	18.0	19	3.463	Ru............	4.861	36.7	44	4.660
Ca............	3.368	19.0	20	3.094	Rh............	4.622	37.7	45	
Ti............	2.758	21.0	22	2.524	Pd............	4.385	38.7	46	4.168
V............	2.519	22.0	23	2.297	Ag............	4.170	39.6	47	
Cr............	2.301	23.0	24	2.093	Sn............	3.619	42.6	50	
Mn............	2.111	24.0	25	1.818	Sb............	3.458	43.6	51	3.245
Fe............	1.946	25.0	26	1.765	La............	2.676	49.5	57	2.471
Co............	1.798	26.0	27	1.629	Ce............	2.567	50.6	58	2.360
Ni............	1.662	27.0	28	1.506	Pr............	(2.471)	51.5	59	2.265
Cu............	1.549	28.0	29	1.402	Md............	2.382	52.5	60	2.175
Zn............	1.445	29.0	30	1.306	Sa............	2.208	54.5	62	2.008
Yt............	0.838	38.1	39		Eu............	2.130	55.5	63	1.925

X-RAY SPECTRA AND ATOMIC NUMBERS

(From Smithsonian Physical Tables)

Element	α line $\lambda \times 10^8$ cm.	Q_K	Atomic number N	β line $\lambda \times 10^8$ cm.	Element	α line $\lambda \times 10^8$ cm.	Q_L	Atomic number N	β line $\lambda \times 10^8$ cm.
Zr............	0.794	39.1	40		Gd............	2.057	56.5	64	1.853
Cb............	0.750	40.2	41		Ho............	1.914	58.6	66	1.711
Mo............	0.721	41.2	42		Er............	1.790	60.6	68	1.591
Ru............	0.638	43.6	44		Ta............	1.525	65.6	73	1.330
Pd............	0.584	45.6	46		W............	1.486	66.5	74	
Ag............	0.560	46.6	47		Os............	1.397	68.5	76	1.201
					Ir............	1.354	69.6	77	1.155
					Pt............	1.316	70.6	78	1.121
					Au............	1.287	71.4	79	1.092

Moseley's summary condensed is as follows: Every element from Al to Au is characterized by an integer N which determines its X-ray spectrum; N is identified with the number of positive units of electricity in its atomic nucleus. The order of these atomic numbers (N) is that of the atomic weights except where the latter disagrees with the order of the chemical properties. Known elements correspond with all the numbers between 13 and 79 except 3. There are here 3 possible elements still undiscovered. The frequency of any line in the X-ray spectrum is approximately proportional to $A(N-b)^2$, where A and b are constants. All X-ray spectra of each series are similar in structure differing only in wave lengths.

RADIOACTIVITY

RADIOACTIVE SUBSTANCES

A list of the fully recognized radioactive substances and transformation products. In each series, each product is obtained from the substance preceding. The table gives also (1) the rays emitted, (2) the transformation period, that is, the time taken for half the active product to undergo change and (3) the radioactive constant, λ, the proportion of active matter which undergoes change each second.

Substance	Properties, etc.	Atomic wt.	Rays	Transformation period Γ	Transformation constant λ
Uranium I	Soluble in excess $(NH_4)_2CO_3$. One gram emits 2.37×10^4 α particles per second	238.5	α	5×10^9 yrs.	1.4×10^{-10} yrs.
Uranium 2	Inseparable from Ur 1	234.5	α	2×10^6 yrs.?	7×10^{-7} yrs.
Uranium X	Less volatile than Ur 1. Insoluble in excess of $(NH_4)_2CO_3$. Soluble in water and ether. Chemically allied to Th	230.5	β, λ	24.6 days (21.5)	0.0282 days
Uranium Y	Probably branch product exists in small quantity	230.5?	β	1.5 days	0.46 days
Ionium	Nonseparable from Th. Soluble in excess of ammon. oxalate. Carried down by H_2O_2 in presence of U salts	230.5	α	2×10^5 yrs. (3×10^4)	3.5×10^{-6} yrs.
Radium	Chemical properties of Ba. Characteristic spect. Spontaneously luminous. RBr_2 and RCl_2 less soluble than $BaBr_2$ and $BaCl_2$. One gr. in equilibrium emits 13.6×10^{10} α particles per sec	226.4	α, β	2000 yrs. (1750)	3.5×10^{-6} yrs.
Radium emanation (Niton)	Inert gas, density 111 H. Boiling point −65° C., density of solid 5–6	222	α	3.85 days	0.180 days
Radium A	Acts as solid. Has + charge, deposits on cathode in electric field. Volatile at 800–900° C. Soluble in strong acids	218	α	3 min.	0.231 min.

Substance	Properties, etc.	Atomic wt.	Rays	Transformation period T	Transformation constant λ
Radium B	Like Ra A. Volatile 600–700° C. Precipitated by $BaSO_4$. Separated pure by recoil from Ra A.	214	β, γ	26.8 min.	0.0258 min.
Radium C	Physically like Ra A, chemically like Ra B. Volatile 800–1300° C. Deposited on Cu and Ni. Perhaps a mixture	214	α, β, γ	19.5 min.	0.0355 min.
Radium C_2	Probably branch product. Separated by recoil from Ra C	210?	β	1.4 min.	0.495 min.
Radium D	Radio lead. Separated with Pb. Not separable. Volatile below 1000° C. Soluble in strong acids.	210	Slow β	16.5 yrs.	0.042 yrs.
Radium E	Reactions analogous to Pb. Volatile at red heat. Soluble in cold acetic acid	210	β	6.2 days (5 days)	1.3×10^{-6} sec. (.139 day)
Radium E_1	Not volatile at red heat. Reactions analogous to Bi	....	β	4.8 days	1.7×10^{-6} sec.
Radium F (Polonium)	Separated with Bi. Probably changes to Pb. Volatile about 1000° C.	210	α	136 days (140)	0.00510 day
Actinium	Probably branch product Ur series. Chemically allied to lanthanum. Precipitated by oxalic acid in acid solutions. With thorium and rare earths.	....	None	....	....
Radio-actinium	Slightly volatile at high temperature. Insoluble in NH_4OH	....	α, β	19.5 days	0.0355 day
Actinium X	Not precipitated by NH_4OH. Chemical properties analogous to Ra	....	α	10.2 days	0.068 day
Actinium emanation	Inert gas, condenses −120 to −150	....	α	3.9 sec.	0.178 sec.
Actinium A	Analogous to Ra A. Volatile above 400° C. Soluble in NH_4OH and strong acids	....	α	0.002 sec.	350 sec.
Actinium B	Analogous to Ra B. Volatile below 700° C. Soluble in NH_4OH and strong acids	....	Slow β	36 min.	0.0193 min.
Actinium C	Analogous to Ra C	....	α	2.1 min.	0.33 min.
Actinium D	Analogous to Ra D	....	$\beta+\gamma$	4.7 min.	0.147 min.

RADIOACTIVITY (Continued)

RADIOACTIVE SUBSTANCES

A list of the fully recognized radioactive substances and transformation products. In each series, each product is obtained from the substance preceding. The table gives also (1) the rays emitted, (2) the transformation period, that is, the time taken for half the active product to undergo change and (3) the radioactive constant, λ, the proportion of active matter which undergoes change each second.

Substance	Properties, etc.	Atomic wt.	Rays	Transformation period Γ	Transformation constant λ
Thorium	Volatile in arc. Colorless salts not spontaneous by phosphorescent salts precipitated by NH_4OH and oxalic acid	232	α	1.3×10^{10} yrs. (3×10^{10})	5.3×10^{-11} yr.
Mesothorium 1	Chemical properties analogous to Ra, from which it is inseparable	228	None	5.5 yrs.	0.126 yr.
Mesothorium 2	....	228	β, γ	6.2 yrs.	0.112 yr.
Radiothorium	Chemically allied to thorium, from which it is non-separable	228	α	2 yrs.	0.347 yr.
Thorium X	Chemically analogous to Ra. Soluble in NH_4OH.	224	α, β	3.65 days	0.190 day
Thorium emanation	Inert gas. Condenses just above −120° C	220	α	54 sec.	0.0128 sec.
Thorium A	Volatile under 630° C. Positively charged. Soluble in strong acids	216	α	0.14 sec.	4.95 sec.
Thorium B	Chemically analogous to Ra B. Volatile above 630° C. and below 730° C.	212	β, γ	10.6 hours	0.0654 hour
Thorium C	Chemically analogous to Ra C. Volatile above 730.	212	α, β	60 min.	0.0118 min.
Thorium C_2	Th C_2 and Th D are probably β and λ-ray products respectively from Th C	212	α	Short	....
Thorium D	By recoil from Th C. Probably transforms to Bi.	208	β + γ	3.1 min.	0.224 min.
Potassium	Activity 1/1000 that of U	39.1	β	....	....
Rubidium	Activity 1/500 that of U	85.5	β	....	....

RADIOACTIVITY, PROPERTIES OF RAYS

Range of the α particle at 76.0 cm. and 15° C. Initial velocity is deduced from formula $V^3 = aR$, where R is range. Velocity for RaC of range 7.06 at 20° is assumed 2.06×10^9 cm. per sec. or $v = 1.077r^{1/3}$.

If μ is the coefficient of absorption, d the thickness of absorbing medium, I_0 the intensity before passage, — the intensity after passage $I = I_0e^{-d\mu}$. μ for β rays is in terms of cms. of Al; for γ rays, cms. of lead.

Substance	α Rays				β Rays		γ Rays
	Range cm.	Initial velocity cm. per sec.	Kinetic energy ergs.	Total number of ions produced by α part.	Absorption coefficient (Al)	Velocity, vel. of light taken as 1	Absorption coefficient (Pb)
Uranium 1	2.50	1.45×10^9	0.65×10^{-5}	1.26×10^5	....	....	....
Uranium 2	2.90	1.53	0.72	137	....	....	....
Uranium X	....	....	....	....	15510	Wide range	0.72
Uranium Y	....	....	....	....	....	....	....
Ionium	3.00	1.56×10^9	0.75×10^{-5}	1.40×10^5	....	....	....
Radium	3.30	1.61	0.79	1.50	312	0.52–0.65	....
Radium emanation	4.16	1.73	0.92	1.74	....	....	....
Radium A	4.75	1.82	1.01	1.88	....	....	....
Radium B	....	....	....	....	13, 80, 890	0.36–0.74	4 to 6
Radium C_1	6.94	2.06	1.31	2.37	13, 53	0.80–0.98	0.50
Radium C_2	....	....	....	....	13	....	....
Radium D	....	....	....	....	0.33, 0.39	....	....
Radium E	....	....	....	....	43	Wide range	....
Radium F (Polonium)	3.77	1.68	0.87	1.63	....	....	....

RADIOACTIVITY, PROPERTIES OF RAYS (Continued)

Substance	α Rays				β Rays		γ Rays
	Range cm.	Initial velocity cm. per sec.	Kinetic energy ergs.	Total number of ions produced by α part.	Absorption coefficient (Al)	Velocity, vel. of light taken as 1	Absorption coefficient (Pb)
Actinium	...	...	...	...	...	...	...
Radio-actinium	4.80	1.83×10^9	1.02×10^{-5}	1.89×10^5	140	...	...
Actinium X	4.40	1.76	0.94	1.79	...	...	...
Actinium emanation	5.70	1.94×10^9	1.15×10^{-5}	2.10×10^5	...	...	...
Actinium A	6.50	2.02	1.25	2.27	...	...	...
Actinium B	...	...	...	...	Very soft	...	...
Actinium C	5.40	1.89	1.10	2.02	...	...	...
Actinium D	...	...	...	...	28.5	...	0.217 (Al)
Thorium	2.72	1.50×10^9	0.69×10^{-5}	1.32×10^5	...	...	...
Mesothorium 1	...	...	...	...	...	0.37–0.66	...
Mesothorium 2	...	...	...	...	20–385	...	0.53
Radiothorium	3.87	1.70	0.89	1.66	...	...	...
Thorium X	5.7	1.94	1.15	2.1	330.	.47–.51	...
Thorium emanation	5.5	1.90	1.10	2.0	...	...	...
Thorium A	5.9	1.97	1.19	2.2	...	...	...
Thorium B	...	...	...	...	110.	0.63–0.72	...
Thorium C_1	5.0	1.85	1.05	1.9	15.6	...	Weak
Thorium C_2	8.6	2.22	1.53	2.0	...	...	...
Thorium D	...	...	...	...	24.8	.3, .4, .93–5	0.46
Potassium	...	...	...	...	38, 102	...	...
Rubidium	...	...	...	...	380, 1020	...	...

DECLINATION OF THE SUN AND EQUATION OF TIME

Date.		Declination.	Diff. 1 day.	Equation of time.		Date.		Declination.	Diff. 1 day.	Equation of time.	
		°	°	m	s			°	°	m	s
Jan.	0	−23.1	0.11	+ 3	15	July	9	+22.4	0.15	+ 4	49
	10	−22.0	0.18	+ 7	42		19	+20.9	0.21	+ 5	58
	20	−20.2	0.25	+11	13		29	+18.8	0.26	+ 6	13
	30	−17.7	0.30	+13	32	Aug.	8	+16.2	0.30	+ 5	27
Feb.	9	−14.7	0.34	+14	27		18	+13.2	0.34	+ 3	44
	19	−11.3	0.37	+14	5		28	+ 9.8	0.36	+ 1	11
Mar.	1	− 7.6	0.38	+12	36	Sept.	7	+ 6.2	0.39	− 1	59
	11	− 3.8	0.40	+10	15		17	+ 2.3	0.39	− 5	26
	21	+ 0.2	0.39	+ 7	23		27	− 1.5	0.38	− 8	55
	31	+ 4.1	0.38	+ 4	19	Oct.	7	− 5.4	0.38	−12	4
Apr.	10	+ 7.9	0.35	+ 1	23		17	− 9.2	0.35	−14	31
	20	+11.4	0.33	− 1	5		27	−12.7	0.32	−16	0
	30	+14.7	0.29	− 2	52	Nov.	6	−15.9	0.26	−16	16
May	10	+17.6	0.23	− 3	48		16	−18.7	0.22	−15	7
	20	+19.9	0.18	− 3	45		26	−20.9	0.16	−12	36
	30	+21.7	0.12	− 2	49	Dec.	6	−22.5	0.08	− 8	54
June	9	+22.9	0.05	− 1	11		16	−23.3	0.01	− 4	17
	19	+23.4	0.01	+ 0	55		26	−23.4	0.08	+ 0	41
	29	+23.3	0.09	+ 3	2	Jan.	5	−22.6	....	+ 5	34

MEAN PLACES OF STARS

Jan. 0, 1913
(Ephemeris, 1913.)

Name of star.	Right Ascen.			Annual Var.	Declination.			Annual Var.
	h	m	s	s	°	′	″	″
α Andromeda (Alpheratz)	0	3	53.3	+ 3.10	+28	36	36.5	+19.88
α Ursæ Min. (Polaris)	1	28	19.0	+28.06	+88	50	29.4	+18.58
α Arietis	2	2	15.9	+ 3.38	+23	3	5.6	+17.12
α Persei	3	18	6.3	+ 4.27	+49	33	8.6	+12.98
α Tauri (Aldebaran)	4	30	55.6	+ 3.44	+16	20	6.7	+ 7.41
α Aurigæ (Capella)	5	10	15.6	+ 4.43	+45	54	38.2	+ 3.89
β Orionis (Rigel)	5	10	21.4	+ 2.88	− 8	18	5.0	+ 4.31
ε Orionis	5	31	47.9	+ 3.04	− 1	15	24.0	+ 2.46
β Aurigæ	5	53	8.9	+ 4.40	+44	56	22.9	+ 0.59
β Canis Majoris	6	18	52.1	+ 2.64	−17	54	43.1	− 1.65
α Canis Majoris (Sirius)	6	41	18.9	+ 2.64	−16	35	46.2	− 4.80
ε Canis Majoris	6	55	12.4	+ 2.36	−28	51	11.0	− 4.78
α Can. Min. (Procyon)	7	34	44.9	+ 3.14	+ 5	26	54.8	− 9.09
α Hydræ	9	23	18.8	+ 2.95	− 8	16	51.4	−15.51
α Leonis (Regulus)	10	3	44.4	+ 3.20	+12	23	34.1	−17.52
α Ursæ Majoris	10	58	22.2	+ 3.73	+62	13	15.3	−19.40
β Leonis (Denebola)	11	44	37.4	+ 3.06	+15	3	30.4	−20.12
ε Ursæ Majoris (Alioth)	12	50	12.3	+ 2.65	+56	25	54.8	−19.58
α Virginis (Spica)	13	20	36.5	+ 3.16	−10	42	26.8	−18.85
α Boötis (Arcturus)	14	11	41.6	+ 2.74	+19	38	5.7	−18.83
β Ursæ Minoris	14	50	56.9	− 0.21	+74	30	39.7	−14.72
α Scorpii (Antares)	16	24	4.2	+ 3.67	−26	14	23.1	− 8.18
λ Scorpii	17	27	41.9	+ 4.07	−37	2	28.3	− 2.84
α Ophiuchi	17	30	53.7	+ 2.78	+12	37	21.2	− 2.77
δ Ursæ Minoris	18	0	19.3	−19.50	+86	36	51.1	+ 0.08
α Lyræ (Vega)	18	33	59.6	+ 2.03	+38	42	7.6	+ 3.24
α Cygni (Deneb)	20	38	27.9	+ 2.04	+44	58	8.3	+12.78
α Aquilæ (Altair)	19	46	32.3	+ 2.93	+ 8	38	16.1	+ 9.37
α Pisc. Aust. (Fomalhaut)	22	52	50.8	+ 3.32	−30	5	1.1	+19.02
α Pegasi (Markab)	23	0	25.6	+ 2.99	+14	44	13.1	+19.33

APPROXIMATE CORRECTION FOR REFRACTION

For Astronomical Observations

Corresponding to temperature of 50° F., and to a barometric pressure of 29.6 inches.

(From Young's General Astronomy, by permission.)

Altitude.	Refraction.	Altitude.	Refraction.	Altitude.	Refraction.
°	′ ″	°	′ ″	°	′ ″
0	34 50	11	4 47.7	30	1 39.5
1	24 22	12	4 24.5	35	1 22.1
2	18 06	13	4 04.4	40	1 08.6
3	14 13	14	3 47.0	45	57.6
4	11 37	16	3 18.2	50	48.3
5	9 45	18	2 55.5	55	40.3
6	8 23	20	2 37.0	60	33.2
7	7 19	22	2 21.6	65	26.8
8	6 29	24	2 08.6	70	20.9
9	5 49	26	1 57.6	80	10.2
10	5 16	28	1 48.0	90	0.0

For every 5° F. by which the temperature is less than 50° F., add one per cent to the tabular refraction, and decrease it in the same ratio for temperatures above 50° F.

Increase the tabular refraction by three and a half per cent for every inch of barometric pressure above 29.6 inches, and decrease it in the same ratio below that point. These corrections for temperature and pressure, though only approximate, will give a result correct within 2″ except in extreme cases.

DATA IN REGARD TO THE EARTH

(Radius, U. S. C. & G. Survey.)

Equatorial radius, 6,378,388 meters, 3,963.399 miles.
Polar radius, 6,365,909 meters, 3,949.992 miles.
1° latitude at the equator = 68.70 miles.
1° latitude at the pole = 69.41 miles.
Mean density of the earth, 5.52 g. per cu.cm.
Mean distance from the earth to the sun
149,500,000 kilometers,
92,900,000 miles.
Mean distance from the earth to the moon
384,393 kilometers,
238,854 miles.

DATA CONCERNING THE SOLAR SYSTEM

(Values from Young's General Astronomy, by permission.)

Name.	Mean dis. from sun, millions of miles.	Period in years.	Mean dia. in miles.	Mass, the earth =1.	Mean density, water =1.
Mercury	36.0	0.24	3030	0.047	4.70
Venus	67.2	0.62	7700	0.82	4.94
The earth	92.9	1.00	7917.6	1.000	5.55
Mars	141.5	1.88	4230	0.107	3.92
Jupiter	483.3	11.86	86500	317.7	1.32
Saturn	886.0	29.46	73000	94.8	0.72
Uranus	1781.9	84.02	31900	14.6	1.22
Neptune	2791.6	164.78	34800	17.0	1.11
Sun	....	....	866400	332000.	1.39
Moon	....	....	2163	0.0123	3.39

METEOROLOGICAL DATA

THE ATMOSPHERE

Total mass, estimated by Elkholm:
5.2×10^{21} grams.
11.4×10^{18} pounds.
Composition:
The total volume = 1.

Substance.	Elevation.		
	Sea level.	10000 meters.	50000 meters.
Argon	0.009	0.006	0.0003
Carbon dioxide	0.0003	0.00015	0.0000
Helium	0.0000015	0.0000	0.00126
Hydrogen	0.0001	0.00035	0.136
Neon	0.000015	0.00002	0.0000
Nitrogen	0.780	0.812	0.792
Oxygen	0.210	0.182	0.070

ATMOSPHERIC POTENTIAL

The potential of the atmosphere increases with the elevation 130 to 200 volts per meter.

VELOCITY OF SEISMIC WAVES IN THE EARTH'S CRUST

Longitudinal	4 to 14 kilometers per sec.
Transverse	3 to 10 kilometers per sec.

ANGULAR RADIUS OF HALOS AND RAINBOWS

Coronæ due to small water drops	1° to 10°
Small halo, due to 60° angles of ice crystals	22°
Large halo, due to 90° angles of ice crystals	46°
Rainbow, primary	41° 20′
Rainbow, secondary	52° 15′

SOLAR CONSTANT

The energy falling on one sq.cm. area at normal incidence equals 1.92 small calories per minute.

ACCELERATION DUE TO GRAVITY, LATITUDE, LONGITUDE AND ELEVATION

United States

Station.	Latitude.			Longitude (Greenwich).			Elevation, meters.	g cm/sec.²
	°	′	″	°	′	″		
Atlanta, Ga.	33	44	58	84	23	18	324	979.523
Austin, Tex. (University)	30	17	11	97	44	14	189	979.282
Austin, Tex. (Capitol)	30	16	30	97	44	16	170	979.287
Baltimore, Md.	39	17	50	76	37	30	30	980.096
Boston, Mass.	42	21	33	71	03	50	22	980.395
Calias, Me.	45	11	11	67	16	54	38	980.630
Cambridge, Mass.	42	22	48	71	07	45	14	980.397
Charleston, S. C.	32	47	14	79	56	03	6	979.545
Charlottesville, Va.	38	02	01	78	30	16	166	979.937
Chicago, Ill.	41	47	25	87	36	03	182	980.277
Cincinnati, Ohio	39	08	20	84	25	20	245	980.003
Cleveland, Ohio	41	30	22	81	36	38	210	980.240
Colorado Springs, Colo.	38	50	44	104	49	02	1841	979.489
Deer Park, Md.	39	25	02	79	19	50	770	979.934
Denver, Colo.	39	40	36	104	56	55	1638	979.608
Ellsworth, Kansas	38	43	43	98	13	32	469	979.925
Ft. Egbert, Eagle, Alaska	64	47	22	141	12	24	174	982.182
Galveston, Texas	29	18	12	94	47	29	3	979.271
Grand Canyon, Wyo.	44	43	16	110	29	44	2386	979.898
Grand Junction, Colo.	39	04	09	108	33	56	1398	979.632
Green River, Utah	38	59	23	110	09	56	1243	979.635
Gunnison, Colo.	38	32	33	106	56	02	2340	979.341
Ithaca, N. Y.	42	27	04	76	29	00	247	980.299
Kansas City, Mo.	39	05	50	94	35	21	278	979.989
Key West, Fla.	24	33	33	81	48	25	1	978.969
Laredo, Texas	27	30	29	99	31	12	129	979.081
Little Rock, Ark.	34	44	57	92	16	24	89	979.720
Lower Geyser Basin, Wyo.	44	33	21	110	48	08	2200	979.931
Madison, Wis. (Univ. of Wis.)	43	04	35	89	24	00	270	980.364
New Orleans, La.	29	56	58	90	04	14	2	979.323
New York, N. Y.	40	48	27	73	57	43	38	980.266
Norris Geyser Basin, Wyo.	44	44	09	110	42	02	2276	979.949

ACCELERATION DUE TO GRAVITY, LATITUDE, LONGITUDE AND ELEVATION (Continued)

United States (Continued)

Station.	Latitude.			Longitude (Greenwich).			Elevation, meters.	g cm/sec².
	°	′	″	°	′	″		
Philadelphia, Pa.	39	57	06	75	11	40	16	980.195
Pike's Peak, Colo.	38	50	20	105	02	02	4293	978.953
Pleasant Valley Junction, Utah	39	50	47	111	00	46	2191	979.511
Princeton, N. J.	40	20	57	74	39	28	64	980.177
Salt Lake City, Utah	40	46	04	111	53	46	1322	979.802
San Francisco, Cal.	37	47	00	124	46	00	114	979.965
St. Louis, Mo.	38	38	03	90	12	13	154	980.000
Terre Haute, Ind.	39	28	42	87	23	49	151	980.071
Wallace, Kans.	38	54	44	101	35	26	1005	979.754
Washington, C. & G. S.	38	53	13	77	00	32	14	980.111
Washington, Smithsonian	38	53	20	77	01	32	10	980.113
Worcester, Mass	42	16	29	71	48	28	170	980.323

Foreign Cities

Station.	Latitude.		Longitute (Paris).		Elevation, meters.	g cm/sec².
	°	′	°	′		
Berlin	+52	30	+ 11	4	38	981.287
Calcutta, India	+22	33	+ 86	1	6	978.822
Cape of Good Hope, Africa	−33	56	+ 16	9	11	979.659
Honolulu, Hawaii	+21	18	−160	12	3	978.966
London (Greenwich)	+51	17	− 2	12	48	981.188
Madrid	+40	24	− 6	1	656	979.981
Melbourne, Australia	−37	50	+142	38	27	979.985
Paris	+48	50	0	0	60	980.943
Rio de Janeiro, Brazil	−22	54	− 45	30	45	978.801
Rome	+41	54	+ 10	9	59	980.350
St. Petersburg	+59	56	+ 27	59	2	981.938
Shanghai, China	+31	12	+119	6	8	979.443
Stockholm	+59	21	+ 15	43	45	981.843
Tokio, Japan	+35	43	+137	26	18	979.801
Valparaiso, Chili	−33	2	− 73	58	0	979.630

MOMENT OF INERTIA FOR VARIOUS BODIES

The mass of the body is indicated by *m*.

Body.	Axis.	Moment of inertia.
Uniform thin rod	Normal to the length, at one end	$m\frac{l^2}{3}$
Uniform thin rod	Normal to the length, at the center	$m\frac{l^2}{12}$
Thin rectangular sheet, sides a and b	Through the center parallel to b	$m\frac{a^2}{12}$
Thin rectangular sheet, sides a and b	Through the center perpendicular to the sheet	$m\frac{a^2+b^2}{12}$
Thin circular sheet of radius r	Normal to the plate through the center	$m\frac{r^2}{2}$
Thin circular sheet of radius r	Along any diameter	$m\frac{r^2}{4}$
Thin circular ring. Plane figure formed by two concentric circles of radius r_1 and r_2	Through center normal to plane of ring	$m\frac{r_1^2+r_2^2}{2}$
Thin circular ring. Plane figure formed by two concentric circles of radius, r_1 and r_2	Any diameter	$m\frac{r_1^2+r_2^2}{4}$
Rectangular parallelopiped, edges a, b, and c	Through center perpendicular to face ab, (parallel to edge c)	$m\frac{a^2+b^2}{12}$
Sphere, radius r	Any diameter	$m\frac{2}{5}r^2$
Spherical shell, external radius, r_1 internal, radius r_2	Any diameter	$m\frac{2}{5}\frac{(r_1^5-r_2^5)}{(r_1^3-r_2^3)}$

MOMENT OF INERTIA FOR VARIOUS BODIES (Continued)

The mass of the body is indicated by m.

Body.	Axis.	Moment of inertia.
Spherical shell, very thin, mean radius, r	Any diameter	$m\frac{2r^2}{3}$
Right circular cylinder of radius r, length l	The longitudinal axis of the solid	$m\frac{r^2}{2}$
Right circular cylinder of radius r, length l	Through center perpendicular to the axis of the figure, (transverse diameter)	$m\left(\frac{r^2}{4}+\frac{l^2}{12}\right)$
Hollow circular cylinder, length l, external radius r_1 internal radius r_2	The longitudinal axis of the figure	$m\frac{(r_1^2+r_2^2)}{2}$
Thin cylindrical shell, length l, mean radius, r	The longitudinal axis of the figure	mr^2
Hollow circular cylinder, length l, external radius r, internal radius r_2	Transverse diameter	$m\left[\frac{r_1^2+r_2^2}{4}+\frac{l^2}{12}\right]$
Hollow circular cylinder, length l, very thin, mean radius r	Transverse diameter	$m\left(\frac{r^2}{2}+\frac{l^2}{12}\right)$
Elliptic cylinder, length l, transverse semiaxes a and b	Longitudinal ax.	$m\left(\frac{a^2+b^2}{4}\right)$
Right cone, altitude h, radius of base r	Axis of the figure	$m\frac{3}{10}r^2$
Spheroid of revolution, equatorial radius r	Polar axis	$m\frac{2r^2}{5}$
Ellipsoid, axes $2a$, $2b$, $2c$	Axis $2a$	$m\frac{(b^2+c^2)}{5}$

ACCELERATION DUE TO GRAVITY AND LENGTH OF THE SECONDS PENDULUM

For Sea Level at Different Latitudes

Latitude.	g cm./sec.^{2}	g ft./sec.^{2}	Length in cm.	Length in ins.
0°	977.989	32.0862	99.0910	39.0121
5	8.029	.0875	.0950	.0137
10	.147	.0916	.1079	.0184
15	.339	.0977	.1265	.0261
20	.600	.1062	.1529	.0365
25	978.922	32.1168	99.1855	39.0493
30	9.295	.1290	.2234	.0642
31	.374	.1316		
32	.456	.1343		
33	.538	.1370		
34	979.622	32.1398		
35	.707	.1425	.2651	.0806
36	.793	.1454		
37	.880	.1490		
38	.968	.1511		
39	980.057	32.1540		
40	.147	.1570	.3096	.0982
41	.237	.1607		
42	.327	.1630		
43	.418	.1659		
44	980.509	32.1688		
45	.600	.1719	.3555	.1163
46	.691	.1748		
47	.782	.1778		
48	.873	.1808		
49	980.963	32.1838		
50	1.053	.1867	99.4014	39.1344
51	.143	.1896		
52	.231	.1924		
53	.318	.1954		
54	981.407	32.1983		
55	.493	.2011	.4459	.1520
56	.578	.2039		
57	.662	.2067		
58	.744	.2094		
59	981.825	32.2121		
60	.905	.2147	.4876	.1683
65	2.278	.2276	.5255	.1832
70	.600	.2375	.5581	.1960
75	.861	.2460	99.5845	39.2065
80	983.053	32.2523	.6040	.2141
85	.171	.2562	.6160	.2188
90	.210	.2575	.6200	.2204

ATOMIC AND MOLECULAR CONSTANTS

(From Smithsonian Physical Tables)

Elementary electrical charge, charge on electron, $\frac{1}{2}$ charge on α particle,	e	$= 4.774 \times 10^{-10}$ e.s.u.
		$= 1.591 \times 10^{-20}$ e.m.u.
		$= 1.591 \times 10^{-19}$ coulombs
Mass of an electron,	m	= about 8.8×10^{-28} grams
Ratio e/m, small velocities,	e/m	$= 1.770 \times 10^{7}$ e.m.u.gm^{-1}
Radius of an electron,	l	= about 1×10^{-13} cm.
Number of molecules per gram molecule,	N	$= 6.06 \times 10^{23}$ gr^{-1}
Number of gas molecules per cc., 760^{mm}, 0° C.,	n	$= 2.70 \times 10^{19}$
Kinetic energy of a molecule at 0 °C.,	E_0	$= 5.62 \times 10^{-14}$ ergs
Constant of molecular energy, E_0/T,	ϵ	$= 2.06 \times 10^{-16}$ ergs/degrees
Constant of entropy equation (Boltzmann), $= R/N = p_0V_0/TN = (2/3)\ \epsilon$,	k	$= 1.37 \times 10^{-16}$ " "
Elementary "Wirkungsquantum,"	h	$= 6.62 \times 10^{-27}$ erg. sec.
Mass of hydrogen atom,		$= 1.64 \times 10^{-24}$ gram
Radius of an atom,		= about 10^{-8} cm.
Rydberg's fundamental frequency	V_0	$= 3.28880 \times 10^{15}$
Rydberg's constant $= \frac{V_0}{C}$		= 109675.
Mol (e) of gas, 76^{cm} pressure, 0° C.,		= 22.4 liters
$PV_m = RT$, V_m = vol. of molec. wt. in grams,		
when P in grams per cm^2, V_m in cm^3,	R	= 84.780 gram. cm.
when P in atmospheres, V_m in liter,	R	= 0.08204 l. atm.
when P in dynes, V_m in cm^3,	R	$= 8.31 \times 10^{5}$ ergs

	H_2	He	N_2	O_2	Xe	CO_2	H_2O
Sq. rt. of mean sq. molec. veloc., cm./sec. at 0°C. $\times 10^{-4}$	18.4	13.1	4.93	4.61	2.28	3.92	7.08
Mean free path cm. $\times 10^{6}$	18.	28.	9.4	9.9	5.6	6.4	7.2
Molecular diameter cm. $\times 10^{8}$	2.2	2.2	3.3	3.0	3.4	4.2	3.8

MISCELLANEOUS CONSTANTS

Mean radius of the earth, 6.371×10^8 cm. = 6371 kilometers.
1 degree of latitude at 40° = 69 miles.
1 knot or nautical mile = 1′ of arc on the earth's surface at the equator.
Mean density of the earth, 5.52 grams per cu.cm.
Constant of gravitation, $K = 6.667 \times 10^{-8}$ = the attraction in dynes between two gram masses one centimeter apart.
Acceleration due to gravity at sea level, lat. 45° = 980.60 cm. per sec. per sec. = 32.172 feet per sec. per sec.
Length of seconds pendulum at sea level, lat. 45° = 99.356 cm. = 39.116 in.

Density of mercury at 0° C. = 13.5955 g. per c.c.
Density of water, maximum at 3.98° C. = 0.999973 g. per c.c.
Density of dry air at 0° C. and 760 mm. = .001293 g. per c.c.

Velocity of sound in dry air at 0° C., 33,136 cm. per sec. = 1089 feet per sec.
Velocity of light in a vacuum = 2.9989×10^{10} cm. per sec. = 984×10^6 feet per sec.

Heat equivalent of fusion of water 79.24 cal. per gram.
Heat equivalent of vaporization of water, 535.9 cal. per gram.
Coefficient of expansion of gases, .003665.
Specific heat of air, at constant pressure, 0.238.

Electrochemical equivalent of silver, 0.001118 g. per sec. per ampere.
Mean wave length of sodium light, .00005893 cm. or 5893. ångström units.
Absolute wave length of red cadmium line in air, 760 mm. pressure, 15° C., ångström units: 6438.4722 (Michelson); 6438.4696 (Fabry and Perot).

GREEK ALPHABET

Greek letter	Greek name	English equivalent	Greek letter	Greek name	English equivalent
Α α	Alpha	a	Ν ν	Nu	n
Β β	Beta	b	Ξ ξ	Xi	x
Γ γ	Gamma	g	Ο ο	Omicron	ŏ
Δ δ	Delta	d	Π π	Pi	p
Ε ε	Epsilon	ĕ	Ρ ρ	Rho	r
Ζ ζ	Zeta	z	Σ σ	Sigma	s
Η η	Eta	ē	Τ τ	Tau	t
Θ θ	Theta	th	Υ υ	Upsilon	u
Ι ι	Iota	i	Φ φ	Phi	ph
Κ κ	Kappa	k	Χ χ	Chi	ch
Λ λ	Lambda	l	Ψ ψ	Psi	ps
Μ μ	Mu	m	Ω ω	Omega	ō

DEFINITIONS AND FORMULÆ

FUNDAMENTAL CHEMICAL LAWS

Scientific laws are statements of facts which have been established by direct experiment.

Boyle's Law for Gases.—At a constant temperature the volume of a given quantity of any gas varies inversely as the pressure to which the gas is subjected. This idea is expressed in the following formulæ:

$$PV = \text{a constant, or } P = 1/V, \text{ or } V = 1/P, \text{ or } PV = P_1V_1$$

The Law of Combining Weights.—If the weights of elements which combine with each other be called their "combining weights," then elements always combine either in the ratio of their combining weights or of simple multiples of these weights.

Law of Definite Proportions.—In every sample of each compound substance the proportions by weight of the constituent elements are always the same.

Dalton's Law of Partial Pressures.—The pressure exerted by a mixture of gases is equal to the sum of the separate pressures which each gas would exert if it alone occupied the whole volume. This fact is expressed in the following formula:

$$PV = V(p_1 + p_2 + p_3, \text{ etc.})$$

Faraday's Law.—The amounts of decomposition effected by the passage of equal quantities of electricity through them are, for the same electrolyte, equal, and for different electrolytes are proportional to the combining weights of the elements or radicles which are deposited.

Gay-Lussac's Law for Gases (or Charles' Law).—At a constant pressure, the volume of a given quantity of any gas increases about 1/273 of its volume at 0° C. for each rise of 1° C. and at constant volume the pressure of a given quantity of any gas increases about 1/273 of the pressure at 0° C. for each rise of 1° C. in temperature.

Gay-Lussac's Law of Combining Volumes.—If gases interact and form a gaseous product, the volumes of the reacting gases and the volumes of the gaseous products are to each other in very simple proportions, which can be expressed by small whole numbers.

Hess' Law of Constant Heat Summation.—The amount of heat generated by a chemical reaction is the same whether reaction takes place in one step or in several steps, or all chemical reactions which start with the same original substances, and end with the same final substances, liberate the same amounts of heat, irrespective of the process by which the final state is reached.

Henry's Law.—The amount of gas which a liquid will dissolve is directly proportional to the pressure of the gas. This holds for all gases which do not unite chemically with the solvent.

The Law of Mass Action.—At a constant temperature the product of the active masses on one side of a chemical equation when divided by the product of the active masses on the other side of the chemical equation is a constant, regardless of the amounts of each substance present at the beginning of the action.

Law of Multiple Proportions.—Two elements may combine in more than one proportion by weight, but if so, the weights of one element which combine with a fixed weight of the other element, are always in a simple ratio to each other.

The Periodic Law.—The physical and chemical properties of the elements are functions of their atomic weights, and most of these properties are periodic functions of the atomic weights.

FUNDAMENTAL CHEMICAL THEORIES

A scientific hypothesis is an endeavor to form a rational mental picture of the causes which lead to a group of observed facts even though these causes may not be subject to direct proof.

A scientific theory is an hypothesis whose consequences have been so thoroughly tested by experiment that it has become generally accepted as the correct explanation for a group of facts.

The Atomic Theory.—All elementary forms of matter are composed of very small unit quantities called atoms. The atoms of a given element all have the same size and weight. The atoms of different elements have different size and weight. Atoms of the same or different elements unite with each other to form very small unit quantities of compound substances called molecules.

Avogadro's Theory.—Equal volumes of all gases under the same conditions of temperature and pressure contain equal numbers of molecules.

The Electrolytic Dissociation or Ionization Theory.—When an acid, base or salt is dissolved in water or any other dissociating solvent, a part or all of the molecules of the dissolved substance are broken up into parts called ions, some of which are charged with positive electricity and are called cations, and an equivalent number of which are charged with negative electricity and are called anions.

Electrolytic Solution Tension Theory (or the Helmholtz Double Layer Theory).—When a metal, or any other substance capable of existing in solution as ion is placed in water or any other dissociating solvent, a part of the metal or other substance passes into solution in the form of ions, thus leaving the remainder of the metal or substance charged with an equivalent amount of electricity of opposite sign from that carried by the ions. This establishes a difference in potential between the metal and the solvent in which it is immersed.

The Electron Theory.—An atom of any element consists of a definite number of unit negative charges of electricity moving in orbits inside the atom with velocities which approach the velocity of light.

DEFINITION OF CHEMICAL TERMS

An Acid is any substance which yields hydrogen ions.

The Active Mass of a substance is the number of gram-molecular-weights per liter in solution, or in gaseous form.

Adsorption. The ability of a solid to condense gases, liquids, or dissolved substances on their surfaces is called adsorption. It is a manifestation of the force of adhesion.

An Atom is the smallest unit quantity of an element that is capable of entering into chemical combination.

A Base is any substance which yields hydroxyl ions.

A Balanced or Reversible Action is one which can be caused to proceed in either direction by suitable variation in the conditions of temperature, volume, pressure or of the quantities of reacting substances.

A Catalytic Agent is a substance which by its mere presence alters the velocity of a reaction, and may be recovered unaltered in nature or amount at the end of the reaction.

A Colligative Property is a property numerically the same for a group of substances, independent of their chemical nature.

A Constitutive Property is a property which depends on the constitution or structure of the molecule.

A Cryohydrate is the solid which separates when a saturated solution freezes. It contains the solvent and the solute in the same proportions as they were in the saturated solution.

The Combining Weight of an element or radicle is its atomic weight divided by its valence.

Eutectic, a term applied to the mixture of two or more substances which has the lowest melting point.

The Hydrogen Equivalent of a substance is the number of replaceable hydrogen atoms in 1 molecule or the number of atoms of hydrogen with which 1 molecule could react.

The Heat of Combustion of a substance is the amount of heat evolved by the combustion of 1 gram molecular weight of the substance.

An Ion is a charged atom or group of atoms in solution. Solutions always contain equivalent numbers of positive and negative ions.

A Molecule is the smallest unit quantity of matter which can exist by itself and retain all the properties of the original substance.

A Molar Solution contains 1 gram molecular weight of dissolved substance per liter of solution.

A Normal Solution contains 1 gram molecular weight of dissolved substance divided by the hydrogen equivalent of the substance per liter of solution.

Oxidation is any process which increases the proportion of oxygen or acid-forming element or radicle in a compound.

Reduction is any process which increases the proportion of hydrogen or base-forming elements or radicle in a compound.

A Salt is any substance which yields ions, other than hydrogen or hydroxyl ions.

The Solubility Product or precipitation value is the product of the concentrations of the ions of a substance in a saturated solution of the substance.

A METHOD OF BALANCING EQUATIONS FOR OXIDATION-REDUCTION REACTIONS

On the left-hand side of the equation write the formulæ for all the compounds entering into the reaction. On the right-hand side write the formulæ for all the compounds formed in the reaction.

Determine the L. C. M. (least common multiple) of the numbers representing the changes in valence per molecule of the oxidizing and reducing agents.

The quotient obtained in dividing the L. C. M. by the number representing the valence change per molecule is the number of molecules of that compound required, or formed.

The reaction between $FeSO_4$, $KMnO_4$, and H_2SO_4 serves to illustrate. Following the rule as given above we write, $KMnO_4 + FeSO_4 + H_2SO_4 \rightarrow K_2SO_4 + MnSO_4 + Fe_2(SO_4)_3 + H_2O$.

The valence change of manganese is five, that of iron is two per molecule of $Fe_2(SO_4)_3$. The L. C. M. of these two numbers is ten.

The quotient obtained by dividing the L. C. M. by the valence change of manganese is two. Therefore two molecules of $KMnO_4$ are required. The quotient obtained by dividing the L. C. M. by the valence change of iron per molecule of $Fe_2(SO_4)_3$ is five. Five molecules of $Fe_2(SO_4)_3$ are formed. Ten molecules of $FeSO_4$ are needed. From the two molecules of $KMnO_4$ used one molecule of K_2SO_4 is formed, as well as two molecules of $MnSO_4$.

Eighteen sulfate radicals are used in forming the salts; ten of these radicals are supplied by the $FeSO_4$ used, the other eight must be supplied by the free acid. The sixteen hydrogens form eight molecules of water.

The complete equation is, therefore,

$$2KMnO_4 + 10FeSO_4 + 8H_2SO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 5Fe_2(SO_4)_3 + 8H_2O.$$

$Cr^{VI} \rightarrow Cr^{III}$

$3\ Fe^{++} \rightarrow 3\ Fe^{+++}$

ONE HUNDRED COMPLETED CHEMICAL EQUATIONS

1. $H_2PtCl_6 + 2KCl = 2HCl + K_2PtCl_6$
2. K_2PtCl_6 + heat $= 2KCl + Pt + 2Cl_2$
3. $KHC_4H_4O_6 + NaOH = KNaC_4H_4O_6 + H_2O$
4. $Na_2O_2 + 2H_2O = 2NaOH + H_2O_2$
5. $2KMnO_4 + 3H_2SO_4 + 5H_2O_2 = K_2SO_4 + 2MnSO_4 + 8H_2O + 5O_2$.
6. $2KI + H_2O_2 = 2KOH + I_2$
7. $2AuCl_3 + 3H_2O_2 + 6NaOH = 6NaCl + 6H_2O + 3O_2 + 2Au$
8. $MnCl_2 + 2KOH + H_2O_2 = 2KCl + H_2O + MnO.(OH)_2$ (brown)
9. $2NiCl_2 + 4KOH + H_2O_2 = 4KCl + 2Ni(OH)_3$ (black)
10. $2CoCl_2 + 4KOH + H_2O_2 = 4KCl + 2Co(OH)_3$ (black)
11. $MgCl_2 + Na_2HPO_4 + NH_3 = 2NaCl + MgNH_4PO_4$
12. $2BaCl_2 + K_2Cr_2O_7 + H_2O = 2BaCrO_4 + 2HCl + 2KCl$
13. $AlCl_3 + 3KOH = 3KCl + Al(OH)_3$
14. $Al(OH)_3 + 3KOH = 3H_2O + Al(OK)_3$
15. $2AlCl_3 + 3Na_2S_2O_3 + 3H_2O = 6NaCl + 3S + 3SO_2 + 2Al(OH)_3$
16. $2CrCl_3 + 3(NH_4)_2S + 6H_2O = 6NH_4Cl + 3H_2S + 2Cr(OH)_3$
17. $CrCl_3 + 8NaC_2H_3O_2 + 4H_2O + 3Cl = 6NaCl + 8HC_2H_3O_2 + Na_2CrO_4$
18. $2CrCl_3 + 3MnO_2 + 2H_2O = 3MnCl_2 + 2H_2CrO_4$
19. $K_2Cr_2O_7 + 2KOH = H_2O + 2K_2CrO_4$
20. $K_2Cr_2O_7 + 6FeSO_4 + 7H_2SO_4 = 7H_2O + K_2SO_4 + 3Fe_2(SO_4)_3 + Cr_2(SO_4)_3$
21. $K_2Cr_2O_7 + 6HI + 4H_2SO_4 = K_2SO_4 + Cr_2(SO_4)_3 + 7H_2O + 6I$
22. $K_2Cr_2O_7 + 14HCl = 2KCl + 2CrCl_3 + 7H_2O + 3Cl_2$
23. $FeCl_2 + 2KCN = 2KCl + Fe(CN)_2$
24. $FeCN_2 + 4KCN = K_4[Fe(CN)_6]$
25. $FeCl_3 + 3NaC_2H_3O_2 = 3NaCl + Fe(C_2H_3O_2)_3$
26. $Fe(C_2H_3O_2)_3 + 2H_2O = 2HC_2H_3O_2 + Fe(OH)_2(C_2H_3O_2)$
27. $K_4[Fe(CN)_6] + 6H_2SO_4 + 6H_2O = 2K_2SO_4 + FeSO_4 + 3(NH_4)_2SO_4 + 6CO$
28. $2MnO_2 + 8HCl = 4H_2O + 2MnCl_2 + 2Cl_2$
29. $2MnSO_4 + 5PbO_2 + 6HNO_3 = 2PbSO_4 + 3Pb(NO_3)_2 + 2H_2O + 2HMnO_4$
30. $2HMnO_4 + 14HCl = 8H_2O + 2MnCl_2 + 5Cl_2$
31. $MnSO_4 + 2Na_2CO_3 + O_2 = 2CO_2 + Na_2SO_4 + Na_2MnO_4$
32. $2KMnO_4 + 10FeSO_4 + 8H_2SO_4 = K_2SO_4 + 2MnSO_4 + 5Fe_2(SO_4)_3 + 8H_2O$
33. $2KMnO_4 + 3MnSO_4 + 2H_2O = K_2SO_4 + 5MnO_2 + 2H_2SO_4$
34. $NiCl_2 + 6NH_3 = Ni(NH_3)_6Cl_2$
35. $NiCl_2 + 2KCN = 2KCl + Ni(CN)_2$
36. $Ni(CN)_2 + 2KCN = K_2Ni(CN)_4$
37. $CoCl_2 + 2KNO_2 = Co(NO_2)_2 + 2KCl$
38. $Co(NO_2)_2 + 2HNO_2 = H_2O + NO + Co(NO_2)_3$
39. $Co(NO_2)_3 + 3KNO_2 = K_3Co(NO_2)_6$
40. $3Zn + 8HNO_3 = 3Zn(NO_3)_2 + 4H_2O + 2NO$
41. $Zn + 2KOH = K_2ZnO_2 + H_2$
42. $Zn(OH)_2 + 2NH_4Cl + 4NH_3 = Zn(NH_3)_6Cl_2 + 2H_2O$
43. $ZnCl_2 + 2KCN = 2KCl + Zn(CN)_2$

44. $Zn(CN)_2 + 2KCN = K_2Zn(CN)_4$
45. $3Hg + 8HNO_3 = 3Hg(NO_3)_2 + 4H_2O + 2NO$
46. $HgCl_2 + 2NH_3 = NH_4Cl + HgNH_2Cl$
47. $3HgCl_2 + 2H_2S = 4HCl + Hg_3Cl_2S_2$ (white)
48. $Hg_3Cl_2S_2 + H_2S = 2HCl + 3HgS$
49. $3Hg(NO_3)_2 + 6FeSO_4 = 2Fe(NO_3)_3 + 2Fe_2(SO_4)_3 + 3Hg$
50. $2HgCl + 2NH_3 = NH_4Cl + HgNH_2Cl + Hg$
51. $Hg_2(NO_3)_2 + H_2S = 2HNO_3 + HgS + Hg$
52. $Hg_2(NO_3)_2 + 2KCN = 2KNO_3 + Hg(CN)_2 + Hg$
53. $Pb(NO_3)_2 + 2KOH = Pb(OH)_2 + 2KNO_3$
54. $Pb(OH)_2 + 2KOH = K_2PbO_2 + 2H_2O$
55. $2PbCl_2 + H_2S = 2HCl + PbCl_2.PbS$ (orange)
56. $PbCl_2.PbS + H_2S = 2PbS + 2HCl$
57. $3PbS + 8HNO_3 = 3Pb(NO_3)_2 + 4H_2O + 2NO + 3S$
58. $BiCl_3 + H_2O = 2HCl + BiOCl$
59. $SnCl_2 + 2KOH = 2KCl + Sn(OH)_2$ (white ppt.)
60. $Sn(OH)_2 + 2KOH = K_2SnO_2 + 2H_2O$ (soluble)
61. $2BiCl_3 + 6KOH = 2Bi(OH)_3 + 6KCl$
62. $2Bi(OH)_3 + 3K_2SnO_2 = 3H_2O + 3K_2SnO_3 + Bi_2$ (black)
63. $3Cu + 8HNO_3 = 4H_2O + 3Cu(NO_3)_2 + 2NO$
64. $Cu + H_2SO_4 = H_2O + SO_2 + CuO$
65. $CuO + H_2SO_4 = CuSO_4 + H_2O$
66. $2CuSO_4 + 2NH_4OH = (NH_4)_2SO_4 + Cu_2SO_4 \cdot (OH)_2$
67. $Cu_2SO_4(OH)_2 + (NH_4)_2SO_4 + 6NH_3 = 2[Cu(NH_3)_4](SO_4) . H_2O$ (soluble, blue)
68. $2Cu(NH_3)_4SO_4 . H_2O + 9KCN = Cu_2(CN)_8NH_4 . K_5 + 2K_2SO_4 + 6NH_3 + NH_4CNO$
69. $Cd(NO_3)_2 + 2KCN = 2KNO_3 + Cd(CN)_2$
70. $Cd(CN)_2 + 2KCN = K_2Cd(CN)_4$
71. $K_2Cd(CN)_4 + H_2S = 2KCN + 2HCN + CdS$
72. $H_3AsO_4 + H_2S = H_2O + S + H_3AsO_3$
73. $2H_3AsO_3 + 3H_2S = 6H_2O + As_2S_3$
74. $As_2S_3 + 3(NH_4)_2S = 2(NH_4)_3AsS_3$
75. $2(NH_4)_3AsS_3 + 6HCl = 6NH_4Cl + As_2S_3 + 3H_2S$
76. $As_2S_5 + 3(NH_4)_2S = 2(NH_4)_3AsS_4$.
77. $2(NH_4)_3AsS_4 + 6HCl = As_2S_5 + 3H_2S + 4NH_4Cl$. Antimony reactions same as arsenic
78. $3Sn + 4HNO_3 + H_2O = 3H_2SnO_3 + 4NO$
79. $SnCl_2 + H_2S = SnS + 2HCl$
80. $SnS + (NH_4)_2S_2 = (NH_4)_2SnS_3$
81. $(NH_4)_2SnS_3 + 2HCl = 2NH_4Cl + H_2S + SnS_2$
82. $SnCl_4 + 2H_2S = SnS_2 + 4HCl$
83. $SnS_2 + (NH_4)_2S = (NH_4)_2SnS_3$
84. $SnO_2 + 2KCN = 2KCNO + Sn$ (fusion)
85. $2Au + 2HNO_3 + 6HCl = 4H_2O + 2NO + 2AuCl_3$
86. $2AgNO_3 + 2KOH = 2KNO_3 + H_2O + Ag_2O$
87. $Ag_2O + 2NH_4OH = 2(AgNH_3)OH + H_2O$
88. $AgCl + 2NH_4OH = Ag(NH_3)_2Cl + 2H_2O$
89. $AgCl + 2KCN = KAg(CN)_2 + KCl$
90. $6NH_4OH + 2NH_3 + 3Cl_2 = 6H_2O + 6NH_4Cl + N_2$
91. $6NaOH + 3Cl_2 = 5NaCl + NaClO_3 + 3H_2O$
92. $H_2SO_4 + 2HI = H_2O + H_2SO_3 + I_2$

93. $H_2SO_4+8HI=4H_2O+H_2S+4I_2$
93. $2Na_2S_2O_3+I_2=2NaI+Na_2S_4O_6$
95. $H_3PO_4 + 12(NH_4)_2MoO_4 + 21HNO_3 = (NH_4)_3PO_4.12MoO_4 +21(NH_4)NO_3+12H_2O$
96. $(NH_4)_3PO_4 . 12MoO_4 + 24NH_4OH = (NH_4)_3PO_4 + 12(NH_4)_2 MoO_4+12H_2O$
97. $6FeSO_4+3H_2SO_4+2HNO_3=3Fe_2(SO_4)_3+4H_2O+2NO$
98. $Fe(NO_3)_2+NO=Fe(NO_3)_2NO$
99. $KClO_3+3H_2SO_4+6FeSO_4=3Fe_2(SO_4)_3+3H_2O+KCl$
100. $Na_2SiO_3+2NH_4Cl+2H_2O=2NaCl+2NH_4OH+H_2SiO_3$

PHYSICAL TERMS, QUANTITIES AND UNITS

Mechanics

Unit of Time.—The second, 1/86400 of a mean solar day. One of the three fundamental units of the C. G. S. system.

Unit of Length.—The centimeter, 1/100 the length of the International Prototype Meter, at Paris, at zero degrees centigrade. One of the three fundamental units of the C. G. S. system. The standard in the British system is the yard, the prototype of which is kept by the British government. The United States standard yard is defined as 3600/3937 meter.

Unit of Area.—The square centimeter. The area of a square whose sides are one centimeter in length. Other units of area are similarly derived.

Unit of Volume.—The cubic centimeter, the volume of a cube whose edges are one centimeter in length. Other units of volume are derived in a similar manner.

Mass.—Quantity of matter.

Units of Mass.—The gram is 1/1000 the quantity of matter in the International Prototype Kilogram; one of the three fundamental units of the C. G. S. system. The British standard of mass is the pound, of which a standard is preserved by the government. The United States standard mass is the avoirdupois pound defined as 1/2.20462 kilogram.

Inertia.—The resistance offered by a body to a change of its state of rest or motion. A particular aspect of a mass; the terms are practically synonymous.

Density.—Concentration of matter, measured by the mass per unit volume, expressed as grams per cubic centimeter.

Specific Gravity.—The ratio of the mass of a body to the mass of an equal volume of water at 4° C.

Angle.—The ratio between the arc and the radius of the arc.

Units of Angle.—The **radian,** the angle subtended by an arc equal to the radius; the degree, 1/360 part of a circumference.

Solid Angle.—Measured by the ratio of the surface of the portion of a sphere enclosed by the conical surface forming the angle, to the square of the radius of the sphere.

Unit of Solid Angle.—The steradian, the solid angle which encloses a surface on the sphere equivalent to the square of the radius.

Speed.—Time rate of motion measured by the distance moved over in unit time. Unit—one centimeter per second.

Velocity.—Time rate of motion in a fixed direction. Unit—one centimeter per second.

Angular Velocity.—Time rate of angular motion about a center. Unit—one radian per second.

Acceleration.—The time rate of change of velocity either in speed or direction measured by the change in unit time. Unit—one centimeter per second per second.

Angular Acceleration.—The time rate of change of angular velocity. Unit—one radian per second per second.

Momentum.—Quantity of motion measured by the product of mass and velocity. Unit—one gram-centimeter per second.

Angular Momentum or Moment of Momentum.—Quantity of angular motion measured by the product of the angular velocity and the moment of inertia. Unit—unnamed, its nature is expressed by $g.cm^2/sec.$

Force.—That which changes the state of rest or motion in matter, measured by the rate of change of momentum. Unit—the dyne, the force which will produce the change of velocity of one centimeter per second in a gram mass in one second.

Moment of Force or Torque.—The effectiveness of a force to produce rotation about a center, measured by the product of the force and the perpendicular distance from the line of action of the force to the center. Unit—the dyne-centimeter.

Gravitation.—The universal attraction existing between all material bodies.

Acceleration Due to Gravity.—The acceleration of a body freely falling in a vacuum. Unit—one centimeter per second per second.

Weight.—The force with which a body is attracted toward the center of the earth. The weight of any fixed mass varies according to its geographical position.

Unit of Weight.—The dyne.

Moment of Inertia.—A measure of the effectiveness of mass in rotation. In the rotation of a rigid body not only the body's mass, but the distribution of the mass about the axis of rotation determines the change in the angular velocity resulting from the action of a given torque for a given time. Moment of inertia in rotation is analogous to mass (inertia) in simple translation. The unit is $g.\ cm.^2$

Period in uniform circular motion is the time of one complete revolution.

Centripetal Force.—The force required to keep a moving mass in a circular path. Centrifugal force is the name given to the outward force of a mass in rotation.

Simple Harmonic Motion.—If a point move uniformly in a circle, the motion of its projection on the diameter (or any straight line in the same plane) is simple harmonic motion.

Displacement at any instant. The distance of a vibrating or oscillating particle from its position of equilibrium or the center of the circle of reference.

Amplitude. — The maximum value of the displacement.

Phase.—The fraction of a whole period which has elapsed since the moving particle last passed through its middle position in a positive direction.

Work.—When a force acts against resistance to produce motion in a body the force is said to do work. Work is measured by the product of the force acting and the distance moved through against the resistance.

Units of Work.—The erg, a force of one dyne acting through one centimeter. The joule is 10^7 ergs.

Power.—The time rate at which work is done.

Units of Power.—The watt, one joule (ten million ergs) per second; the kilowatt is equal to 1000 watts; the horse-power, 33,000 foot-pounds per minute, is equal to 746 watts.

Energy.—The capability of doing work. Units of energy the same as of work.

Potential Energy.—Energy due to position of one body with respect to another or to the relative parts of the same body.

Kinetic Energy.—Energy due to motion.

Simple Machine.—A contrivance for the transfer of energy and for increased convenience in the performance of work.

Mechanical advantage of a machine is the ratio of the distance through which force is applied to the distance through which resistance is overcome, also called the velocity ratio.

Efficiency is the ratio of the work done by a machine to the work done upon it.

Elasticity.—The property by virtue of which a body recovers from deformation produced by force.

Stress.—The force producing or tending to produce deformation in the body measured by the force applied per unit area. Unit—one dyne per square centimeter.

Strain.—The deformation resulting from a stress measured by the ratio of the change to the total value of the dimension in which the change occurred.

Modulus of Elasticity.—The stress required to produce unit strain, which may be a change of length (Young's modulus); a twist or shear (modulus of rigidity) or of volume (bulk modulus).

Limit of Elasticity.—The smallest value of the stress producing permanent alteration.

Coefficient of Restitution of two bodies on impact, the ratio of the difference in velocity before impact to the difference after impact.

Viscosity.—All liquids possess a definite resistance to change of form and many solids show a gradual yielding to forces tending to change their form. This property is called viscosity.

Pressure.—Force applied to, or distributed, over a surface; measured as force per unit area. Unit—the barye, one dyne per square centimeter. The mega-barye is equal to 10^6 dynes per square centimeter. Pressure is also measured by the height of the column of mercury or water which it supports.

Surface Tension.—The tension exhibited by the free surface of liquids measured in dynes per centimeter.

Heat

Temperature.—The condition of a body which determines the transfer of heat to or from other bodies. The unit of temperature is the Centigrade degree, 1/100 the difference in temperature between that of melting ice and boiling water at 76 centimeters pressure. The degree Fahrenheit is 1/180 and the degree Reaumur is 1/80 the above-mentioned difference of temperature.

Heat Quantity is measured by the change of temperature produced. The unit of heat is the calorie, the quantity of heat necessary to change the temperature of one gram of water from 3.5° C. to 4.5° C. (called a small calorie). If the temperature changed involved is from 14.5 to 15.5° C. the unit is the normal calorie. The mean calorie is 1/100 the quantity of heat necessary to raise one gram of water from 0° C. to 100° C. The large calorie is equal to 1000 small calories. The British thermal unit is the heat required to raise the temperature of one pound of water at its maximum density, 1° F. It is equal to 252 calories.

Coefficient of Thermal Expansion.—The coefficient of linear expansion is the ratio of the change in length per degree to the length at 0° C. The coefficient of surface expansion is two times the linear coefficient. The coefficient of volume expansion (for solids) is three times the linear coefficient. The coefficient of volume expansion for liquids is the ratio of the change in volume per degree to the volume at 0° C. The value of the coefficient varies with temperature. The coefficient of volume expansion for a gas under constant pressure is nearly the same for all gases and temperatures and is equal to 0.00367 for 1° C.

Absolute Zero.—The temperature at which a gas would show no pressure if the general law for gases should hold for all temperatures. It is equal to −273° C. or −459.4° F.

Specific Heat.—The quantity of heat necessary to cause a unit change of temperature in unit mass measured in C. G. S. units as calories per gram per degree centigrade.

Thermal Capacity or Water Equivalent.—The total quantity of heat necessary to raise any body or system unit temperature, measured as calories per degree centigrade in the C. G. S. system.

Heat Equivalent, or Latent Heat, of Fusion.—The quantity of heat necessary to change one gram of solid to a liquid with no temperature change.

Latent Heat of Vaporization.—The quantity of heat necessary to change one gram of liquid to vapor without change of temperature. Both the above quantities are measured as calories per gram.

Thermal Conductivity.—Time rate of transfer of heat by conduction, through unit thickness, across unit area for unit difference of temperature. It is measured as calories per second per square centimeter for a thickness of one centimeter and a difference of temperature of 1° C.

Mechanical Equivalent of Heat is the quantity of energy which, when transformed into heat, is equivalent to unit quantity of heat, 4.18×10^7 ergs = 1 calorie (20° C.).

Isothermal. — When a gas passes through a series of pressure and volume variations without change of temperature the changes are called isothermal. A line on a pressure-volume diagram representing these changes is called an isothermal line.

Adiabatic. — A body is said to undergo an adiabatic change when its condition is altered without gain or loss of heat. The line on the pressure volume diagram representing the above change is called an adiabatic line.

Entropy. — A quantity depending on the quantity of heat in a body and on its temperature, which, when multiplied by any lower temperature (minimum available), gives the unavailable energy, or unavoidable waste when mechanical work is derived from the heat energy of the body.

Absolute Humidity. — Mass of water vapor present in the atmosphere measured as grams per cubic meter.

Relative Humidity. — The ratio of the quantity of water vapor present in the atmosphere to the quantity which would saturate at the existing temperature.

Wave Motion and Sound

Wave Motion. — A progressive disturbance propagated in a medium by the periodic vibration of the particles of the medium. Transverse wave motion is that in which the vibration of the particles is perpendicular to the direction of propagation. Longitudinal wave motion is that in which the vibration of the particles is parallel to the direction of propagation.

Pitch of sound is determined by the frequency or number of vibrations per second.

Intensity or loudness of a sound depends upon the energy of the wave motion. The term intensity as used in physics is measured by the energy transmitted per second through one square centimeter of surface.

Quality or timbre of a sound depends on the coexistence with the fundamental of other vibrations of various frequencies and amplitudes.

Lissajou's Figures. — The path described by a particle which is simultaneously displaced by two simple harmonic motions at right angles, when the periods of the two motions are in the ratio of two small whole numbers, shows a variety of characteristic curves called Lissajou's figures.

Beats. — Two tones of slightly different frequencies sounded together interfere to give a sound of regularly varying intensity. The number of beats per second is the difference in frequency of the two tones.

Static Electricity

Unit Quantity of electricity or charge is the quantity which, when concentrated at a point and placed at unit distance from an equal and similarly concentrated quantity, is repelled with unit force. If the distance is one centimeter and the force of repulsion one dyne and the surrounding medium a vacuum, we have the electrostatic unit of quantity. The coulomb = 3×10^9 electrostatic units.

Line of Force.—A line such that its direction at every point is the same as the direction of the force which would act on a small positive charge placed at that point. A line of force is defined as starting from a positive charge and ending on a negative charge.

Conductors.—A class of bodies which are incapable of supporting electric strain. A charge given to a conductor spreads to all parts of the body.

Dielectrics or Insulators or Non-Conductors.—A class of bodies supporting an electric strain. A charge on one part of a non-conductor is not communicated to any other part.

Electric Surface Density.—Quantity of electricity per unit area.

Intensity of Electric Field is measured by the force exerted on unit charge. Unit field intensity is the field which exerts the force of one dyne on unit positive charge.

Electric Potential at any point is measured by the work necessary to bring unit positive charge from an infinite distance. Difference of potential between two points is measured by the work necessary to carry unit positive charge from one to the other. If the work involved is one C. G. S. unit of work we have the electrostatic unit of potential.

Electromotive Force is defined as that which causes a flow of current. The electromotive force of a cell is measured by the maximum difference of potential between its plates. The **volt** is the electromotive force which performs work at the rate of one joule per second (one watt) in producing a current of one ampere. A watt hour is the work equivalent to a current of one ampere at a pressure of one volt flowing for one hour. A kilowatt hour equals 1000 watt hours. A volt equals 10^8 electro static units of potential.

Capacity is measured by the charge which must be communicated to a body to raise its potential one unit. Electrostatic unit capacity is that which requires one electrostatic unit of charge to raise its potential one electrostatic unit. The farad = 9×10^{11} electrostatic units.

Specific Inductive Capacity.—The ratio of the capacity of a condensor with a given substance as dielectric to the capacity of the same condenser with air or a vacuum as dielectric is called the specific inductive capacity.

Magnetism

Unit Magnetic Pole or Quantity of Magnetism.—Two unit quantities of magnetism concentrated at points unit distance apart in a vacuum repel each other with unit force. If the distance involved is one centimeter and the force one dyne the quantity of magnetism at each point is one C. G. S. unit of magnetism.

Surface Density of Magnetism.—Quantity of magnetism per unit area.

Magnetic Line of Force is a line which at every point has the direction of the magnetic force at that point.

Magnetic Field Intensity is measured by the force acting on unit magnetic pole. The unit of magnetic field intensity, the gauss, is that field which exerts a force of one dyne on unit magnetic pole.

Magnetic Moment of a magnet is given by the product of the quantity of magnetism in each pole by the distance between the poles.

Intensity of Magnetization is given by the quotient of magnetic moment of a magnet by its volume or it is magnetic moment per unit volume.

Declination.—The angle between the vertical plane containing the direction of the earth's field at any point and a plane containing the geographic north and south meridian.

Dip.—The angle measured in a vertical plane between the direction of the earth's magnetic field and the horizontal.

Paramagnetic bodies are those which tend to set the longest dimension parallel to the magnetic field, e.g., iron, cobalt, nickel.

Diamagnetic bodies tend to set the longest dimension across the magnetic field, e.g., bismuth.

Hysteresis.—The magnetization of a sample of iron or steel due to a magnetic field which is made to vary through a cycle of values, lags behind the field. This phenomenon is called hysteresis.

Current Electricity

Electric Current.—The rate of transfer of electricity. The transfer at the rate of one electrostatic unit of electricity in one second is the electrostatic unit of current. The electromagnetic unit of current is a current of such strength that one centimeter of the wire in which it flows is pushed sideways with a force of one dyne when the wire is at right angles to a magnetic field of unit intensity. The practical unit of current is the ampere, a transfer of one coulomb per second.

Conductivity.—A property of electric conductors depending on their dimensions, material and temperature which determines the current produced by a given electromotive force. The practical unit of conductivity is the mho, the reciprocal of the ohm.

Resistance.—The reciprocal of conductivity. The unit of resistance, the legal ohm is defined as the resistance to an unvarying current of a column of mercury at 0° C., 14.4521 grams in mass, of a constant cross-section, and 106.3 centimeters long. The cross-section is nearly one square millimeter.

Specific Resistance.—The resistance at 0° C. of a portion of substance of unit length and cross-section.

Temperature Resistance Coefficient.—The ratio of the change of resistance in a wire due to a change of temperature of 1° C. to its resistance at 0° C.

Induction.—Any change in the intensity or direction of a magnetic field causes an electromotive force in any conductor in the field. The induced electromotive force generates an induced current if the conductor forms a closed circuit.

Self-Induction.—The change in magnetic field due to the variation of a current in a conducting circuit causes an induced electromotive force in the circuit itself. This phenomenon is known as self-induction. It is measured as electromotive force produced in a conductor by unit rate of variation of the current through it. Units of self-induction are the centimeter (electro static) and the henry, which is equal to 10^9 centimeters of inductance.

Mutual Induction.—A change of current in a conductor is accompanied by a change of magnetic field which induces an electromotive force in a neighboring circuit. The mutual induction is measured by the electromotive force induced in one circuit by unit rate of variation of current in the other. Units, as of self-induction.

Light

Index of Refraction for any substance is the ratio of the velocity of light in a vacuum to its velocity in the substance. It is also the ratio of the sine of the angle of incidence to the sine of the angle of refraction. In general, the index of refraction for any substance varies with the wave length of the refracted light.

Minimum Deviation.—The deviation or change of direction of light passing through a prism is a minimum when the angle of incidence is equal to the angle of emergence.

Principal Focus of a lens or spherical mirror is the point of convergence of light coming from a source at an infinite distance.

Conjugate Foci.—Under proper conditions light divergent from a point on or near the axis of a lens or spherical mirror is focused at another point. The point of convergence and the position of the source are conjugate foci.

Spherical Aberration.—When large surfaces of spherical mirrors or lenses are used the light divergent from a point source cannot be exactly focused at a point. The phenomenon is known as spherical aberration.

Chromatic Aberration.—Due to the difference in the index of refraction for different wave lengths, light of various wave lengths from the same source cannot be focused in a point by a simple lens. This is called chromatic aberration.

Achromatic.—A term applied to lenses signifying their more or less complete correction for chromatic aberration.

Magnifying Power of an optical instrument is the ratio of the angle subtended by the image of the object seen through the instrument to the angle subtended by the object when seen by the unaided eye at a distance of 25 cms. (10 ins.)

Resolving Power of a telescope or microscope is indicated by the minimum separation of two objects for which they appear distinct and separate when viewed through the instrument.

Angular Aperture of an objective is the largest angular extent of wave surface which it can transmit.

Numerical Aperture is the sine of half the angular aperture, used as a measure of the optical power of the objective.

Dispersion.—The difference between the index of refraction of any substance for any two wave lengths is a measure of the dispersion for these wave lengths, called the coefficient of dispersion.

Diffraction.—If the light source were a point the shadow of any object would have its maximum sharpness; a certain amount of illumination, however, would be found within the geometrical shadow due to the diffraction of the light at the edge of the object.

Polarized Light.—Light which exhibits different properties in different directions at right angles to the line of propagation is said to be polarized. Specific rotation is the power of liquids to rotate the plane of polarization. It is stated in terms of specific rotation or the rotation in degrees per decimeter per unit density.

PHYSICAL FORMULÆ

Mechanics

Composition of Vectors.—If the angle between two vectors is A, and their magnitudes a and b, their resultant,

$$c=\sqrt{a^2+b^2+2ab\cos A}.$$

Velocity.—If s is space passed over in time t, the velocity,

$$v=\frac{s}{t}.$$

Uniformly Accelerated Motion.—If v_0 is the initial velocity, v_t the velocity after time t, the acceleration,

$$a=\frac{v_t-v_0}{t}.$$

The velocity after time t,

$$v_t=v_0+at.$$

Space passed over in time t,

$$s=v_0t+\tfrac{1}{2}at^2.$$

Velocity after passing over space s,

$$v_s=\sqrt{v_0{}^2+2as}.$$

Space over in the nth second,

$$s=v_0+\tfrac{1}{2}a(2n-1).$$

Falling Bodies.—Symbols as for uniformly accelerated motion except that $v_0=0$ and g is the acceleration due to gravity. The above formulæ become, — air resistance neglected,

$$v_t=gt,\quad s=\tfrac{1}{2}gt^2,\quad v_s=\sqrt{2gs}.$$

Bodies Projected Vertically Upward.—If v is the velocity of projection, the time to reach greatest height, neglecting the resistance of the air,

$$t = \frac{v}{g}.$$

Greatest height,

$$h = \frac{v^2}{2g}.$$

Projectiles.—For bodies projected with velocity v at an angle α with the horizontal, the time to highest point of flight,

$$t = \frac{v \sin \alpha}{g}.$$

Total time of flight,

$$T = \frac{2v \sin \alpha}{g}.$$

Maximum height,

$$h = \frac{v^2 \sin^2 \alpha}{2g}.$$

Horizontal range,

$$R = \frac{v^2 \sin 2\alpha}{g}.$$

In the above equations the resistance of the air is neglected.

Angular Velocity.—If the angle described in time t is θ, the angular velocity,

$$\omega = \frac{\theta}{t}.$$

Angular Acceleration.—If the initial angular velocity is ω_0, and the velocity after time t is $\equiv \omega_t$, the angular acceleration,

$$A = \frac{\omega_t - \omega_0}{t}.$$

The angular velocity after time t,

$$\omega_t = \omega_0 + At.$$

The angle swept out in time t,

$$\theta = \omega_0 t + \tfrac{1}{2}At^2.$$

The angular velocity after movement through the arc θ,

$$\omega = \sqrt{\omega_0{}^2 + 2A\theta},$$

Momentum.—A mass m moving with velocity v has a momentum

$$M = mv.$$

Angular momentum of a mass whose moment of inertia is I, rotating with angular velocity ω, is

$$I\omega.$$

Force.—For a mass m and an acceleration a,

$$F = ma.$$

Moment of Force or Torque.—If a force F acts to produce rotation about a center at a distance d from the line in which the force acts, the force has a torque,

$$T = Fd.$$

Gravitation.—The force of attraction between two masses, m and m', separated by a distance r, k being the constant of gravitation,

$$F = k\frac{mm'}{r^2}.$$

(If m amd m' are given in grams, and r in centimeters, F will be in dynes if $k = 6.658 \times 10^{-8}$.)

Weight of mass m, where g is the acceleration due to gravity,

$$W = mg.$$

Acceleration Due to Gravity at any Latitude and Elevation. If ϕ is the latitude and H the elevation in centimeters the acceleration in C. G. S. units is,

$$g = 980.616 - 2.5928 \cos 2\phi + 0.0069 \cos^2 2\phi - 3.086 \times 10^{-6} H.$$

(Helmert's equation.)

Uniform Circular Motion.—If r is the radius of a circle, s the linear speed in the arc, ω the angular velocity and T the period or time of one revolution, the angular velocity is,

$$\omega = \frac{s}{r} = \frac{2\pi}{T}.$$

The acceleration toward the center is

$$a = \frac{s^2}{r} = \omega^2 r = \frac{4\pi^2 r}{T^2}.$$

The centrifugal force for a mass m,

$$F = \frac{ms^2}{r} = m\omega^2 r = \frac{4\pi^2 mr}{T^2}.$$

Application to the Solar System.—If M is the mass of the sun, G the constant of gravitation, P the period of the planet and r the distance of the planet from the sun, then the mass of the sun

$$M = \frac{4\pi^2 r^3}{GP^2} \quad (G = 6.657 \text{ for C. G. S. units.})$$

If P is the period and r the distance of a satellite revolving around the planet, the above expression for M gives the mass of the planet. The formula is written on the assumption that the orbit of the planet or satellite is circular, which is only approximately true.

Simple Harmonic Motion.—If r is the radius of the reference circle, ω the angular velocity of the point in the circle, θ the angular displacement at the time t after the particle passes the mid-point of its path, the linear displacement,

$$x = r \sin \theta = r \sin \omega t.$$

The velocity at the same instant,

$$v = r\omega \cos \theta = \omega\sqrt{r^2 - x^2}.$$

The acceleration,

$$a = -\omega^2 x.$$

The force for a mass m,

$$F = -m\omega^2 x = -\frac{4\pi^2 m x}{T^2}.$$

The period

$$T = 2\pi\sqrt{\frac{x}{a}}.$$

The Pendulum.—For a simple pendulum of length l, for a small amplitude, the period,

$$T = 2\pi\sqrt{\frac{l}{g}}, \quad \text{or} \quad g = 4\pi^2\frac{l}{T^2}.$$

For a sphere suspended by a wire of negligible mass where d is the distance from the knife edge to the center of the sphere whose radius is r, the length of the equivalent simple pendulum,

$$l = d + \frac{2r^2}{5d}.$$

If the period is P for an arc θ, the time of vibration in an infinitely small arc is approximately,

$$T = \frac{P}{1 + \frac{1}{4}\sin^2\frac{\theta}{4}}.$$

Foucault's Pendulum.—The rate of rotation in degrees per hour of a line on the surface of the earth relative to the plane of a Foucault's pendulum at latitude ϕ is,

$$\omega = 15 \sin \phi.$$

Work.—If a force F act through a space s, the work done is

$$W = Fs.$$

Power.—If an amount of work W is done in time t the power or rate of doing work is,

$$P = \frac{W}{t} = \frac{Fs}{t}.$$

Energy.—The potential energy of a mass m, raised through a distance h, where g is the acceleration due to gravity, is

$$PE = mgh.$$

The kinetic energy of mass m, moving with a velocity v, is

$$KE = \tfrac{1}{2}mv^2.$$

Simple Machines.—If a force P applied through a distance p results in a force F through a distance f, neglecting friction,

$$Pp = Ff.$$

Mechanical advantage in the case stated above is $\frac{f}{p}$.

If the force applied to overcome friction alone is x, the efficiency is,

$$E = \frac{Ff}{(P+x)p}.$$

Mass by Weighing on a Balance with Unequal Arms.—If W_1 is the value for one side, W_2 the value for the other, the true mass,

$$W = \sqrt{W_1 W_2}.$$

Sensitiveness of a Balance.—If w is the weight of the beam, h the distance of the center of gravity below the knife edge, a the length of the balance arms and x a small mass added to one pan, the deflection θ produced is given by

$$\tan\theta = \frac{a}{wh}x.$$

Elastic Coefficients

Young's modulus by stretching.—If an elongation s is produced by the weight of the mass m, in a wire of length l, and radius r, the modulus,

$$M = \frac{mgl}{\pi r^2 s}.$$

Young's modulus by bending, bar supported at both ends. If a flexure s is produced by the weight of mass m, added midway between the supports separated by a distance l, for a rectangular bar with vertical dimensions of cross-sectión a and horizontal dimension b, the modulus is,

$$M = \frac{mgl^3}{4sa^3b}.$$

For a cylindrical bar of radius r,

$$M = \frac{mgl^3}{12\pi r^4 s}.$$

For a bar supported at one end. In the case of a rectangular bar as described above,

$$M=\frac{4mgl^3}{sa^3b}.$$

For a round bar supported at one end,

$$M=\frac{4mgl^3}{3\pi r^4 s}.$$

Modulus of Rigidity.—If a couple $C(=mgx)$ produces a twist of θ radians in a bar of length l and radius r, the modulus is

$$M=\frac{2Cl}{\pi r^4\theta}.$$

Coefficient of Restitution.—Two bodies moving in the same straight line with velocities v_1 and v_2 respectively, collide and after impact move with velocities v_3 and v_4. The coefficient of restitution is

$$C=\frac{v_4-v_3}{v_2-v_1}.$$

Viscosity.—Flow of liquids through a tube; where l is the length of the tube, r its radius, t the difference of pressure at the ends, η the coefficient of viscosity, the volume escaping per second,

$$v=\frac{\pi p r^4}{8l\eta} \qquad \text{(Poiseuille.)}$$

Rate of Fall of a Small Sphere in a Fluid.—Where V is the maximum velocity, r the radius of the sphere, M_s the mass of the sphere, M_l the mass of the same volume of liquid, g the acceleration due to gravity and η the coefficient of viscosity,

$$V=\frac{(M_s-M_l)g}{6\pi r\eta}.$$

Diffusion.—If the concentration (mass of solid per unit volume of solution) at one surface of a layer of liquid is d_1, and at the other surface d_2, the thickness of the layer h and the area under consideration A, then the mass of the substance which diffuses through the cross-section A in time t is,

$$m=KA\frac{(d_2-d_1)}{h}t.$$

where K is the coefficient of diffusion.

Surface Tension.—The total force along a line of length l on the surface of a liquid whose surface tension is T,

$$F=lT.$$

Capillary Tubes.—If a liquid of density D rises a height h in a tube of internal radius r the surface tension is,

$$T = \frac{rhDg}{2}.$$

Pressure.—The pressure due to a force F distributed over an area A,

$$P = \frac{F}{A}.$$

Hydrostatic pressure on an area A at a distance h from the surface of a liquid of density D is,

$$F = PA\,(\text{total pressure}) = AhDg.$$

Archimedes' Principle.—A body of volume V immersed in a liquid of density D is buoyed up by a force

$$F = DgV.$$

Velocity of Efflux of a Liquid.—If h is the distance from the opening to the free surface of the liquid, the velocity of efflux is

$$V = \sqrt{2gh}.$$

Diminution of Pressure at the Side of a Moving Stream.—If a fluid of density d moves with a velocity v the diminution of pressure due to the motion is (neglecting viscosity),

$$p = hdg = \tfrac{1}{2}dv^2.$$

Boyle's Law.—For a perfect gas, changing from pressure p and volume v to pressure p' and volume v' without change of temperature,

$$pv = p'v'.$$

Altitudes with the Barometer.—If b_1 and b_2 denote the corrected barometer readings at two stations, t the mean of the temperatures t_1 and t_2 of the air at the two stations, e_1 and e_2, the tension of water vapor at the two stations, h the mean height above sea level, ϕ the latitude, then the difference in elevation in centimeters is

$$H = 1{,}843{,}000(\log b_1 - \log b_2)(1 + 0.00367t)(1 + 0.0026 \cos 2\phi + 0.00002h + \tfrac{3}{8}k),$$

where

$$k = \tfrac{1}{2}\left(\frac{e_1}{b_1} + \frac{e_2}{b_2}\right).$$

An approximate formula, sufficient for differences not over 1000 meters is

$$H = 1{,}600{,}000 \cdot \frac{b_1 - b_2}{b_1 + b_2}(1 + 0.004t).$$

Heat

Thermal Expansion.—If l_0 is the length at 0° C., α the the coefficient of linear expansion, the length at t° C. is,

$$l_t = l_0(1+\alpha t).$$

General Formula for Thermal Expansion.—The rate of thermal expansion varies with the temperature. The general equation giving the magnitude m_t (length or volume) at a temperature t, where m_0 is the magnitude at 0° C., is

$$m_t = m_0(1+\alpha t+\beta t^2+\gamma t^3 \ldots)$$

where α, β, γ, etc., are empirically determined coefficients.

Volume expansion. If V represents volume and β the coefficient of expansion,

$$V_t = V_0(1+\beta t).$$

For solids, $\beta = 3\alpha$ (approximately).

Expansion of Gases.—For an original volume V_0 at 0° C. the volume at t° C. (at constant pressure) is

$$V_t = V_0(1+0.00367t).$$

General Law for Gases:

$$p_t v_t = p_0 v_0\left(1+\frac{t}{273}\right).$$

Reduction of a Gas Volume to 0°C., 760 mm. Pressure.—If V is the original volume of a gas at temperature t and pressure H the volume at 0° C. and 760 mm. pressure will be,

$$V_0 = \frac{V}{(1+\alpha t)}\,\frac{H}{760}.$$

If d is the original density the density at 0° C. and 760 mm. pressure will be,

$$d_0 = d(1+\alpha t)\frac{760}{H},$$

$$\alpha \doteq 0.00367 \text{ approximately.}$$

Gas Thermometer.—Where P_0, P_s, and P_x represent the total pressures with the bulb at 0° C., at the boiling-point of water and at the unknown temperature respectively, t_s the temperature of steam and t_x the unknown temperature,

$$t_x = t_s\frac{P_x - P_0}{P_s - P_0}$$

(approximately). The total pressure on the gas in the bulb is the sum of barometric pressure at the time and that measured by the manometer.

Specific Heat.—If a quantity of heat H calories is necessary to raise the temperature of m grams of a substance from t_1 to $t_2°$ C., the specific heat,

$$s=\frac{H}{m(t_2-t_1)}.$$

Specific Heat by the Method of Mixtures.—Where a mass m_1 of the substance is heated to a temperature t_1, then placed in a mass of water m_2 at a temperature t_2 contained in a calorimeter with stirrer (of same material) of mass m_3, specific heat of the calorimeter c, v the volume of the immersed portion of the thermometer, t_3 the final temperature, the specific heat of the substance,

$$s=\frac{(m_2+m_3c+0.46v)(t_3-t_2)}{m_1(t_1-t_3)}.$$

Black's Ice Calorimeter.—If a body of mass m and temperature t melts a mass m' of ice, its temperature being reduced to 0° C., the specific heat of the substance is,

$$s=\frac{80.1m'}{mt}.$$

Bunsen's Ice Calorimeter.—A body of mass m at temperature t causes a motion of the mercury column of l centimeters in a tube whose volume per unit length is v. The specific heat is

$$s=\frac{884lv}{mt}.$$

Conduction of Heat.—If the two opposite faces of a cube of a substance are maintained at temperatures t_1 and t_2, the heat conducted across the cube of section a and thickness d in a time T will be,

$$Q=K\frac{(t_2-t_1)aT}{d}.$$

K is a constant depending on the nature of the substance, designated as the specific heat conductivity.

Wave Motion and Sound

Velocity of a Wave.—The velocity of propagation in terms of wave length λ and period T or frequency n is,

$$V=\frac{\lambda}{T}=n\lambda.$$

Velocity of a transverse wave in a stretched cord. If T is the tension of the cord and m the mass per unit length,

$$V=\sqrt{\frac{T}{m}}.$$

Velocity of Sound.—In terms of elasticity (bulk modulus) E and density d,

$$V=\sqrt{\frac{E}{d}}.$$

Frequency of Vibrating Strings.—For a string of length l, tension T, density d, and radius r, the frequency is,

$$n=\frac{1}{2rl}\sqrt{\frac{T}{\pi d}}.$$

Organ Pipes.—The frequency of vibration in a closed organ pipe of length l, where V is the velocity of sound in air, is

$$n=\frac{V}{4l} \text{ (fundamental.)}$$

In an open pipe,

$$n=\frac{V}{2l} \text{ (approximate.)}$$

Velocity of sound in air at a temperature t,

$$V=33{,}136+60.7t \text{ cm. per sec.}$$

Static Electricity

Force between Two Charges.—If two charges q and q' are at a distance r in a vacuum, the force between them is,

$$F=\frac{qq'}{r^2}.$$

Field Intensity, or force exerted on unit charge at a point distant r from a charge q in a vacuum,

$$H=\frac{q}{r^2}.$$

If the dielectric in the above cases is not a vacuum the dielectric constant K must be introduced. The formulæ become,

$$F=\frac{qq'}{Kr^2}. \qquad H=\frac{q}{Kr^2}.$$

The value of K is frequently considered unity for air. If the dielectric constant of a vacuum is considered unity the value for air at 0° C. and 760 mm. pressure is 1.000576.

Potential at a point due to a charge q at a distance r,

$$V=\frac{q}{Kr}.$$

Capacity in terms of charge and potential. A conductor charged with a quantity q to a potential V has a capacity,

$$C = \frac{q}{V}.$$

Capacity of a spherical conductor of radius r,

$$C = Kr.$$

Capacity of two concentric spheres of radii r and r',

$$C = K\frac{rr'}{r - r'}.$$

Capacity of a parallel plate condenser, the area of whose plates is A and the distance between them d,

$$C = \frac{KA}{4\pi d}.$$

Magnetism

Force between Two Magnetic Poles.—If two poles of strength m and m' are separated by a distance r in a medium whose permeability is μ (unity for a vacuum), the force between them is

$$F = \frac{mm'}{\mu r^2}.$$

The strength of a magnetic field at a point distant r from an isolated pole of strength m is,

$$H = \frac{m}{\mu r^2}.$$

Magnetic Moment.—If the poles are separated by a distance which is great compared with the dimensions of the magnet, the magnetic moment of a magnet of length l whose poles have values of $+m$ and $-m$ is,

$$M = ml.$$

Couple acting on a magnet of magnetic moment ml in a field of strength H. If the magnet is perpendicular to the direction of the field,

$$C = Hml = HM.$$

If the angle between the magnet and the field is θ,

$$C = Hml \sin \theta.$$

Action of One Magnet on Another.—The turning moment experienced by a magnet of pole strength m' and length $2l'$ placed at a distance r from another magnet of length $2l$ and pole strength m, where the center of the first magnet is on the axis (extended) of the second and the axis of the first is perpendicular to the axis of the second,

$$C = 8\frac{mm'll'}{r^3} = \frac{2MM'}{r^3}.$$

If the first magnet is deflected through an angle θ, the expression becomes,

$$C = \frac{2MM'}{r^3}\cos\theta.$$

Period of vibration of a magnet of magnetic moment M and moment of inertia I vibrating in a field of strength H,

$$T = 2\pi\sqrt{\frac{K}{MH}}.$$

Magnetic Induction.—If a substance of permeability μ is placed in a magnetic field H the magnetic induction in the substance,

$$B = \mu H.$$

If I is the magnetic moment for unit volume,

$$B = H + 4\pi I.$$

The susceptibility,

$$K = \frac{I}{H}, \qquad \mu = 1 + 4\pi K.$$

Tractive Force of a Magnet.—If a magnet with induction B has a pole face of area A the force is,

$$F = \frac{B^2 A}{8\pi}.$$

If B and A are in C. G. S. units, A will be in dynes.

Current Electricity

Ohm's Law.—Current in terms of electromotive force E and resistance R,

$$i = \frac{E}{R}.$$

Current in a Simple Circuit.—The current in a circuit including an external resistance R and a cell of electromotive force E, and internal reistance r,

$$i = \frac{E}{R + r}.$$

For two cells in parallel,

$$i = \frac{E}{R + \frac{r}{2}}.$$

For two cells in series,

$$i = \frac{2E}{R + 2r}.$$

Resistance of a conductor at 0° C., of length l, cross-section s and specific resistance ρ,

$$R_0 = \rho \frac{l}{s}.$$

Resistance of a conductor at a temperature t whose resistance at 0° C. is R_0 and whose temperature resistance coefficient is α,

$$R_t = R_0(1 + \alpha t).$$

Resistance of Conductors in Series and Parallel.—The total resistance of any number of resistances joined in series is the sum of the separate resistances. The total resistance of conductors in parallel whose separate resistances are r_1, r_2, r_3, . . . r_n is given by the formula

$$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} \ldots + \frac{1}{r_n}.$$

R is the total resistance.

For two terms this becomes,

$$R = \frac{r_1 r_2}{r_1 + r_2}.$$

Wheatstone's Bridge.—If the resistances r_1, r_2, r_3, and r_4 form the arms of a Wheatstone's bridge in order as the circuit (omitting cell and galvanometer connections) is traced, when the bridge is balanced,

$$\frac{r_1}{r_2} = \frac{r_4}{r_3} \quad \text{or} \quad \frac{r_1}{r_4} = \frac{r_2}{r_3}.$$

Heat Effect.—The heat in calories developed in a circuit by an electric current i flowing through a resistance r for a time t is,

$$H = \frac{ri^2t}{4.18} = \frac{Eit}{4.18}.$$

Electromagnetic Field.—The intensity of the magnetic field at the center of a circular conductor of radius r in which a current i flowing is,

$$H = \frac{2\pi i}{r}.$$

If the circular coil has n turns, the magnetic intensity at the center is,

$$H=\frac{2\pi ni}{r}.$$

Tangent Galvanometer.—A tangent galvanometer with n turns, of radius r, in the earth's field H, has a deflection θ. The current flowing is,

$$i=\frac{Hr}{2\pi n}\tan\theta.$$

If $\frac{2\pi n}{r}=G$ (the galvanometer constant),

$$i=\frac{H}{G}\tan\theta.$$

Electrolysis.—If a current i flows for a time t and deposits a metal whose electrochemical equivalent is e, the mass deposited is

$$m=eit.$$

Light

Spherical Mirrors.—If R is the radius of curvature, F principal focus, and f_1 and f_2 any two conjugate focal distances,

$$\frac{1}{f_1}+\frac{1}{f_2}=\frac{1}{F}=\frac{2}{R}.$$

Lenses.—For a single thin lens whose surfaces have radii of curvature r_1 and r_2, whose principal focus is F, the index of the fraction n and conjugate focal distances f_1 and f_2,

$$\frac{1}{F}=\frac{1}{f_1}+\frac{1}{f_2}=(n-1)\left(\frac{1}{r_1}+\frac{1}{r_2}\right).$$

Radius of Curvature from Spherometer Readings.—If l is the mean length of the sides of the triangle formed by the points of the three legs, d the spherometer reading, the radius of curvature of the surface is

$$R=\frac{l^2}{6d}+\frac{d}{2}.$$

Index of Refraction.—If i is the angle of incidence, r the angle of refraction, v the velocity of light in the first medium, v' the velocity in the second medium, the index of refraction n,

$$n=\frac{\sin i}{\sin r}=\frac{v}{v'}.$$

For a prism of angle A where light passes at the angle of minimum deviation D, the index of refraction,

$$n=\frac{\sin\frac{1}{2}(A+D)}{\sin\frac{1}{2}A}.$$

Reflection of Light by a Transparent Medium in Air. (Fresnel's Formulæ).—If i is the angle of incidence, r the angle of refraction, n_1 the index of refraction for air (nearly equal to unity), n_2 index of refraction for a medium, then the ratio of the reflected light to the incident light is,

$$R=\frac{1}{2}\left[\frac{\sin^2(i-r)}{\sin^2(i+r)}+\frac{\tan^2(i-r)}{\tan^2(i+r)}\right].$$

If $i=0$ (normal incidence), and $n_1=1$ (approximate for air),

$$R=\left(\frac{n_2-1}{n_2+1}\right)^2.$$

Diffraction Grating.—If s is the distance between the rulings, d the angle of diffraction, then the wave length where the angle of incidence is 90° is (for the nth order spectrum),

$$\lambda=\frac{s\sin d}{n}.$$

If i is the angle of incidence, d the angle of diffraction, s the distance between the rulings, n the order of the spectrum, the wave length is,

$$\lambda=\frac{s}{n}(\sin i+\sin d).$$

Specific Rotation.—If there are n grams of active substance in v cubic centimeters of solution and the light passes through l centimeters, r being the observed rotation in degrees, the specific rotation (for 1 centimeter),

$$[\alpha]=\frac{rv}{nl}.$$

ACID PROOF WOOD STAIN

SOLUTION No. 1	SOLUTION No. 2
125 grams of copper sulphate	150 grams of good fresh anilin oil
125 grams of potassium chlorate	180 grams of concentrated hydrochloric acid
1000 grams of water	1000 grams of water

Wood must be free from paint, varnish, grease or chemicals. Apply two coats of solution No. 1 boiling hot with a paint brush, allowing each coat to dry thoroughly before the next coat is applied. Then apply two coats of solution No. 2 in the same way. When the wood is completely dried wash off excess chemicals with hot soapsuds. Finish with raw linseed oil. Polish comes from rubbing the oil down well with a cloth or sponge. Whenever the tables get dingy again go over them with a coat of linseed oil and rub smooth.

BLUE PRINT PAPER, Formula for Sensitizing

Solution A:	Water	50. c.c.,	8.5 oz.
	Iron and ammonium citrate	10. grams,	1.7 oz.
Solution B:	Water	50. c.c.,	8.5 oz.
	Potassium ferricyanide	8. grams,	1.4 oz.

Filter separately. The solutions, which may be preserved separately for some time, are best kept in the dark. For use, mix, in a dark room or by an artificial light of low intensity, equal quantities of the two solutions.

Any non-absorbent paper may be sensitized by brushing the solution over it rapidly with a soft, wide, flat brush, going over the surface twice, the second coat being applied in a direction at right angles to the first. An alternative method is to lower the paper, beginning at one edge, on to the surface of the solution in a tray and allow it to float for a few seconds. Care must be taken to exclude air bubbles. After sensitizing by either method, the paper should be hung by one edge in a dark room to dry.

CEMENTS

Glues of all kinds are useful for wood, leather, paper and glass, where the joints are not required to be waterproof.

For waterproof joints of nearly all substances, including metals, shellac may be used. Flakes of solid shellac may be used with heat or it may be used as a solution in alcohol.

Kotinsky cement, Chatterton's compound and other resinous cements are used for similar purposes and in the same way as solid shellac. Glass cells made up with compounds of this nature may be made impervious to alcohol by painting over the joints with a rubber cement made by melting up small pieces of rubber tubing and adding carbon disulphide to make a thin syrup.

For celluloid a cement made by dissolving celluloid shavings in acetone is recommended.

Brass fittings are usually cemented on glass tubing with sealing wax. The glass tube should be wound with thread or twine to secure a close fit. The glass and the brass fitting should be warmed slightly above the melting-point of wax. (Thick, or pressed glass should be warmed slowly.) Wax may be applied to both parts and the thread well saturated with the melted wax. Enough should be used to insure filling the space completely. Join the parts while the wax is very soft and clamp in position until it is thoroughly cold.

For optical purposes, cementing glass, etc., Canada balsam is universally employed, and makes a permanent and nearly invisible joint.

CLEANING MERCURY

Mercury may be cleaned sufficiently for many laboratory purposes without distilling. Allow the mercury to fall in a fine spray into a quantity of dilute nitric acid, 25 parts of acid to 75 parts distilled water. After being passed through the acid one or more times it should be passed through distilled water and dried. Most of the water may be removed with a clean filter, and the mercury heated in a porcelain dish to about 110° C. To produce the spray the stem of a glass funnel may be drawn down so as to leave only a small opening for the escape of mercury or a glass tube with a capillary point attached to a funnel with a tightly fitting rubber tube.

A three- to four-foot length of one-inch glass tube closed at one end and supported in a vertical position may be used to contain the acid solution. If a small glass tube be fused into the lower closed end of the large tube, and bent so as to stand up for a distance a little greater than 1/13.6, the column of acid solution in the large tube, a U-tube is formed in which a short column of mercury supports the long column of acid solution.

The end of the small tube should be bent over at the top so as to facilitate the delivery of the mercury and a short piece of clean rubber tubing with a pinch-cock put on at the start; as soon as mercury enough has collected in the bottom of the tube the pinch-cock may be opened. The mercury will rise nearly or quite to the top of the small tube, and as the quantity increases will be delivered from the small tube as fast as it falls in the spray.

The reversed end of the small tube should be short to avoid forming a siphon, which would completely empty the apparatus.

An efficient procedure, especially if the mercury is greasy, consists in spraying the mercury by means of the above apparatus, first, through a dilute solution (10%) of potassium hydroxide, then through dilute nitric acid (10–15%) and finally through distilled water.

CLEANING OPTICAL SURFACES FOR SILVERING

(From Miller's Laboratory Physics, Ginn & Co., publishers, by permission.)

Probably the most important part of the silvering process is the proper cleaning of the surface to be silvered.

The surface is thoroughly cleaned of grease or other organic matter by the usual methods, using alcohol or chromic acid. Then it should be carefully cleaned with strong nitric acid, the whole surface being firmly rubbed with pure cotton tied to a rod of wood or glass. Care should be taken not to injure the surface. Rinse with water, and then wash the surface thoroughly with a strong solution of caustic potash, rubbing with a cotton brush as before. Finally, rinse with distilled water, and keep the surface wet until it is placed in the silvering solution. If the distilled water wets the whole surface uniformly the cleaning may be sufficient; if it does not wet uniformly, the operations must be repeated. The fingers should not touch the edges of the glass during the latter cleaning operations, as a layer of organic matter is apt to spread over the surface and render the silvering uneven.

Dr. Brashear recommends that the surface, after the washings described above, be rubbed with prepared chalk on a cotton wad until it is thoroughly dry and clean. It may then be put into the silvering solution at one's convenience.

COLORED LIQUIDS

For rendering columns of water easily visible, add a few drops of one per cent alcoholic solution of fluorescein to a liter of water. The dilute solution of fluorescein is bright green by reason of its fluorescence, although colorless by transmitted light.

A small quantity of an aqueous (1%) solution of uranine (the sodium salt of fluorescein) may be used in place of the alcoholic solution mentioned above.

If solutions showing color by transmission are desired, dilute aqueous may be made with any of the following dyes:

Dye	Color
Erythrosine	Pink
Eosine	Pink (green fluorescence)
Rhodamine B	Pink (red fluorescence)
Ponceau 2R	Scarlet
Naphthol green	Green
Methylene green	Bluish green
Methylene blue	Blue
Methyl violet	Purple

CROSS HAIRS

The spider lines which serve as an index in reading telescopes may be quickly replaced in an emergency by single silk fibers (from ordinary sewing silk) attached by soft wax. Single fibers may easily be removed from an untwisted strand.

Spider web should be used in permanent work. The fibers of the egg nest of certain species are employed and may be obtained of most dealers in scientific apparatus. In mounting them the following suggestions may be useful: The cross hair diaphragm of the telescope should be removed and clamped in a horizontal position. A bow of brass wire, about No. 28, should be employed to stretch the fiber. A background of black velvet makes the fibers more easily visible. With soft wax or other convenient adhesive ready on both tips of the bow, a fiber of the required length is to be disentangled with tweezers and wrapped several times about the ends of the bow under tension sufficient to straighten the fiber. The fiber, now conveniently handled by the wire bow, should be cautiously lowered onto the diaphragm in the proper position, the wire left hanging.

A small drop of shellac varnish applied at each side will hold the fiber in position as soon as it is thoroughly dry, after which the ends of the fiber should be cut away.

FLUORESCENT SCREENS

For observations of the ultra-violet spectrum, moisten a small quantity of anthracene with water and brush a thin layer over a ground-glass surface. On drying most of the anthracene will adhere to the glass. The prepared surface should be placed so as to receive the radiation directly, glass being comparatively opaque to the shorter wave lengths.

GLASS-GRINDING FLUID

Turpentine	45	c.cm.
Ether (ethyl oxide)	22.5	c.cm.
Camphor gum	31	grams

To be used with powdered emery for grinding glass.

For smoothing edges a sheet of emery cloth moistened with the above solution may be used.

Plane surfaces should be ground on thick plate glass.

For grinding glass stoppers use coarse emery, turn in one direction, finish with fine emery.

LABELS FOR BOTTLES

Ordinary gummed labels written upon, preferably, with India ink, may be protected after being gummed to the bottle by a coat of lacquer or varnish. A more complete protection is obtained by painting the label, after it is in place, with melted paraffin.

MIRRORS FOR SPECTROMETER ADJUSTMENT

A small square of thick plate glass with edges ground smooth and silvered on one surface affords a means of accurate adjustment.

To avoid the necessity of frequently resilvering, which arises where the mirrors are in constant use, the following course is suggested:

From selected German plate mirror 2 to 3 mm. thick, cut two pieces of the same size, say 4×5 cm. Remove the protective layer of varnish or paint from both pieces by soaking in alcohol and rubbing with cotton, being careful not to injure the silver surface. From one piece remove every trace of varnish by repeated rinsing, dry and polish the silver surface thus exposed by stroking lightly with a chamois rouge pad. From the other piece remove the silver by nitric acid, wash thoroughly in distilled water and dry. Cement the clear piece on the silver face of the other with Canada balsam. This is accomplished by placing two or three drops of Canada balsam in xylol (obtained in collapsible tubes) on the center of the silver face, and evenly lowering upon it the clear glass. The balsam should spread rapidly to the edges of the plates. Minute bubbles of air in the balsam film are harmless; if large bubbles are present the plates should be slipped apart, cleaned with alcohol and the process repeated.

The balsam will be sufficiently hard in a few days to allow the excess to be scraped from the edges and the plates bound together with lantern slide binding strip. Gentle heat may be used to harden the balsam more rapidly.

POLARITY TEST PAPER

Dissolve one gram of phenolphthalein in a small quantity of alcohol. Add the solution of phenolphthalein to 100 c.cm. of a 10 per cent solution of potassium chloride in distilled water. Filter paper should be soaked in the solution and dried. A strip of paper moistened with water and placed in contact with the two terminals will show a bright red stain at the negative terminal.

SILVERING GLASS

Brashear's Process

(From Miller's Laboratory Physics, Ginn & Co., publishers, by permission.)

Two solutions are required, one, the reducing solution, should be prepared at least a week before it is used, and it may be made in large quantity and kept in stock with advantage; the other solution is to be prepared when used.

Reducing Solution

Distilled water	700 c.cm.
Pure sugar (loaf, granulated or rock candy)	80 g.

When dissolved add

Alcohol	175 c.cm.
Strong nitric acid (sp. gr. 1.42)	3 c.cm.
Add water to make	1000 c.cm.

For silvering, the mirror may rest face up on the bottom of a suitable dish; it may stand on edge, or be supported in any manner, face downward, dipping into the upper part of the solution. In the latter case, the mirror may be fastened with wax to a stick laid across the dish, or it may be supported on glass feet or on paraffined wood wedges. Dr. Brashear recommends that the mirror, if round, form the bottom of the silvering dish, which is completed by wrapping a strip of paraffined paper around the edge of the mirror, this being held in place by rubber bands or fastened with several wrappings of cord.

Having selected a dish and support for the mirror, measure with water the quantity of solution that will be required to make a layer a centimeter or two thick over the surface to be silvered. For each 150 c.cm. of final solution, 1 g. of silver nitrate and 0.5 g. of caustic potash (purified by alcohol) will be required. Dissolve the silver and potash separately, using quantities of water of the proportion of 100 c.cm. to 1 g.

of the solid. Ordinary graduates or flasks are the most convenient form of vessel in which to mix the solutions. Into the silver nitrate solution pour a few drops of dilute aqua ammonia. The solution will turn to a dark brown color; add ammonia little by little till the precipitate is nearly but not quite redissolved. Now add the potash solution, when a precipitate will again be formed. This is to be nearly, but not entirely, redissolved by the addition of more ammonia, a few drops being sufficient this time. After the ammonia has been added shake or stir the solution well and wait a minute or two to be certain that it does not entirely clear. If by chance too much ammonia has been used, a little silver nitrate is to be dissolved and added, a few drops at a time, till a permanent precipitate is formed. This excess of silver must be present, the solution showing a decided brown tint. The solution may be filtered, though usually this is not necessary.

A quantity of reducing solution equal to about a twenty-fifth part of the solution just prepared is measured out. The mirror, having been properly cleaned and rinsed with distilled water, is placed in position. The reducing solution is poured into the silver and potash solution, and mixed by a quick shaking of the graduate or stirring with a glass rod; the whole is then poured into the dish. If the mirror is immersed face down, care is necessary to remove air bubbles; the mirror may well be immersed after the solution is in, being dipped in at one side first. If the mirror is at the bottom of the dish, after cleaning it is covered with a thin layer of water, and the prepared solutions are poured into the dish without further trouble. In the latter case the dish must be rocked during the time of deposition.

The solution soon turns to a black color, which in a few minutes will turn to a brown; and when it becomes a light gray and the precipitate is flocculent, which may be in ten or fifteen minutes, the operation is at an end. If the mirror is allowed to remain in the solution too long, the surface will have a bleached appearance, which polishing will hardly remove. Remove the mirror, rinse with water, and carefully wipe off the sediment with a tuft of absorbent cotton. It is then set on edge to dry; a rinsing with alcohol will facilitate the drying, or all water may be safely taken up by pressing clean blotting paper over the surface.

When dry, the surface may be polished, if necessary, with a small pad of chamois leather stuffed with cotton, on which is spread a little rouge. Small, circular strokes of the pad, with light pressure, will soon bring out the deep luster of the silver.

A uniform temperature of the bath and the glass, of about 20° is essential to success.

Since fulminating silver is liable to be produced by the action of ammonia on silver oxide, especially in a warm room, all solutions should be thrown away as soon as the silvering operation is completed. The used solutions may be poured into a large jar, in which is thrown some common salt; this causes the silver to be precipitated as the chloride, and about 90 per cent of the original silver may be recovered.

ROCHELLE SALTS PROCESS

(From Miller's Laboratory Physics, Ginn & Co., publishers, by permission.)

For depositing the uniform thin film of silver required on the half-silvered glass of the interferometer, the following method is more suitable than the one described above, as the silver is deposited more slowly. If a thick film is desired, two or more successive deposits may be made, each of which may require an hour's time.

Dissolve 5 g. of silver nitrate in 300 c.cm. of distilled water, and add dilute aqua ammonia until the precipitate formed is nearly, *but not entirely*, redissolved in the manner explained in the preceding method. Filter the solution and add water to make 500 c.cm.

Dissolve one g. of silver nitrate in a small quantity of water and pour into about half a liter of boiling water; dissolve 0.83 g. of Rochelle salts in a small quantity of water, and add to the boiling solution. Continue the boiling for half an hour, till the gray precipitate collects as a powder in the bottom of the flask. Filter hot, and add water to make 500 c.cm.

These solutions may be kept in the dark for a month or two.

For silvering, equal volumes of the two solutions are mixed, and the glass is supported in the mixture in whatever fashion is convenient. Various methods are mentioned in the preceding article. The thickest possible deposit may require an hour's time. A second deposit may be made upon the first if necessary to secure the desired thickness. The drying and polishing may be carried out as described above.

A half-silvered film will be produced in about a minute; only experience can determine when the proper thickness has been secured. The glass appears as though it were very lightly smoked. A film that reflects a little more than half the light incident at 45° is desirable for interferometer use. A simple method of testing is to look at two similar gas flames, one seen through the film and the other seen reflected by it. It is well to silver at once all four surfaces of the two plane-parallel plates of the interferometer and to select for use that film which is of the proper and most uniform thickness.

SOAP SOLUTION FOR SOAP FILM EXPERIMENTS

Pure castile or palm-oil soap..........	1 oz.
Distilled water........................	8 oz.
Pure glycerine.........................	4 oz.

Cut the soap in thin shavings and dissolve in the water. When the solution is complete, add the glycerine and mix very thoroughly. On standing the liquid becomes clear at the bottom. The clear portion may conveniently be removed by a siphon and preserved indefinitely.

SODIUM LIGHT

Paper is to be soaked in a saturated solution of common salt, borax or other salt of sodium, and dried. When wrapped around a Bunsen burner, secured by a twist of wire and pushed up into the edge of the flame, a sodium flame of considerable intensity is obtained. As the ash of the paper breaks away it must be occasionally raised. Lithium chloride may be used in place of or with sodium salt to give the lithium line for spectrometric measurement. Sheet asbestos (thin) may replace the paper if convenient.

SOLDERS

Composition by weight.						Temperature of fusion.	Metals for which it is used.	Flux commonly used.
Lead.	Tin	Copper.	Zinc.	Silver.	Gold.			
1	1	...	...	..	...	188° C.	Lead	Tallow
3	5	...	...	..	...	176	Zinc	Zinc chloride with 25% HCl
2	5	...	...	..	...	170	Copper brass	Zinc chloride (neutral) or resin
							Iron	Zinc chloride or ammonium chloride
		2	1	..	...	......	Iron or copper	Borax
		55	45	..	...	880	Iron, copper or brass	Borax
		4.5	0.5	15.0	...	1005	Iron, copper or gold	Borax
		6.5	2.0	11.0	...	983	Iron, copper or gold	Borax
		4	...	6	10	......	Gold	

STOPCOCK GREASE

Vaseline........................ 16 parts
Pure gum rubber................. 8 parts
Paraffin........................ 1 part

Melt all together. More paraffin may be added if the compound is not stiff enough.

UNIVERSAL WAX

(1) A soft wax useful in the laboratory may be made by melting together paraffin, vaseline and paraffin oil in various proportions according to the pliability desired.

(2) Another authority recommends equal quantities of beeswax and turpentine (by weight). It is customary to color the wax by adding finely-powdered Venetian red.

(3) Melt together 1 part of Venice turpentine and 5 parts of beeswax. Color with vermilion.

PHOTOGRAPHIC FORMULÆ

Developers for Plates and Films

NOTE. — Pure water, preferably distilled, should be used in all solutions. Chemicals should be dissolved in the order given. The abbreviation "anhy." is used in connection with sodium sulphite and carbonate to indicate the anhydrous or dried salt. If crystals are used about twice the quantity is necessary.

AMIDOL (Diamidophenol)

1

Amidol	2–3 gr.	4.5–7 gm.
Sodium sulphite, anhy	12 gr.	29 gm.
Water	1 oz.	1000 cc.

Solution mixed as above will keep about one week.

2

Stock solution of sodium sulphite:

Sodium sulphite, anhy	2 oz.	100 gm.
Potassium metabisulphite	0.5 oz.	25 gm.
Water	20 oz.	1000 cc.

Boil after dissolving in warm water. Developer is made when needed by adding dry amidol to the stock solution of sulphite which keeps for a long period:

Stock solution of sodium sulphite	2 oz.	200 cc.
Water	10 oz.	4.5–7 gm.
Amidol	20–30 gr.	1000 cc.

ELON. *See under Metol-Hydroquinone*

GLYCIN

Boiling water	4 oz.	1000 cc.
Sodium sulphite, anhy	1.25 oz.	312 gm.

When dissolved add:

Glycin	1 oz.	250 gm.

Slowly add:

Potassium carbonate (dry)	5 oz.	1250 gm.

Forms thick cream; for use, shake and dilute with water. Normal, 1 oz. stock solution to 15 oz. water; for less contrast use more water up to 30 oz.

Keeps indefinitely in stock solution, — slow acting, free from stain.

PHOTOGRAPHIC FORMULÆ (Continued)

Hydroquinone

1

Normal developer: —

Water	20 oz.	1000 cc.
Hydroquinone	100 gr.	11.5 gm.
Sodium sulphite, anhy	0.75 oz.	38 gm.
Sodium carbonate, anhy	1.5 oz.	75 gm.

Becomes inert below 16° C. (60° F.). Is a rather slow developer.

2

Solution A: —

Water	20 oz.	1000 cc.
Hydroquinone	160 gr.	18 gm.
Sodium sulphite, anhy	1 oz.	50 gm.
Citric acid	60 gr.	7 gm.
Potassium bromide	40 gr.	4.5 gm.

Solution B: —

Sodium hydroxide (stick)	160 gr.	18 gm.
Water	20 oz.	1000 c.c.

For use take A, 1 oz.; B, 1 oz.; water, 2 oz.

A more rapid developer than No. 1 but tends to great density in high lights.

3

Developer for process work: —

Solution A: —

Water	40 oz.	1000 cc.
Hydroquinone	1 oz.	25 gm.
Potassium metabisulphite	1 oz.	25 gm.
Potassium bromide	1 oz.	25 gm.

Solution B: —

Water	40 oz.	1000 cc.
Potassium hydroxide (caustic potash)	2 oz.	50 gm.

To develop use equal parts A and B. Will develop in 3 minutes at 65° F. (18° C.). Inert below 55° F. Use developer once only; if yellow stain occurs reduce bromide to half quantity.

Metol

Water, warm	20 oz.	1000 cc.
Metol	150 gr.	17 gm.
Sodium sulphite, anhy	1.25 oz.	63 gm.
Sodium carbonate, anhy	1.75 oz.	88 gm.
Potassium bromide	16 gr.	1.8 gm.

Always dissolve metol first.

For use dilute with equal part water for portraiture; for landscape use two parts of water to one of stock solution. Gives detail without density except by prolonged development.

PHOTOGRAPHIC FORMULÆ (Continued)

Metol-Hydroquinone

Note: — Elon may be used with hydroquinone in place of metol, in equal quantity.

Solution A: —

Dissolve in the order given:

Water	64 oz.	1820 cc.
Metol	120 gr.	7.8 gm.
Hydroquinone	120 gr.	7.8 gm.
Sodium sulphite, anhy.	2 oz.	57 gm.

Solution B: —

Water	16 oz.	455 cc.
Sodium carbonate, anhy.	2 oz.	57 gm.

For use take A, 4 oz.; B, 1 oz.; water, 4 oz.

Factor 15

Monomet

Water	20 oz.	1000 cc.
Monomet	20 gr.	2.2 gm.
Sodium sulphite, anhy.	120 gr.	14 gm.
Sodium carbonate, anhy.	120 gr.	14 gm.
Potassium bromide, 10% sol.	20–40 drops	2–4 cc.

Use 1 part stock solution with 1 part water; gives soft negatives.

Monomet-Hydroquinone

Water	20 oz.	1000 cc.
Monomet	16 gr.	2 gm.
Hydroquinone	32 gr.	4 gm.
Sodium sulphite, anhy.	120 gr.	14 gm.
Sodium carbonate, anhy.	120 gr.	14 gm.
Potassium bromide, 10% sol.	20 drops	2–4 cc.

For use take one part stock solution with one part water.

Ortol

Solution A: —

Ortol	140 gr.	16 gm.
Potassium metabisulphite	70 gr.	8 gm.
Cold water	20 oz.	1000 cc.

Solution B: —

Sodium carbonate, anhy.	1.25 oz.	63 gm.
Sodium sulphite, anhy.	1.75 oz.	88 gm.
Potassium bromide	10–20 gr.	1.1–2.3 gm.
Water	20 oz.	1000 cc.

For rapid developer take A, 1 part; B, 1 part. For slower, softer development take A, 1 part; B, 1 part; water, 1 part.

PHOTOGRAPHIC FORMULÆ (Continued)

Paramidophenol

Water, boiling	20 oz.	1000 cc.
Potassium metabisulphite	6 oz.	300 gm.
Paramidophenol	2 oz.	100 gm.

Add sodium or potassium hydroxide in small quantities to dissolve the precipitate first formed.

For use take 1 part stock solution with 20 parts water.

Pyro

1

Solution A:—

Water	16 oz.	455 cc.
Oxalic acid	12 gr.	0.8 gm.
Pyrogallic acid	1 oz.	28 gm.

Solution B:—

Water	16 oz.	455 cc.
Sodium sulphite, anhy	2 oz.	57 gm.

Solution C:—

Water	16 oz.	455 cc.
Sodium carbonate, anhy	1 oz.	28 gm.

For immediate use mix 1 part each of A, B and C with 10 parts water.

Factor 12

2

Hurter and Driffield standard developer for plate testing:—

Pyro	8 parts
Sodium sulphite, crystal	40 "
Sodium carbonate, crystal	40 "
Water to make	1000 "

Factors

If the image first appears after immersion in the developer for a certain time, then this period of time multiplied by the "factor" for the particular developer used will give the total time required for full, normal development. The factor for the degree of development desired may well be determined by experiment; the following are suggested.

Amidol, 2 gr. per oz.	18
Glycin	8–12
Hydroquinone	$4\frac{1}{2}$–5
Metol	30
Metol-hydroquinone	14
Ortol	10

PHOTOGRAPHIC FORMULÆ (Continued)

Pyro, without bromide: —

1 gr. per oz.	18
2 " " "	12
3 " " "	10
4 " " "	8
5 " " "	6

With 1 part bromide to 4 parts pyro: —

1 gr. pyro per oz.	9
2 " " " "	5
3 " " " "	4½
4 " " " "	4

FORMULÆ FOR TANK DEVELOPMENT

1

Water	48 oz.	1360 cc.
Sodium sulphite, anhy.	115 gr.	7.5 gm.
Sodium carbonate, anhy.	90 gr.	5.8 gm.
Pyro	45 gr.	2.9 gm.

Dissolve immediately before use. Use full strength. Develop 15 minutes at 65° F. (18° C.).

2

Solution A: —		
Water	16 oz.	455 cc.
Oxalic acid	10 gr.	0.65 gm.
Pyro	1 oz.	28 gm.
Solution B: —		
Water	16 oz.	455 cc.
Sodium sulphite, anhy.	3 oz.	85 gm.
Solution C: —		
Water	16 oz.	455 cc.
Sodium carbonate, anhy.	1 oz.	28 gm.

For use take A, 1 part; B, 1 part; C, 1 part; water, 61 parts. Develop 30 minutes at 65° F. (18° C.) for best results.

For temperature 60° F. develop 35 min.
" " 65° F. " 30 "
" " 70° F. " 25 "

3

Stock solution:		
Hot water (200° F.)	60 oz.	1700 cc.
Sodium carbonate, anhy.	2 oz.	57 gm.
Glycin	0.5 oz.	14 gm.
Sodium sulphite, anhy.	0.5 oz.	14 gm.

Dissolve in order. For use take stock solution, 6 parts; water, 58 parts.

For temperature 60° F. develop 30 minutes.
" " 65° F. " 25 "
" " 70° F. " 20 "

PHOTOGRAPHIC FORMULÆ (Continued)

DEVELOPER FOR LANTERN SLIDES

1

Water	20 oz.	568 cc.
Hydroquinone	60 gr.	3.9 gm.
Sodium sulphite, anhy	120 gr.	7.8 gm.
Potassium bromide	6 gr.	0.4 gm.
Citric acid	6 gr.	0.4 gm.
Sodium carbonate, anhy	1 oz.	28 gm.

Use full strength.

2

Solution A:—		
Water	24 oz.	682 cc.
Sodium sulphite, anhy	3 oz.	85 gm.
Hydroquinone	150 gr.	9.7 gm.
Solution B:—		
Water	16 oz.	455 cc.
Potassium carbonate, anhy	2 oz.	57 gm.
Potassium bromide	15 gr.	1 gm.

For use take A, 3 parts; B, 2 parts.

FIXING BATHS FOR PLATES OR FILMS

A.	Water (1 gallon)	128 oz.	3600 cc.
	Hypo (sodium thiosulphate)	32 oz.	850 gm.
B.	Water	32 oz.	852 cc.
	Sodium sulphite, anhy	3 oz.	85 gm.
	Sulphuric acid, C. P.	0.5 oz.	14 cc.
	Chrome alum, powd	2 oz.	56 gm.

NOTE:—Be sure to mix Solution B exactly in given proportions and rotation.

Always pour B into A while stirring well. If this is not done precipitation will take place.

During the cold season one half the quantity of Solution B is sufficient for full quantity of Solution A.

This bath remains clear after frequent use, does not discolor the negatives and hardens the film to such a degree that the negatives can be washed in warm water and dried by artificial heat if necessary. They should be left in the bath ten to twenty minutes after the bromide of silver appears to have been dissolved, to insure permanency, freedom from stain and perfect hardening.

If the bath becomes exhausted by continued use, replace it by a new one.

It is not advisable to use this bath, which contains sulphuric acid, in metal developing tanks.

PHOTOGRAPHIC FORMULÆ (Continued)

PLAIN FIXING BATH

Water	32 oz.	852 cc.
Hypo (sodium thiosulphate)	8 oz.	227 gm.

Do not use the bath when it is discolored; it must be made fresh each day.

INTENSIFICATION

Prepare the following solution, which will keep and work well until exhausted.

No. 1.	Water	16 oz.	455 cc.
	Mercuric chloride, $HgCl_2$	120 gr.	7.8 gm.
	Potassium bromide	120 gr.	7.8 gm.
No. 2.	Number 2 should be mixed fresh.		
	Water	8 oz.	227 cc.
	Sodium sulphite, anhy	1 oz.	28 gm.

After the negative is well fixed and washed, immerse in No. 1 until it has become thoroughly whitened, and after rinsing carefully place it in No. 2, leaving it there until entirely cleared. In case sufficient intensification has not been gained, wash for ten minutes, repeat the operation and finally wash well. If after intensification the negative is too dense it may be reduced by placing it for a few seconds in water 16 oz., hypo 1 oz.

If the negative has not been thoroughly fixed and washed before intensification, stains will ensue.

REDUCTION

A.	Water	16 oz.	455 cc.
	Hypo (sodium thiosulphate)	1 oz.	28 gm.
B.	Water	16 oz.	455 cc.
	Potassium ferricyanide	1 oz.	28 gm.

As this solution is affected by light, the bottle containing it should be of amber color or wrapped in opaque paper and kept in the dark when not in use.

Mix for immediate use:—

A	8 parts
B	1 part

Use in subdued daylight.

The negative can be placed in this solution directly after fixing. If a dry negative is to be reduced, it must be soaked in water for at least half an hour before applying the solution. To avoid streaks, always rinse the negative before holding it up for examination. As soon as sufficiently reduced wash thoroughly.

IRON CLEARING SOLUTION

To remove yellow stain caused by pyro or hydroquinone developer, wash well to free from hypo and place in

Water	20 oz.	568 cc.
Ferrous sulphate, pure	3 oz.	85 gm.
Sulphuric acid, C. P.	1 oz.	28 gm.
Powdered alum	1 oz.	28 gm.

until stain is gone, then wash well.

DEVELOPERS FOR GASLIGHT PAPERS

Hydro-Metol

1

Water	16 oz.	455 cc.
Metol	18 gr.	1.2 gm.
Hydroquinone	18 gr.	1.2 gm.
Sodium sulphite, dry	204 gr.	13 gm.
Sodium carbonate, dry	408 gr.	26 gm.
Potassium bromide	10 gr.	0.6 gm.

If the whites fail to develop without fog, 10% potassium bromide solution may be added, a few drops at a time, until the desired results are obtained.

2

Water (soft or distilled)	40 oz.	1000 cc.
Metol	15 gr.	1 gm.
Sodium sulphite (dried powd.)	1 oz.	28 gm.
Hydroquinone	60 gr.	4 gm.
Sodium carbonate (dried powd.)	¾ oz.	21 gm.
Potassium bromide (10% solution)	40 drops	40 drops

Fixing Bath

Water	64 oz.
Hypo	16 oz.

Dissolve, then add the following acid hardener:

Water	5 oz.
Sodium sulphite (dried powd.)	½ oz.
Acetic acid, 25%	3 oz.
Alum (powd.)	½ oz.

This fixing bath is also excellent for dry plates and films, and will keep indefinitely before using; therefore it can be made up some time in advance. One pint of the bath should fix at least fifty 4 × 5 prints. The acid fixing bath can be used repeatedly. It keeps with but little care. It will by degrees become alkaline by the gradual addition of developer adhering to the prints. It should be discarded entirely when it becomes frothy, and a fresh bath prepared.

DIAPHRAGM NUMBERS

U. S. 1	equals F/4	U. S. 32	equals F/22
" 4	" F/8	" 64	" F/32
" 8	" F/11	" 128	" F/45
" 16	" F/16	" 256	" F/64

MEASURES AND UNITS

WEIGHTS AND MEASURES

U. S. System

Length

Inches.	Feet.	Yards.	Rods.	Miles.
12	1	....	....	....
36	3	1	....	....
198	$16\frac{1}{2}$	$5\frac{1}{2}$	1	....
....	5280	1760	320	1

1 fathom = 6 feet
1 furlong = 40 rods = 660 feet
1 knot or nautical mile = 1.15 statute miles = 1′ of arc on the earth's surface at the equator
1 surveyor's chain = 66 feet = 100 links (each link = 7.92 inches)
1 engineer's chain = 100 feet = 100 links
1 mil = .001 inch

Area

Square inches.	Square feet.	Square yards.	Square rods.	Acres.
144	1	....	....	....
1296	9	1	....	....
....	$272\frac{1}{4}$	$30\frac{1}{4}$	1	....
....	43560	4840	160	1

1 square mile = 640 acres
1 acre = 10 square chains (surveyor's)
1 sq. mil = .000001 sq.in.
1 circular mil = .000000785 sq.in. (area of a circle whose diameter is one mil)

Volume

1728 cubic inches = 1 cubic foot
27 cubic feet = 1 cubic yard

WEIGHTS AND MEASURES (Continued)

U. S. System (Continued)

Liquid Measure

Gills.	Pints.	Quarts.	Gallons.	Cubic inches.
4	1	....	....	28.38
8	2	1	....	57.75
32	8	4	1	231.

1 hogshead = 63 gallons
1 tun = 252 gallons
1 British imperial gallon = 277.3 cu.in. = 1.2 U. S. gallons

Apothecaries' Fluid Measure

Minims (♏).	Fluid drams (f ʒ).	Fluid ounces (f ℥).	Pints (o).	Gallons (c).
60	1	....	....	....
480	8	1	....	....
7680	128	16	1	....
....	....	128	8	1

Dry Measure

Pints.	Quarts.	Pecks.	Bushels.	Cubic inches.
2	1	....	....	67.2
16	8	1	....	537.6
	32	4	1	2150.4

1 British imperial bushel = 2218.2 cu.in. = 1.03 U. S. bushels
1 cord = 128 cu.ft.

Mass

Note.—Three systems are in use—avoirdupois, troy and apothecaries'. The grain is the same in all.

Avoirdupois—Commercial

Grains.	Drams.	Ounces.	Pounds.	Tons.
27.34	1		....	....
437.5	16	1	....	....
7000.	256	16	1	....
....	....	....	2000	1

1 long ton = 2240 lbs. = 20 hundred weight (long)
1 hundred weight (short measure) = 100 lbs.
1 pound avoirdupois = the mass of 27.70 cu.in. of water weighed in air at 35.85° F. barometer pressure 30 in. of mercury.

WEIGHTS AND MEASURES (Continued)

U. S. System (Continued)

Troy Weight

Grains.	Pennyweight.	Ounces.	Pounds.
24	1		
480	20	1	
5760	240	12	1

1 pound troy = .823 pound avoirdupois
1 carat = 3.2 grains

Apothecaries' Weight

The grain, ounce and pound are the same as in troy weight.

Grains (gr.).	Scruples (℈).	Drams (ʒ).	Ounces (℥).	Pounds (℔.).
20	1			
60	3	1		
480	24	8	1	
5760	288	96	12	1

Time

Seconds.	Minutes.	Hours.	Days.	Years.
60	1			
3600	60	1		
86400	2040	24	1	
			365.24	1 (common)
			365.256	1 (sidereal)

Angle

Seconds.	Minutes.	Degrees.	Circumference.
60	1		
3600	60	1	
		360	1

1 radian $= 57.^\circ 2958 = 206265''$
2π radians = 1 circumference.

WEIGHTS AND MEASURES (Continued)

Metric System

Length

1 millimeter	= .001	meter
1 centimeter	= .01	meter
1 decimeter	= .1	meter
1 meter		
1 dekameter	= 10.	meters
1 hektometer	= 100.	meters
1 kilometer	= 1000.	meters
1 myriameter	= 10000.	meters
1 micron	= .001 mm. (symbol μ)	
1 ångström unit	= .0000001 mm.	
1 micromillimeter	= .000001 mm.	

Area

1 square millimeter	= .0000001 square meter
1 square centimeter	= .00001 square meter
1 square decimeter	= .001 square meter
1 centare	= 1 square meter
1 are	= 100 square meters
1 hectare	= 10,000 square meters

Volume and Capacity

1 milliliter	= .001	liter = 1 cubic centimeter
1 centiliter	= .01	liter
1 deciliter	= .1	liter
1 liter	= 1	cubic decimeter, 1000 cubic centimeters
1 dekaliter	= 10	liters
1 hektoliter	= 100	liters
1 kiloliter	= 1000	liters = 1 cubic meter = 1,000,000 cu.cm.

Mass

1 milligram	= .001	gram
1 centigram	= .01	gram
1 decigram	= .1	gram
1 gram		
1 dekagram	= 10	grams
1 hektogram	= 100	grams
1 kilogram	= 1000	grams
1 myriagram	= 10000	grams
1 quintol	= 100000	grams
1 millier or tonneau	= 1000000	grams

1 cubic centimeter of water at ordinary temperature weighs about 1 gram

MISCELLANEOUS REDUCTION FACTORS

π radians = 180 degrees
1 degree = 0.017453 radian
1 radian = 57°.2958 = 3437′.75 = 206265″.
1 sidereal second = 0.99727 mean solar second
1 pound per cubic foot = .01602 gram per cubic centimeter
1 foot per second per second = 30.4796 cm. per second per second
1 poundal = 13825 dynes
76 cm. of mercury at 0° C. (g. = 980) = 1.012630 dynes per sq.cm. or 14.697 pounds per sq.in.
1 foot-pound (g. = 980) = 13.55×10^6 ergs
1 foot-poundal = 421.390 ergs
1 horse power (g. = 980) = 745.2 watts
1 mean calorie = 4.184×10^7 ergs (mechanical equivalent of heat)
1 B.T.U. = 251.99 calories.
1 calorie = 0.003968 B.T.U.
1 B.T.U. per pound = 0.5556 calorie per gram
1 calorie per gram = 1.800 B.T.U. per pound

RELATIONS OF ELECTRICAL UNITS

1 ohm = 10^9 electromagnetic units = $1/9 \times 10^{-11}$ electrostatic units,
1 volt = 10^8 electromagnetic units = $1/3 \times 10^{-2}$ electrostatic units
1 ampere = 10^{-1} electromagnetic units = 3×10^9 electrostatic units
1 coulomb = 10^{-1} electromagnetic units = 3×10^9 electrostatic units
1 farad = 10^{-9} electromagnetic units = 9×10^{11} electrostatic units
1 farad = 1,000,000 microfarads.

VALUE OF THE GAS CONSTANT *R* FOR VARIOUS UNITS

Units of pressure.	Units of volume.	*R* per gram molecule.
Atmospheres	Volume at 0° C.	0.003662
Atmospheres	c.cm.	82.07
Atmospheres	liters	0.08207
Atmospheres	cubic meters	
Dynes per sq.cm. (barye)	c.cm.	8.3156×10^7
Kilograms per sq.m. (g. = 980.6)	c.cm.	8.48×10^5
		R per lb. molecule.
Pounds per sq.in.	cu.in.	18510.
Pounds per sq.in.	cu.ft.	10.71
Atmospheres	cu.in.	1260.
Atmospheres	cu.ft.	0.729

FACTORS FOR CONVERSION OF ENERGY UNITS

(From Perkins' Introduction to General Thermodynamics, John Wiley & Sons, publishers, by permission.)

	Gram-Calories. (4° C.).	B.T.U.*	Joules.	Foot-pounds.	Kilogm.-meters.	Liter-atmos.	Cu.ft.-atmos.	Foot-Poundals	Horse-power Hours.
Gram-calorie...	1.	3.968×10^{-3}	4.185	3.087	.4267	4.130×10^{-2}	1.459×10^{-3}	99.31	1.5591×10^{-6}
B.T.U.........	252.	1	1055.	777.9	107.5	10.41	.3676	25030.	3.929×10^{-4}
Joule..........	.2389	9.482×10^{-4}	1.	.73756	.1019	9.689×10^{-3}	3.485×10^{-4}	23.73	3.725×10^{-7}
Foot-pound....	.3240	1.286×10^{-3}	1.356	1.	.113826	1.3381×10^{-2}	4.7253×10^{-4}	32.174	5.0505×10^{-7}
Kilogr-.meter ..	2.343	9.298×10^{-3}	9.806	7.2327	1.	9.678×10^{-2}	3.4177×10^{-3}	232.7	3.6529×10^{-6}
Liter-atmos....	24.21	9.607×10^{-2}	101.32	74.733	10.333	1.	3.5319×10^{-2}	2403.8	3.7734×10^{-5}

* At temp. of maximum density.

CONVERSION OF PRESSURE UNITS

(From Perkins' Introduction to General Thermodynamics, John Wiley & Sons, publishers, by permission.)

	Dynes per sq.cm.	Grams per sq.cm.	Kilo. per sq. meter.	Mm. of Mercury.	Atmospheres.	Lbs. per sq.in.	Lbs. per sq.ft.
Dynes per sq. centimeter..	1.	1.0198×10^{-3}	1.0198×10^{-2}	7.5010×10^{-4}	9.8697×10^{-7}	1.4504×10^{-5}	2.0887×10^{-3}
Gram per sq. centimeter...	980.6	1	10	7.3551×10^{-1}	9.6777×10^{-4}	1.4223×10^{-2}	2.0481
Kilogram per sq. meter....	98.06	10^{-1}	1	7.3551×10^{-2}	9.6777×10^{-5}	1.4223×10^{-3}	2.0481×10^{-1}
Millimeter of mercury.....	133.2	1.3595	13.595	1	1.3158×10^{3}	1.9337×10^{-2}	2.7845
Atmosphere..............	1013200.	1033.3	10333	760	1	14.696	2116.32
Pound per square inch....	68944	70.308	703.12	51.715	6.8046×10^{-2}	1	144
Pound per square foot....	478.78	4.883×10^{-1}	4.883	3.5912×10^{-1}	4.7252×10^{-4}	6.9445×10^{-3}	1

In the two tables above the numbers show the value of the energy or pressure unit named at the left in the units named at the top. For example, 1 gram-calorie is equivalent to 3.968×10^{-3} B.T.U.

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10

Length

INCHES		MILLIMETERS	INCHES		CENTIMETERS	FEET		METERS	U. S. YARDS		METERS	U. S. MILES		KILOMETERS
0.03937	=	**1**	0.3937	=	**1**	**1**	=	0.304801	**1**	=	0.914402	0.62137	=	**1**
0.07874	=	**2**	0.7874	=	**2**	**2**	=	0.609601	1.093611	=	**1**	**1**	=	1.60935
0.11811	=	**3**	**1**	=	2.54001	**3**	=	0.914402	**2**	=	1.828804	1.24274	=	**2**
0.15748	=	**4**	1.1811	=	**3**	3.28083	=	**1**	2.187222	=	**2**	1.86411	=	**3**
0.19685	=	**5**	1.5748	=	**4**	**4**	=	1.219202	**3**	=	2.743205	**2**	=	3.21869
0.23622	=	**6**	1.9685	=	**5**	**5**	=	1.524003	3.280833	=	**3**	2.48548	=	**4**
0.27559	=	**7**	**2**	=	5.08001	**6**	=	1.828804	**4**	=	3.657607	**3**	=	4.82804
0.31496	=	**8**	2.3622	=	**6**	6.56167	=	**2**	4.374444	=	**4**	3.10685	=	**5**
0.35433	=	**9**	2.7559	=	**7**	**7**	=	2.133604	**5**	=	4.572009	3.72822	=	**6**
1	=	25.4001	**3**	=	7.62002	**8**	=	2.438405	5.468056	=	**5**	**4**	=	6.43739
2	=	50.8001	3.1496	=	**8**	**9**	=	2.743205	**6**	=	5.486411	4.34959	=	**7**
3	=	76.2002	3.5433	=	**9**	9.84250	=	**3**	6.561667	=	**6**	4.97096	=	**8**
4	=	101.6002	**4**	=	10.16002	13.12333	=	**4**	**7**	=	6.400813	**5**	=	8.04674
5	=	127.0003	**5**	=	12.70003	16.40417	=	**5**	7.655278	=	**7**	5.59233	=	**9**
6	=	152.4003	**6**	=	15.24003	19.68500	=	**6**	**8**	=	7.315215	**6**	=	9.65608
7	=	177.8004	**7**	=	17.78004	22.96583	=	**7**	8.748889	=	**8**	**7**	=	11.26543
8	=	203.2004	**8**	=	20.32004	26.24667	=	**8**	**9**	=	8.229616	**8**	=	12.87478
9	=	228.6005	**9**	=	22.86005	29.52750	=	**9**	9.842500	=	**9**	**9**	=	14.48412

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10—Continued

Area

Square inches	Square millimeters	Square inches	Square centimeters	Square feet	Square meters	Square yards	Square meters	Square miles	Square kilometers
0.00155	1	0.1550	1	1	0.09290	1	0.8361	0.3861	1
0.00310	2	0.3100	2	2	0.18581	1.1960	1	0.7722	2
0.00465	3	0.4650	3	3	0.27871	2	1.6723	1	2.5900
0.00620	4	0.6200	4	4	0.37161	2.3920	2	1.1583	3
0.0075	5	0.7750	5	5	0.46452	3	2.5084	1.5444	4
0.00930	6	0.9300	6	6	0.55742	3.5880	3	1.9305	5
0.01085	7	1	6.452	7	0.65032	4	3.3445	2	5.1800
0.01240	8	1.0850	7	8	0.74323	4.7839	4	2.3166	6
0.01395	9	1.2400	8	9	0.83613	5	4.1807	2.7027	7
1	645.16	1.3950	9	10.764	1	5.9799	5	3	7.7700
2	1,290.33	2	12.903	21.528	2	6	5.0168	3.0888	8
3	1,935.49	3	19.355	32.292	3	7	5.8529	3.4749	9
4	2,580.65	4	25.807	43.055	4	7.1759	6	4	10.3600
5	3,225.81	5	32.258	53.819	5	8	6.6890	5	12.9500
6	3,870.98	6	38.710	64.583	6	8.3719	7	6	15.5400
7	4,516.14	7	45.161	75.347	7	9	7.5252	7	18.1300
8	5,161.30	8	51.613	86.111	8	9.5679	8	8	20.7200
9	5,806.46	9	58.065	96.875	9	10.7639	9	9	23.3100

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10—Continued

Volume								AREA—Continued	
CUBIC INCHES	CUBIC MILLIMETERS	CUBIC INCHES	CUBIC CENTIMETERS	CUBIC FEET	CUBIC METERS	CUBIC YARDS	CUBIC METERS	ACRES	HECTARES
0.000061 =	**1**	0.0610 =	**1**	**1**	= 0.02832	**1**	= 0.7646	**1**	= 0.4047
0.000122 =	**2**	0.1220 =	**2**	**2**	= 0.05663	1.3079	= **1**	**2**	= 0.8094
0.000183 =	**3**	0.1831 =	**3**	**3**	= 0.08495	**2**	= 1.5291	2.471	= **1**
0.000244 =	**4**	0.2441 =	**4**	**4**	= 0.11327	2.6159	= **2**	**3**	= 1.2141
0.000305 =	**5**	0.3051 =	**5**	**5**	= 0.14159	**3**	= 2.2937	**4**	= 1.6187
0.000366 =	**6**	0.3661 =	**6**	**6**	= 0.16990	3.9238	= **3**	4.942	= **2**
0.000427 =	**7**	0.4272 =	**7**	**7**	= 0.19822	**4**	= 3.0582	**5**	= 2.0234
0.000488 =	**8**	0.4882 =	**8**	**8**	= 0.22654	**5**	= 3.8228	**6**	= 2.4281
0.000549 =	**9**	0.5492 =	**9**	**9**	= 0.25485	5.2318	= **4**	**7**	= 2.8328
1	= 16,387.2	**1**	= 16.3872	35.314	= **1**	**6**	= 4.5874	7.413	= **3**
2	= 32,774.3	**2**	= 32.7743	70.629	= **2**	6.5397	= **5**	**8**	= 3.2375
3	= 49,161.5	**3**	= 49.1615	105.943	= **3**	**7**	= 5.3519	**9**	= 3.6422
4	= 65,548.6	**4**	= 65.5486	141.258	= **4**	7.8477	= **6**	9.884	= **4**
5	= 81,935.8	**5**	= 81.9358	176.572	= **5**	**8**	= 6.1165	12.355	= **5**
6	= 98,323.0	**6**	= 98.3230	211.887	= **6**	**9**	= 6.8810	14.826	= **6**
7	= 114,710.1	**7**	= 114.7101	247.201	= **7**	9.1556	= **7**	17.297	= **7**
8	= 131,097.3	**8**	= 131.0973	282.516	= **8**	10.4635	= **8**	19.768	= **8**
9	= 147,484.5	**9**	= 147.4845	317.830	= **9**	11.7715	= **9**	22.239	= **9**

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10—Continued

Capacity

MILLILITERS (cc.)	U. S. LIQUID OUNCES	MILLILITERS (cc.)	U. S. APOTHECARIES' DRAMS	U. S. APOTHECARIES' SCRUPLES	MILLILITERS (cc.)	U. S. LIQUID QUARTS	LITERS	U. S. LIQUID GALLONS	LITERS
1	= 0.03381	1	= 0.2705	0.8115	= 1	1	= 0.94636	0.26417	= 1
2	= 0.06763	2	= 0.5410	1	= 1.2322	1.05668	= 1	0.52834	= 2
3	= 0.10144	3	= 0.8115	1.6231	= 2	2	= 1.89272	0.79251	= 3
4	= 0.13526	3.6967	= 1	2	= 2.4645	2.11336	= 2	1	= 3.78543
5	= 0.16907	4	= 1.0820	2.4346	= 3	3	= 2.83908	1.05668	= 4
6	= 0.20288	5	= 1.3525	3	= 3.6967	3.17005	= 3	1.32085	= 5
7	= 0.23670	6	= 1.6231	3.2461	= 4	4	= 3.78543	1.58502	= 6
8	= 0.27051	7	= 1.8936	4	= 4.9290	4.22673	= 4	1.84919	= 7
9	= 0.30432	7.3934	= 2	4.0577	= 5	5	= 4.73179	2	= 7.57087
29.574	= 1	8	= 2.1641	4.8692	= 6	5.28341	= 5	2.11336	= 8
59.147	= 2	9	= 2.4346	5	= 6.1612	6	= 5.67815	2.37753	= 9
88.721	= 3	11.0901	= 3	5.6807	= 7	6.34009	= 6	3	= 11.35630
118.295	= 4	14.7869	= 4	6	= 7.3934	7	= 6.62451	4	= 15.14174
147.869	= 5	18.4836	= 5	6.4923	= 8	7.39677	= 7	5	= 18.92717
177.442	= 6	22.1803	= 6	7	= 8.6257	8	= 7.57088	6	= 22.71261
207.016	= 7	25.8770	= 7	7.3038	= 9	8.45345	= 8	7	= 26.49804
236.590	= 8	29.5737	= 8	8	= 9.8579	9	= 8.51723	8	= 30.28348
266.163	= 9	33.2704	= 9	9	= 11.0901	9.51014	= 9	9	= 34.06891

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10—Continued

U. S. DRY QUARTS	LITERS	U. S. PECKS	LITERS	DEKA-LITERS	U. S. PECKS.	U. S. BUSHELS	HECTO-LITERS	U. S. BUSHELS PER ACRE	HECTO-LITERS PER HECTARE
0.9081 =	1	0.11351 =	1	0.8810 =	1	1 =	0.35239	1 =	0.87078
1 =	1.1012	0.22702 =	2	1 =	1.1351	2 =	0.70479	1.14840 =	1
1.8162 =	2	0.34053 =	3	1.7620 =	2	2.83774 =	1	2 =	1.74156
2 =	2.2025	0.45404 =	4	2 =	2.2702	3 =	1.05718	2.29680 =	2
2.7242 =	3	0.56755 =	5	2.6429 =	3	4 =	1.40957	3 =	2.61233
3 =	3.3037	0.68106 =	6	3 =	3.4053	5 =	1.76196	3.44519 =	3
3.6323 =	4	0.79457 =	7	3.5239 =	4	5.67548 =	2	4 =	3.48311
4 =	4.4049	0.90808 =	8	4 =	4.5404	6 =	2.11436	4.59359 =	4
4.5404 =	5	1 =	8.80982	4.4049 =	5	7 =	2.46675	5 =	4.35389
5 =	5.5061	1.02157 =	9	5 =	5.6755	8 =	2.81914	5.74199 =	5
5.4485 =	6	2 =	17.61964	5.2859 =	6	8.51323 =	3	6 =	5.22467
6 =	6.6074	3 =	26.42946	6 =	6.8106	9 =	3.17154	6.89039 =	6
6.3565 =	7	4 =	35.23928	6.1669 =	7	11.35097 =	4	7 =	6.09545
7 =	7.7086	5 =	44.04910	7 =	7.9457	14.18871 =	5	8 =	6.96622
7.2646 =	8	6 =	52.85892	7.0479 =	8	17.02645 =	6	8.03879 =	7
8 =	8.8098	7 =	61.66874	7.9288 =	9	19.86420 =	7	9 =	7.83700
8.1727 =	9	8 =	70.47856	8 =	9.0808	22.70194 =	8	9.18719 =	8
9 =	9.9110	9 =	79.28838	9 =	10.2159	25.53968 =	9	10.33558 =	9

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10—Continued

Weight (or Mass)

GRAINS	GRAMS	AVOIRDUPOIS OUNCES	GRAMS	TROY OUNCES	GRAMS	AVOIRDUPOIS POUNDS	KILOGRAMS	TROY POUNDS	KILOGRAMS
1	= 0.06480	0.03527	= 1	0.03215	= 1	1	= 0.45359	1	= 0.37324
2	= 0.12960	0.07055	= 2	0.06430	= 2	2	= 0.90718	2	= 0.74648
3	= 0.19440	0.10582	= 3	0.09645	= 3	2.20462	= 1	2.67923	= 1
4	= 0.25920	0.14110	= 4	0.12860	= 4	3	= 1.36078	3	= 1.11973
5	= 0.32399	0.17637	= 5	0.16075	= 5	4	= 1.81437	4	= 1.49297
6	= 0.38879	0.21164	= 6	0.19290	= 6	4.40924	= 2	5	= 1.86621
7	= 0.45359	0.24692	= 7	0.22506	= 7	5	= 2.26796	5.35846	= 2
8	= 0.51839	0.28219	= 8	0.25721	= 8	6	= 2.72155	6	= 2.23945
9	= 0.58319	0.31747	= 9	0.28936	= 9	6.61387	= 3	7	= 2.61269
15.4324	= 1	1	= 28.3495	1	= 31.10348	7	= 3.17515	8	= 2.98593
30.8647	= 2	2	= 56.6991	2	= 62.20696	8	= 3.62874	8.03769	= 3
46.2971	= 3	3	= 85.0486	3	= 93.31044	8.81849	= 4	9	= 3.35918
61.7294	= 4	4	= 113.3981	4	= 124.41392	9	= 4.08233	10.71691	= 4
77.1618	= 5	5	= 141.7476	5	= 155.51740	11.02311	= 5	13.39614	= 5
92.5941	= 6	6	= 170.0972	6	= 186.62088	13.22773	= 6	16.07537	= 6
108.0265	= 7	7	= 198.4467	7	= 217.72437	15.43236	= 7	18.75460	= 7
123.4589	= 8	8	= 226.7962	8	= 248.82785	17.63698	= 8	21.43383	= 8
138.8912	= 9	9	= 255.1457	9	= 279.93133	19.84160	= 9	24.11306	= 9

COMPARISON OF THE VARIOUS TONS AND POUNDS IN USE IN THE UNITED STATES

From 1 *to* 10 *Units*

Long tons	Short tons	Metric tons	Kilograms	Avoirdupois pounds	Troy pounds
0.00036735	0.00041143	0.00037324	0.37324	0.822857	1.
0.00044643	0.00050000	0.00045359	0.45359	1.	1.21528
0.00073469	0.00082286	0.00074648	0.74648	1.64571	2.
0.00089286	0.00100000	0.00090718	0.90718	2.	2.43056
0.00098421	0.00110231	0.00100000	1.	2.20462	2.67923
0.00110204	0.00123429	0.00111973	1.11973	2.46857	3.
0.00133929	0.00150000	0.00136078	1.36078	3.	3.64583
0.00146939	0.00164571	0.00149297	1.49297	3.29143	4.
0.00178571	0.00200000	0.00181437	1.81437	4.	4.86111
0.00183673	0.00205714	0.00186621	1.86621	4.11429	5.
0.00196841	0.00220462	0.00200000	2.	4.40924	5.35846
0.00220408	0.00246857	0.00223945	2.23945	4.93714	6.
0.00223214	0.00250000	0.00226796	2.26796	5.	6.07639
0.00257143	0.00288000	0.00261269	2.61269	5.76000	7.
0.00267857	0.00300000	0.00272155	2.72155	6.	7.29167
0.00293878	0.00329143	0.00298593	2.98593	6.58286	8.
0.00295262	0.00330693	0.00300000	3.	6.61387	8.03769
0.00312500	0.00350000	0.00317515	3.17515	7.	8.50694
0.00330612	0.00370286	0.00335918	3.35918	7.40571	9.
0.00357143	0.00400000	0.00362874	3.62874	8.	9.72222

COMPARISON OF THE VARIOUS TONS AND POUNDS IN USE IN THE UNITED STATES (Continued)

From 1 *to* 10 *Units*

Long tons	Short tons	Metric tons	Kilograms	Avoirdupois pounds	Troy pounds
0.00393683	0.00440924	0.00400000	4.	8.81849	10.71691
0.00401786	0.00450000	0.00408233	4.08233	9.	10.93750
0.00492103	0.00551156	0.00500000	5.	11.0231	13.39614
0.00590524	0.00661387	0.00600000	6.	13.2277	16.07537
0.00688944	0.00771618	0.00780000	7.	15.4324	18.75460
0.00787365	0.00881849	0.00800000	8.	17.6370	21.43383
0.00885786	0.00992080	0.00900000	9.	19.8416	24.11306
0.89287	1.	0.9718	907.18	2,000.	2,430.56
0.98421	1.10231	1.	1,000.	2,204.62	2,679.23
1.	1.12000	1.01605	1,016.05	2,240.00	2,722.22
1.78571	2.	1.81437	1,814.37	4,000.00	4,861.11
1.96841	2.20462	2.	2,000.00	4,409.24	5,358.46
2.	2.24000	2.03209	2,032.09	4,480.00	5,444.44
2.67857	3.	2.72155	2,721.55	6,000.00	7,291.67
2.95262	3.30693	3.	3,000.00	6,613.87	8,037.69
3.	3.36000	3.04814	3,048.14	6,720.00	8,166.67
3.57143	4.	3.62874	3,628.74	8,000.00	9,722.22
3.93683	4.40924	4.	4,000.00	8,818.49	10,716.91
4.	4.48000	4.06419	4,064.19	8,960.00	10,888.89
4.46429	5.	4.53592	4,535.92	10,000.00	12,152.78

COMPARISON OF THE VARIOUS TONS AND POUNDS IN USE IN THE UNITED STATES (Continued)

Long tons	Short tons	Metric tons	Kilograms	Avoirdupois pounds	Troy pounds
4.92103	5.51156	5.	5,000.00	11,023.11	13,396.14
5.	5.60000	5.08024	5,080.24	11,200.00	13,611.11
5.35714	6.	5.44311	5,443.11	12,000.00	14,583.33
5.90524	6.61387	6.	6,000.00	13,227.73	16,075.37
6.	6.72000	6.09628	6,096.28	13,440.00	16,333.33
6.25000	7.	6.35029	6,350.29	14,000.00	17,013.89
6.88944	7.71618	7.	7,000.00	15,432.36	18,754.60
7.	7.84000	7.11232	7,112.32	15,680.00	19,055.56
7.14286	8.	7.25748	7,257.48	16,000.00	19,444.44
7.87365	8.81849	8.	8,000.00	17,636.98	21,433.83
8.	8.96000	8.12838	8,128.38	17,920.00	21,777.78
8.03571	9.	8.16466	8,164.66	18,000.00	21,875.00
8.85786	9.92080	9.	9,000.00	19,841.60	24,113.06
9.	10.08000	9.14442	9,144.42	20,160.00	24,500.00

LENGTHS — CENTIMETERS TO INCHES

0.1 to 100 Units

1 centimeter = 0.393700 inches

The values found in the body of the table give, in inches, the lengths indicated in centimeters at the top and side.

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0		0.03937	0.07874	0.11811	0.15748	0.19685	0.23622	0.27559	0.31496	0.35433
1	0.39370	0.43307	0.47244	0.51181	0.55118	0.59055	0.62992	0.66929	0.70866	0.74803
2	0.78740	0.82677	0.86614	0.90551	0.94488	0.98425	1.0236	1.0630	1.1024	1.1417
3	1.1811	1.2205	1.2598	1.2992	1.3386	1.3780	1.4173	1.4567	1.4961	1.5354
4	1.5748	1.6142	1.6535	1.6929	1.7323	1.7717	1.8110	1.8504	1.8898	1.9291
5	1.9685	2.0079	2.0472	2.0866	2.1260	2.1654	2.2047	2.2441	2.2835	2.3228
6	2.3622	2.4016	2.4409	2.4803	2.5197	2.5591	2.5984	2.6378	2.6772	2.7165
7	2.7559	2.7953	2.8346	2.8740	2.9134	2.9528	2.9921	3.0315	3.0709	3.1102
8	3.1496	3.1890	3.2283	3.2677	3.3071	3.3465	3.3858	3.4252	3.4646	3.5039
9	3.5433	3.5827	3.6220	3.6614	3.7008	3.7402	3.7795	3.8189	3.8583	3.8976

LENGTHS — CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
10	3.9370	3.9764	4.0158	4.0551	4.0945	4.1339	4.1732	4.2126	4.2520	4.2913
11	4.3307	4.3701	4.4094	4.4488	4.4882	4.5276	4.5669	4.6063	4.6457	4.6850
12	4.7244	4.7638	4.8031	4.8425	4.8819	4.9213	4.9606	5.0000	5.0394	5.0787
13	5.1181	5.1575	5.1968	5.2362	5.2756	5.3150	5.3543	5.3937	5.4331	5.4724
14	5.5118	5.5512	5.5905	5.6299	5.6693	5.7087	5.7480	5.7874	5.8268	5.8661
15	5.9055	5.9449	5.9842	6.0236	6.0630	6.1024	6.1417	6.1811	6.2205	6.2598
16	6.2992	6.3386	6.3779	6.4173	6.4567	6.4961	6.5354	6.5748	6.6142	6.6535
17	6.6929	6.7323	6.7716	6.8110	6.8504	6.8898	6.9291	6.9685	7.0079	7.0472
18	7.0866	7.1260	7.1653	7.2047	7.2441	7.2835	7.3228	7.3622	7.4016	7.4409
19	7.4803	7.5197	7.5590	7.5984	7.6378	7.6772	7.7165	7.7559	7.7953	7.8346
20	7.8740	7.9134	7.9527	7.9921	8.0315	8.0709	8.1102	8.1496	8.1890	8.2283
21	8.2677	8.3071	8.3464	8.3858	8.4252	8.4646	8.5039	8.5433	8.5827	8.6220
22	8.6614	8.7008	8.7401	8.7795	8.8189	8.8583	8.8976	8.9370	8.9764	9.0157
23	9.0551	9.0945	9.1338	9.1732	9.2126	9.2520	9.2913	9.3307	9.3701	9.4094
24	9.4488	9.4882	9.5275	9.5669	9.6063	9.6457	9.6850	9.7244	9.7638	9.8031
25	9.8425	9.8819	9.9212	9.9606	10.000	10.039	10.079	10.118	10.157	10.197
26	10.236	10.276	10.315	10.354	10.394	10.433	10.472	10.512	10.551	10.591
27	10.630	10.669	10.709	10.748	10.787	10.827	10.866	10.905	10.945	10.984
28	11.024	11.063	11.102	11.142	11.181	11.220	11.260	11.299	11.339	11.378
29	11.417	11.457	11.496	11.535	11.575	11.614	11.654	11.693	11.732	11.772

LENGTHS — CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
30	11.811	11.850	11.890	11.929	11.968	12.008	12.047	12.087	12.126	12.165
31	12.205	12.244	12.283	12.323	12.362	12.402	12.441	12.480	12.520	12.559
32	12.598	12.638	12.677	12.717	12.756	12.795	12.835	12.874	12.914	12.953
33	12.992	13.031	13.071	13.110	13.150	13.189	13.228	13.268	13.307	13.346
34	13.386	13.425	13.465	13.504	13.543	13.583	13.622	13.661	13.701	13.740
35	13.780	13.819	13.858	13.898	13.937	13.976	14.016	14.055	14.094	14.134
36	14.173	14.213	14.252	14.291	14.331	14.370	14.409	14.449	14.488	14.528
37	14.567	14.606	14.646	14.685	14.724	14.764	14.803	14.842	14.882	14.921
38	14.961	15.000	15.039	15.079	15.118	15.157	15.197	15.236	15.276	15.315
39	15.354	15.394	15.433	15.472	15.512	15.551	15.591	15.630	15.669	15.709
40	15.748	15.787	15.827	15.866	15.905	15.945	15.984	16.024	16.063	16.102
41	16.142	16.181	16.220	16.260	16.299	16.339	16.378	16.417	16.457	16.496
42	16.535	16.575	16.614	16.654	16.693	16.732	16.772	16.811	16.850	16.890
43	16.929	16.968	17.008	17.047	17.087	17.126	17.165	17.205	17.244	17.283
44	17.323	17.362	17.402	17.441	17.480	17.520	17.559	17.598	17.638	17.677
45	17.717	17.756	17.795	17.835	17.874	17.913	17.953	17.992	18.031	18.071
46	18.110	18.150	18.189	18.228	18.268	18.307	18.346	18.386	18.425	18.465
47	18.504	18.543	18.583	18.622	18.661	18.701	18.740	18.779	18.819	18.858
48	18.898	18.987	18.976	19.016	19.055	19.094	19.134	19.173	19.213	19.252
49	19.291	19.331	19.370	19.409	19.449	19.488	19.526	19.567	19.606	19.646

LENGTHS — CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
50	19.685	19.724	19.764	19.803	19.842	19.882	19.921	19.961	20.000	20.039
51	20.079	20.118	20.157	20.197	20.236	20.276	20.315	20.354	20.394	20.433
52	20.472	20.512	20.551	20.591	20.630	20.669	20.709	20.748	20.787	20.827
53	20.866	20.905	20.945	20.984	21.024	21.063	21.102	21.142	21.181	21.220
54	21.260	21.299	21.339	21.378	21.417	21.457	21.496	21.535	21.575	21.614
55	21.654	21.693	21.732	21.772	21.811	21.850	21.890	21.929	21.968	22.008
56	22.047	22.087	22.126	22.165	22.205	22.244	22.283	22.323	22.362	22.402
57	22.441	22.480	22.520	22.559	22.598	22.638	22.677	22.716	22.756	22.795
58	22.835	22.874	22.913	22.953	22.992	23.031	23.071	23.110	23.150	23.189
59	23.228	23.268	23.307	23.346	23.386	23.425	23.465	23.504	23.543	23.583
60	23.622	23.661	23.701	23.740	23.779	23.819	23.858	23.898	23.937	23.976
61	24.016	24.055	24.094	24.134	24.173	24.213	24.252	24.291	24.331	24.370
62	24.409	24.449	24.488	24.528	24.567	24.606	24.646	24.685	24.724	24.764
63	24.803	24.842	24.882	24.921	24.961	25.000	25.039	25.079	25.118	25.157
64	25.197	25.236	25.276	25.315	25.354	25.394	25.433	25.472	25.512	25.551
65	25.591	25.630	25.669	25.709	25.748	25.787	25.827	25.866	25.905	25.945
66	25.984	26.024	26.063	26.102	26.142	26.181	26.220	26.260	26.299	26.339
67	26.378	26.417	26.457	26.496	26.535	26.575	26.614	26.653	26.693	26.732
68	26.772	26.811	26.850	26.890	26.929	26.968	27.008	27.047	27.087	27.126
69	27.165	27.205	27.244	27.283	27.323	27.362	27.402	27.441	27.480	27.520

LENGTHS — CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
70	27.559	27.598	27.638	27.677	27.716	27.756	27.795	27.835	27.874	27.913
71	27.953	27.992	28.031	28.071	28.110	28.150	28.189	28.228	28.268	28.307
72	28.346	28.386	28.425	28.465	28.504	28.543	28.583	28.622	28.661	28.701
73	28.740	28.779	28.819	28.859	28.898	28.937	28.976	29.016	29.055	29.094
74	29.134	29.173	29.213	29.252	29.291	29.331	29.370	29.409	29.449	29.488
75	29.528	29.567	29.606	29.646	29.685	29.724	29.764	29.803	29.842	29.882
76	29.921	29.961	30.000	30.039	30.079	30.118	30.157	30.197	30.236	30.276
77	30.315	30.354	30.394	30.433	30.472	30.512	30.551	30.590	30.630	30.669
78	30.709	30.748	30.787	30.827	30.866	30.905	30.945	30.984	31.024	31.063
79	31.102	31.142	31.181	31.220	31.260	31.299	31.339	31.378	31.417	31.457
80	31.496	31.535	31.575	31.614	31.653	31.693	31.732	31.772	31.811	31.850
81	31.890	31.929	31.968	32.008	32.047	32.087	32.126	32.165	32.205	32.244
82	32.283	32.323	32.362	32.402	32.441	32.480	32.520	32.559	32.598	32.638
83	32.677	32.716	32.756	32.795	32.835	32.874	32.913	32.953	32.992	33.031
84	33.071	33.110	33.150	33.189	33.228	33.268	33.307	33.346	33.386	33.425
85	33.465	33.504	33.543	33.583	33.622	33.661	33.701	33.740	33.779	33.819
86	23.858	33.898	33.937	33.976	33.016	34.055	34.094	34.134	34.173	34.213
87	34.252	34.291	34.331	34.370	34.409	34.449	34.488	34.527	34.567	34.606
88	34.646	34.685	34.724	34.764	34.803	34.842	34.882	34.921	34.961	35.000
89	35.039	35.079	35.118	35.157	35.197	35.236	35.276	35.315	35.354	35.394

LENGTHS — CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
90	35.433	35.472	35.512	35.551	35.590	35.630	35.669	35.709	35.748	35.787
91	35.827	35.866	35.905	35.945	35.984	36.024	36.063	36.102	36.142	36.181
92	36.220	36.260	36.299	36.339	36.378	36.417	36.457	36.496	36.535	36.575
93	36.614	36.653	36.693	36.732	36.772	36.811	36.850	36.890	36.929	36.968
94	37.008	37.047	37.087	37.126	37.165	37.205	37.244	37.283	37.323	37.362
95	37.402	37.441	37.480	37.520	37.559	37.598	37.638	37.677	37.716	37.756
96	37.795	37.835	37.874	37.913	37.953	37.992	38.031	38.071	38.110	38.150
97	38.189	38.228	38.268	38.307	38.346	38.386	38.425	38.464	38.504	38.543
98	38.583	38.622	38.661	38.701	38.740	38.779	38.819	38.858	38.898	38.937
99	38.976	39.016	39.055	39.094	39.034	39.173	39.213	39.252	39.291	39.331

LENGTHS — INCHES TO CENTIMETERS

From 0.1 *to* 100 *Units*

1 inch = 2.54001 centimeters

The values found in the body of the table give, in centimeters, the lengths indicated in inches at the top and side.

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	....	0.25400	0.50800	0.76200	1.0160	1.2700	1.5240	1.7780	2.0320	2.2860
1	2.5400	2.7940	3.0480	3.3020	3.5560	3.8100	4.0640	4.3180	4.5720	4.8260
2	5.0800	5.3340	5.5880	5.8420	6.0960	6.3500	6.6040	6.8580	7.1120	7.3660
3	7.6200	7.8740	8.1280	8.3820	8.6360	8.8900	9.1440	9.3980	9.6520	9.9060
4	10.160	10.414	10.668	10.922	11.176	11.430	11.684	11.938	12.192	12.446
5	12.700	12.954	13.208	13.462	13.716	13.970	14.224	14.478	14.732	14.986
6	15.240	15.494	15.748	16.002	16.256	16.510	16.764	17.018	17.272	17.526
7	17.780	18.034	18.288	18.542	18.796	19.050	19.304	19.558	19.812	20.066
8	20.320	20.574	20.828	21.082	21.336	21.590	21.844	22.098	22.352	22.606
9	22.860	23.114	23.368	23.622	23.876	24.130	24.384	24.638	24.892	25.146

LENGTHS — INCHES TO CENTIMETERS (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
10	25.400	25.654	25.908	26.162	26.416	26.670	26.924	27.178	27.432	27.686
11	27.940	28.194	28.448	28.702	28.956	29.210	29.464	29.718	29.972	30.226
12	30.480	30.734	30.988	31.242	31.496	31.750	32.004	32.258	32.512	32.766
13	33.020	33.274	33.528	33.782	34.036	34.290	34.544	34.798	35.052	35.306
14	35.560	35.814	36.068	36.322	36.576	36.830	37.084	37.338	37.592	37.846
15	38.100	38.354	38.608	38.862	39.116	39.370	39.624	39.878	40.132	40.386
16	40.640	40.894	41.148	41.402	41.656	41.910	42.164	42.418	42.672	42.926
17	43.180	43.434	43.688	43.942	44.196	44.450	44.704	44.958	45.212	45.466
18	45.720	45.974	46.228	46.482	46.736	46.990	47.244	47.498	47.752	48.006
19	48.260	48.514	48.768	49.022	49.276	49.530	49.784	50.038	50.292	50.546
20	50.800	51.054	51.308	51.562	51.816	52.070	52.324	52.578	52.832	53.086
21	53.340	53.594	53.848	54.102	54.356	54.610	54.864	55.118	55.372	55.626
22	55.880	56.134	56.388	56.642	56.896	57.150	57.404	57.658	57.912	58.166
23	58.420	58.674	58.928	59.182	59.436	59.690	59.944	60.198	60.452	60.706
24	60.960	61.214	61.468	61.722	61.976	62.230	62.484	62.738	62.992	63.246
25	63.500	63.754	64.008	64.262	64.516	64.770	65.024	65.278	65.532	65.786
26	66.040	66.294	66.548	66.802	67.056	67.310	67.564	67.818	68.072	68.326
27	68.580	68.834	69.088	69.342	69.596	69.850	70.104	70.358	70.612	70.866
28	71.120	71.374	71.628	71.882	72.136	72.390	72.644	72.898	73.152	73.406
29	73.660	73.914	74.168	74.422	74.676	74.930	75.184	75.438	75.692	75.946

LENGTHS — INCHES TO CENTIMETERS (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
30	76.200	76.454	76.708	76.962	77.216	77.470	77.724	77.978	78.232	78.486
31	78.740	78.994	79.248	79.502	79.756	80.010	80.264	80.518	80.772	81.026
32	81.280	81.534	81.788	82.042	82.296	82.550	82.804	83.058	83.312	83.566
33	83.820	84.074	84.328	84.582	84.836	85.090	85.344	85.598	85.852	86.106
34	86.360	86.614	86.868	87.122	87.376	87.630	87.884	88.138	88.392	88.646
35	88.900	89.154	89.408	89.662	89.916	90.170	90.424	90.678	90.932	91.186
36	91.440	91.694	91.948	92.202	92.456	92.710	92.964	93.218	93.472	93.726
37	93.980	94.234	94.488	94.742	94.996	95.250	95.504	95.758	96.012	96.266
38	96.520	96.774	97.028	97.282	97.536	97.790	98.044	98.298	98.552	98.806
39	99.060	99.314	99.568	99.822	100.08	100.33	100.58	100.84	101.09	101.35
40	101.60	101.85	102.11	102.36	102.62	102.87	103.12	103.38	103.63	103.89
41	104.14	104.39	104.65	104.90	105.16	105.41	105.66	105.92	106.17	106.43
42	106.68	106.93	107.19	107.44	107.70	107.95	108.20	108.46	108.71	108.97
43	109.22	109.47	109.73	109.98	110.24	110.49	110.74	111.00	111.25	111.51
44	111.76	112.01	112.27	112.52	112.78	113.03	113.28	113.54	113.79	114.05
45	114.30	114.55	114.81	115.06	115.32	115.57	115.82	116.08	116.33	116.59
46	116.84	117.09	117.35	117.60	117.86	118.11	118.36	118.62	118.87	119.13
47	119.38	119.63	119.89	120.14	120.40	120.65	120.90	121.16	121.41	121.67
48	121.92	122.17	122.43	122.68	122.94	123.19	123.44	123.70	123.95	124.21
49	124.46	124.71	124.97	125.22	125.48	125.73	125.98	126.24	126.49	126.75

LENGTHS — INCHES TO CENTIMETERS (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
50	127.00	127.25	127.51	127.76	128.02	128.27	128.52	128.78	129.03	129.29
51	129.54	129.79	130.05	130.30	130.56	130.81	131.06	131.32	131.57	131.83
52	132.08	132.33	132.59	132.84	133.10	133.35	133.60	133.86	134.11	134.37
53	134.62	134.87	135.13	135.38	135.64	135.89	136.14	136.40	136.65	136.91
54	137.16	137.41	137.67	137.92	138.18	138.43	138.68	138.94	139.19	139.45
55	139.70	139.95	140.21	140.46	140.72	140.97	141.22	141.48	141.73	141.99
56	142.24	142.49	142.75	143.00	143.26	143.51	143.76	144.02	144.27	144.53
57	144.78	145.03	145.29	145.54	145.80	146.05	146.30	146.56	146.81	147.07
58	147.32	147.57	147.83	148.08	148.34	148.59	148.84	149.10	149.35	149.61
59	149.86	150.11	150.37	150.62	150.88	151.13	151.38	151.64	151.89	152.15
60	152.40	152.65	152.91	153.16	153.42	153.67	153.92	154.18	154.43	154.69
61	154.94	155.19	155.45	155.70	155.96	156.21	156.46	156.72	156.97	157.23
62	157.48	157.73	157.99	158.24	158.50	158.75	159.00	159.26	159.51	159.77
63	160.02	160.27	160.53	160.78	161.04	161.29	161.54	161.80	162.05	162.31
64	162.56	162.81	163.07	163.32	163.58	163.83	164.08	164.34	164.59	164.85
65	165.10	165.35	165.61	165.86	166.12	166.37	166.62	166.88	167.13	167.39
66	167.64	167.89	168.15	168.40	168.66	168.91	169.16	169.42	169.67	169.93
67	170.18	170.43	170.69	170.94	171.20	171.45	171.70	171.96	172.21	172.47
68	172.72	172.97	173.23	173.48	173.74	173.99	174.24	174.50	174.75	175.01
69	175.26	175.51	175.77	176.02	176.28	176.53	176.78	177.04	177.29	177.55

LENGTHS — INCHES TO CENTIMETERS (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
70	177.80	178.05	178.31	178.56	178.82	179.07	179.32	179.58	179.83	180.09
71	180.34	180.59	180.85	181.10	181.36	181.61	181.86	182.12	182.37	182.63
72	182.88	183.13	183.39	183.64	183.90	184.15	184.40	184.66	184.91	185.17
73	185.42	185.67	185.93	186.18	186.44	186.69	186.94	187.20	187.45	187.71
74	187.96	188.21	188.47	188.72	188.98	189.23	189.48	189.74	189.99	190.25
75	190.50	190.75	191.01	191.26	191.52	191.77	192.02	192.28	192.53	192.79
76	193.04	193.29	193.55	193.80	194.06	194.31	194.56	194.82	195.07	195.33
77	195.58	195.83	196.09	196.34	196.60	196.85	197.10	197.36	197.61	197.87
78	198.12	198.37	198.63	198.88	199.14	199.39	199.64	199.90	200.15	200.41
79	200.66	200.91	201.17	201.42	201.68	201.93	202.18	202.44	202.69	202.95
80	203.20	203.45	203.71	203.96	204.22	204.47	204.72	204.98	205.23	205.49
81	205.74	205.99	206.25	206.50	206.76	207.01	207.26	207.52	207.77	208.03
82	208.28	208.53	208.79	209.04	209.30	209.55	209.80	210.06	210.31	210.57
83	210.82	211.07	211.33	211.58	211.84	212.09	212.34	212.60	212.85	213.11
84	213.36	213.61	213.87	214.12	214.38	214.63	214.88	215.14	215.39	215.65
85	215.90	216.15	216.41	216.66	216.92	217.17	217.42	217.68	217.93	218.19
86	218.44	218.69	218.95	219.20	219.46	219.71	219.96	220.22	220.47	220.73
87	220.98	221.23	221.49	221.74	222.00	222.25	222.50	222.76	223.01	223.27
88	223.52	223.77	224.03	224.28	224.54	224.79	225.04	225.30	225.55	225.81
89	226.06	226.31	226.57	226.82	227.08	227.33	227.58	227.84	228.09	228.35

LENGTHS—INCHES TO CENTIMETERS (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
90	228.60	228.85	229.11	229.36	229.62	229.87	230.12	230.38	230.63	230.89
91	231.14	231.39	231.65	231.90	232.16	232.41	232.66	232.92	233.17	233.43
92	233.68	233.93	234.19	234.44	234.70	234.95	235.20	235.46	235.71	235.97
93	236.22	236.47	236.73	236.98	237.24	237.49	237.74	238.00	238.25	238.51
94	238.76	239.01	239.27	239.52	239.78	240.03	240.28	240.54	240.79	241.05
95	241.30	241.55	241.81	242.06	242.32	242.57	242.82	243.08	243.33	243.59
96	243.84	246.09	244.35	244.60	244.86	245.11	245.36	245.62	245.87	246.13
97	246.38	246.63	246.89	247.14	247.40	247.65	247.90	248.16	248.41	248.67
98	248.92	249.17	249.43	249.68	249.94	250.19	250.44	250.70	250.95	251.21
99	251.46	251.71	251.97	252.22	252.48	252.73	252.98	253.24	253.49	253.75

LENGTHS — METERS TO FEET

From 1 *to* 1,000 *Units*

Reduction factor: 1 meter = 3.280833333 feet

The values found in the body of the table give, in feet, the length indicated in meters at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	....	3.2808	6.5617	9.8425	13.123	16.404	19.685	22.966	26.247	29.528
10	32.808	36.089	39.370	42.651	45.932	49.213	52.493	55.774	59.055	62.336
20	65.617	68.898	72.178	75.459	78.740	82.021	85.302	88.583	91.863	95.144
30	98.425	101.71	104.99	108.27	111.55	114.83	118.11	121.39	124.67	127.95
40	131.23	134.51	137.80	141.08	144.36	147.64	150.92	154.20	157.48	160.76
50	164.04	167.32	170.60	173.88	177.17	180.45	183.73	187.01	190.29	193.57
60	196.85	200.13	203.41	206.69	209.97	213.25	216.54	219.82	223.10	226.38
70	229.66	232.94	236.22	239.50	242.78	246.06	249.34	252.62	255.91	259.19
80	262.47	265.75	269.03	272.31	275.59	278.87	282.15	285.43	288.71	291.99
90	295.28	298.56	301.84	305.12	308.40	311.68	314.96	318.24	321.52	324.80

LENGTHS — METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
100	328.08	331.36	334.65	337.93	341.21	344.49	347.77	351.05	354.33	357.61
110	360.89	364.17	367.45	370.73	374.02	377.30	380.58	383.86	387.14	390.42
120	393.70	396.98	400.26	403.54	406.82	410.10	413.39	416.67	419.95	423.23
130	426.51	429.79	433.07	436.35	439.63	442.91	446.19	449.47	452.76	456.04
140	459.32	462.60	465.88	469.16	472.44	475.72	479.00	482.28	485.56	488.84
150	492.13	495.41	498.69	501.97	505.25	508.53	511.81	515.09	518.37	521.65
160	524.93	528.21	531.50	534.78	538.06	541.34	544.62	547.90	551.18	554.46
170	557.74	561.02	564.30	567.58	570.87	574.15	577.43	580.71	583.99	587.27
180	590.55	593.83	597.11	600.39	603.67	606.95	610.24	613.52	616.80	620.08
190	623.36	626.64	629.92	633.20	636.48	639.76	643.04	646.32	649.61	652.89
200	656.17	659.45	662.73	666.01	669.29	672.57	675.85	679.13	682.41	685.69
210	688.98	692.26	695.54	698.82	702.10	705.38	708.66	711.94	715.22	718.50
220	721.78	725.06	728.35	731.63	734.91	738.19	741.47	744.75	748.03	751.31
230	754.59	757.87	761.15	764.43	767.72	771.00	774.28	777.56	780.84	784.12
240	787.40	790.68	793.96	797.24	800.52	803.80	807.09	810.37	813.65	816.93
250	820.21	823.49	826.77	830.05	833.33	836.61	839.89	843.17	846.46	849.74
260	853.02	856.30	859.58	862.86	866.14	869.42	872.70	875.98	879.26	882.54
270	885.83	889.11	892.39	895.67	898.95	902.23	905.51	908.79	912.07	915.35
280	918.63	921.91	925.20	928.48	931.76	935.04	938.32	941.60	944.88	948.16
290	951.44	954.72	958.00	961.28	964.57	967.85	971.13	974.41	977.69	980.97

LENGTHS — METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
300	984.25	987.53	990.81	994.09	997.37	1,000.7	1,003.9	1,007.2	1,010.5	1,013.8
310	1,017.1	1,020.3	1,023.6	1,026.9	1,030.2	1,033.5	1,036.7	1,040.0	1,043.3	1,046.6
320	1,049.9	1,053.1	1,056.4	1,059.7	1,063.0	1,066.3	1,069.6	1,072.8	1,076.1	1,079.4
330	1,082.7	1,086.0	1,089.2	1,092.5	1,095.8	1,099.1	1,102.4	1,105.6	1,108.9	1,112.2
340	1,115.5	1,118.8	1,122.0	1,125.3	1,128.6	1,131.9	1,135.2	1,138.4	1,141.7	1,145.0
350	1,148.3	1,151.6	1,154.9	1,158.1	1,161.4	1,164.7	1,168.0	1,171.3	1,174.5	1,177.8
360	1,181.1	1,184.4	1,187.7	1,190.9	1,194.2	1,197.5	1,200.8	1,204.1	1,207.3	1,210.6
370	1,213.9	1,217.2	1,220.5	1,223.8	1,227.0	1,230.3	1,233.6	1,236.9	1,240.2	1,243.4
380	1,246.7	1,250.0	1,253.3	1,256.6	1,259.8	1,263.1	1,266.4	1,269.7	1,273.0	1,276.2
390	1,279.5	1,282.8	1,286.1	1,289.4	1,292.6	1,295.9	1,299.2	1,302.5	1,305.8	1,309.1
400	1,312.3	1,315.6	1,318.9	1,322.2	1,325.5	1,328.7	1,332.0	1,335.3	1,338.6	1,341.9
410	1,345.1	1,348.4	1,351.7	1,355.0	1,358.3	1,361.5	1,364.8	1,368.1	1,371.4	1,374.7
420	1,378.0	1,381.2	1,384.5	1,387.8	1,391.1	1,394.4	1,397.6	1,400.9	1,404.2	1,407.5
430	1,410.8	1,414.0	1,417.3	1,420.6	1,423.9	1,427.2	1,430.4	1,433.7	1,437.0	1,440.3
440	1,443.6	1,446.8	1,450.1	1,453.4	1,456.7	1,460.0	1,463.3	1,466.5	1,469.8	1,473.1
450	1,476.4	1,479.7	1,482.9	1,486.2	1,489.5	1,492.8	1,496.1	1,499.3	1,502.6	1,505.9
460	1,509.2	1,512.5	1,515.7	1,519.0	1,522.3	1,525.6	1,528.9	1,532.1	1,535.4	1,538.7
470	1,542.0	1,545.3	1,548.6	1,551.8	1,555.1	1,558.4	1,561.7	1,565.0	1,568.2	1,571.5
480	1,574.8	1,578.1	1,581.4	1,584.6	1,587.9	1,591.2	1,594.5	1,597.8	1,601.0	1,604.3
490	1,607.6	1,610.9	1,614.2	1,617.5	1,620.7	1,624.0	1,627.3	1,630.6	1,633.9	1,637.1

LENGTHS — METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
500	1,640.4	1,643.7	1,647.0	1,650.3	1,653.5	1,656.8	1,660.1	1,663.4	1,666.7	1,669.9
510	1,673.2	1,676.5	1,679.8	1,683.1	1,686.3	1,689.6	1,692.9	1,696.2	1,699.5	1,702.8
520	1,706.0	1,709.3	1,712.6	1,715.9	1,719.2	1,722.4	1,725.7	1,729.0	1,732.3	1,735.6
530	1,738.8	1,742.1	1,745.4	1,748.7	1,752.0	1,755.2	1,758.5	1,761.8	1,765.1	1,768.4
540	1,771.7	1,774.9	1,778.2	1,781.5	1,784.8	1,788.1	1,791.3	1,794.6	1,797.9	1,801.2
550	1,804.5	1,807.7	1,811.0	1,814.3	1,817.6	1,820.9	1,824.1	1,827.4	1,830.7	1,834.0
560	1,837.3	1,840.5	1,843.8	1,847.1	1,850.4	1,853.7	1,857.0	1,860.2	1,863.5	1,866.8
570	1,870.1	1,873.4	1,876.6	1,879.9	1,883.2	1,886.5	1,889.8	1,893.0	1,896.3	1,899.6
580	1,902.9	1,906.2	1,909.4	1,912.7	1,916.0	1,919.3	1,922.6	1,925.8	1,929.1	1,932.4
590	1,935.7	1,939.0	1,942.3	1,945.5	1,948.8	1,952.1	1,955.4	1,958.7	1,961.9	1,965.2
600	1,968.5	1,971.8	1,975.1	1,978.3	1,981.6	1,984.9	1,988.2	1,991.5	1,994.7	1,998.0
610	2,001.3	2,004.6	2,007.9	2,011.2	2,014.4	2,017.7	2,021.0	2,024.3	2,027.6	2,030.8
620	2,034.1	2,037.4	2,040.7	2,044.0	2,047.2	2,050.5	2,053.8	2,057.1	2,060.4	2,063.6
630	2,066.9	2,070.2	2,073.5	2,076.8	2,080.0	2,083.3	2,086.6	2,089.9	2,093.2	2,096.5
640	2,099.7	2,103.0	2,106.3	2,109.6	2,112.9	2,116.1	2,119.4	2,122.7	2,126.0	2,129.3
650	2,132.5	2,135.8	2,139.1	2,142.4	2,145.7	2,148.9	2,152.2	2,155.5	2,158.8	2,162.1
660	2,165.4	2,168.6	2,171.9	2,175.2	2,178.5	2,181.8	2,185.0	2,188.3	2,191.6	2,194.9
670	2,198.2	2,201.4	2,204.7	2,208.0	2,211.3	2,214.6	2,217.8	2,221.1	2,224.4	2,227.7
680	2,231.0	2,234.2	2,237.5	2,240.8	2,244.1	2,247.4	2,250.7	2,253.9	2,257.2	2,260.5
690	2,263.8	2,267.1	2,270.3	2,273.6	2,276.9	2,280.2	2,283.5	2,286.7	2,290.0	2,293.3

LENGTHS—METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
700	2,296.6	2,299.9	2,303.1	2,306.4	2,309.7	2,313.0	2,316.3	2,319.5	2,322.8	2,326.1
710	2,329.4	2,332.7	2,336.0	2,339.2	2,342.5	2,345.8	2,349.1	2,352.4	2,355.6	2,358.9
720	2,362.2	2,365.5	2,368.8	2,372.0	2,375.3	2,378.6	2,381.9	2,385.2	2,388.4	2,391.7
730	2,395.0	2,398.3	2,401.6	2,404.9	2,408.1	2,411.4	2,414.7	2,418.0	2,421.3	2,424.5
740	2,427.8	2,431.1	2,434.4	2,437.7	2,440.9	2,444.2	2,447.5	2,450.8	2,454.1	2,457.3
750	2,460.6	2,463.9	2,467.2	2,470.5	2,473.7	2,477.0	2,480.3	2,483.6	2,486.9	2,490.2
760	2,493.4	2,496.7	2,500.0	2,503.3	2,506.6	2,509.8	2,513.1	2,516.4	2,519.7	2,523.0
770	2,526.2	2,529.5	2,532.8	2,536.1	2,539.4	2,542.6	2,545.9	2,549.2	2,552.5	2,555.8
780	2,559.1	2,562.3	2,565.6	2,568.9	2,572.2	2,575.5	2,578.7	2,582.0	2,585.3	2,588.6
790	2,591.9	2,595.1	2,598.4	2,601.7	2,605.0	2,608.3	2,611.5	2,614.8	2,618.1	2,621.4
800	2,624.7	2,627.9	2,631.2	2,634.5	2,637.8	2,641.1	2,644.4	2,647.6	2,650.9	2,654.2
810	2,657.5	2,660.8	2,664.0	2,667.3	2,670.6	2,673.9	2,677.2	2,680.4	2,683.7	2,687.0
820	2,690.3	2,693.6	2,696.8	2,700.1	2,703.4	2,706.7	2,710.0	2,713.2	2,716.5	2,719.8
830	2,723.1	2,726.4	2,729.7	2,732.9	2,736.2	2,739.5	2,742.8	2,746.1	2,749.3	2,752.6
840	2,755.9	2,759.2	2,762.5	2,765.7	2,769.0	2,772.3	2,775.6	2,778.9	2,782.1	2,785.4
850	2,788.7	2,792.0	2,795.3	2,798.6	2,801.8	2,805.1	2,808.4	2,811.7	2,815.0	2,818.2
860	2,821.5	2,824.8	2,828.1	2,831.4	2,834.6	2,827.9	2,841.2	2,844.5	2,847.8	2,851.0
870	2,854.3	2,857.6	2,860.9	2,864.2	2,867.4	2,870.7	2,874.0	2,877.3	2,880.6	2,883.9
880	2,887.1	2.890.4	2,893.7	2,897.0	2,900.3	2,903.5	2,906.8	2,910.1	2,913.4	2,916.7
890	2,919.9	2,923.2	2,926.5	2,929.8	2,933.1	2,936.3	2,939.6	2,942.9	2,946.2	2,949.5

LENGTHS — METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
900	2,952.8	2,956.3	2,959.3	2,962.6	2,965.9	2,969.2	2,972.4	2,975.7	2,979.0	2,982.3
910	2,985.6	2,988.8	2,992.1	2,995.4	2,998.7	3,002.0	3,005.2	3,008.5	3,011.8	3,015.1
920	3,018.4	3,021.6	3,024.9	3,028.2	3,031.5	3,034.8	3,038.1	3,041.3	3,044.6	3,047.9
930	3,051.2	3,054.5	3,057.7	3,061.0	3,064.3	3,067.6	3,070.9	3,074.1	3,077.4	3,080.7
940	3,084.0	3,087.3	3,090.5	3,093.8	3,097.1	3,100.4	3,103.7	3,106.9	3,110.2	3,113.5
950	3,116.8	3,120.1	3,123.4	3,126.6	3,129.9	3,133.2	3,136.5	3,139.8	3,143.0	3,146.3
960	3,149.6	3,152.9	3,156.2	3,159.4	3,162.7	3,166.0	3,169.3	3,172.6	3,175.8	3,179.1
970	3,182.4	3,185.7	3,189.0	3,192.3	3,195.5	3,198.8	3,202.1	3,205.4	3,208.7	3,211.9
980	3,215.2	3,218.5	3,221.8	3,225.1	3,228.3	3,231.6	3,234.9	3,238.2	3,241.5	3,244.7
990	3,248.0	3,251.3	3,254.6	3,257.9	3,261.1	3,264.4	3,267.7	3,271.0	3,274.3	3,277.6

LENGTHS — FEET TO METERS

From 1 *to* 1,000 *Units*

Reduction factor: 1 foot = 0.3048006096 meter

The values found in the body of the table give, in meters, the lengths indicated in feet at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	....	0.30480	0.60960	0.91440	1.2192	1.5240	1.8288	2.1336	2.4384	2.7432
10	3.0480	3.3528	3.6576	3.9624	4.2672	4.5720	4.8768	5.1816	5.4864	5.7912
20	6.0960	6.4008	6.7056	7.0104	7.3152	7.6200	7.9248	8.2296	8.5344	8.8392
30	9.1440	9.4488	9.7536	10.058	10.363	10.668	10.973	11.278	11.582	11.887
40	12.192	12.497	12.802	13.106	13.411	13.716	14.021	14.326	14.630	14.935
50	15.240	15.545	15.850	16.154	16.459	16.764	17.069	17.374	17.678	17.983
60	18.288	18.593	18.898	19.202	19.507	19.812	20.117	20.422	20.726	21.031
70	21.336	21.641	21.946	22.250	22.555	22.860	23.165	23.470	23.774	24.079
80	24.384	24.689	24.994	24.298	25.603	25.908	26.213	26.518	26.822	27.127
90	27.432	27.737	28.042	28.346	28.651	28.956	29.261	29.566	29.870	30.175

LENGTHS — FEET TO METERS (Continued)

	0	1	2	3	4	5	6	7	8	9
100	30.480	30.785	31.090	31.394	31.699	32.004	32.309	32.614	32.918	33.223
110	33.528	33.833	34.138	34.442	34.747	35.052	35.357	35.662	35.966	36.271
120	36.576	36.881	37.186	37.490	37.795	38.100	38.406	38.710	39.014	39.319
130	39.624	39.929	40.234	40.538	40.843	41.148	41.453	41.758	42.062	42.367
140	42.672	42.977	43.282	43.586	43.891	44.196	44.501	44.806	45.110	45.415
150	45.720	46.025	46.330	46.634	46.939	47.244	47.549	47.854	48.169	48.463
160	48.768	49.073	49.378	49.683	49.987	50.292	50.697	50.902	51.207	51.511
170	51.816	52.121	52.426	52.731	53.035	53.340	53.645	53.950	54.255	54.559
180	54.864	55.169	55.474	55.779	56.083	56.388	56.693	56.998	57.303	57.607
190	57.912	58.217	58.522	58.827	59.131	59.436	59.741	60.046	60.351	60.655
200	60.960	61.265	61.570	61.875	62.179	62.484	62.789	63.094	63.399	63.703
210	64.008	64.313	64.618	64.923	65.227	65.532	65.837	66.142	66.447	66.751
220	67.056	67.361	67.666	67.971	68.275	68.580	68.885	69.190	69.495	69.799
230	70.104	70.409	70.714	71.019	71.323	71.628	71.933	72.238	72.543	72.847
240	73.152	73.457	73.762	74.067	74.371	74.676	74.981	75.286	75.591	75.895
250	76.200	76.505	76.810	77.115	77.419	77.724	78.029	78.334	78.639	78.943
260	79.248	79.553	79.858	80.163	80.467	80.772	81.077	81.382	81.687	81.991
270	82.296	82.601	82.906	83.211	83.515	83.820	84.125	84.430	84.735	85.039
280	85.344	85.649	85.954	86.259	86.563	86.868	87.173	87.478	87.783	88.087
290	88.392	88.697	89.002	89.307	89.611	89.916	90.221	90.526	90.831	91.135

LENGTHS — FEET TO METERS (Continued)

	0	1	2	3	4	5	6	7	8	9
300	91.440	91.745	92.050	92.355	92.659	92.964	93.269	93.574	93.879	94.183
310	94.488	94.793	95.098	95.403	95.707	96.012	96.317	96.622	96.927	97.231
320	97.536	97.841	98.146	98.451	98.755	99.060	99.365	99.670	99.975	100.28
330	100.58	100.89	101.19	101.50	101.80	102.11	102.41	102.72	103.02	103.33
340	103.63	103.94	104.24	104.55	104.85	105.16	105.46	105.77	106.07	106.38
350	106.68	106.99	107.29	107.59	107.90	108.20	108.51	108.81	109.12	109.42
360	109.73	110.03	110.34	110.64	110.95	111.25	111.56	111.86	112.17	112.47
370	112.78	113.08	113.39	113.69	114.00	114.30	114.61	114.91	115.21	115.52
380	115.82	116.13	116.43	116.74	117.04	117.35	117.65	117.96	118.26	118.57
390	118.87	119.18	119.48	119.79	120.09	120.40	120.70	121.01	121.31	121.62
400	121.92	122.23	122.53	122.83	123.14	123.44	123.75	124.05	124.36	124.66
410	124.97	125.27	125.58	125.88	126.19	126.49	126.80	127.10	127.41	127.71
420	128.02	128.32	128.63	128.93	129.24	129.54	129.85	130.15	130.45	130.76
430	131.06	131.37	131.67	131.98	132.28	132.59	132.89	133.20	133.50	133.81
440	134.11	134.42	134.72	135.03	135.33	135.64	135.94	136.25	136.55	136.86
450	137.16	137.47	137.77	138.07	138.38	138.68	138.99	139.29	139.60	139.90
460	140.21	140.51	140.82	141.12	141.43	141.73	142.04	142.34	142.65	142.95
470	143.26	143.56	143.87	144.17	144.48	144.78	145.09	145.39	145.69	146.00
480	146.30	146.61	146.91	147.22	147.52	147.83	148.13	148.44	148.74	149.05
490	149.35	149.56	149.96	150.27	150.57	150.88	151.18	151.49	151.79	152.10

LENGTHS—FEET TO METERS (Continued)

	0	1	2	3	4	5	6	7	8	9
500	152.40	152.71	153.01	153.31	153.62	153.92	154.23	154.53	154.84	155.14
510	155.45	155.75	156.06	156.36	156.57	156.97	157.28	157.58	157.89	158.19
520	158.50	158.80	159.11	159.41	159.72	160.02	160.33	160.63	160.93	161.24
530	161.54	161.85	162.15	162.46	162.76	163.07	163.37	163.68	163.98	164.29
540	164.59	164.90	165.20	165.51	165.81	166.12	166.42	166.73	167.03	167.34
550	167.64	167.95	168.25	168.55	168.86	169.16	169.47	169.77	170.08	170.38
560	170.69	170.99	171.30	171.60	171.91	172.21	172.52	172.82	173.13	173.43
570	173.74	174.04	174.35	174.65	174.96	175.26	175.57	175.87	176.17	176.48
580	176.78	177.09	177.39	177.70	178.00	178.31	178.61	178.92	179.22	179.53
590	179.83	180.14	180.44	180.75	181.05	181.36	181.66	181.97	182.27	182.58
600	182.88	183.19	183.49	183.79	184.10	184.40	184.71	185.01	185.32	185.62
610	185.93	186.23	186.54	186.84	187.15	187.45	187.76	188.06	188.37	188.67
620	188.98	189.28	189.59	189.89	190.20	190.50	190.81	191.11	191.41	191.72
630	192.02	192.33	192.63	192.94	193.24	193.55	193.85	194.16	194.46	194.77
640	195.07	195.38	195.68	195.99	196.29	196.60	196.90	197.21	197.51	197.82
650	198.12	198.43	198.73	199.03	199.34	199.64	199.95	200.25	200.56	200.86
660	201.17	201.47	201.78	202.08	202.39	202.69	203.00	203.30	203.61	203.91
670	204.22	204.52	204.83	205.13	205.44	205.74	206.05	206.35	206.65	206.96
680	207.26	207.57	207.87	208.18	208.48	208.78	209.09	209.40	209.70	210.01
690	210.31	210.62	210.92	211.23	211.53	211.84	212.14	212.45	212.75	213.06

LENGTHS—FEET TO METERS (Continued)

	0	1	2	3	4	5	6	7	8	9
700	213.36	213.67	213.97	214.27	214.58	214.88	215.19	215.49	215.80	216.10
710	216.41	216.71	217.02	217.32	217.63	217.93	218.24	218.54	218.85	219.15
720	219.46	219.76	220.07	220.37	220.68	220.98	221.29	221.59	221.89	222.20
730	222.50	222.81	223.11	223.42	223.72	224.03	224.33	224.64	224.94	225.25
740	225.55	225.86	226.16	226.47	226.77	227.08	227.38	227.69	227.99	228.30
750	228.60	228.91	229.21	229.51	229.82	230.12	230.43	230.73	231.04	231.34
760	231.65	231.95	232.26	232.56	232.87	233.17	233.48	233.78	234.09	234.39
770	234.70	235.00	235.31	231.61	231.92	236.22	236.53	236.83	237.13	237.44
780	237.74	238.05	238.35	238.66	238.96	239.27	239.67	239.88	240.18	240.49
790	240.79	241.10	241.40	241.71	242.01	242.32	242.62	242.93	243.23	243.54
800	243.84	244.15	244.45	244.75	245.06	245.36	245.67	245.97	246.28	246.58
810	246.89	247.19	247.50	247.80	248.11	248.41	248.72	249.02	249.33	249.63
820	249.94	250.24	250.55	250.85	251.16	251.46	251.77	252.07	252.37	252.68
830	252.98	253.29	253.59	253.90	254.20	254.51	254.81	255.12	255.42	255.73
840	256.03	256.34	256.64	256.95	257.25	257.56	257.86	258.17	258.47	258.78
850	259.08	259.39	259.69	259.99	260.30	260.60	260.91	261.21	261.52	261.82
860	262.13	262.43	262.74	263.04	263.35	263.65	263.96	264.26	264.57	264.87
870	265.18	265.48	265.79	266.09	266.40	266.70	267.01	267.31	267.61	267.92
880	268.22	268.53	268.83	269.14	269.44	269.75	270.05	270.36	270.66	270.97
890	271.27	271.57	271.88	272.19	272.49	272.80	273.10	273.41	273.71	274.02

LENGTHS—FEET TO METERS (Continued)

	0	1	2	3	4	5	6	7	8	9
900	274.32	274.63	274.93	275.23	275.54	275.84	276.15	276.45	276.76	277.06
910	277.37	277.67	277.98	278.28	278.59	278.89	279.20	279.50	279.81	280.11
920	280.42	280.72	281.03	281.33	281.64	281.94	282.25	282.55	282.85	283.16
930	283.46	283.77	284.07	284.38	284.68	284.99	285.29	285.60	285.90	286.21
940	286.51	286.82	287.12	287.43	287.73	288.04	288.34	288.65	288.95	289.26
950	289.56	289.87	289.17	290.47	290.78	291.08	291.39	291.69	292.00	292.30
960	292.61	292.91	293.22	293.52	293.83	294.13	294.44	294.74	295.05	295.35
970	295.66	295.96	296.27	296.57	296.88	297.18	297.49	297.79	298.10	298.40
980	298.70	299.01	299.31	299.62	299.92	300.23	300.53	300.84	301.14	301.45
990	301.75	302.06	302.36	302.67	302.97	303.28	303.58	303.89	304.19	304.50

LENGTHS — KILOMETERS TO MILES

From 1 *to* 1,000 *Units*

Reduction factor: 1 kilometer = 0.6213699495 mile

Values found in the body of the table give, in miles, the length indicated in kilometers at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	....	0.62137	1.2427	1.8641	2.4855	3.1069	3.7282	4.3496	4.9710	5.5923
10	6.2137	6.8351	7.4564	8.0778	8.6992	9.3206	9.9419	10.563	11.185	11.806
20	12.427	13.049	13.670	14.292	14.913	15.534	16.156	16.777	17.398	18.020
30	18.641	19.262	19.884	20.505	21.127	21.748	22.369	22.991	23.612	24.233
40	24.855	25.476	26.098	26.719	27.340	27.962	28.583	29.204	29.826	30.447
50	31.069	31.690	32.311	32.933	33.554	34.175	34.797	35.418	36.039	36.661
60	37.282	37.904	38.525	39.146	39.768	40.389	41.010	41.632	42.253	42.875
70	43.496	44.117	44.739	45.360	45.981	46.603	47.224	47.845	48.467	49.088
80	49.710	50.331	50.952	51.574	52.195	52.816	53.438	54.059	54.681	55.302
90	55.923	56.945	57.166	57.787	58.409	59.030	59.652	60.273	60.894	61.516

LENGTHS — KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
100	62.137	62.758	63.380	64.001	64.622	65.244	65.865	66.487	67.108	67.729
110	68.351	68.972	69.593	70.215	70.836	71.458	72.079	72.700	73.322	73.943
120	74.564	75.186	75.807	76.429	77.050	77.671	78.293	78.914	79.535	80.157
130	80.778	81.399	82.021	82.642	83.264	83.885	84.506	85.128	85.749	86.370
140	86.992	87.613	88.235	88.856	89.477	90.099	90.720	91.341	91.963	92.584
150	93.205	93.827	94.448	95.070	95.691	96.312	96.934	97.555	98.176	98.798
160	99.419	100.04	100.66	101.28	101.90	102.53	103.15	103.77	104.39	105.01
170	105.63	106.25	106.88	107.50	108.12	108.74	109.36	109.98	110.60	111.23
180	111.85	112.47	113.09	113.71	114.33	114.95	115.57	116.20	116.82	117.44
190	118.06	118.68	119.30	119.92	120.55	121.17	121.79	122.41	123.03	123.65
200	124.27	124.90	125.52	126.14	126.76	127.38	128.00	128.62	129.24	129.87
210	130.49	131.11	131.73	132.35	132.97	133.59	134.22	134.84	135.46	136.08
220	136.70	137.32	137.94	138.57	139.19	139.81	140.43	141.05	141.67	142.29
230	142.92	143.54	144.16	144.78	145.40	146.02	146.64	147.26	147.89	148.51
240	149.13	149.75	150.37	150.99	151.61	152.24	152.86	153.48	154.10	154.72
250	155.34	155.96	156.59	157.21	157.83	158.45	159.07	159.69	160.31	160.93
260	161.56	162.18	162.80	163.42	164.04	164.66	165.28	165.91	166.53	167.15
270	167.77	168.39	169.01	169.63	170.26	170.88	171.50	172.12	172.74	173.36
280	173.98	174.60	175.23	175.85	176.47	177.09	177.71	178.33	178.95	179.58
290	180.20	180.82	181.44	182.06	182.68	183.30	183.93	184.55	185.17	185.79

LENGTHS — KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
300	186.41	187.03	187.65	188.28	188.90	189.52	190.14	190.76	191.38	192.00
310	192.62	193.25	193.87	194.49	195.11	195.73	196.35	196.97	197.60	198.22
320	198.84	199.46	200.08	200.70	201.32	201.95	202.57	203.19	203.81	204.43
330	205.05	205.67	206.29	206.92	207.54	208.16	208.78	209.40	210.02	210.64
340	211.27	211.89	212.51	213.13	213.75	214.37	214.99	215.62	216.24	216.86
350	217.48	218.10	218.72	219.34	219.96	220.59	221.21	221.83	222.45	223.07
360	223.69	224.31	224.94	225.56	226.18	226.80	227.42	228.04	228.66	229.29
370	229.91	230.53	231.15	231.77	232.39	233.01	233.64	234.26	234.88	235.50
380	236.12	236.74	237.36	237.98	238.61	239.23	239.85	240.47	241.09	241.71
390	242.33	242.96	243.58	244.20	244.82	245.44	246.06	246.68	247.31	247.93
400	248.55	249.17	249.79	250.41	251.03	251.65	252.28	252.90	253.52	254.14
410	254.76	255.38	256.00	256.63	257.25	257.87	258.49	259.11	259.73	260.35
420	260.98	261.60	262.22	262.84	263.46	264.08	264.70	265.32	265.95	266.57
430	267.19	267.81	268.43	269.05	269.67	270.30	270.92	271.54	272.16	272.78
440	273.40	274.02	274.65	275.27	275.89	276.51	277.13	277.75	278.37	279.00
450	279.62	280.24	280.86	281.48	282.10	282.72	283.34	283.97	284.59	285.21
460	285.83	286.45	287.07	287.69	288.32	288.94	289.56	290.18	290.80	291.42
470	292.04	292.67	293.29	293.91	294.53	295.15	295.77	296.39	297.01	297.64
480	298.26	298.88	299.50	300.12	300.74	301.36	301.99	302.61	303.23	303.85
490	304.47	305.09	305.71	306.34	306.96	307.58	308.20	308.82	309.44	310.06

LENGTHS—KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
500	310.68	311.31	311.93	312.55	313.17	313.79	314.41	315.03	315.66	316.28
510	316.90	317.52	318.14	318.76	319.38	320.01	320.63	321.35	321.87	322.49
520	323.11	323.73	324.36	324.98	325.60	326.22	326.84	327.46	328.08	328.70
530	329.33	329.95	330.57	331.19	331.81	332.43	333.05	333.68	334.30	334.92
540	335.54	336.16	336.78	337.40	338.03	338.65	339.27	339.89	340.51	341.13
550	341.75	342.37	343.00	343.62	344.24	344.86	345.48	346.10	346.72	347.35
560	347.97	348.59	349.21	349.83	350.45	351.07	351.70	352.32	352.94	353.56
570	354.18	354.80	355.42	356.04	356.67	357.29	357.91	358.53	359.15	359.77
580	360.39	361.02	361.64	362.26	262.88	363.50	364.12	364.74	365.37	365.99
590	366.61	367.23	367.85	368.47	369.09	369.72	370.34	370.96	371.58	372.20
600	372.82	373.44	374.06	374.69	375.31	375.93	376.55	377.17	377.79	378.41
610	379.04	379.66	380.28	380.90	381.52	382.14	382.76	383.39	384.01	384.63
620	385.25	385.87	386.49	387.11	387.73	388.36	388.98	389.60	390.22	390.84
630	391.46	392.08	392.71	393.33	393.95	394.57	395.19	395.81	396.43	397.06
640	397.68	398.30	398.92	399.54	400.16	400.78	401.40	402.03	402.65	403.27
650	403.89	404.51	405.13	405.75	406.38	407.00	407.62	408.24	408.86	409.48
660	410.10	410.73	411.35	411.97	412.59	413.21	413.83	414.45	415.08	415.70
670	416.32	416.94	417.56	418.18	418.80	419.42	420.05	420.67	421.29	421.91
680	422.53	423.15	423.77	424.40	425.02	425.64	426.26	426.88	427.50	428.12
690	428.75	429.37	429.99	430.61	431.23	431.85	432.47	433.09	433.72	434.34

LENGTHS — KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
700	434.96	435.58	436.20	436.82	437.44	438.07	438.69	439.31	439.93	440.55
710	441.17	441.79	442.42	443.04	443.66	444.28	444.90	445.52	446.14	446.76
720	447.39	448.01	448.63	449.25	449.87	450.49	451.11	451.74	452.36	452.98
730	453.60	454.22	454.84	455.46	456.09	456.71	457.33	457.95	458.57	459.19
740	459.81	460.44	461.06	461.68	462.30	462.92	463.54	464.16	464.78	465.41
750	466.03	466.65	467.27	467.89	468.51	469.13	469.76	470.38	471.00	471.62
760	472.24	472.86	473.48	474.11	474.73	475.35	475.97	476.59	477.21	477.83
770	478.45	479.08	479.70	480.32	480.94	481.56	482.18	482.80	483.43	484.05
780	484.67	485.29	485.91	486.53	487.15	487.78	488.40	489.02	489.64	490.26
790	490.88	491.50	492.13	492.75	493.37	493.99	494.61	495.23	495.85	496.47
800	497.10	497.72	498.34	498.96	499.58	500.20	500.82	501.45	502.07	502.69
810	503.31	503.93	504.55	505.17	505.80	506.42	507.04	507.66	508.28	508.90
820	509.52	510.14	510.77	511.39	512.01	512.63	513.25	513.87	514.49	515.12
830	515.74	516.36	516.98	517.60	518.22	518.84	519.47	520.09	520.71	521.33
840	521.95	522.57	523.19	523.81	524.44	525.06	525.68	526.30	526.92	527.54
850	528.16	528.79	529.41	530.03	530.65	531.27	531.89	532.51	533.14	533.76
860	534.38	535.00	535.62	536.24	536.86	537.49	538.11	538.73	539.35	539.97
870	540.59	541.21	541.83	542.46	543.08	543.70	544.32	544.94	545.56	546.18
880	546.81	547.43	548.05	548.67	549.29	549.91	550.53	551.16	551.78	552.40
890	553.02	553.64	554.26	554.88	555.50	556.13	556.75	557.37	557.99	558.61

LENGTHS — KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
900	559.23	559.85	560.48	561.10	561.72	562.34	562.96	563.58	564.20	564.83
910	565.45	566.07	566.69	567.31	567.93	568.55	569.17	569.80	570.42	571.04
920	571.66	572.28	572.90	573.52	574.15	574.77	575.39	576.01	576.63	577.25
930	577.87	578.50	579.12	579.74	580.35	580.98	581.60	582.22	582.85	583.47
940	584.09	584.71	585.33	585.95	586.57	587.19	587.82	588.44	589.06	589.68
950	590.30	590.92	591.54	592.17	592.79	593.41	594.03	594.65	595.27	595.89
960	596.52	597.14	597.76	598.38	599.98	599.62	600.24	600.86	601.49	602.11
970	602.73	603.35	603.97	604.59	605.21	605.84	606.46	607.08	607.70	608.32
980	608.94	609.56	610.19	610.81	611.43	612.05	612.67	613.29	613.91	614.53
990	615.16	615.78	616.40	617.02	617.64	618.26	618.88	619.51	620.13	620.75

LENGTHS — MILES TO KILOMETERS

From 1 *to* 1,000 *Units*

Reduction factor: 1 mile = 1.609347219 kilometers

Values found in the body of the table give, in kilometers, the length indicated in miles at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	....	1.6094	3.2187	4.8280	6.4374	8.0467	9.6561	11.265	12.875	14.484
10	16.094	17.703	19.312	20.922	22.531	24.140	25.750	27.359	28.968	30.578
20	32.187	33.796	35.406	37.015	38.624	40.234	41.843	43.452	45.062	46.671
30	48.280	49.890	51.499	53.109	54.718	56.327	57.937	59.546	61.155	62.765
40	64.374	65.983	67.593	69.202	70.811	72.421	74.030	75.639	77.249	78.858
50	80.467	82.077	83.686	85.295	86.905	88.514	90.123	91.733	93.342	94.952
60	96.561	98.170	99.780	101.39	103.00	104.61	106.22	107.83	109.44	111.05
70	112.65	114.26	115.87	117.48	119.09	120.70	122.31	123.92	125.53	127.14
80	128.75	130.36	131.97	133.58	135.19	136.79	138.40	140.01	141.62	143.23
90	144.84	146.45	148.06	149.67	151.28	152.89	154.50	156.11	157.72	159.33

LENGTHS — MILES TO KILOMETERS (Continued)

	0	1	2	3	4	5	6	7	8	9
100	160.94	162.54	164.15	165.76	167.37	168.98	170.59	172.20	173.81	175.42
110	177.03	178.64	180.25	181.86	183.47	185.07	186.68	188.29	189.90	191.51
120	193.12	194.73	196.34	197.95	199.56	201.17	202.78	204.39	206.00	207.61
130	209.22	210.82	212.43	214.04	215.65	217.26	218.87	220.48	222.09	223.70
140	225.31	226.92	228.53	230.14	231.75	233.36	234.96	236.57	238.18	239.79
150	241.40	243.01	244.62	246.23	247.84	249.45	251.06	252.67	254.28	255.89
160	257.50	259.10	260.71	262.32	263.93	265.54	267.15	268.76	270.37	271.98
170	273.59	275.20	276.81	278.42	280.03	281.64	283.25	284.85	286.46	288.07
180	289.68	291.29	292.90	294.51	296.12	297.73	299.34	300.95	302.56	304.17
190	305.78	307.39	308.99	310.60	312.21	313.82	315.43	317.04	318.65	320.26
200	321.87	323.48	325.09	326.70	328.31	329.92	331.53	333.13	334.74	336.35
210	337.96	339.57	341.18	342.79	344.40	346.01	347.62	349.23	350.84	352.45
220	354.06	355.67	357.28	358.88	360.49	362.10	363.71	365.32	366.93	368.54
230	370.15	371.76	373.37	374.98	376.59	378.20	379.81	381.42	383.02	384.63
240	386.24	387.86	389.46	391.07	392.68	394.29	395.90	397.51	399.12	300.73
250	402.34	403.95	405.56	407.16	408.77	410.38	411.99	413.60	415.21	416.82
260	418.43	420.04	421.65	423.26	424.87	426.48	428.09	429.70	431.31	432.91
270	434.52	436.13	437.74	439.35	440.96	442.57	444.18	445.79	447.40	449.01
280	450.62	452.27	453.84	455.45	457.05	458.66	460.27	461.88	463.49	465.10
290	466.71	468.32	469.93	471.54	473.15	474.76	476.37	477.98	479.59	481.19

LENGTHS — MILES TO KILOMETERS (Continued)

	0	1	2	3	4	5	6	7	8	9
300	482.80	484.41	486.02	487.63	489.24	490.85	492.46	494.07	495.68	497.29
310	498.90	500.51	502.12	503.73	505.34	506.94	508.55	510.16	511.77	513.38
320	514.99	516.60	518.21	519.82	521.43	523.04	524.65	526.26	527.87	529.48
330	531.08	532.69	534.30	535.91	537.52	539.13	540.74	542.35	543.96	545.57
340	547.18	548.79	550.40	552.01	553.62	555.22	556.83	558.44	560.05	561.66
350	563.27	564.88	566.49	568.10	569.71	571.32	572.93	574.54	576.15	577.76
360	579.37	580.97	582.58	584.19	585.80	587.41	589.02	590.63	592.24	593.85
370	595.46	597.07	598.68	600.29	601.90	603.51	605.12	606.72	608.33	609.94
380	611.55	613.16	614.77	616.38	317.99	619.60	621.21	622.82	624.43	626.04
390	627.65	629.25	630.86	632.47	634.08	635.69	637.30	638.91	640.52	642.13
400	643.74	645.35	646.96	648.57	650.18	651.79	653.40	655.00	656.61	658.22
410	659.83	661.44	663.05	664.66	666.27	667.88	669.49	671.10	672.71	674.32
420	675.93	677.54	679.14	680.75	682.36	683.97	685.58	687.19	688.80	690.41
430	692.02	693.63	695.24	696.85	698.46	700.07	701.68	703.28	704.89	706.50
440	708.11	709.72	711.33	712.94	714.55	716.16	717.77	719.38	720.99	722.60
450	724.21	725.82	727.42	729.03	730.64	732.25	733.86	735.47	737.08	738.69
460	740.30	741.91	743.52	745.13	746.74	748.35	749.96	751.57	753.17	754.78
470	756.39	758.00	759.61	761.22	762.83	764.44	766.05	767.66	769.27	770.88
480	772.49	774.10	775.71	777.31	778.92	780.53	782.14	783.75	785.36	786.97
490	788.58	790.19	791.80	793.41	795.02	796.63	798.24	799.85	801.45	803.06

LENGTHS — MILES TO KILOMETERS (Continued)

	0	1	2	3	4	5	6	7	8	9
500	804.67	806.28	807.89	809.50	811.11	812.72	814.33	815.94	817.55	819.16
510	820.77	822.38	823.99	825.60	827.20	828.81	830.42	832.03	833.64	835.25
520	836.86	838.47	840.08	841.69	843.30	844.91	846.52	848.13	849.74	851.34
530	852.95	854.56	856.17	857.78	859.39	861.00	862.61	864.22	865.83	867.44
540	869.05	870.66	872.27	873.88	875.48	877.09	878.70	880.31	881.92	883.53
550	885.14	886.75	888.36	889.97	891.58	893.19	894.80	896.41	898.02	899.63
560	901.23	902.84	904.45	906.06	907.67	909.28	910.89	912.50	914.11	915.72
570	917.33	918.94	920.55	922.16	923.77	925.37	926.98	928.59	930.20	931.81
580	933.42	935.03	936.64	938.25	939.86	941.47	943.08	944.69	946.30	947.91
590	949.51	951.12	952.73	954.34	955.95	957.56	959.17	960.78	962.39	964.00
600	965.61	967.22	968.83	970.44	972.05	973.66	975.26	976.87	978.48	980.09
610	981.70	983.31	984.92	986.53	988.14	989.75	991.36	992.97	994.58	996.19
620	997.80	999.40	1,001.0	1,002.6	1,004.2	1,005.8	1,007.5	1,009.1	1,010.7	1,012.3
630	1,013.9	1,015.5	1,017.1	1,018.7	1,020.3	1,021.9	1,023.5	1,025.2	1,026.8	1,028.4
640	1,030.0	1,031.6	1,033.2	1,034.8	1,036.4	1,038.0	1,039.6	1,041.2	1,042.9	1,044.5
650	1,046.1	1,047.7	1,049.3	1,050.9	1,052.5	1,054.1	1,055.7	1,057.3	1,059.0	1,060.6
660	1,062.2	1,063.8	1,065.4	1,067.0	1,068.6	1,070.2	1,071.8	1,073.4	1,075.0	1,076.7
670	1,078.3	1,079.9	1,081.5	1,083.1	1,084.7	1,086.3	1,087.9	1,089.5	1,091.1	1,092.7
680	1,094.4	1,096.0	1,097.6	1,099.2	1,100.8	1,102.4	1,104.0	1,105.6	1,107.2	1,108.8
690	1,110.4	1,112.1	1,113.7	1,115.3	1,116.9	1,118.5	1,120.1	1,121.7	1,123.3	1,124.9

LENGTHS—MILES TO KILOMETERS (Continued)

	0	1	2	3	4	5	6	7	8	9
700	1,126.5	1,128.2	1,129.8	1,131.4	1,133.0	1,134.6	1,136.2	1,137.8	1,139.4	1,141.0
710	1,142.6	1,144.2	1,145.9	1,147.5	1,149.1	1,150.7	1,152.3	1,153.9	1,155.5	1,157.1
720	1,158.7	1,160.3	1,161.9	1,163.6	1,165.2	1,166.8	1,168.4	1,170.0	1,171.6	1,173.2
730	1,174.8	1,176.4	1,178.0	1,179.7	1,181.3	1,182.9	1,184.5	1,186.1	1,187.7	1,189.3
740	1,190.9	1,192.5	1,194.1	1,195.7	1,197.4	1,199.0	1,200.6	1,202.2	1,203.8	1,205.4
750	1,207.0	1,208.6	1,210.2	1,211.8	1,213.4	1,215.1	1,216.7	1,218.3	1,219.9	1,221.5
760	1,223.1	1,224.7	1,226.3	1,227.9	1,229.5	1,231.2	1,232.8	1,234.4	1,236.0	1,237.6
770	1,239.2	1,240.8	1,242.4	1,244.0	1,245.6	1,247.2	1,248.9	1,250.5	1,252.1	1,253.7
780	1,255.3	1,256.9	1,258.5	1,260.1	1,261.7	1,263.3	1,264.9	1,266.6	1,268.2	1,269.8
790	1,271.4	1,273.0	1,274.6	1,276.2	1,277.8	1,279.4	1,281.0	1,282.6	1,284.3	1,285.9
800	1,287.5	1,289.1	1,290.7	1,292.3	1,293.9	1,295.5	1,297.1	1,298.7	1,300.4	1,302.0
810	1,303.6	1,305.2	1,306.8	1,308.4	1,310.0	1,311.6	1,313.2	1,314.8	1,316.4	1,318.1
820	1,319.7	1,321.3	1,322.9	1,324.5	1,326.1	1,327.7	1,329.3	1,330.9	1,332.5	1,334.1
830	1,335.8	1,337.4	1,339.0	1,340.6	1,342.2	1,343.8	1,345.4	1,347.0	1,348.6	1,350.2
840	1,351.9	1,353.5	1,355.1	1,356.7	1,358.3	1,359.9	1,361.5	1,363.1	1,364.7	1,366.3
850	1,367.9	1,369.6	1,371.2	1,372.7	1,374.4	1,376.0	1,377.6	1,379.2	1,380.8	1,382.4
860	1,384.0	1,385.6	1,387.3	1,388.9	1,390.5	1,392.1	1,393.7	1,395.3	1,396.9	1,398.5
870	1,400.1	1,401.7	1,403.4	1,405.0	1,406.6	1,408.2	1,409.8	1,411.4	1,413.0	1,414.6
880	1,416.2	1,417.8	1,419.4	1,421.1	1,422.7	1,424.3	1,425.9	1,427.5	1,429.1	1,430.7
890	1,432.3	1,433.9	1,435.5	1,437.1	1,438.8	1,440.4	1,442.0	1,443.6	1,445.2	1,446.8

LENGTHS — MILES TO KILOMETERS (Continued)

	0	1	2	3	4	5	6	7	8	9
900	1,448.4	1,450.0	1,451.6	1,453.2	1,454.8	1,456.5	1,458.1	1,459.7	1,461.3	1,462.9
910	1,464.5	1,466.1	1,467.7	1,469.3	1,470.9	1,472.6	1,474.2	1,475.8	1,477.4	1,479.0
920	1,480.6	1,482.2	1,483.8	1,485.4	1,487.0	1,488.6	1,490.3	1,491.9	1,493.5	1,495.1
930	1,496.7	1,498.3	1,499.9	1,501.5	1,503.1	1,504.7	1,506.3	1,508.0	1,509.6	1,511.2
940	1,512.8	1,514.4	1,516.0	1,517.6	1,519.2	1,520.8	1,522.4	1,524.1	1,525.7	1,527.3
950	1,528.8	1,530.5	1,532.1	1,533.7	1,535.3	1,536.9	1,538.5	1,540.1	1,541.8	1,543.4
960	1,545.0	1,546.6	1,548.2	1,549.8	1,551.4	1,553.0	1,554.6	1,556.2	1,557.8	1,559.5
970	1,561.1	1,562.7	1,564.3	1,565.9	1,567.5	1,569.1	1,570.7	1,572.3	1,573.9	1,575.6
980	1,577.2	1,578.8	1,580.4	1,582.0	1,583.6	1,585.2	1,586.8	1,588.4	1,590.0	1,591.6
990	1,593.3	1,594.9	1,596.5	1,598.1	1,599.7	1,601.3	1,602.9	1,604.5	1,606.1	1,606.7

CAPACITIES — LITERS TO LIQUID QUARTS

From 1 *to* 1,000 *Units*

Reduction factor: 1 liter = 1.056681869 liquid quarts

The values found in the body of the table give, in liquid quarts, the capacities indicated in liters at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	....	1.0567	2.1134	3.1701	4.2267	5.2834	6.3401	7.3968	8.4535	9.5101
10	10.567	11.624	12.680	13.737	14.794	15.850	16.907	17.964	19.020	20.077
20	21.134	22.190	23.247	24.304	25.360	26.417	27.474	28.530	29.587	30.644
30	31.700	32.757	33.814	34.871	35.927	36.984	38.041	39.097	40.154	41.211
40	42.267	43.324	44.381	45.437	46.494	47.551	48.607	49.664	50.721	51.777
50	52.834	53.891	54.947	56.004	57.061	58.118	59.174	60.231	61.288	62.344
60	63.401	64.458	65.514	66.571	67.628	68.684	69.741	70.798	71.854	72.911
70	73.968	75.024	76.081	77.138	78.194	79.251	80.308	81.365	82.421	83.478
80	84.535	85.591	86.648	87.705	88.761	89.818	90.875	91.931	92.988	94.045
90	95.101	96.158	97.215	98.271	99.328	100.38	101.44	102.50	103.55	104.61

CAPACITIES — LITERS TO LIQUID QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
100	105.67	106.72	107.78	108.84	109.89	110.95	112.01	113.06	114.12	115.18
110	116.24	117.29	118.35	119.41	120.46	121.52	122.58	123.63	124.69	125.75
120	126.80	127.86	128.92	129.97	131.03	132.09	133.14	134.20	135.26	136.31
130	137.37	138.43	139.48	140.54	141.60	142.65	143.71	144.77	145.82	146.88
140	147.94	148.99	150.05	151.11	152.16	153.22	154.28	155.33	156.39	157.45
150	158.50	159.56	160.62	161.67	162.73	163.79	164.84	165.90	166.96	168.01
160	169.07	170.13	171.18	172.24	173.30	174.35	175.41	176.47	177.52	178.58
170	179.64	180.69	181.75	182.81	183.86	184.92	185.98	187.03	188.09	189.15
180	190.20	191.26	192.32	193.37	194.43	195.49	196.54	197.60	198.66	199.71
190	200.77	201.83	202.88	203.94	205.00	206.05	207.11	208.17	209.22	210.28
200	211.34	212.39	213.45	214.51	215.56	216.62	217.68	218.73	219.79	220.85
210	221.90	222.96	224.02	225.07	226.13	227.19	228.24	229.30	230.36	231.41
220	232.47	233.53	234.58	235.64	236.70	237.75	238.81	239.87	240.92	241.98
230	243.04	244.09	245.15	246.21	247.26	248.32	249.38	250.43	251.49	252.55
240	253.60	254.66	255.72	256.77	257.83	258.89	259.94	261.00	262.06	263.11
250	264.17	265.23	266.28	267.34	268.40	269.45	270.51	271.57	272.62	273.68
260	274.74	275.79	276.85	277.91	278.96	280.02	281.08	282.13	283.19	284.25
270	285.30	286.36	287.42	288.47	289.53	290.59	291.64	292.70	293.76	294.81
280	295.87	296.93	297.98	299.04	300.10	301.15	302.21	303.27	304.32	305.38
290	306.44	307.49	308.55	309.61	310.66	311.72	312.78	313.83	314.89	315.95

CAPACITIES — LITERS TO LIQUID QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
300	317.00	318.06	319.12	320.17	321.23	322.29	323.34	324.40	325.46	326.51
310	327.57	328.63	329.68	330.74	331.80	332.85	333.91	334.97	336.02	337.08
320	338.14	339.19	340.25	341.31	342.36	343.42	344.48	345.53	346.59	347.65
330	348.71	349.76	350.82	351.88	352.93	353.99	355.05	356.10	357.16	358.22
340	359.27	360.33	361.39	362.44	363.50	364.56	365.61	366.67	367.73	368.78
350	369.84	370.90	371.95	373.01	374.07	375.12	376.18	377.24	378.29	379.35
360	380.41	381.46	382.52	383.58	384.63	385.69	386.75	387.80	388.86	389.92
370	390.97	392.03	393.09	394.14	395.20	396.26	397.31	398.37	399.43	400.48
380	401.54	402.60	403.65	404.71	405.77	406.82	407.88	408.94	409.99	411.05
390	412.11	413.16	414.22	415.28	416.33	417.39	418.45	419.50	420.56	421.62
400	422.67	423.73	424.79	425.84	426.90	427.96	429.01	430.07	431.13	432.18
410	433.24	434.30	435.35	436.41	437.47	438.52	439.58	440.64	441.69	442.75
420	443.81	444.86	445.92	446.98	448.03	449.09	450.15	451.20	452.26	453.32
430	454.37	455.43	456.49	457.54	458.60	459.66	460.71	461.77	462.83	463.88
440	464.94	466.00	467.05	468.11	469.17	470.22	471.28	472.34	473.39	474.45
450	475.51	476.56	477.62	478.68	479.73	480.79	481.85	482.90	483.96	485.02
460	486.07	487.13	488.19	489.24	490.30	491.36	492.41	493.47	494.53	495.58
470	496.64	497.70	498.75	499.81	500.87	501.92	502.98	504.04	505.09	506.15
480	507.21	508.26	509.32	510.38	511.43	512.49	513.55	514.60	515.66	516.72
490	517.77	518.83	519.89	520.94	522.00	523.06	524.11	525.17	526.23	527.28

CAPACITIES — LITERS TO LIQUID QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
500	528.34	529.40	530.45	531.51	532.57	533.62	534.68	535.74	536.79	537.85
510	538.91	539.96	541.02	542.08	543.13	544.19	545.25	546.30	547.36	548.42
520	549.47	550.53	551.59	552.64	553.70	554.76	555.81	556.87	557.93	558.98
530	560.04	561.10	562.15	563.21	564.27	565.32	566.38	567.44	568.49	569.55
540	570.61	571.66	572.72	573.78	574.83	575.89	576.95	578.00	579.06	580.12
550	581.18	582.23	583.29	584.35	585.40	586.46	587.52	588.57	589.63	590.69
560	591.74	592.80	593.86	594.91	595.97	597.03	598.08	599.14	600.20	601.25
570	602.31	603.37	604.42	605.48	606.54	607.59	608.65	609.71	610.76	611.82
580	612.88	613.93	614.99	616.05	617.10	618.16	619.22	620.27	621.33	622.39
590	623.44	624.50	625.56	626.61	627.67	628.73	629.78	630.84	631.90	632.95
600	634.01	635.07	636.12	637.18	638.24	639.29	640.35	641.41	642.46	643.52
610	644.58	645.63	646.69	647.75	648.80	649.86	650.92	651.97	653.03	654.09
620	655.14	656.20	657.26	658.31	659.37	660.43	661.48	662.54	663.60	664.65
630	665.71	666.77	667.82	668.88	669.94	670.99	672.05	673.11	674.16	675.22
640	676.28	677.33	678.39	679.45	680.50	681.56	682.62	683.67	684.73	685.79
650	686.84	687.90	688.96	690.01	691.07	692.13	693.18	694.24	695.30	696.35
660	697.41	698.47	699.52	700.58	701.64	702.69	703.75	704.81	705.86	706.92
670	707.98	709.03	710.09	711.15	712.20	713.26	714.32	715.37	716.43	717.49
680	718.54	719.60	720.66	721.71	722.77	723.83	724.88	725.94	727.00	728.05
690	729.11	730.17	731.22	732.28	733.34	734.39	735.45	736.51	737.56	738.62

CAPACITIES — LITERS TO LIQUID QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
700	739.68	740.73	741.79	742.85	743.90	744.96	746.02	747.07	748.13	749.19
710	750.24	751.30	752.36	753.41	754.47	755.53	756.58	757.64	758.70	759.75
720	760.81	761.87	762.92	763.98	765.04	766.09	767.15	768.21	769.26	770.32
730	771.38	772.43	773.49	774.55	775.60	776.61	777.72	778.77	779.83	780.89
740	781.94	783.00	784.06	785.11	786.17	787.23	788.28	789.34	790.40	791.45
750	792.51	793.57	794.62	795.68	796.74	797.79	798.85	799.91	800.96	802.02
760	803.08	804.13	805.19	806.25	807.30	808.36	809.42	810.47	811.53	812.59
770	813.65	814.70	815.76	816.82	817.87	818.93	819.99	821.04	822.10	823.16
780	824.21	825.27	826.33	827.38	828.44	829.50	830.55	831.61	832.67	833.72
790	834.78	835.84	836.89	837.95	839.01	840.06	841.12	842.18	843.23	844.29
800	845.35	846.40	847.46	848.52	849.57	850.63	851.69	852.74	853.80	854.86
810	855.91	856.97	858.03	859.08	860.14	861.20	862.25	863.31	864.37	865.42
820	866.48	867.54	868.59	869.65	870.71	871.76	872.82	873.88	874.93	875.99
830	877.05	878.10	879.16	880.22	881.27	882.33	883.39	884.44	885.50	886.56
840	887.61	888.67	889.73	890.78	891.84	892.90	893.95	895.01	896.07	897.12
850	898.18	899.24	900.29	901.35	902.41	903.46	904.52	905.58	906.63	907.69
860	908.75	909.80	910.86	911.92	912.97	914.03	915.09	916.14	917.20	918.26
870	919.31	920.37	921.43	922.48	923.54	924.60	925.65	926.71	927.77	928.82
880	929.88	930.94	931.99	933.05	934.11	935.16	936.22	937.28	938.33	939.39
890	940.47	941.50	942.56	953.62	944.67	945.73	946.79	947.84	948.90	949.96

CAPACITIES—LITERS TO LIQUID QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
900	951.01	952.07	953.13	954.18	955.24	956.30	957.35	958.41	959.47	960.52
910	961.58	962.64	963.69	964.75	965.81	966.86	967.92	968.98	970.03	971.09
920	972.15	973.20	974.26	975.32	976.37	977.43	978.49	979.54	980.60	981.66
930	982.71	983.77	984.83	985.88	986.94	988.00	989.05	990.11	991.17	992.22
940	993.28	994.34	995.39	996.45	997.51	998.56	999.62	1,000.7	1,001.7	1,002.8
950	1,003.8	1,004.9	1,006.0	1,007.0	1,008.1	1,009.1	1,010.2	1,011.2	1,012.3	1,013.4
960	1,014.4	1,015.5	1,016.5	1,017.6	1,018.6	1,019.7	1,020.8	1,021.8	1,022.9	1,023.9
970	1,025.0	1,026.0	1,027.1	1,028.2	1,029.2	1,030.3	1,031.3	1,032.4	1,033.4	1,034.5
980	1,035.5	1,036.6	1,037.7	1,038.7	1,039.8	1,040.8	1,041.9	1,042.9	1,044.0	1,045.1
990	1,046.1	1,047.2	1,048.2	1,049.3	1,050.3	1,051.4	1,052.5	1,053.5	1,054.6	1,055.6

CAPACITIES—LIQUID QUARTS TO LITERS

From 1 *to* 1,000 *Units*

Reduction factor; 1 liquid quart = 0.9463586241 liter

The values found in the body of the table give, in liters, the capacities indicated in liquid quarts at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	....	0.94636	1.8927	2.8391	3.7854	4.7318	5.6782	6.6245	7.5709	8.5172
10	9.4636	10.410	11.356	12.303	13.249	14.195	15.142	16.088	17.034	17.981
20	18.927	19.874	20.820	21.766	22.713	23.659	24.605	25.552	26.498	27.444
30	28.391	29.337	30.283	31.230	32.176	33.123	34.069	35.015	35.962	36.908
40	37.854	38.801	39.747	40.693	41.640	42.586	43.533	44.479	45.425	46.372
50	47.318	48.264	49.211	50.157	51.103	52.050	52.996	53.942	54.889	55.835
60	56.782	57.728	58.674	59.621	60.567	61.513	62.460	63.406	64.352	65.299
70	66.245	67.191	68.138	69.084	70.031	70.977	71.923	72.870	73.816	74.862
80	75.709	76.655	77.601	78.548	79.494	80.440	81.387	82.333	83.280	84.226
90	85.172	86.119	87.065	88.011	88.958	89.904	90.850	91.797	92.743	93.690

CAPACITIES — LIQUID QUARTS TO LITERS (Continued)

	0	1	2	3	4	5	6	7	8	9
100	94.636	95.582	96.529	97.475	98.421	99.368	100.31	101.26	102.21	103.15
110	104.10	105.05	105.99	106.94	107.88	108.83	109.78	110.72	111.67	112.62
120	113.56	114.51	115.46	116.40	117.35	118.29	119.24	120.19	121.13	122.08
130	123.03	123.97	124.92	125.87	126.81	127.76	128.70	129.65	130.60	131.54
140	132.49	133.44	134.38	135.33	136.28	137.22	138.17	139.11	140.06	141.01
150	141.95	142.90	143.85	144.79	145.74	146.69	147.63	148.58	149.52	150.47
160	151.42	152.36	153.31	154.26	155.20	156.15	157.10	158.04	158.99	159.93
170	160.88	161.83	162.77	163.72	164.67	165.61	166.56	167.51	168.45	169.40
180	170.34	171.29	172.24	173.18	174.13	175.08	176.02	176.97	177.92	178.86
190	179.81	180.75	181.70	182.65	183.59	184.54	185.49	186.43	187.38	188.33
200	189.27	190.22	191.16	192.11	193.06	194.00	194.95	195.90	196.84	197.79
210	198.74	199.68	200.63	201.57	202.52	203.47	204.41	205.36	206.31	207.25
220	208.20	209.15	210.09	211.04	211.98	212.93	213.88	214.82	215.77	216.72
230	217.66	218.61	219.56	220.50	221.45	222.39	223.34	224.29	225.23	226.18
240	227.13	228.07	229.02	229.97	230.91	231.86	232.80	233.75	234.70	235.64
250	236.59	237.54	238.48	239.43	240.38	241.32	242.27	243.21	244.16	245.11
260	246.05	247.00	247.95	248.89	249.84	250.79	251.73	252.68	253.62	254.57
270	255.52	256.46	257.41	258.36	259.30	260.25	261.19	262.14	263.09	264.03
280	264.98	265.93	266.87	267.82	268.77	269.71	270.66	271.60	272.55	273.50
290	274.44	275.39	276.34	277.28	278.23	279.18	280.12	281.07	282.01	282.96

CAPACITIES — LIQUID QUARTS TO LITERS (Continued)

	0	1	2	3	4	5	6	7	8	9
300	283.91	284.85	285.80	286.75	287.69	288.64	289.59	290.53	291.48	292.42
310	293.37	294.32	295.26	296.21	297.16	298.10	299.05	300.00	300.94	301.89
320	302.83	303.78	304.73	305.67	306.62	307.57	308.51	309.46	310.41	311.35
330	312.30	313.24	314.19	315.14	316.08	317.03	317.98	318.92	319.87	320.82
340	321.76	322.71	323.65	324.60	325.55	326.49	327.44	328.39	329.33	330.28
350	331.23	332.17	333.12	334.06	335.01	335.96	336.90	337.85	338.80	339.74
360	340.69	341.64	342.58	343.53	344.47	345.42	346.37	347.31	348.26	349.21
370	350.15	351.10	352.05	352.99	353.94	354.88	355.83	356.78	357.72	358.67
380	359.62	360.56	361.51	362.46	363.40	364.35	365.29	366.24	367.19	368.13
390	369.08	370.03	370.97	371.92	372.87	373.81	374.76	375.70	376.65	377.60
400	378.54	379.49	380.44	381.38	382.33	383.28	384.22	385.17	386.11	387.06
410	388.01	388.95	389.90	390.85	391.79	392.74	393.69	394.63	395.58	396.52
420	397.47	398.42	399.36	400.31	401.26	402.20	403.15	404.10	405.04	405.99
430	406.93	407.88	408.83	409.77	410.72	411.67	412.61	413.56	414.51	415.45
440	416.40	417.34	418.29	419.24	420.18	421.13	422.08	423.02	423.97	424.92
450	425.86	426.81	427.75	428.70	429.65	430.59	431.54	432.49	433.43	434.38
460	435.32	436.27	437.22	438.16	439.11	440.06	441.00	441.95	442.90	443.84
470	444.79	445.73	446.68	447.63	448.57	449.52	450.47	451.41	452.36	453.31
480	454.25	455.20	456.14	457.09	458.04	458.98	459.93	460.88	461.82	462.77
490	463.72	464.66	465.61	466.55	467.50	468.45	469.39	470.34	471.29	472.23

CAPACITIES—LIQUID QUARTS TO LITERS (Continued)

	0	1	2	3	4	5	6	7	8	9
500	473.18	474.13	475.07	476.02	476.96	477.91	478.86	479.80	480.75	481.70
510	482.64	483.59	484.54	485.48	486.43	487.37	488.32	489.27	490.21	491.16
520	492.11	493.05	494.00	494.95	495.89	496.84	497.78	498.73	499.68	500.62
530	501.57	502.52	503.46	504.41	505.36	506.30	507.25	508.19	509.14	510.09
540	511.03	511.97	512.93	513.87	514.82	515.77	516.71	517.66	518.60	519.55
550	520.50	521.44	522.39	523.34	524.28	525.23	526.18	527.12	528.07	529.01
560	529.96	530.91	531.85	532.80	533.75	534.69	535.64	536.59	537.53	538.48
570	539.42	540.37	541.32	542.26	543.21	544.16	545.10	546.05	547.00	547.94
580	548.89	549.83	550.78	551.73	552.67	553.62	554.57	555.51	556.46	557.41
590	558.35	559.30	560.24	561.19	562.14	563.08	564.03	564.98	565.92	566.87
600	567.82	568.76	569.71	570.65	571.60	572.55	573.49	574.44	575.39	576.33
610	577.28	578.23	579.17	580.12	581.06	582.01	582.96	583.90	584.85	585.80
620	586.74	587.69	588.64	589.58	590.53	591.47	592.42	593.37	594.31	595.26
630	596.21	597.15	598.10	599.05	599.99	600.94	601.88	602.83	603.78	604.72
640	605.67	606.62	607.56	608.51	609.45	610.40	611.35	612.29	613.24	614.19
650	615.13	616.08	617.03	617.97	618.92	619.86	620.81	621.76	622.70	623.65
660	624.60	625.54	626.49	627.44	628.38	629.33	630.27	631.22	632.17	633.11
670	634.06	635.01	635.95	636.90	637.85	638.79	639.74	640.68	641.63	642.58
680	643.52	644.47	645.42	646.36	647.31	648.26	649.20	650.15	651.09	652.04
690	652.99	653.93	654.88	655.83	656.77	657.72	658.67	659.61	660.56	661.50

CAPACITIES—LIQUID QUARTS TO LITERS (Continued)

	0	1	2	3	4	5	6	7	8	9
700	662.45	663.40	664.34	665.29	666.24	667.18	668.13	669.08	670.02	670.97
710	671.91	672.86	673.81	674.75	675.70	676.65	677.59	678.54	679.49	680.43
720	681.38	682.32	683.27	684.22	685.16	686.11	687.06	688.00	688.95	689.90
730	690.84	691.79	692.73	693.68	694.63	695.57	696.52	697.47	698.41	699.36
740	700.31	701.25	702.20	703.14	704.09	705.04	705.98	706.93	707.88	708.82
750	709.77	710.72	711.66	712.61	713.55	714.50	715.45	716.39	717.34	718.29
760	719.23	720.18	721.13	722.07	723.02	723.96	724.91	725.86	726.80	727.75
770	728.70	729.64	730.59	731.54	732.48	733.43	734.37	735.32	736.27	737.21
780	738.16	739.11	740.05	741.00	741.95	742.89	743.84	744.78	745.73	746.68
790	747.62	748.57	749.52	750.46	751.41	752.36	753.30	754.25	755.19	756.14
800	757.09	758.03	758.98	759.93	760.87	761.82	762.77	763.71	764.66	765.60
810	766.55	767.50	768.44	769.39	770.34	771.28	772.23	773.18	774.12	775.07
820	776.01	776.96	777.91	778.85	779.80	780.75	781.69	782.64	783.58	784.53
830	785.48	786.42	787.37	788.32	789.26	790.21	791.16	792.10	793.05	793.99
840	794.94	795.89	796.83	797.78	798.73	799.67	800.62	801.57	802.51	803.46
850	804.40	805.35	806.30	807.24	808.19	809.14	810.08	811.03	811.98	812.92
860	813.87	814.81	815.76	816.71	817.65	818.60	819.55	820.49	821.44	822.39
870	823.33	824.28	825.22	826.17	827.12	828.06	829.01	829.96	830.90	831.85
880	832.80	833.74	834.69	835.63	836.58	837.53	838.47	839.42	840.37	841.31
890	842.26	843.21	844.15	845.10	846.04	846.99	847.94	848.88	849.83	850.78

CAPACITIES — LIQUID QUARTS TO LITERS (Continued)

	0	1	2	3	4	5	6	7	8	9
900	851.72	852.67	853.62	854.56	855.51	856.45	857.40	858.35	859.29	860.24
910	861.19	862.13	863.08	864.03	864.97	865.92	866.86	867.81	868.76	869.70
920	870.65	871.60	872.54	873.49	874.44	875.38	876.33	877.27	878.22	879.17
930	880.11	881.06	882.01	882.95	883.90	884.85	885.79	886.74	887.68	888.63
940	889.57	890.52	891.47	892.42	893.36	894.31	895.26	896.20	897.15	898.09
950	899.04	899.99	900.93	901.88	902.83	903.77	904.72	905.67	906.61	907.56
960	908.50	909.45	910.40	911.34	912.29	913.24	914.18	915.13	916.08	917.02
970	917.97	918.91	919.86	920.81	921.75	922.70	923.65	924.59	925.54	926.49
980	927.43	928.38	929.32	930.27	931.22	932.16	933.11	934.06	935.00	935.95
990	936.90	937.84	938.79	939.73	940.68	941.63	942.57	943.52	944.47	945.41

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS

From 1 *to* 1,000 *Units*

Reduction factor: 1 kilogram = 2.204622341 avoirdupois pounds

The values found in the body of the table give, in avoirdupois pounds, the weights indicated in kilograms at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	....	2.2046	4.4092	6.6139	8.8185	11.023	13.278	15.432	17.637	19.842
10	22.046	24.251	26.456	28.660	30.865	33.069	35.274	37.479	39.683	41.888
20	44.092	46.297	48.502	50.706	52.911	55.116	57.320	59.525	61.729	63.934
30	66.139	68.343	70.548	72.753	74.957	77.162	79.366	81.571	83.776	85.980
40	88.185	90.390	92.594	94.799	97.003	99.208	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.20
90	198.42	200.62	202.83	205.03	207.23	209.44	211.64	213.85	216.05	218.26

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
100	220.46	222.67	224.87	227.08	229.28	231.49	233.69	235.89	238.10	240.30
110	242.51	244.71	246.92	249.12	251.33	253.53	255.74	257.94	260.15	262.35
120	264.55	266.76	268.96	271.17	273.37	275.58	277.78	279.99	282.19	284.40
130	286.60	288.81	291.01	293.21	295.42	297.62	299.83	302.03	304.24	306.44
140	308.65	310.85	313.06	315.26	317.47	319.67	321.87	324.08	326.28	328.49
150	330.69	332.90	335.10	337.31	339.51	341.72	343.92	346.13	348.33	350.54
160	352.74	354.94	357.15	359.35	361.56	363.76	365.97	368.17	370.38	372.58
170	374.79	376.99	379.20	381.40	383.60	385.81	388.01	390.22	392.42	394.63
180	396.83	399.04	401.24	403.45	405.65	407.86	410.06	412.26	414.47	416.67
190	418.88	421.08	423.29	425.49	427.70	429.90	432.11	434.31	436.52	438.72
200	440.92	443.13	445.33	447.54	449.74	451.95	454.15	456.36	458.56	460.77
210	462.97	465.18	467.38	469.58	471.79	473.99	476.20	478.40	480.61	482.81
220	485.02	487.22	489.43	491.63	493.84	496.04	498.24	500.45	502.65	504.86
230	507.06	509.27	511.47	513.68	515.88	518.09	520.29	522.50	524.70	526.90
240	529.11	531.31	533.52	535.72	537.93	540.13	542.34	544.54	546.75	548.95
250	551.16	553.36	555.56	557.77	559.97	562.18	564.38	566.59	568.79	571.00
260	573.20	575.41	577.61	579.82	582.02	584.22	586.43	588.63	590.84	593.04
270	595.25	597.45	599.66	601.86	604.07	606.27	608.48	610.68	612.89	615.09
280	617.29	619.50	621.70	623.91	626.11	628.32	630.52	632.73	634.93	637.14
290	639.34	641.55	643.75	645.95	648.16	650.36	652.57	654.77	656.98	659.18

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
300	661.39	663.59	665.80	668.00	670.21	672.41	674.61	676.82	679.02	681.23
310	683.43	685.64	687.84	690.05	692.25	694.46	696.66	698.87	701.07	703.27
320	705.48	707.68	709.89	712.09	714.30	716.50	718.71	720.91	723.12	725.32
330	727.53	729.73	731.93	734.14	736.35	738.55	740.75	742.96	745.16	747.37
340	749.57	751.78	753.98	756.19	758.39	760.59	762.80	765.00	767.21	769.41
350	771.62	773.82	776.03	778.23	780.44	782.64	784.85	787.05	789.25	791.46
360	793.66	795.87	798.07	800.28	802.48	804.69	806.89	809.10	811.30	813.51
370	815.71	817.91	820.12	822.32	824.53	826.73	828.94	831.14	833.35	835.55
380	837.76	839.96	842.17	844.37	846.58	848.78	850.98	853.19	855.38	857.60
390	859.80	862.01	864.21	866.42	868.62	870.83	873.03	875.24	877.44	879.64
400	881.85	884.05	886.26	888.46	890.67	892.87	895.08	897.28	899.49	901.69
410	903.90	906.10	908.30	910.51	912.71	914.92	917.12	919.33	921.53	923.74
420	925.94	928.15	930.35	932.56	934.76	936.96	939.17	941.37	943.58	945.78
430	947.99	950.20	952.40	954.60	956.71	959.01	961.22	963.42	965.62	967.83
440	970.03	972.24	974.44	976.65	978.85	981.06	983.26	985.47	987.67	989.88
450	992.08	994.28	996.49	998.69	1,000.9	1,003.1	1,005.3	1,007.5	1,009.7	1,011.9
460	1,014.1	1,016.3	1,018.5	1,020.7	1,022.9	1,025.1	1,027.4	1,029.6	1,031.8	1,034.0
470	1,036.2	1,038.4	1,040.6	1,042.8	1,045.0	1,047.2	1,049.4	1,051.6	1,053.8	1,056.0
480	1,058.2	1,060.4	1,062.6	1,064.8	1,067.0	1,069.2	1,071.4	1,073.7	1,075.9	1,078.1
490	1,080.3	1,082.5	1,084.7	1,086.9	1,089.1	1,091.3	1,093.5	1,095.7	1,097.9	1,100.1

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
500	1,102.3	1,104.5	1,106.7	1,108.9	1,111.1	1,113.3	1,115.5	1,117.7	1,119.9	1,122.2
510	1,124.4	1,126.6	1,128.8	1,131.0	1,133.2	1,135.4	1,137.6	1,139.8	1,142.0	1,144.2
520	1,146.4	1,148.6	1,150.8	1,153.0	1,155.2	1,157.4	1,159.6	1,161.8	1,164.0	1,166.2
530	1,168.4	1,170.7	1,172.9	1,175.1	1,177.3	1,179.5	1,181.7	1,183.9	1,186.9	1,188.3
540	1,190.5	1,192.7	1,194.9	1,197.1	1,199.3	1,201.5	1,203.7	1,205.9	1,208.1	1,210.3
550	1,212.5	1,214.7	1,217.0	1,219.2	1,221.4	1,223.6	1,225.8	1,228.0	1,230.2	1,232.4
560	1,234.6	1,236.8	1,239.0	1,241.2	1,243.4	1,245.6	1,247.8	1,250.0	1,252.2	1,254.4
570	1,256.6	1,258.8	1,261.0	1,263.2	1,265.5	1,267.7	1,269.9	1,272.1	1,274.3	1,276.5
580	1,278.7	1,280.9	1,283.1	1,285.3	1,287.5	1,289.7	1,291.9	1,294.1	1,296.3	1,298.5
590	1,300.7	1,302.9	1,305.1	1,307.3	1,309.5	1,311.8	1,314.0	1,316.2	1,318.3	1,320.6
600	1,322.8	1,325.0	1,327.2	1,329.4	1,331.6	1,333.8	1,336.0	1,338.2	1,340.4	1,342.6
610	1,344.8	1,347.0	1,349.2	1,351.4	1,353.6	1,355.8	1,358.0	1,360.3	1,362.5	1,364.7
620	1,366.9	1,369.1	1,371.3	1,375.5	1,375.7	1,377.9	1,380.1	1,382.3	1,384.5	1,386.7
630	1,388.9	1,391.1	1,393.3	1,395.5	1,397.7	1,399.9	1,402.1	1,404.3	1,406.5	1,408.8
640	1,411.0	1,413.2	1,415.4	1,417.6	1,419.8	1,422.0	1,424.2	1,426.4	1,428.6	1,430.8
650	1,433.0	1,435.2	1,437.4	1,439.6	1,441.8	1,444.0	1,446.2	1,448.4	1,450.6	1,452.8
660	1,455.1	1,457.3	1,459.5	1,461.7	1,463.9	1,466.1	1,468.3	1,470.5	1,472.7	1,474.9
670	1,477.1	1,479.3	1,481.5	1,483.7	1,485.9	1,488.1	1,490.3	1,492.5	1,494.7	1,496.9
680	1,499.1	1,501.3	1,503.6	1,505.8	1,508.0	1,510.2	1,512.4	1,514.6	1,516.8	1,519.0
690	1,521.2	1,523.4	1,525.6	1,527.8	1,530.0	1,532.2	1,534.4	1,536.6	1,538.8	1,541.0

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
700	1,543.2	1,545.4	1,547.6	1,549.8	1,552.1	1,554.3	1,556.5	1,558.7	1,560.9	1,563.1
710	1,565.3	1,567.5	1,569.7	1,571.9	1,574.1	1,576.3	1,578.5	1,580.7	1,582.9	1,585.1
720	1,587.3	1,589.5	1,591.7	1,593.9	1,596.1	1,598.4	1,600.6	1,602.8	1,605.0	1,607.2
730	1,609.4	1,611.6	1,613.8	1,616.0	1,618.2	1,620.4	1,622.6	1,624.8	1,627.0	1,629.2
740	1,631.4	1,633.6	1,635.8	1,638.0	1,640.2	1,642.4	1,644.6	1,646.9	1,649.1	1,651.3
750	1,653.5	1,655.7	1,657.9	1,660.1	1,662.3	1,664.5	1,666.7	1,668.9	1,671.1	1,673.3
760	1,675.5	1,677.7	1,679.9	1,682.1	1,684.3	1,686.5	1,688.7	1,690.9	1,693.2	1,695.4
770	1,697.6	1,699.8	1,702.0	1,704.2	1,706.4	1,708.6	1,710.8	1,713.0	1,715.2	1,717.4
780	1,719.6	1,721.8	1,724.0	1,726.2	1,728.4	1,730.6	1,732.8	1,735.0	1,737.2	1,739.4
790	1,741.7	1,743.9	1,746.1	1,748.3	1,750.5	1,752.7	1,754.9	1,757.1	1,759.3	1,761.5
800	1,763.7	1,766.0	1,768.1	1,770.3	1,772.5	1,774.7	1,776.9	1,779.1	1,781.3	1,783.5
810	1,785.7	1,787.9	1,790.2	1,792.4	1,794.6	1,796.8	1,799.0	1,801.2	1,803.4	1,805.6
820	1,807.8	1,810.0	1,812.2	1,814.4	1,816.6	1,818.8	1,821.0	1,823.2	1,825.4	1,827.6
830	1,829.8	1,832.0	1,834.2	1,836.5	1,838.7	1,840.9	1,843.1	1,845.3	1,847.5	1,849.7
840	1,851.9	1,854.1	1,856.3	1,858.5	1,860.7	1,862.9	1,865.1	1,867.3	1,869.5	1,871.7
850	1,873.9	1,876.1	1,878.3	1,880.5	1,882.7	1,885.0	1,887.2	1,889.4	1,891.6	1,893.8
860	1,896.0	1,898.2	1,900.4	1,902.6	1,904.8	1,907.0	1,909.2	1,911.4	1,913.6	1,915.8
870	1,918.0	1,920.2	1,922.4	1,924.6	1,926.8	1,929.0	1,931.2	1,933.5	1,935.7	1,937.9
880	1,940.1	1,942.3	1,944.5	1,946.7	1,948.9	1,951.1	1,953.3	1,955.6	1,957.7	1,959.9
890	1,962.1	1,964.3	1,966.5	1,968.7	1,970.9	1,973.1	1,975.3	1,977.5	1,979.8	1,982.0

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
900	1,984.2	1,986.4	1,988.6	1,990.8	1,993.0	1,995.2	1,997.4	1,999.6	2,001.8	2,004.0
910	2,006.2	2,008.4	2,010.6	2,012.8	2,015.0	2,017.2	2,019.4	2,021.6	2,023.8	2,026.0
920	2,028.3	2,030.5	2,032.7	2,034.9	2,037.1	2,039.3	2,041.5	2,043.7	2,045.9	2,048.1
930	2,050.3	2,052.5	2,054.7	2,056.9	2,059.1	2,061.3	2,063.5	2,065.7	2,067.9	2,070.1
940	2,072.3	2,074.5	2,076.8	2,079.0	2,081.2	2,083.4	2,085.6	2,087.8	2,090.0	2,092.2
950	2,094.4	2,096.6	2,098.8	2,101.0	2,103.2	2,105.4	2,107.6	2,109.8	2,112.0	2,114.2
960	2,116.4	2,118.6	2,120.8	2,123.1	2,125.3	2,127.5	2,129.7	2,131.9	2,134.1	2,136.3
970	2,138.5	2,140.7	2,142.9	2,145.1	2,147.3	2,149.5	2,151.7	2,153.9	2,156.1	2,158.3
980	2,160.5	2,162.7	2,164.9	2,167.1	2,169.3	2,171.6	2,173.8	2,176.0	2,178.2	2,180.4
990	2,182.6	2,184.8	2,187.0	2,189.2	2,191.4	2,193.6	2,195.8	2,198.0	2,200.2	2,202.4

WEIGHTS — AVOIRDUPOIS POUNDS TO KILOGRAMS

From 1 *to* 1,000 *Units*

Reduction factor: 1 avoirdupois pound = 0.4535924277 kilogram

The values found in the body of the table give, in kilograms, the weights indicated in avoirdupois pounds at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	....	0.45359	0.90718	1.3608	1.8144	2.2680	2.7216	3.1752	3.6287	4.0823
10	4.5359	4.9895	5.4431	5.8967	6.3503	6.8039	7.2575	7.7111	8.1647	8.6183
20	9.0719	9.5254	9.9790	10.433	10.886	11.340	11.793	12.247	12.701	13.154
30	13.608	14.061	14.515	14.969	15.422	15.876	16.329	16.783	17.237	17.690
40	18.144	18.597	19.051	19.504	19.958	20.412	20.865	21.319	21.772	22.226
50	22.680	23.133	23.587	24.040	24.494	24.948	25.401	25.855	26.308	26.762
60	27.216	27.669	28.123	28.576	29.030	29.484	29.937	30.391	30.844	31.298
70	31.751	32.205	32.659	33.112	33.566	34.019	34.473	34.927	35.380	35.834
80	36.287	36.741	37.195	37.648	38.102	38.555	39.009	39.463	39.916	40.370
90	40.823	41.277	41.731	42.184	42.638	43.091	43.545	43.998	44.452	44.906

WEIGHTS — AVOIRDUPOIS POUNDS TO KILOGRAMS (Continued)

	0	1	2	3	4	5	6	7	8	9
100	45.359	45.813	46.266	46.720	47.174	47.627	48.081	48.534	48.988	49.442
110	49.895	50.349	50.802	51.256	51.710	52.163	52.617	53.070	53.524	53.978
120	54.431	54.885	55.338	55.792	56.245	56.699	57.153	57.606	58.060	58.513
130	58.967	59.421	59.874	60.328	60.781	61.235	61.689	62.142	62.596	63.049
140	63.503	63.957	64.410	64.864	65.317	65.771	66.224	66.678	67.132	67.585
150	68.039	68.492	68.946	69.400	69.853	70.307	70.760	71.214	71.668	72.121
160	72.575	73.028	73.482	73.936	74.389	74.843	75.296	75.750	76.204	76.657
170	77.111	77.564	78.018	78.471	78.925	79.379	79.832	80.286	80.739	81.193
180	81.647	82.100	82.554	83.007	83.461	83.915	84.368	84.822	85.275	85.729
190	86.183	86.636	87.090	87.543	87.997	88.451	88.904	89.358	89.811	90.256
200	90.718	91.172	91.626	91.179	92.533	92.986	93.440	93.894	94.347	94.801
210	95.254	95.708	96.162	96.615	97.069	97.522	97.976	98.430	98.883	99.337
220	99.790	100.24	100.70	101.15	101.60	102.06	102.51	102.97	103.42	103.87
230	104.33	104.78	105.23	105.69	106.14	106.59	107.05	107.50	107.96	108.41
240	108.86	109.32	109.77	110.22	110.68	111.13	111.58	112.04	112.49	112.94
250	113.40	113.85	114.31	114.76	115.21	115.67	116.12	116.57	117.03	117.48
260	117.93	118.39	118.84	119.29	119.75	120.20	120.66	121.11	121.56	122.02
270	122.47	122.92	123.38	123.83	124.28	124.74	125.19	125.65	126.10	126.55
280	127.01	127.46	127.91	128.37	128.82	129.27	129.73	130.18	130.63	131.09
290	131.54	132.00	132.45	132.90	133.36	133.81	134.26	134.72	135.17	135.62

WEIGHTS — AVOIRDUPOIS POUNDS TO KILOGRAMS (Continued)

	0	1	2	3	4	5	6	7	8	9
300	136.08	136.53	136.98	137.44	137.89	138.35	138.80	139.25	139.71	140.16
310	140.61	141.07	141.52	141.97	142.43	142.88	143.34	143.79	144.24	144.70
320	145.15	145.60	146.06	146.51	146.96	147.42	147.87	148.32	148.78	149.23
330	149.69	150.14	150.59	151.05	151.50	151.95	152.41	152.86	153.31	153.77
340	154.22	154.68	155.13	155.58	156.04	156.49	156.94	157.40	157.85	158.30
350	158.76	159.21	159.66	160.12	160.57	161.03	161.48	161.93	162.39	162.84
360	163.29	163.75	164.20	164.65	165.11	165.56	166.01	166.47	166.92	167.38
370	167.83	168.28	168.74	169.19	169.64	170.10	170.55	171.00	171.46	171.91
380	172.37	172.82	173.27	173.73	174.18	174.63	175.09	175.54	175.99	176.45
390	176.90	177.35	177.81	178.26	178.72	179.17	179.62	180.08	180.53	180.98
400	181.44	181.89	182.34	182.80	183.25	183.70	184.16	184.61	185.07	185.52
410	185.97	186.43	186.88	187.33	187.79	188.24	188.69	189.15	189.60	190.06
420	190.51	190.96	191.42	191.87	192.32	192.78	193.23	193.68	194.14	194.59
430	195.04	195.50	195.95	196.41	196.86	197.31	197.77	198.22	198.67	199.13
440	199.58	200.03	200.49	200.94	201.40	201.85	202.30	202.76	203.21	203.66
450	204.12	204.57	205.02	205.48	205.93	206.38	206.84	207.29	207.75	208.20
460	208.65	209.11	209.56	210.01	210.47	210.92	211.37	211.83	212.28	212.73
470	213.19	213.64	214.10	214.55	215.00	215.46	215.91	216.36	216.82	217.27
480	217.72	218.18	218.63	219.09	219.54	219.99	220.45	220.90	221.35	221.81
490	222.26	222.71	223.17	223.62	224.07	224.53	224.98	225.44	225.89	226.34

WEIGHTS — AVOIRDUPOIS POUNDS TO KILOGRAMS (Continued)

	0	1	2	3	4	5	6	7	8	9
500	226.80	227.25	227.70	228.16	228.61	229.06	229.52	229.97	230.42	230.88
510	231.33	231.79	232.24	232.69	233.15	233.60	234.05	234.51	234.96	235.41
520	235.87	236.32	236.78	237.23	237.68	238.14	238.59	239.04	239.50	239.95
530	240.40	240.86	241.31	241.76	242.22	242.67	243.13	243.58	244.03	244.49
540	244.94	245.39	245.85	246.30	246.75	247.21	247.66	248.12	248.57	249.02
550	249.48	249.93	250.38	250.84	251.29	251.74	252.20	252.65	253.10	253.56
560	254.01	254.47	254.92	255.37	255.83	256.28	256.73	257.19	257.64	258.09
570	258.55	259.00	259.45	259.91	260.36	260.82	261.27	261.72	262.18	262.63
580	263.08	263.54	263.99	264.44	264.90	265.35	265.81	266.26	266.71	267.17
590	267.62	268.07	268.53	268.98	269.43	269.89	270.34	270.79	271.25	271.70
600	272.16	272.61	273.06	273.52	273.97	274.42	274.88	275.33	275.78	276.24
610	276.69	277.14	277.60	278.05	278.51	278.96	279.41	279.87	280.32	280.77
620	281.23	281.68	282.13	282.59	283.04	283.50	283.95	284.40	284.86	285.31
630	285.76	286.22	286.67	287.12	287.58	288.03	288.48	288.94	289.39	289.85
640	290.30	290.75	291.21	291.66	292.11	292.57	293.02	293.47	293.93	294.38
650	294.84	295.29	295.74	296.20	296.65	297.10	297.56	298.01	298.46	298.92
660	299.27	299.82	300.28	300.73	301.19	301.64	302.09	302.55	303.00	303.45
670	303.91	304.35	304.81	305.27	305.72	306.17	306.63	307.08	307.54	307.99
680	308.44	308.90	309.38	309.80	310.26	310.71	311.16	311.62	312.07	312.53
690	312.98	313.43	313.89	314.34	314.79	315.25	315.70	316.15	316.61	317.06

WEIGHTS — AVOIRDUPOIS POUNDS TO KILOGRAMS (Continued)

	0	1	2	3	4	5	6	7	8	9
700	317.51	317.97	318.42	318.88	319.33	319.78	320.24	320.69	321.14	321.60
710	322.05	322.50	322.96	323.41	323.86	324.32	324.77	325.23	325.68	326.13
720	326.59	327.04	327.49	327.95	328.40	328.85	329.31	329.76	330.22	330.67
730	331.12	331.58	332.03	332.48	332.94	333.39	333.84	334.30	334.75	335.21
740	335.66	336.11	336.57	337.02	337.47	337.93	338.38	338.83	339.29	339.74
750	340.19	340.65	341.10	341.56	342.01	342.46	342.92	343.37	343.82	344.28
760	344.73	345.18	345.64	346.09	346.54	347.00	347.45	347.91	348.36	348.81
770	349.27	349.72	350.17	350.63	351.08	351.53	351.99	352.44	352.89	353.35
780	353.80	354.26	354.71	355.16	355.62	356.07	356.52	356.98	357.43	357.88
790	358.34	358.79	359.25	359.70	360.15	360.61	361.06	361.51	361.97	362.42
800	362.87	363.33	363.78	364.23	364.69	365.14	365.60	366.05	366.50	366.96
810	367.41	367.86	368.32	368.77	369.22	369.68	370.13	370.59	371.04	371.49
820	371.95	372.40	372.85	373.31	373.76	374.21	374.67	375.12	375.57	376.03
830	376.48	376.94	377.39	377.84	378.30	378.75	379.20	379.66	380.11	380.56
840	381.02	381.47	381.92	382.38	382.83	383.29	383.74	384.19	384.65	385.10
850	385.55	386.01	386.46	386.91	387.37	387.82	388.28	388.73	389.18	389.64
860	390.09	390.54	391.00	391.45	391.90	392.36	392.81	393.26	393.72	394.17
870	394.63	395.08	395.53	395.99	396.44	396.89	397.35	397.80	398.25	398.71
880	399.16	399.61	400.07	400.52	400.98	401.43	401.88	402.34	402.79	403.24
890	403.70	404.15	404.60	405.06	405.51	405.97	406.42	406.87	407.33	407.78

WEIGHTS—AVOIRDUPOIS POUNDS TO KILOGRAMS (Continued)

	0	1	2	3	4	5	6	7	8	9
900	408.23	408.69	409.14	409.59	410.05	410.50	410.95	411.41	411.86	412.32
910	412.77	413.22	413.68	414.13	414.58	415.04	415.49	415.94	416.40	416.85
920	417.31	417.76	418.21	418.67	419.12	419.57	420.03	420.48	420.93	421.39
930	421.84	422.29	422.75	423.20	423.66	424.11	424.56	425.02	425.47	425.92
940	426.38	426.83	427.28	427.74	428.19	428.64	429.10	429.55	430.01	430.46
950	430.91	431.37	431.82	432.27	432.73	433.18	433.63	434.09	434.54	435.00
960	435.45	435.90	436.36	436.81	437.26	437.72	438.17	438.62	439.08	439.53
970	439.98	440.44	440.89	441.35	441.80	442.25	442.71	443.16	443.61	444.07
980	444.52	444.97	445.43	445.88	446.33	446.79	447.24	447.70	448.15	448.60
990	449.06	449.51	449.96	450.42	450.87	451.32	451.78	452.23	452.69	453.14

TEMPERATURES

CENTIGRADE TO FAHRENHEIT
FAHRENHEIT TO CENTIGRADE

TEMPERATURES — CENTIGRADE TO FAHRENHEIT

Conversion Table

The values in the body of the table give, in degrees Fahrenheit, the temperatures indicated in degrees Centigrade at the top and side.

1° C. = 1.8° F.

For temperatures below 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
0	+ 32.0	30.2	28.4	26.6	24.8	23.0	21.2	19.4	17.6	15.8
− 10	+ 14.0	12.2	10.4	8.6	6.8	5.0	3.2	+ 1.4	− 0.4	− 2.2
− 20	− 4.0	5.8	7.6	9.4	11.2	13.0	14.8	16.6	18.4	20.2
− 30	− 22.0	23.8	25.6	27.4	29.2	31.0	32.8	34.6	36.4	38.2
− 40	− 40.0	41.8	43.6	45.4	47.2	49.0	50.8	52.6	54.4	56.2
− 50	− 58.0	59.8	61.6	63.4	65.2	67.0	68.8	70.6	72.4	74.2
− 60	− 76.0	77.8	79.6	81.4	83.2	85.0	86.8	88.6	90.4	92.2
− 70	− 94.0	95.8	97.6	99.4	101.2	103.0	104.8	106.6	108.4	110.2
− 80	− 112.0	113.8	115.6	117.4	119.2	121.0	122.8	124.6	126.4	128.2
− 90	− 130.0	131.8	133.6	135.4	137.2	139.0	140.8	142.6	144.4	146.2

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
– 100	–148.0	149.8	151.6	153.4	155.2	157.0	158.8	160.6	162.4	164.2
– 110	–166.0	167.8	169.6	171.4	173.2	175.0	176.8	178.6	180.4	182.2
– 120	–184.0	185.8	187.6	189.4	191.2	193.0	194.8	196.6	198.4	200.2
– 130	–202.0	203.8	205.6	207.4	209.2	211.0	212.8	214.6	216.4	218.2
– 140	–220.0	221.8	223.6	225.4	227.2	229.0	230.8	232.6	234.4	236.2
– 150	–238.0	239.8	241.6	243.4	245.2	247.0	248.8	250.6	252.4	254.2
– 160	–256.0	257.8	259.6	261.4	263.2	265.0	266.8	268.6	270.4	272.2
– 170	–274.0	275.8	277.6	279.4	281.2	283.0	284.8	286.6	288.4	290.2
– 180	–292.0	293.8	295.6	297.4	299.2	301.0	302.8	304.6	306.4	308.2
– 190	–310.0	311.8	313.6	315.4	317.2	319.0	320.8	322.6	324.4	326.2
– 200	–328.0	329.8	331.6	333.4	335.2	337.0	338.8	340.6	342.4	344.2
– 210	–346.0	347.8	349.6	351.4	353.2	355.0	356.8	358.6	360.4	362.2
– 220	–364.0	365.8	367.6	369.4	371.2	373.0	374.8	376.6	378.4	380.2
– 230	–382.0	383.8	385.6	387.4	389.2	391.0	392.8	394.6	396.4	398.2
– 240	–400.0	401.8	403.6	405.4	407.2	409.0	410.8	412.6	414.4	416.2
– 250	–418.0	419.8	421.6	423.4	425.2	427.0	428.8	430.6	432.4	434.2
– 260	–436.0	437.8	439.6	441.4	443.2	445.0	446.8	448.6	450.4	452.2
– 270	–454.0	455.8	457.6	459.4	......	......	......	......	......	......

– 273° C. = –459.4° F. = absolute zero

For interpolation										
°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
0	32.0	33.8	35.6	37.4	39.2	41.0	42.8	44.6	46.4	48.2
10	50.0	51.8	53.6	55.4	57.2	59.0	60.8	62.6	64.4	66.2
20	68.0	69.8	71.6	73.4	75.2	77.0	78.8	80.6	82.4	84.2
30	86.0	87.8	89.6	91.4	93.2	95.0	96.8	98.6	100.4	102.2
40	104.0	105.8	107.6	109.4	111.2	113.0	114.8	116.6	118.4	120.2
50	122.0	123.8	125.6	127.4	129.2	131.0	132.8	134.6	136.4	138.2
60	140.0	141.8	143.6	145.4	147.2	149.0	150.8	152.6	154.4	156.2
70	158.0	159.8	161.6	163.4	165.2	167.0	168.8	170.6	172.4	174.2
80	176.0	177.8	179.6	181.4	183.2	185.0	186.8	188.6	190.4	192.2
90	194.0	195.8	197.6	199.4	201.2	203.0	204.8	206.6	208.4	210.2
100	212.0	213.8	215.6	217.4	219.2	221.0	222.8	224.6	226.4	228.2
110	230.0	231.8	233.6	235.4	237.2	239.0	240.8	242.6	244.4	246.2
120	248.0	249.8	251.6	253.4	255.2	257.0	258.8	260.6	262.4	264.2
130	266.0	267.8	269.6	271.4	273.2	275.0	276.8	278.6	280.4	282.2
140	284.0	285.8	287.6	289.4	291.2	293.0	294.8	296.6	298.4	300.2
150	302.0	303.8	305.6	307.4	309.2	311.0	312.8	314.6	316.4	318.2
160	320.0	321.8	323.6	325.4	327.2	329.0	330.8	332.6	334.4	336.2
170	338.0	339.8	341.6	343.4	345.2	347.0	348.8	350.6	352.4	354.2
180	356.0	357.8	359.6	361.4	363.2	365.0	366.8	368.6	370.4	372.2
190	374.0	375.8	377.6	379.4	381.2	383.0	384.8	386.6	388.4	390.2

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
200	392.0	393.8	395.6	397.4	399.2	401.0	402.8	404.6	406.4	408.2
210	410.0	411.8	413.6	415.4	417.2	419.0	420.8	422.6	424.4	426.2
220	428.0	429.8	431.6	433.4	435.2	437.0	438.8	440.6	442.4	444.2
230	446.0	447.8	449.6	451.4	453.2	455.0	456.8	458.6	460.4	462.2
240	464.0	465.8	467.6	469.4	471.2	473.0	474.8	476.6	478.4	480.2
250	482.0	483.8	485.6	487.4	489.2	491.0	492.8	494.6	496.4	498.2
260	500.0	501.8	503.6	505.4	507.2	509.0	510.8	512.6	514.4	516.2
270	518.0	519.8	521.6	523.4	525.2	527.0	528.8	530.6	532.4	534.2
280	536.0	537.8	539.6	541.4	543.2	545.0	546.8	548.6	550.4	552.2
290	554.0	555.8	557.6	559.4	561.2	563.0	564.8	566.6	568.4	570.2
300	572.0	573.8	575.6	577.4	579.2	581.0	582.8	584.6	586.4	588.2
310	590.0	591.8	593.6	595.4	597.2	599.0	600.8	602.6	604.4	606.2
320	608.0	609.8	611.6	613.4	615.2	617.0	618.8	620.6	622.4	624.2
330	626.0	627.8	629.6	631.4	633.2	635.0	636.8	638.6	640.4	642.2
340	644.0	645.8	647.6	649.4	651.2	653.0	654.8	656.6	658.4	660.2
350	662.0	663.8	665.6	667.4	669.2	671.0	672.8	674.6	676.4	678.2
360	680.0	681.8	683.6	685.4	687.2	689.0	690.8	692.6	694.4	696.2
370	698.0	699.8	701.6	703.4	705.2	707.0	708.8	710.6	712.4	714.2
380	716.0	717.8	719.6	721.4	723.2	725.0	726.8	728.6	730.4	732.2
390	734.0	735.8	737.6	739.4	741.2	743.0	744.8	746.6	748.4	750.2

For interpolation										
°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
400	752.0	753.8	755.6	757.4	759.2	761.0	762.8	764.6	766.4	768.2
410	770.0	771.8	773.6	775.4	777.2	779.0	780.8	782.6	784.4	786.2
420	788.0	789.8	791.6	793.4	795.2	797.0	798.8	800.6	802.4	804.2
430	806.0	807.8	809.6	811.4	813.2	815.0	816.8	818.6	820.4	822.2
440	824.0	825.8	827.6	829.4	831.2	833.0	834.8	836.6	838.4	840.2
450	842.0	843.8	845.6	847.4	849.2	851.0	852.8	854.6	856.4	858.2
460	860.0	861.8	863.6	865.4	867.2	869.0	870.8	872.6	874.4	876.2
470	878.0	879.8	881.6	883.4	885.2	887.0	888.8	890.6	892.4	894.2
480	896.0	897.8	899.6	901.4	903.2	905.0	906.8	908.6	910.4	912.2
490	914.0	915.8	917.6	919.4	921.2	923.0	924.8	926.6	928.4	930.2
500	932.0	933.8	935.6	937.4	939.2	941.0	942.8	944.6	946.4	948.2
510	950.0	951.8	953.6	955.4	957.2	959.0	960.8	962.6	964.4	966.2
520	968.0	969.8	971.6	973.4	975.2	977.0	978.8	980.6	982.4	984.2
530	986.0	987.8	989.6	991.4	993.2	995.0	996.8	998.6	1000.4	1002.2
540	1004.0	1005.8	1007.6	1009.4	1011.2	1013.0	1014.8	1016.6	1018.4	1020.2
550	1022.0	1023.8	1025.6	1027.4	1029.2	1031.0	1032.8	1034.6	1036.4	1038.2
560	1040.0	1041.8	1043.6	1045.4	1047.2	1049.0	1050.8	1052.6	1054.4	1056.2
570	1058.0	1059.8	1061.6	1063.4	1065.2	1067.0	1068.8	1070.6	1072.4	1074.2
580	1076.0	1077.8	1079.6	1081.4	1083.2	1085.0	1086.8	1088.6	1090.4	1092.2
590	1094.0	1095.8	1097.6	1099.4	1101.2	1103.0	1104.8	1106.6	1108.4	1110.2

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
600	1112.0	1113.8	1115.6	1117.4	1119.2	1121.0	1122.8	1124.6	1126.4	1128.2
610	1130.0	1131.8	1133.6	1135.4	1137.2	1139.0	1140.8	1142.6	1144.4	1146.2
620	1148.0	1149.8	1151.6	1153.4	1155.2	1157.0	1158.8	1160.6	1162.4	1164.2
630	1166.0	1167.8	1169.6	1171.4	1173.2	1175.0	1176.8	1178.6	1180.4	1182.2
640	1184.0	1185.8	1187.6	1189.4	1191.2	1193.0	1194.8	1196.6	1198.4	1200.2
650	1202.0	1203.8	1205.6	1207.4	1209.2	1211.0	1212.8	1214.6	1216.4	1218.2
660	1220.0	1221.8	1223.6	1225.4	1227.2	1229.0	1230.8	1232.6	1234.4	1236.2
670	1238.0	1239.8	1241.6	1243.4	1245.2	1247.0	1248.8	1250.6	1252.4	1254.2
680	1256.0	1257.8	1259.6	1261.4	1263.2	1265.0	1266.8	1268.6	1270.4	1272.2
690	1274.0	1275.8	1277.6	1279.4	1281.2	1283.0	1284.8	1286.6	1288.4	1290.2
700	1292.0	1293.8	1295.6	1297.4	1299.2	1301.0	1302.8	1304.6	1306.4	1308.2
710	1310.0	1311.8	1313.6	1315.4	1317.2	1319.0	1320.8	1322.6	1324.4	1326.2
720	1328.0	1329.8	1331.6	1333.4	1335.2	1337.0	1338.8	1340.6	1342.4	1344.2
730	1346.0	1347.8	1349.6	1351.4	1353.2	1355.0	1356.8	1358.6	1360.4	1362.2
740	1364.0	1365.8	1367.6	1369.4	1371.2	1373.0	1374.8	1376.6	1378.4	1380.2
750	1382.0	1383.8	1385.6	1387.4	1389.2	1391.0	1392.8	1394.6	1396.4	1398.2
760	1400.0	1401.8	1403.6	1405.4	1407.2	1409.0	1410.8	1412.6	1414.4	1416.2
770	1418.0	1419.8	1421.6	1423.4	1426.2	1427.0	1428.8	1430.6	1432.4	1434.2
780	1436.0	1437.8	1439.6	1441.4	1443.2	1445.0	1446.8	1448.6	1450.4	1452.2
790	1454.0	1455.8	1457.6	1459.4	1461.2	1463.0	1464.8	1466.6	1468.4	1470.2

For interpolation										
°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
800	1472.0	1473.8	1475.6	1477.4	1479.2	1481.0	1482.8	1484.6	1486.4	1488.2
810	1490.0	1491.8	1493.6	1496.4	1497.2	1499.0	1500.8	1502.6	1504.4	1506.2
820	1508.0	1509.9	1511.6	1513.4	1515.2	1517.0	1518.8	1520.6	1522.4	1524.2
830	1526.0	1527.8	1529.6	1531.4	1533.2	1535.0	1536.8	1538.6	1540.4	1542.2
840	1544.0	1545.8	1547.6	1549.4	1551.2	1553.0	1554.8	1556.6	1558.4	1560.2
850	1562.0	1563.8	1565.6	1567.4	1569.2	1571.0	1572.8	1574.6	1576.4	1578.2
860	1580.0	1581.8	1583.6	1585.4	1587.2	1589.0	1590.8	1592.6	1594.4	1596.2
870	1598.0	1599.8	1601.6	1603.4	1605.2	1607.0	1608.8	1610.6	1612.4	1614.2
880	1616.0	1617.8	1619.6	1621.4	1623.2	1625.0	1626.8	1628.6	1630.4	1632.2
890	1634.0	1635.8	1637.6	1639.4	1641.2	1643.0	1644.8	1646.6	1648.4	1650.2
900	1652.0	1653.8	1655.6	1657.4	1659.2	1661.0	1662.8	1664.6	1666.4	1668.2
910	1670.0	1671.8	1673.6	1675.4	1677.2	1679.0	1680.8	1682.6	1684.4	1686.2
920	1688.0	1689.8	1691.6	1693.4	1695.2	1697.0	1698.8	1700.6	1702.4	1704.2
930	1706.0	1707.8	1709.6	1711.4	1713.2	1715.0	1716.8	1718.6	1720.4	1722.2
940	1724.0	1725.8	1727.6	1729.4	1731.2	1733.0	1734.8	1736.6	1738.4	1740.2
950	1742.0	1743.8	1745.6	1747.4	1749.2	1751.0	1752.8	1754.6	1756.4	1758.2
960	1760.0	1761.8	1763.6	1765.4	1767.2	1769.0	1770.8	1772.6	1774.4	1776.2
970	1778.0	1779.8	1781.6	1783.4	1785.2	1787.0	1788.8	1790.6	1792.4	1794.2
980	1796.0	1797.8	1799.6	1801.4	1803.2	1805.0	1806.8	1806.6	1810.4	1812.2
990	1814.0	1815.8	1817.6	1819.4	1821.2	1823.0	1824.8	1826.6	1828.4	1830.2

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
1000	1832.0	1833.8	1835.6	1837.4	1839.2	1841.0	1842.8	1844.6	1846.4	1848.2
1010	1850.0	1851.8	1853.6	1855.4	1857.2	1859.0	1860.8	1862.6	1864.4	1866.2
1020	1868.0	1869.8	1871.6	1873.4	1875.2	1877.0	1878.8	1880.6	1882.4	1884.2
1030	1886.0	1887.8	1889.6	1891.4	1893.2	1895.0	1896.8	1898.6	1900.4	1902.2
1040	1904.0	1905.8	1907.6	1909.4	1911.2	1913.0	1914.8	1916.6	1918.4	1920.2
1050	1922.0	1923.8	1925.6	1927.4	1929.2	1931.0	1932.8	1934.6	1936.4	1938.2
1060	1940.0	1941.8	1943.6	1945.4	1947.2	1949.0	1950.8	1952.6	1954.4	1956.2
1070	1958.0	1959.8	1961.6	1963.4	1965.2	1967.0	1968.8	1970.6	1972.4	1974.2
1080	1976.0	1977.8	1979.6	1981.4	1983.2	1985.0	1986.8	1988.6	1990.4	1992.2
1090	1994.0	1995.8	1997.6	1999.4	2001.2	2003.0	2004.8	2006.6	2008.4	2010.2
1100	2012.0	2013.8	2015.6	2017.4	2019.2	2021.0	2022.8	2024.6	2026.4	2028.2
1110	2030.0	2031.8	2033.6	2035.4	2037.2	2039.0	2040.8	2042.6	2044.4	2046.2
1120	2048.0	2049.8	2051.6	2053.4	2055.2	2057.0	2058.8	2060.6	2062.4	2064.2
1130	2066.0	2067.8	2069.6	2071.4	2073.2	2075.0	2076.8	2078.6	2080.4	2082.2
1140	2084.0	2085.8	2087.6	2089.4	2091.2	2093.0	2094.8	2096.6	2098.4	2100.2
1150	2102.0	2103.8	2105.6	2107.4	2109.2	2111.0	2112.8	2114.6	2116.4	2118.2
1160	2120.0	2121.8	2123.6	2125.4	2127.2	2129.0	2130.8	2132.6	2134.4	2136.2
1170	2138.0	2139.8	2141.6	2143.4	2145.2	2147.0	2148.8	2150.6	2152.4	2154.2
1180	2156.0	2157.8	2159.6	2161.4	2163.2	2165.0	2166.8	2168.6	2170.4	2172.2
1190	2174.0	2175.8	2177.6	2179.4	2181.2	2183.0	2184.8	2186.6	2188.4	2190.2

For interpolation											
	°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
	°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
1200	2192.0	2193.8	2195.6	2197.4	2199.2	2201.0	2202.8	2204.6	2206.4	2208.2
1210	2210.0	2211.8	2213.6	2215.4	2217.2	2219.0	2220.8	2222.6	2224.4	2226.2
1220	2228.0	2229.8	2231.6	2233.4	2235.2	2237.0	2238.8	2240.6	2242.4	2244.2
1230	2246.0	2247.8	2249.6	2251.4	2253.2	2255.0	2256.8	2258.6	2260.4	2262.2
1240	2264.0	2265.8	2267.6	2269.4	2271.2	2273.0	2274.8	2276.6	2278.4	2280.2
1250	2282.0	2283.8	2285.6	2287.4	2289.2	2291.0	2292.8	2294.6	2296.4	2298.2
1260	2300.0	2301.8	2303.6	2305.4	2307.2	2309.0	2310.8	2312.6	2314.4	2316.2
1270	2318.0	2319.8	2321.6	2323.4	2325.2	2327.0	2328.8	2330.6	2332.4	2334.2
1280	2336.0	2337.8	2339.6	2341.4	2343.2	2345.0	2346.8	2348.6	2350.4	2352.2
1290	2354.0	2355.8	2357.6	2359.4	2361.2	2363.0	2364.8	2366.6	2368.4	2370.2
1300	2372.0	2373.8	2375.6	2377.4	2379.2	2381.0	2382.8	2384.6	2386.4	2388.2
1310	2390.0	2391.8	2393.6	2395.4	2397.2	2399.0	2400.8	2402.6	2404.4	2406.2
1320	2408.0	2409.8	2411.6	2413.4	2415.2	2417.0	2418.8	2420.6	2422.4	2424.2
1330	2426.0	2427.8	2429.6	2431.4	2433.2	2435.0	2436.8	2438.6	2440.4	2442.2
1340	2444.0	2445.8	2447.6	2449.4	2451.2	2453.0	2454.8	2456.6	2458.4	2460.2
1350	2462.0	2463.8	2465.6	2467.4	2469.2	2471.0	2472.8	2474.6	2476.4	2478.2
1360	2480.0	2481.8	2483.6	2485.4	2487.2	2489.0	2490.8	2492.6	2494.4	2496.2
1370	2498.0	2499.8	2501.6	2503.4	2505.2	2507.0	2508.8	2510.6	2512.4	2514.2
1380	2516.0	2517.8	2519.6	2521.4	2523.2	2525.0	2526.8	2528.6	2530.4	2532.2
1390	2534.0	2535.8	2537.6	2539.4	2541.2	2543.0	2544.8	2546.6	2548.4	2550.2

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
1400	2552.0	2553.8	2555.6	2557.4	2559.2	2561.0	2562.8	2564.6	2566.4	2568.2
1410	2570.0	2571.8	2573.6	2575.4	2577.2	2579.0	2580.8	2582.6	2584.4	2586.2
1420	2583.0	2589.8	2591.6	2593.4	2595.2	2597.0	2598.8	2600.6	2602.4	2604.2
1430	2606.0	2607.8	2609.6	2611.4	2613.2	2615.0	2616.8	2618.6	2620.4	2622.2
1440	2624.0	2625.8	2627.6	2629.4	2631.2	2633.0	2634.8	2636.6	2638.4	2640.2
1450	2642.0	2643.8	2645.6	2647.4	2649.2	2651.0	2652.8	2654.6	2656.4	2658.2
1460	2660.0	2661.8	2663.6	2665.4	2667.2	2669.0	2670.8	2672.6	2674.4	2676.2
1470	2678.0	2679.8	2681.6	2683.4	2685.2	2687.0	2688.8	2690.6	2692.4	2694.2
1480	2696.0	2697.8	2699.6	2701.4	2703.2	2705.0	2706.8	2708.6	2710.4	2712.2
1490	2714.0	2715.8	2717.6	2719.4	2721.2	2723.0	2724.8	2726.6	2728.4	2730.2
1500	2732.0	2733.8	2735.6	2737.4	2739.2	2741.0	2742.8	2744.6	2746.4	2748.2
1510	2750.0	2751.8	2753.6	2755.4	2757.2	2759.0	2760.8	2762.6	2764.4	2766.2
1520	2768.0	2769.8	2771.6	2773.4	2775.2	2777.0	2778.8	2780.6	2782.4	2784.2
1530	2786.0	2787.8	2789.6	2791.4	2793.2	2795.0	2796.8	2798.6	2800.4	2802.2
1540	2804.0	2805.8	2807.6	2809.4	2811.2	2813.0	2814.8	2816.6	2818.4	2820.2
1550	2822.0	2823.8	2825.6	2827.4	2829.2	2831.0	2832.8	2834.6	2836.4	2838.2
1560	2840.0	2841.8	2843.6	2845.4	2847.2	2849.0	2850.8	2852.6	2854.4	2856.2
1570	2858.0	2859.8	2861.6	2863.4	2865.2	2867.0	2868.8	2870.6	2872.4	2874.2
1580	2876.0	2877.8	2879.6	2881.4	2883.2	2885.0	2886.8	2888.6	2890.4	2892.2
1590	2894.0	2895.8	2897.6	2899.4	2901.2	2903.0	2904.8	2906.6	2908.4	2910.2

For interpolation										
°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
1600	2912.0	2913.8	2915.6	2917.4	2919.2	2921.0	2922.8	2924.6	2926.4	2928.2
1610	2930.0	2931.8	2933.6	2935.4	2937.2	2939.0	2940.8	2942.6	2944.4	2946.2
1620	2948.0	2949.8	2951.6	2953.4	2955.2	2957.0	2958.8	2960.6	2962.4	2964.2
1630	2966.0	2967.8	2969.6	2971.4	2973.2	2975.0	2976.8	2978.6	2980.4	2982.2
1640	2984.0	2985.8	2987.6	2989.4	2991.2	2993.0	2994.8	2996.6	2998.4	3000.2
1650	3002.0	3003.8	3005.6	3007.4	3009.2	3011.0	3012.8	3014.6	3016.4	3018.2
1660	3020.0	3021.8	3023.6	3025.4	3027.2	3029.0	3030.8	3032.6	3034.4	3036.2
1670	3038.0	3039.8	3041.6	3043.4	3045.2	3047.0	3048.8	3050.6	3052.4	3054.2
1680	3056.0	3057.8	3059.6	3061.4	3063.2	3065.0	3066.8	3068.6	3070.4	3072.2
1690	3074.0	3075.8	3077.6	3079.4	3081.2	3083.0	3084.8	3086.6	3088.4	3090.2
1700	3092.0	3093.8	3095.6	3097.4	3099.2	3101.0	3102.8	3104.6	3106.4	3108.2
1710	3110.0	3111.8	3113.6	3115.4	3117.2	3119.0	3120.8	3122.6	3124.4	3126.2
1720	3128.0	3129.8	3131.6	3133.4	3135.2	3137.0	3138.8	3140.6	3142.4	3144.2
1730	3146.0	3147.8	3149.6	3151.4	3153.2	3155.0	3156.8	3158.6	3160.4	3162.2
1740	3164.0	3165.8	3167.6	3169.4	3171.2	3173.0	3174.8	3176.6	3178.4	3180.2
1750	3182.0	3183.8	3185.6	3187.4	3189.2	3191.0	3192.8	3194.6	3196.4	3198.2
1760	3200.0	3201.8	3203.6	3205.4	3207.2	3209.0	3210.8	3212.6	3214.4	3216.2
1770	3218.0	3219.8	3221.6	3223.4	3225.2	3227.0	3228.8	3230.6	3232.4	3234.2
1780	3236.0	3237.8	3239.6	3241.4	3243.2	3245.0	3246.8	3248.6	3250.4	3252.2
1790	3254.0	3255.8	3257.6	3259.4	3261.2	3263.0	3264.8	3266.6	3268.4	3270.2

TEMPERATURES—CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
1800	3272.0	3273.8	3275.6	3277.4	3279.2	3281.0	3282.8	3284.6	3286.4	3288.2
1810	3290.0	3291.8	3293.6	3295.4	3297.2	3299.0	3300.8	3302.6	3304.4	3306.2
1820	3308.0	3309.8	3311.6	3313.4	3315.2	3317.0	3318.8	3320.6	3322.4	3324.2
1830	3326.0	3327.8	3329.6	3331.4	3333.2	3335.0	3336.8	3338.6	3340.4	3342.2
1840	3344.0	3345.8	3347.6	3349.4	3351.2	3353.0	3354.8	3356.6	3358.4	3360.2
1850	3362.0	3363.8	3365.6	3367.4	3369.2	3371.0	3372.8	3374.6	3376.4	3378.2
1860	3380.0	3381.8	3383.6	3385.4	3387.2	3389.0	3390.8	3392.6	3394.4	3396.2
1870	3398.0	3399.8	3401.6	3403.4	3405.2	3407.0	3408.8	3410.6	3412.4	3414.2
1880	3416.0	3417.8	3419.6	3421.4	3423.2	3425.0	3426.8	3428.6	3430.4	3432.2
1890	3434.0	3435.8	3437.6	3439.4	3441.2	3443.0	3444.8	3446.6	3448.4	3450.2
1900	3452.0	3453.8	3455.6	3457.4	3459.2	3461.0	3462.8	3464.6	3466.4	3468.2
1910	3470.0	3471.8	3473.6	3475.4	3477.2	3479.0	3480.8	3482.6	3484.4	3486.2
1920	3488.0	3489.8	3491.6	3493.4	3495.2	3497.0	3498.8	3500.6	3502.4	3504.2
1930	3506.0	3507.8	3509.6	3511.4	3513.2	3515.0	3516.8	3518.6	3520.4	3522.2
1940	3424.0	3525.8	3527.6	3529.4	3531.2	3533.0	3534.8	3536.6	3538.4	3540.2
1950	3542.0	3543.8	3545.6	3547.4	3549.2	3551.0	3552.8	3554.6	3556.4	3558.2
1960	3560.0	3561.8	3563.6	3565.4	3567.2	3569.0	3570.8	3572.6	3574.4	3576.2
1970	3578.0	3579.8	3581.6	3583.4	3585.2	3587.0	3588.8	3590.6	3592.4	3594.2
1980	3596.0	3597.8	3599.6	3601.4	3603.2	3605.0	3606.8	3608.6	3610.4	3612.2
1990	3614.0	3615.8	3617.6	3619.4	3621.2	3623.0	3624.8	3626.6	3628.4	3630.2

For interpolation										
°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2000	3632.0	3633.8	3635.6	3637.4	3639.2	3641.0	3642.8	3644.6	3646.4	3648.2
2010	3650.0	3651.8	3653.6	3655.4	3657.2	3659.0	3660.8	3662.6	3664.4	3666.2
2020	3668.0	3669.8	3671.6	3673.4	3675.2	3677.0	3678.8	3680.6	3682.4	3684.2
2030	3686.0	3687.8	3689.6	3691.4	3693.2	3695.0	3696.8	3698.6	3700.4	3702.2
2040	3704.0	3705.8	3707.6	3709.4	3711.2	3713.0	3714.8	3716.6	3718.4	3720.2
2050	3722.0	3723.8	3725.6	3727.4	3729.2	3731.0	3732.8	3734.6	3736.4	3738.2
2060	3740.0	3741.8	3743.6	3745.4	3747.2	3749.0	3750.8	3752.6	3754.4	3756.2
2070	3758.0	3759.8	3761.6	3763.4	3765.2	3767.0	3768.8	3770.6	3772.4	3774.2
2080	3776.0	3777.8	3779.6	3781.4	3783.2	3785.0	3786.8	3788.6	3790.4	3792.2
2090	3794.0	3795.8	3797.6	3799.4	3801.2	3803.0	3804.8	3806.6	3808.4	3810.2
2100	3812.0	3813.8	3815.6	3817.4	3819.2	3821.0	3822.8	3824.6	3826.4	3828.2
2110	3830.0	3831.8	3833.6	3835.4	3837.2	3839.0	3840.8	3842.6	3844.4	3846.2
2120	3848.0	3849.8	3851.6	3853.4	3855.2	3857.0	3858.8	3860.6	3862.4	3864.2
2130	3866.0	3867.8	3869.6	3871.4	3873.2	3875.0	3876.8	3878.6	3880.4	3882.2
2140	3884.0	3885.8	3887.6	3889.4	3891.2	3893.0	3894.8	3896.6	3898.4	3900.2
2150	3902.0	3903.8	3905.6	3907.4	3909.2	3911.0	3912.8	3914.6	3916.4	3918.2
2160	3920.0	3921.8	3923.6	3925.4	3927.2	3929.0	3930.8	3932.6	3934.4	3936.2
2170	3938.0	3939.8	3941.6	3943.4	3945.2	3947.0	3948.8	3950.6	3952.4	3954.2
2180	3956.0	3957.8	3959.6	3961.4	3963.2	3965.0	3966.8	3968.6	3970.4	3972.2
2190	3974.0	3975.8	3977.6	3979.4	3981.2	3983.0	3984.8	3986.6	3988.4	3990.2

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2200	3992.0	3993.8	3995.6	3997.4	3999.2	4001.0	4002.8	4004.6	4006.4	4008.2
2210	4010.0	4011.8	4013.6	4015.4	4017.2	4019.0	4020.8	4022.6	4024.4	4026.2
2220	4028.0	4029.8	4031.6	4033.4	4035.2	4037.0	4038.8	4040.6	4042.4	4044.2
2230	4046.0	4047.8	4049.6	4051.4	4053.2	4055.0	4056.8	4058.6	4060.4	4062.2
2240	4064.0	4065.8	4067.6	4069.4	4071.2	4073.0	4074.8	4076.6	4078.4	4080.2
2250	4082.0	4083.8	4085.6	4087.4	4089.2	4091.0	4092.8	4094.6	4096.4	4098.2
2260	4100.0	4101.8	4103.6	4105.4	4107.2	4109.0	4110.8	4112.6	4114.4	4116.2
2270	4118.0	4119.8	4121.6	4123.4	4125.2	4127.0	4128.8	4130.6	4132.4	4134.2
2280	4136.0	4137.8	4139.6	4141.4	4143.2	4145.0	4146.8	4148.6	4150.4	4152.2
2290	4154.0	4155.8	4157.6	4159.4	4161.2	4163.0	4164.8	4166.6	4168.4	4170.2
2300	4172.0	4173.8	4175.6	4177.4	4179.2	4181.0	4182.8	4184.6	4186.4	4188.2
2310	4190.0	4191.8	4193.6	4195.4	4197.2	4199.0	4200.8	4202.6	4204.4	4206.2
2320	4208.0	4209.8	4211.6	4213.4	4215.2	4217.0	4218.8	4220.6	4222.4	4224.2
2330	4226.0	4227.8	4229.6	4231.4	4233.2	4235.0	4236.8	4238.6	4240.4	4242.2
2340	4244.0	4245.8	4247.6	4249.4	4251.2	4253.0	4254.8	4256.6	4258.4	4260.2
2350	4262.0	4263.8	4265.6	4267.4	4269.2	4271.0	4272.8	4274.6	4276.4	4278.2
2360	4280.0	4281.8	4383.6	4285.4	4287.2	4289.0	4290.8	4292.6	4294.4	4296.2
2370	4298.0	4299.8	4301.6	4303.4	4305.2	4307.0	4308.8	4310.6	4312.4	4314.2
2380	4316.0	4317.8	4319.6	4321.4	4323.2	4325.0	4326.8	4328.6	4330.4	4332.2
2390	4334.0	4335.8	4337.6	4339.4	4341.2	4343.0	4344.8	4346.6	4348.4	4350.2

For interpolation										
°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2400	4352.0	4353.8	4355.6	4357.4	4359.2	4361.0	4362.8	4364.6	4366.4	4368.2
2410	4370.0	4371.8	4373.6	4375.4	4377.2	4379.0	4380.8	4382.6	4384.4	4386.2
2420	4388.0	4389.8	4391.6	4393.4	4395.2	4397.0	4398.8	4400.6	4402.4	4404.2
2430	4406.0	4407.8	4409.6	4411.4	4413.2	4415.0	4416.8	4418.6	4420.4	4422.2
2440	4424.0	4425.8	4427.6	4429.4	4431.2	4433.0	4434.8	4436.6	4438.4	4440.2
2450	4442.0	4443.8	4445.6	4447.4	4449.2	4451.0	4452.8	4454.6	4456.4	4458.2
2460	4460.0	4461.8	4463.6	4465.4	4467.2	4469.0	4470.8	4472.6	4474.4	4476.2
2470	4478.0	4479.8	4481.6	4483.4	4485.2	4487.0	4488.8	4490.6	4492.4	4494.2
2480	4496.0	4497.8	4499.6	4501.4	4503.2	4505.0	4506.8	4508.6	4510.4	4512.2
2490	4514.0	4515.8	4517.6	4519.4	4521.2	4523.0	4524.8	4526.6	4528.4	4530.2
2500	4532.0	4533.8	4535.6	4537.4	4539.2	4541.0	4542.8	4544.6	4546.4	4548.2
2510	4550.0	4551.8	4553.6	4555.4	4557.2	4559.0	4560.8	4562.6	4564.4	4566.2
2520	4568.0	4569.8	4571.6	4573.4	4575.2	4577.0	4578.8	4580.6	4582.4	4584.2
2530	4586.0	4587.8	4589.6	4591.4	4593.2	4595.0	4596.8	4598.6	4600.4	4602.2
2540	4604.0	4605.8	4607.6	4609.4	4611.2	4613.0	4614.8	4616.6	4618.4	4620.2
2550	4622.0	4623.8	4625.6	4627.4	4629.2	4631.0	4632.8	4634.6	4636.4	4638.2
2560	4640.0	4641.8	4643.6	4645.4	4647.2	4649.0	4650.8	4652.6	4654.4	4656.2
2570	4658.0	4659.8	4661.6	4663.4	4665.2	4667.0	4668.8	4670.6	4672.4	4674.2
2580	4676.0	4677.8	4679.6	4681.4	4683.2	4685.0	4686.8	4688.6	4690.4	4692.2
2590	4694.0	4695.8	4697.6	4699.4	4701.2	4703.0	4704.8	4706.6	4708.4	4710.2

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2600	4712.0	4713.8	4715.6	4717.4	4719.2	4721.0	4722.8	4724.6	4726.4	4728.2
2610	4730.0	4731.8	4733.6	4735.4	4737.2	4739.0	4740.8	4742.6	4744.4	4746.2
2620	4748.0	4749.8	4751.6	4753.4	4755.2	4757.0	4758.8	4760.6	4762.4	4764.2
2630	4766.0	4767.8	4769.6	4771.4	4773.2	4775.0	4776.8	4778.6	4780.4	4782.2
2640	4784.0	4785.8	4787.6	4789.4	4791.2	4793.0	4794.8	4796.6	4798.4	4800.2
2650	4802.0	4803.8	4805.6	4807.4	4809.2	4811.0	4812.8	4814.6	4816.4	4818.2
2660	4820.0	4821.8	4823.6	4825.4	4827.2	4829.0	4830.8	4832.6	4834.4	4836.2
2670	4838.0	4839.8	4841.6	4843.4	4845.2	4847.0	4848.8	4850.6	4852.4	4854.2
2680	4856.0	4857.8	4859.6	4861.4	4863.2	4865.0	4866.8	4868.6	4870.4	4872.2
2690	4874.0	4875.8	4877.6	4879.4	4881.2	4883.0	4884.8	4886.6	4888.4	4890.2
2700	4892.0	4893.8	4895.6	4897.4	4899.2	4901.0	4902.8	4904.6	4906.4	4908.2
2710	4910.0	4911.8	4913.6	4915.4	4917.2	4919.0	4920.8	4922.6	4924.4	4926.2
2720	4928.0	4929.8	4931.6	4933.4	4935.2	4937.0	4938.8	4940.6	4942.4	4944.2
2730	4946.0	4947.8	4949.6	4951.4	4953.2	4955.0	4956.8	4958.6	4960.4	4962.2
2740	4964.0	4965.8	4967.6	4969.4	4971.2	4973.0	4974.8	4976.6	4978.4	4980.2
2750	4982.0	4983.8	4985.6	4987.4	4989.2	4991.0	4992.8	4994.6	4996.4	4998.2
2760	5000.0	5001.8	5003.6	5005.4	5007.2	5009.0	5010.8	5012.6	5014.4	5016.2
2770	5018.0	5019.8	5021.6	5023.4	5025.2	5027.0	5028.8	5030.6	5032.4	5034.2
2780	5036.0	5037.8	5039.6	5041.4	5043.2	5045.0	5046.8	5048.6	5050.4	5052.2
2790	5054.0	5055.8	5057.6	5059.4	5061.2	5063.0	5064.8	5066.6	5068.4	5070.2

For interpolation										
	°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
	°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2800	5072.0	5073.8	5075.6	5077.4	5079.2	5081.0	5082.8	5084.6	5086.4	5088.2
2810	5090.0	5091.8	5093.6	5095.4	5097.2	5099.0	5100.8	5102.6	5104.4	5106.2
2820	5108.0	5109.8	5111.6	5113.4	5115.2	5117.0	5118.8	5120.6	5122.4	5124.2
2830	5126.0	5127.8	5129.6	5131.4	5133.2	5135.0	5136.8	5138.6	5140.4	5142.2
2840	5144.0	5145.8	5147.6	5149.4	5151.2	5153.0	5154.8	5156.6	5158.4	5160.2
2850	5162.0	5163.8	5165.6	5167.4	5169.2	5171.0	5172.8	5174.6	5176.4	5178.2
2860	5180.0	5181.8	5183.6	5185.4	5187.2	5189.0	5190.8	5192.6	5194.4	5196.2
2870	5198.0	5199.8	5201.6	5203.4	5205.2	5207.0	5208.8	5210.6	5212.4	5214.2
2880	5216.0	5217.8	5219.6	5221.4	5223.2	5225.0	5226.8	5228.6	5230.4	5232.2
2890	5234.0	5235.8	5237.6	5239.4	5241.2	5243.0	5244.8	5246.6	5248.4	5250.2
2900	5252.0	5253.8	5255.6	5257.4	5259.2	5261.0	5262.8	5264.6	5266.4	5268.2
2910	5270.0	5271.8	5273.6	5275.4	5277.2	5279.0	5280.8	5282.6	5284.4	5286.2
2920	5288.0	5289.8	5291.6	5293.4	5295.2	5297.0	5298.8	5300.6	5302.4	5304.2
2930	5306.0	5307.8	5309.6	5311.4	5313.2	5315.0	5316.8	5318.6	5320.4	5322.2
2940	5324.0	5325.8	5327.6	5329.4	5331.2	5333.0	5334.8	5336.6	5338.4	5340.2
2950	5342.0	5343.8	5345.6	5347.4	5349.2	5351.0	5352.8	5354.6	5356.4	5358.2
2960	5360.0	5361.8	5363.6	5365.4	5367.2	5369.0	5370.8	5372.6	5374.4	5376.2
2970	5378.0	5379.8	5381.6	5383.4	5385.2	5387.0	5388.8	5390.6	5392.4	5394.2
2980	5396.0	5397.8	5399.6	5401.4	5403.2	5405.0	5406.8	5408.6	5410.4	5412.2
2990	5414.0	5415.8	5417.6	5419.4	5421.2	5423.0	5424.8	5426.6	5428.4	5430.2

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Concluded)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
3000	5432.0	5433.8	5435.6	5437.4	5439.2	5441.0	5442.8	5444.6	5446.4	5448.2
3010	5450.0	5451.8	5453.6	5455.4	5457.2	5459.0	5460.8	5462.6	5464.4	5466.2
3020	5468.0	5469.8	5471.6	5473.4	5475.2	5477.0	5478.8	5480.6	5482.4	5484.2
3030	5486.0	5487.8	5489.6	5491.4	5493.2	5495.0	5496.8	5498.6	5500.4	5502.2
3040	5504.0	5505.8	5507.6	5509.4	5511.2	5513.0	5514.8	5516.6	5518.4	5520.2
3050	5522.0	5523.8	5525.6	5527.4	5529.2	5531.0	5532.8	5534.6	5536.4	5538.2
3060	5540.0	5541.8	5543.6	5545.4	5547.2	5549.0	5550.8	5552.6	5554.4	5556.2
3070	5558.0	5559.8	5561.6	5563.4	5565.2	5567.0	5568.8	5570.6	5572.4	5574.2
3080	5576.0	5577.8	5579.6	5581.4	5583.2	5585.0	5586.8	5588.6	5590.4	5592.2
3090	5594.0	5595.8	5597.6	5599.4	5601.2	5603.0	5604.8	5606.6	5608.4	5610.2

For interpolation										
°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — FAHRENHEIT TO CENTIGRADE

Conversion Table

The values in the body of the table give in degrees Centigrade the temperatures indicated in degrees Fahrenheit at the top and side.

1° F. = 0.5556° C.

Temperatures below 0° F.

Temp. ° F.	0	1	2	3	4	5	6	7	8	9
0	− 17.78	18.33	18.89	19.44	20.00	20.56	21.11	21.67	22.22	22.78
− 10	− 23.33	23.89	24.44	25.00	25.56	26.11	26.67	27.22	27.78	28.33
− 20	− 28.89	29.44	30.00	30.56	31.11	31.67	32.22	32.78	33.33	33.89
− 30	− 34.44	35.00	35.56	36.11	36.67	37.22	37.78	38.33	38.89	39.44
− 40	− 40.00	40.56	41.11	41.67	42.22	42.78	43.33	43.89	44.44	45.00
− 50	− 45.56	46.11	46.67	47.22	47.78	48.33	48.89	49.44	50.00	50.56
− 60	− 51.11	51.67	52.22	52.78	53.33	53.89	54.44	55.00	55.56	56.11
− 70	− 56.67	57.22	57.78	58.33	58.89	59.44	60.00	60.56	61.11	61.67
− 80	− 62.22	62.78	63.33	63.89	64.44	65.00	65.56	66.11	66.67	67.22
− 90	− 67.78	68.33	68.89	69.44	70.00	70.56	71.11	71.67	72.22	72.78

TEMPERATURES—FAHRENHEIT TO CENTIGRADE (Continued)

Temp. ° F.	0	1	2	3	4	5	6	7	8	9
−100	−73.33	73.89	74.44	75.00	75.56	76.11	76.67	77.22	77.78	78.33
−110	−78.89	79.44	80.00	80.56	81.11	81.67	82.22	82.78	83.33	83.89
−120	−84.44	85.00	85.56	86.11	86.67	87.22	87.78	88.33	88.89	89.44
−130	−90.00	90.56	91.11	91.67	92.22	92.78	93.33	93.89	94.44	95.00
−140	−95.56	96.11	96.67	97.22	97.78	98.33	98.89	99.44	100.00	100.56
−150	−101.11	101.67	102.22	102.78	103.33	103.89	104.44	105.00	105.56	106.11
−160	−106.67	107.22	107.78	108.33	108.89	109.44	110.00	110.56	111.11	111.67
−170	−112.22	112.78	113.33	113.89	114.44	115.00	115.56	116.11	116.67	117.22
−180	−117.78	118.33	118.89	119.44	120.00	120.56	121.11	121.67	122.22	122.76
−190	−123.33	123.89	124.44	125.00	125.56	126.11	126.67	127.22	127.78	128.33
−200	−128.89	129.44	130.00	130.56	131.11	131.67	132.22	132.78	133.33	133.89
−210	−134.44	135.00	135.56	136.11	136.67	137.22	137.78	138.33	138.89	139.44
−220	−140.00	140.56	141.11	141.67	142.22	142.78	143.33	143.89	144.44	145.00
−230	−145.56	146.11	146.67	147.22	147.78	148.33	148.89	149.44	150.00	150.56
−240	−151.11	151.67	152.22	152.78	153.33	153.89	154.44	155.00	155.56	156.11
−250	−156.67	157.22	157.78	158.33	158.89	159.44	160.00	160.56	161.11	161.67
−260	−162.22	163.78	163.33	163.89	164.44	165.00	165.56	166.11	166.67	167.22
−270	−167.78	168.33	168.89	169.44	170.00	170.56	171.11	171.67	172.22	172.78
−280	−173.33	173.89	174.44	175.00	175.56	176.11	176.67	177.22	177.78	178.33
−290	−178.89	179.44	180.00	180.56	181.11	181.67	182.22	182.78	183.33	183.89

For interpolation										
°F	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
°C	0.06	0.11	0.17	0.22	0.28	0.33	0.39	0.44	0.50	0.56

TEMPERATURES — FAHRENHEIT TO CENTIGRADE (Continued)

Conversion Tables

Temperature below 0° F.

Temp. ° F.	0	1	2	3	4	5	6	7	8	9
– 300	– 184.44	185.00	185.56	186.11	186.67	187.22	187.78	188.33	188.89	189.44
– 310	– 190.00	190.56	191.11	191.67	192.22	192.78	193.33	193.89	194.44	195.00
– 320	– 195.56	196.11	196.67	197.22	197.78	198.33	198.89	199.44	200.00	200.56
– 330	– 201.11	201.67	202.22	202.78	203.33	203.89	204.44	205.00	205.56	206.11
– 340	– 206.67	207.22	207.78	208.33	208.89	209.44	210.00	210.56	211.11	211.67
– 350	– 212.22	212.78	213.33	213.89	214.44	215.00	215.56	216.11	216.67	217.22
– 360	– 217.78	218.33	218.89	219.44	220.00	220.56	221.11	221.67	222.22	222.78
– 370	– 223.33	223.89	224.44	225.00	225.56	226.11	226.67	227.22	227.78	228.33
– 380	– 228.89	229.44	230.00	230.56	231.11	231.67	232.22	232.78	233.33	233.89
– 390	– 234.44	235.00	235.56	236.11	236.67	237.22	237.78	238.33	238.89	239.44
– 400	– 240.00	240.56	241.11	241.67	242.22	242.78	243.33	243.89	244.44	245.00
– 410	– 245.56	246.11	246.67	247.22	247.78	248.33	248.89	249.44	250.00	250.56
– 420	– 251.11	251.67	252.22	252.78	253.33	253.89	254.44	255.00	255.56	256.11
– 430	– 256.67	257.22	257.78	258.33	258.89	259.44	260.00	260.56	261.11	261.67
– 440	– 262.22	262.78	263.33	263.89	264.44	265.00	265.56	266.11	266.67	267.22
– 450	– 267.78	268.33	268.89	269.44	270.00	270.56	271.11	271.67	272.22	272.78

– 459.4° F. = – 273° C. = absolute zero.

TEMPERATURES—FAHRENHEIT TO CENTIGRADE (Continued)

Temperatures above 0° F.

Temp. ° F	0	1	2	3	4	5	6	7	8	9
0	− 17.78	17.22	16.67	16.11	15.56	15.00	14.44	13.89	13.33	12.78
+ 10	− 12.22	11.67	11.11	10.56	10.00	9.44	8.89	8.33	7.78	7.22
20	− 6.67	6.11	5.56	5.00	4.44	3.89	3.33	2.78	2.22	1.67
30	− 1.11	−0.56	0.00	+0.56	+1.11	+1.67	+2.22	+2.78	+3.33	+3.89
40	+ 4.44	5.00	5.56	6.11	6.67	7.22	7.78	8.33	8.89	9.48
50	10.00	10.56	11.11	11.67	12.22	12.78	13.33	13.89	14.44	15.04
60	15.56	16.11	16.67	17.22	17.78	18.33	18.89	19.44	20.00	20.50
70	21.11	21.67	22.22	22.78	23.33	23.89	24.44	25.00	25.56	26.16
80	26.67	27.22	27.78	28.33	28.89	29.44	30.00	30.56	31.11	31.61
90	32.22	32.78	33.33	33.89	34.44	35.00	35.56	36.11	36.67	37.27
100	37.78	38.33	38.89	39.44	40.00	40.56	41.11	41.67	42.22	42.72
110	43.33	43.89	44.44	45.00	45.56	46.11	46.67	47.22	47.78	48.33
120	48.89	49.44	50.00	50.56	51.11	51.67	52.22	52.78	53.33	53.89
130	54.44	55.00	55.56	56.11	56.67	57.22	57.78	58.33	58.89	59.44
140	60.00	60.56	61.11	61.67	62.22	62.78	63.33	63.89	64.44	65.00
150	65.56	66.11	66.67	67.22	67.78	68.33	68.89	69.44	70.00	70.56
160	71.11	71.67	72.22	72.78	73.33	73.89	74.44	75.00	75.56	76.11
170	76.67	77.22	77.78	78.33	78.89	79.44	80.00	80.56	81.11	81.67
180	82.22	82.78	83.33	83.89	84.44	85.00	85.56	86.11	86.67	87.22
190	87.78	88.33	88.89	89.44	90.00	90.56	91.11	91.67	92.22	92.78

For interpolation										
°F	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
°C	0.06	0.11	0.17	0.22	0.28	0.33	0.39	0.44	0.50	0.56

TEMPERATURES — FAHRENHEIT TO CENTIGRADE (Continued)

Conversion Tables

Temperatures above 0° F.

Temp. °F.	0	1	2	3	4	5	6	7	8	9
200	93.33	93.89	94.44	95.00	95.56	96.11	96.67	97.22	97.78	98.33
210	98.89	99.44	100.00	100.56	101.11	101.67	102.22	102.78	103.33	103.89
220	104.44	105.00	105.56	106.11	106.67	107.22	107.78	108.33	108.89	109.44
230	110.00	110.56	111.11	111.67	112.22	112.78	113.33	113.89	114.44	115.00
240	115.56	116.11	116.67	117.22	117.78	118.33	118.89	119.44	120.00	120.56
250	121.11	121.67	122.22	122.78	123.33	123.89	124.44	125.00	125.56	126.11
260	126.67	127.22	127.78	128.33	128.89	129.44	130.00	130.56	131.11	131.67
270	132.22	132.78	133.33	133.89	134.44	135.00	135.56	136.11	136.67	137.22
280	137.78	138.33	138.89	139.44	140.00	140.56	141.11	141.67	142.22	142.78
290	143.33	143.89	144.44	145.00	145.56	146.11	146.67	147.22	147.78	148.33
300	148.89	149.44	150.00	150.56	151.11	151.67	152.22	152.78	153.33	153.89
310	154.44	155.00	155.56	156.11	156.67	157.22	157.78	158.33	158.89	159.44
320	160.00	160.56	161.11	161.67	162.22	162.78	163.33	163.89	164.44	165.00
330	165.56	166.11	166.67	167.22	167.78	168.33	168.89	169.44	170.00	170.56
340	171.11	171.67	172.22	172.78	173.33	173.89	174.44	175.00	175.56	176.11
350	176.67	177.22	177.78	178.33	178.89	179.44	180.00	180.56	181.11	181.67
360	182.22	182.78	183.33	183.89	184.44	185.00	185.56	186.11	186.67	187.22
370	187.78	188.33	188.89	189.44	190.00	190.56	191.11	191.67	192.22	192.78
380	193.33	193.89	194.44	105.00	195.56	196.11	196.67	197.22	197.78	198.33
390	198.89	194.94	200.00	200.56	201.11	201.67	202.22	202.78	203.33	203.89

TEMPERATURES—FAHRENHEIT TO CENTIGRADE (Continued)

Temp. °F.	0	1	2	3	4	5	6	7	8	9
400	204.44	205.00	205.56	206.11	206.67	207.22	207.78	208.33	208.89	209.44
410	210.00	210.56	211.11	211.67	212.22	212.78	213.33	213.89	214.44	215.00
420	215.56	216.11	216.67	217.22	217.78	218.33	218.89	219.44	220.00	220.56
430	221.11	221.67	222.22	222.78	223.33	223.89	224.44	225.00	225.56	226.11
440	226.67	227.22	227.78	228.33	228.89	229.44	230.00	230.56	231.11	231.67
450	232.22	232.78	233.33	233.89	234.44	235.00	235.56	236.11	236.67	237.22
460	237.78	238.33	238.89	239.44	240.00	240.56	241.11	241.67	242.22	242.78
470	243.33	243.89	244.44	245.00	245.56	246.11	246.67	247.22	247.78	248.33
480	248.89	249.44	250.00	250.56	251.11	251.67	252.22	252.78	253.33	253.89
490	254.44	255.00	255.56	256.11	256.67	257.22	257.78	258.33	258.89	259.44
500	260.00	260.56	261.11	261.67	262.22	262.76	263.33	263.89	264.44	265.00
510	265.56	266.11	266.67	267.22	267.78	268.33	268.89	269.44	270.00	270.56
520	271.11	271.67	272.22	272.78	273.33	273.89	274.44	275.00	275.56	276.11
530	276.67	277.22	277.78	278.33	278.89	279.44	280.00	280.56	281.11	281.67
540	282.22	282.78	283.33	283.89	284.44	285.00	285.56	286.11	286.67	287.22
550	287.78	288.33	288.89	289.44	290.00	290.56	291.11	291.67	292.22	292.78
560	293.33	293.89	294.44	295.00	295.56	296.11	296.67	297.22	297.78	298.33
570	298.89	299.44	300.00	300.56	301.11	301.67	302.22	302.78	303.33	303.84
580	304.44	305.00	305.56	306.11	306.67	307.22	307.78	308.33	308.89	309.49
590	310.00	310.56	311.11	311.67	312.22	312.78	313.33	313.89	314.44	315.00

For interpolation	°F	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
	°C	0.06	0.11	0.17	0.22	0.28	0.33	0.39	0.44	0.50	0.56

TEMPERATURES — FAHRENHEIT TO CENTIGRADE (Continued)

Conversion Tables

Temperatures above 0° F.

Temp. ° F.	0	1	2	3	4	5	6	7	8	9
600	315.56	316.11	316.67	317.22	317.78	318.33	318.39	319.44	320.00	320.56
610	321.11	321.67	322.22	322.78	323.33	323.89	324.44	325.00	325.56	326.11
620	326.67	327.22	327.78	328.33	328.89	329.44	330.00	330.56	331.11	331.67
630	332.22	332.78	333.33	333.89	334.44	335.00	335.56	356.11	336.67	337.22
640	337.78	338.33	338.89	339.44	340.00	340.56	341.11	341.67	342.22	342.78
650	343.33	343.89	344.44	345.00	345.56	346.11	346.67	347.22	347.78	348.33
660	348.89	349.44	350.00	350.56	351.11	351.67	352.22	352.78	353.33	353.89
670	354.44	355.00	355.56	356.11	356.67	357.22	357.78	358.33	358.89	359.44
680	360.00	360.56	361.11	361.67	362.22	362.78	363.33	363.89	364.44	365.00
690	365.56	366.11	366.67	367.22	367.78	368.33	368.89	369.44	370.00	370.56
700	371.11	371.67	372.22	372.78	373.33	373.89	374.44	375.00	375.56	376.11
710	376.67	377.22	377.78	378.33	378.89	379.44	380.00	380.56	381.11	381.67
720	382.22	382.78	383.33	383.89	384.44	385.00	385.56	386.11	386.67	387.22
730	387.78	388.33	388.89	389.44	390.00	390.56	391.11	391.67	392.22	392.78
740	393.33	393.89	394.44	395.00	395.56	396.11	396.67	397.22	397.78	398.33
750	398.89	399.44	400.00	400.56	401.11	401.67	402.22	402.78	403.33	403.89
760	404.44	405.00	405.56	406.11	406.67	407.22	407.78	408.33	408.89	409.44
770	410.00	410.56	411.11	411.67	412.22	412.78	413.33	413.89	414.44	415.00
780	415.56	416.11	416.67	417.22	417.78	418.33	418.89	419.44	420.00	420.56
790	421.11	421.67	422.22	422.78	423.33	423.89	424.44	425.00	425.56	426.11

TEMPERATURES—FAHRENHEIT TO CENTIGRADE (Concluded)

Temp. 0° F.	0	1	2	3	4	5	6	7	8	9
800	426.67	427.22	427.78	428.33	428.89	429.44	430.00	430.56	431.11	431.67
810	432.22	432.78	433.33	433.89	434.44	435.00	435.56	436.11	436.67	437.22
820	437.78	438.33	438.89	439.44	440.00	440.56	441.11	441.67	442.22	442.78
830	443.33	443.89	444.44	445.00	445.56	446.11	446.67	447.22	447.78	448.33
840	448.89	449.44	450.00	450.56	451.11	451.67	452.22	452.78	453.33	453.89
850	454.44	455.00	455.56	456.11	456.67	457.22	457.78	458.33	458.89	459.44
860	460.00	460.56	461.11	461.67	462.22	462.78	463.33	463.89	464.44	465.00
870	465.56	466.11	466.67	467.22	467.78	468.33	468.89	469.44	470.00	470.56
880	471.11	471.67	472.22	472.78	473.33	473.89	474.44	475.00	475.56	476.11
890	476.67	477.22	477.78	478.33	478.89	479.44	480.00	480.56	481.11	481.67
900	482.22	482.78	483.33	483.89	484.44	485.00	485.56	486.11	486.67	487.22
910	487.78	488.33	488.89	489.44	490.00	490.56	491.11	491.67	492.22	492.78
920	493.33	493.89	494.44	495.00	495.56	496.11	496.67	497.22	497.78	498.33
930	498.89	499.44	500.00	500.56	501.11	501.67	502.22	502.78	503.33	503.89
940	504.44	505.00	505.56	506.11	506.67	507.22	507.78	508.33	508.89	509.44
950	510.00	510.56	511.11	511.67	512.22	512.78	513.33	513.89	514.44	515.00
960	515.56	516.11	516.67	517.22	517.78	518.33	518.89	519.44	520.00	520.56
970	521.11	521.67	522.22	522.78	523.33	523.89	524.44	525.00	525.56	526.11
980	526.67	527.22	527.78	523.33	528.89	529.44	530.00	530.56	531.11	531.67
990	532.22	532.78	533.33	533.89	534.44	535.00	535.56	536.11	536.67	537.22

For interpolation										
°F	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.10
°C	0.06	0.11	0.17	0.22	0.28	0.33	0.39	0.44	0.50	0.56

WIRE TABLES

COMPARISON OF WIRE GAUGES

DIAMETER OF WIRE IN INCHES

Gauge No.	Brown & Sharpe.	Birmingham or Stub's.	Washburn & Moen.	Imperial or Brit. Std.	Stub's Steel.	U. S. Std. plate.	Music wire.
00000000	.....	....	....	....	..	....	.0083
0000000	.....	....	....	.500	..	....	.0087
000000	.....	....	....	.464	..	.46875	.0095
00000	.....	....	....	.432	..	.4375	.0100
0000	.4600	.454	.3938	.400	..	.40625	.0110
000	.4096	.425	.3625	.372	..	.375	.0120
00	.3648	.380	.3310	.348	..	.34375	.0133
0	.3249	.340	.3065	.324	..	.3125	.0144
1	.2893	.300	.2830	.300	.227	.28125	.0156
2	.2576	.284	.2625	.276	.219	.265625	.0166
3	.2294	.259	.2437	.252	.212	.25	.0178
4	.2043	.238	.2253	.232	.207	.234375	.0188
5	.1819	.220	.2070	.212	.204	.21875	.0202
6	.1620	.203	.1920	.192	.201	.203125	.0215
7	.1443	.180	.1770	.176	.199	.1875	.0230
8	.1285	.165	.1620	.160	.197	.171875	.0243
9	.1144	.148	.1483	.144	.194	.15625	.0256
10	.1019	.134	.1350	.128	.191	.140625	.0270
11	.09074	.120	.1205	.116	.188	.125	.0284
12	.08081	.109	.1055	.104	.185	.109375	.0296
13	.07196	.095	.0915	.092	.182	.09375	.0314
14	.06408	.083	.0800	.080	.180	.078125	.0326
15	.05707	.072	.0720	.072	.178	.0703125	.0345
16	.05082	.065	.0625	.064	.175	.0625	.0360
17	.04526	.058	.0540	.056	.172	.05625	.0377
18	.04030	.049	.0475	.048	.168	.05	.0395
19	.03589	.042	.0410	.040	.164	.04375	.0414
20	.03196	.035	.0348	.036	.161	.0375	.0434
21	.02846	.032	.0318	.032	.157	.034375	.0460
22	.02535	.028	.0286	.028	.155	.03125	.0483
23	.02257	.025	.0258	.024	.153	.028125	.0515
24	.02010	.022	.0230	.022	.151	.025	.0550

COMPARISON OF WIRE GAUGES (Continued)

DIAMETER OF WIRE IN INCHES

Gauge No.	Brown & Sharpe.	Birmingham or Stub's.	Washburn & Moen.	Imperial or Brit. Std.	Stub's steel.	U. S. Std. plate.	Music wire.
25	.01790	.020	.0204	.020	.148	.021875	.0586
26	.01594	.018	.0181	.018	.146	.01875	.0626
27	.01419	.016	.0173	.0164	.143	.0171875	.0658
28	.01264	.014	.0162	.0149	.139	.015625	.0720
29	.01126	.013	.0150	.0136	.134	.0140625	.0760
30	.01003	.012	.0140	.0124	.127	.0125	.0800
31	.008928	.010	.0132	.0116	.120	.0109375	.0820
32	.007950	.009	.0128	.0108	.115	.01015625	.0860
33	.007080	.008	.0118	.0100	.112	.009375	.0900
34	.006304	.007	.0104	.0092	.110	.00859375	.0950
35	.005614	.005	.0095	.0084	.108	.0078125	
36	.005000	.004	.0090	.0076	.106	.00703125	
37	.004453	....	....	.0068	.103	.006640625	
38	.003965	....	....	.0060	.101	.00625	
39	.003531	....	....	.0052	.099		
40	.003145	....	....	.0048	.097		

TWIST DRILL AND STEEL WIRE GAUGE

INCHES

No.	Size.	No.	Size.	No.	Size.	No.	Size.	No.	Size.	No.	Size.
1	.2280	11	.1910	21	.1590	31	.1200	41	.0960	51	.0670
2	.2210	12	.1890	22	.1570	32	.1160	42	.0935	52	.0635
3	.2130	13	.1850	23	.1540	33	.1130	43	.0890	53	.0595
4	.2090	14	.1820	24	.1520	34	.1110	44	.0860	54	.0550
5	.2055	15	.1800	25	.1495	35	.1100	45	.0820	55	.0520
6	.2040	16	.1770	26	.1470	36	.1065	46	.0810	56	.0465
7	.2010	17	.1730	27	.1440	37	.1040	47	.0785	57	.0430
8	.1990	18	.1695	28	.1405	38	.1015	48	.0760	58	.0420
9	.1960	19	.1660	29	.1360	39	.0995	49	.0730	59	.0410
10	.1935	20	.1610	30	.1285	40	.0980	50	.0700	60	.0400

DIMENSIONS OF WIRE

Stub's Gauge

Giving the diameter and cross-section in English and metric system for the Birmingham or Stub's gauge.

Gauge No.	Diameter in ins.	Section in sq.ins.	Diameter in cms.	Section in sq.cms.
0000	0.454	0.16188	1.1532	1.0444
000	.425	.14186	.0795	0.9152
00	.380	.11341	0.9652	.7317
0	.340	.09079	.8636	.5858
1	0.300	0.07069	0.7620	0.4560
2	.284	.06335	.7214	.4087
3	.259	.05269	.6579	.3399
4	.238	.04449	.6045	.2870
5	.220	.03801	.5588	.2452
6	0.203	0.03237	0.5156	0.20881
7	.180	.02545	.4572	.16147
8	.165	.02138	.4191	.13795
9	.148	.01720	.3759	.11099
10	.134	.01410	.3404	.09098
11	0.120	0.011310	0.3048	0.07297
12	.109	.009331	.2769	.06160
13	.095	.007088	.2413	.04573
14	.083	.005411	.2108	.03491
15	.072	.004072	.1829	.02627
16	0.065	0.0033183	0.16510	0.021409
17	.058	.0026421	.14732	.017046
18	.049	.0018857	.12446	.012166
19	.042	.0013854	.10668	.008938
20	.035	.0009621	.08890	.006207
21	0.032	0.0008042	0.08128	0.005189
22	.028	.0006158	.07112	.003973
23	.025	.0004909	.06350	.003167
24	.022	.0003801	.05588	.002452
25	.020	.0003142	.05080	.002027
26	0.018	0.0002545	0.04572	0.0016417
27	.016	.0002011	.04064	.0012972
28	.014	.0001539	.03556	.0009932
29	.013	.0001327	.03302	.0008563
30	.012	.0001181	.03048	.0007297
31	0.010	0.00007854	0.02540	0.0005067
32	.009	.00006362	.02286	.0004104
33	.008	.00005027	.02032	.0003243
34	.007	.00003848	.01778	.0002483
35	.005	.00001963	.01270	.0001267
36	0 004	0 00001257	0.01016	0.0000811

DIMENSIONS OF WIRE (Continued)

British Standard Gauge

Giving the diameter and cross-section in English and metric system for the British Standard Gauge.

Gauge No.	Diameter in ins.	Section in sq.ins.	Diameter in cms.	Section in sq.cms.
7-0	0.500	0.1963	1.2700	1.267
6-0	.464	.1691	1.1786	1.091
5-0	0.432	0.1466	1.0973	0.9456
4-0	.400	.1257	1.0160	.8107
3-0	.372	.1087	0.9449	.7012
2-0	.348	.0951	.8839	.6136
0	.324	.0825	.8230	.5319
1	0.300	0.07069	0.7620	0.4560
2	.276	.05983	.7010	.3858
3	.252	.04988	.6401	.3218
4	.232	.04227	.5893	.2727
5	.212	.03530	.5385	.2277
6	0.192	0.02895	0.4877	0.18679
7	.176	.02433	.4470	.15696
8	.160	.02010	.4064	.12973
9	.144	.01629	.3658	.10507
10	.128	.01287	.3251	.08302
11	0.116	0.010568	0.2946	0.06818
12	.104	.008495	.2642	.05480
13	.092	.006648	.2337	.04289
14	.080	.005027	.2032	.03243
15	.072	.004071	.1829	.02627
16	0.064	0.003217	0.16256	0 020755
17	.056	.002463	.14224	.015890
18	.048	.001810	.12192	.011675
19	.040	.001257	.10160	.008107
20	.036	.001018	.09144	.006567
21	0.032	0.0008042	0.08128	0.005189
22	.028	.0006158	.07112	.003973
23	.024	.0004524	.06096	.002922
24	.022	.0003801	.05588	.002452
25	.020	.0003142	.05080	.002027
26	0.0180	0.0002545	0.04572	0.0016417
27	.0164	.0002112	.04166	.0013628
28	.0148	.0001728	.03759	.0011099
29	.0136	.0001453	.03454	.0009363
30	.0124	.0001208	.03150	.0007791
31	0.0116	0.00010568	0.02946	0.0006818
32	.0108	.00009161	.02743	.0005910
33	.0100	.00007854	.02540	.0005067
34	.0092	.00006648	.02337	.0004289
35	.0084	.00005542	.02134	.0003575
36	0.0076	0.00004536	0.01930	0.0002927
37	.0068	.00003632	.01727	.0002343
38	.0060	.00002827	.01524	.0001824
39	.0052	.00002124	.01321	.0001370
40	.0048	.00001810	.01219	.0001167
41	0.0044	0.00001521	0.01118	0.0000982
42	.0040	.00001257	.01016	.0000811
43	.0036	.00001018	.00914	.0000656
44	.0032	.00000804	.00813	.0000519
45	.0028	.00000616	.00711	.0000397
46	0.0024	0.00000452	0.00610	0.0000212
47	.0020	.00000314	.00508	.0000203
48	.0016	.00000201	.00406	.0000129
49	.0012	.00000113	.00305	.0000073
50	.0010	.00000079	.00254	.0000051

PLATINUM WIRE TABLE, BROWN & SHARPE GAUGE

GIVING DIAMETER AND APPROXIMATE MASS

GAUGE No.	10	11	12	13	14	15	16
Diameter in dec. in....	0.106	0.091	0.081	0.072	0.064	0.057	0.051
Approximate mass in grams, per foot.....	37.5	28.0	22.0	17.5	14.0	11.0	9.0
GAUGE No.	17	18	19	20	21	22	
Diameter in dec. in...	0.045	0.041	0.036	0.032	0.029	0.026	
Approximate mass in grams, per foot.....	7.0	5.7	4.4	3.4	2.9	2.3	
GAUGE No.	23	24	25	26	27	28	
Diameter in dec. in...	0.023	0.020	0.018	0.016	0.014	0.013	
Approximate mass in in grams, per foot...	1.8	1.4	1.1	0.9	0.7	0.6	
GAUGE No.	29	30	31	32	33	34	35
Diameter in dec. in...	0.0115	0.010	0.009	0.008	0.007	0.0063	0.0056
Approximate mass in in grams, per foot...	0.45	0.35	0.28	0.22	0.17	0.15	0.11

RESISTANCE OF ALUMINUM WIRE

GIVING THE RESISTANCE OF HARD DRAWN ALUMINUM WIRE AT 20° C.

(From the Bureau of Standards.)

Gauge number.	Ohms per 1000 ft.	Ohms per kilometer.	Gauge number.	Ohms per 1000 ft.	Ohms per kilometer.
0000	0.0804	0.264	20	16.7	54.6
000	.101	.333	21	21.0	68.9
00	.128	.419	22	26.5	86.9
0	.161	.529	23	33.4	110.
1	.203	.667	24	42.1	138.
2	.256	.841	25	53.1	174.
3	.323	1.06	26	67.0	220.
4	.408	1.34	27	84.4	277.
5	.514	1.69	28	106.	349.
6	.648	2.13	29	134.	440.
7	.817	2.68	30	169.	555.
8	1.03	3.38	31	213.	700.
9	1.30	4.26	32	269.	883.
10	1.64	5.38	33	339.	1110.
11	2.07	6.78	34	428.	1400.
12	2.61	8.55	35	540.	1770.
13	3.29	10.8	36	681.	2230.
14	4.14	13.6	37	858.	2820.
15	5.22	17.1	38	1080.	3550.
16	6.59	21.6	39	1360.	4480.
17	8.31	27.3	40	1720.	5640.
18	10.5	34.4			
19	13.2	43.3			

DIMENSIONS OF WIRE, B. & S. GAUGE, U. S.

Diameter and cross-section of wires, Brown & Sharpe Gauge, mass of pure hard-drawn copper wire at 32° F. (density 8.90).

Gauge number.	Diam. in ins.	Cross-section in sq.in.	Pounds per ft.	Feet per lb.
0000	0.4600	0.1662	0.6412	1.560
000	.4096	.1318	.5085	1.967
00	.3648	.1045	.4033	2.480
0	.3249	.0829	.3198	3.127
1	0.2893	0.06573	0.2536	3.943
2	.2576	.05213	.2011	4.972
3	.2294	.04134	.1595	6.270
4	.2043	.03278	.1265	7.905
5	.1819	.02600	.1003	9.969
6	0.1620	0.02062	0.07955	12.57
7	.1443	.01635	.06309	15.85
8	.1285	.01297	.05003	19.99
9	.1144	.01028	.03968	25.20
10	.1019	.00815	.03146	31.78
11	0.09074	0.006467	0.02495	40.08
12	.08081	.005129	.01979	50.54
13	.07196	.004067	.01569	63.72
14	.06408	.003225	.01244	80.35
15	.05707	.002558	.00987	101.32
16	0.05082	0.002028	0.007827	127.8
17	.04526	.001609	.006207	161.1
18	.04030	.001276	.004922	203.2
19	.03589	.001012	.003904	256.2
20	.03196	.000802	.003096	323.1
21	0.02846	0.0006363	0.002455	408.2
22	.02535	.0005046	.001947	513.6
23	.02257	.0004001	.001544	647.7
24	.02010	.0003173	.001224	816.7
25	.01790	.0002517	.000971	1029.9
26	0.01594	0.0001996	0.0007700	1298.
27	.01419	.0001583	.0006107	1638.
28	.01264	.0001255	.0004843	2065.
29	.01126	.0000995	.0003841	2604.
30	.01003	.0000789	.0003046	3283.
31	0.008928	0.00006260	0.0002415	4140.
32	.007950	.00004964	.0001915	5221.
33	.007080	.00003937	.0001519	6583.
34	.006304	.00003122	.0001205	8301.
35	.005614	.00002476	.0000955	10468.
36	0.005000	0.00001963	0.00007576	13200.
37	.004453	.00001557	.00006008	16644.
38	.003965	.00001235	.00004765	20988.
39	.003531	.00000979	.00003778	26465.
40	.003145	.00000777	.00002996	33372.

MASS AND RESISTANCE FOR COPPER

Measure

Electrical resistance of pure hard-drawn copper wire at 32° F. (density 8.90.)

Gauge number.	Ohms per ft.	Ft. per ohm.	Ohms per lb.	Lbs. per ohm.
0000	0.00004629	21601.	0.00007219	13852.
000	.00005837	17131.	.00011479	8712.
00	.00007361	13586.	.00018253	5479.
0	.00009282	10774.	.00029023	3445.
1	0.0001170	8544.	0.0004615	2166.8
2	.0001476	6775.	.0007338	1362.8
3	.0001861	5373.	.0011668	857.0
4	.0002347	4261.	.0018552	539.0
5	.0002959	3379.	.0029499	339.0
6	0.0003731	2680.	0.004690	213.22
7	.0004705	2125.	.007458	134.08
8	.0005933	1685.	.011859	84.32
9	.0007482	1337.	.018857	53.03
10	.0009434	1060.	.029984	33.35
11	0.001190	840.6	0.04768	20.973
12	.001500	666.6	.07581	13.191
13	.001892	528.7	.12054	8.296
14	.002385	419.2	.19166	5.218
15	.003008	332.5	.30476	3.281
16	0.003793	263.7	0.4846	2.0636
17	.004783	209.1	.7705	1.2979
18	.006031	165.8	1.2252	0.8162
19	.007604	131.5	1.9481	.5133
20	.009589	104.3	3.0976	.3228
21	0.01209	82.70	4.925	0.20305
22	.01525	65.59	7.832	.12768
23	.01923	52.01	12.453	.08030
24	.02424	41.25	19.801	.05051
25	.03057	32.71	31.484	.03176
26	0.03855	25.94	50.06	0.019976
27	.04861	20.57	79.60	.012563
28	.06130	16.31	126.57	.007901
29	.07729	12.94	201.26	.004969
30	.09746	10.26	320.01	.003125
31	0.1229	8.137	508.8	0.0019654
32	.1550	6.452	809.1	.0012359
33	.1954	5.117	1286.5	.0007773
34	.2464	4.058	2045.6	.0004889
35	.3107	3.218	3252.6	.0003074
36	0.3918	2.552	5172.	0.0001934
37	.4941	2.024	8224.	.0001216
38	.6230	1.605	13076.	.0000765
39	.7856	1.273	20792.	.0000481
40	.9906	1.009	33060.	.0000303

DIMENSIONS OF WIRE B. & S. GAUGE,

Metric

Diameter, cross-section of wires, Brown & Sharpe gauge, mass of pure hard-drawn copper wire at 0° C. (density 8.90).

Gauge number.	Diam. in cm.	Cross-section in sq.cm.	Grams per meter.	Meters per gram.
0000	1.1684	1.0722	954.3	0.001048
000	.0405	0.8503	756.8	.001322
00	0.9266	.7643	600.1	.001666
0	.8251	.5348	475.9	.002101
1	0.7348	0.4241	377.4	0.002649
2	.6544	.3363	299.3	.003341
3	.5827	.2667	237.4	.004213
4	.5189	.2115	188.2	.005312
5	.4621	.1677	149.3	.006699
6	0.4115	0.13302	118.39	0.00845
7	.3665	.10549	93.88	.01065
8	.3264	.08366	74.45	.01343
9	.2906	.06634	59.04	.01694
10	.2588	.05261	46.82	.02136
11	0.2305	0.04172	37.13	0.02693
12	.2053	.03309	29.45	.03396
13	.1828	.02624	23.35	.04282
14	.1628	.02081	18.52	.05400
15	.1450	.01650	14.69	.06809
16	0.12908	0.013087	11.648	0.0859
17	.11495	.010378	9.237	.1083
18	.10237	.008231	7.325	.1365
19	.09116	.006527	5.809	.1721
20	.08118	.005176	4.607	.2171
21	0.07229	0.004105	3.653	0.2737
22	.06438	.003255	2.898	.3450
23	.05733	.002582	2.298	.4352
24	.05106	.002047	1.822	.5488
25	.04545	.001624	1.445	.6920
26	0.04049	0.0012876	1.1459	0.873
27	.03606	.0010211	.9088	1.100
28	.03211	.0008098	.7207	1.388
29	.02859	.0006422	.5715	1.750
30	.02546	.0005093	.4532	2.206
31	0.02268	0.0004039	0.3594	2.782
32	.02019	.0003203	.2850	3.508
33	.01798	.0002540	.2261	4.424
34	.01601	.0002014	.1793	5.578
35	.01426	.0001597	.1422	7.034
36	0.01270	0.0001267	0.1127	8.87
37	.01131	.0001005	.0894	11.18
38	.01007	.0000797	.0709	14.10
39	.00897	.0000632	.0562	17.78
40	.00799	.0000501	.0446	22.43

MASS AND RESISTANCE FOR COPPER (Continued)

System

Electrical resistance of pure hard-drawn copper wire at 0° C. (density 8.90).

Gauge number.	Ohms per meter.	Meters per ohm.	Ohms per gram.	Grams per ohm.
0000	0.0001519	6584.	0.0000001592	6283000.
000	.0001915	5221.	.0000002531	3951000.
00	.0002415	4141.	.0000004024	2485000.
0	.0003045	3284.	.0000006398	1563000.
1	0.0003840	2604.	0.000001017	928900.
2	.0004842	2065.	.000001618	618200.
3	.0006106	1638.	.000002572	388800.
4	.0007699	1299.	.000004090	244500.
5	.0009709	1030.	.000006504	153800.
6	0.001224	816.9	0.00001034	96700.
7	.001544	647.8	.00001644	60820.
8	.001947	513.7	.00002615	38250.
9	.002455	407.4	.00004157	24050.
10	.003095	323.1	.00006610	15130.
11	0.003903	256.2	0.00010511	9514.
12	.004922	203.2	.00016712	5984.
13	.006206	161.1	.00026574	3763.
14	.007826	127.8	.00042254	2367.
15	.009868	101.3	.00067187	1488.
16	0.01244	80.37	0.0010683	936.1
17	.01569	63.73	.0016987	588.7
18	.01979	50.54	.0027010	370.2
19	.02495	40.08	.0042948	232.8
20	.03146	31.79	.0068290	146.4
21	0.03967	25.21	0.010859	92.09
22	.05002	19.99	.017266	57.92
23	.06308	15.85	.027454	36.42
24	.07954	12.57	.043653	22.91
25	.10030	9.97	.069411	11.88
26	0.12647	7.907	0.11037	9.060
27	.15948	6.270	.17549	5.698
28	.20110	4.973	.27904	3.584
29	.25358	3.943	.44369	2.254
30	.31976	3.127	.70550	1.417
31	0.4032	2.480	1.1218	0.8914
32	.5084	1.967	1.7837	.5606
33	.6411	1.560	2.8362	.3526
34	.8085	1.237	4.5097	.2217
35	1.0194	0.981	7.1708	.1394
36	1.2855	0.7779	11.376	0.08790
37	1.6210	.6169	18.130	.05516
38	2.0440	.4892	28.828	.03469
39	2.5775	.3880	45.838	.02182
40	3.2501	.3076	72.885	.01372

CROSS-SECTION AND MASS OF WIRES

U. S. Measure

Diameters are given in mils (1 mil = .001 in.), and area in square mils (1 sq. mil = .000001 sq.in.). For sections and masses for one-tenth the diameters given, divide by 100 and for sections and masses for ten times the diameter multiply by 100.

Diam. in mils.	Cross-sec. in sq. mils.	Pounds per foot. Copper, density 8.90.	Iron, density 7.80.	Brass, density 8.56.	Aluminum, density 2.67.
10	78.54	0.000303	0.0002656	0.0002915	0.0000909
11	95.03	0367	03214	03527	01100
12	113.10	0436	03825	04197	01309
13	132.73	0512	04488	04926	01536
14	153.94	0594	05206	05713	01782
15	176.71	0.000682	0.0005976	0.0006558	0.0002045
16	201.06	0776	06799	07461	02327
17	226.98	0876	07675	08423	02627
18	254.47	0982	08605	09443	02946
19	283.53	1094	09588	10522	03282
20	314.16	0.001212	0.001062	0.001166	0.0003636
21	346.36	1336	1171	1285	04009
22	380.13	1467	1286	1411	04400
23	415.48	1603	1405	1542	04809
24	452.39	1746	1530	1679	05237
25	490.87	0.001894	0.001660	0.001822	0.0005682
26	530.93	2046	1795	1970	06147
27	572.56	2209	1936	2125	06628
28	615.75	2376	2082	2285	07127
29	660.52	2549	2234	2451	07646
30	706.86	0.002727	0.002390	0.002623	0.0008182
31	754.77	2912	2552	2801	08737
32	804.25	3103	2720	2985	09309
33	855.30	3300	2892	3174	09900
34	907.92	3503	3070	3369	10509
35	962.11	0.003712	0.003253	0.003570	0.001114
36	1017.88	3927	3442	3777	1178
37	1075.21	4149	3636	3990	1245
38	1134.11	4376	3844	4218	1316
39	1194.59	4609	4040	4433	1383
40	1256.64	0.004849	0.004249	0.004664	0.001455
41	1320.25	5094	4465	4900	1528
42	1385.44	5346	4685	5141	1604
43	1452.20	5603	4911	5389	1681
44	1520.53	5867	5142	5643	1760
45	1590.43	0.006137	0.005378	0.005902	0.001841
46	1661.90	6412	5620	6167	1924
47	1734.94	6694	5867	6438	2008
48	1809.56	6982	6119	6715	2095
49	1885.74	7276	6377	6998	2183
50	1963.50	0.007576	0.006640	0.007287	0.002273
51	2042.82	7882	6908	7581	2365
52	2123.72	8194	7181	7881	2458
53	2206.18	8512	7460	8187	2554
54	2290.22	8837	7744	8499	2651

CROSS-SECTION AND MASS OF WIRES (Continued)

U. S. Measure (Continued)

Diameters are given in mils (1 mil = .001 in.), and area in square mils (1 sq. mil = .000001 sq. in.). For sections and masses for one-tenth the diameters given, divide by 100 and for sections and masses for ten times the diameter multiply by 100.

Diam. in mils.	Cross-sec. in sq. mils.	Pounds per foot.			
		Copper, density 8.90.	Iron, density 7.80.	Brass, density 8.56.	Aluminum, density 2.67.
55	2375.83	0.009167	0.008034	0.008817	0.002750
56	2463.01	09504	08329	09140	2851
57	2551.76	09846	08629	09470	2954
58	2642.08	10195	08934	09805	3058
59	2733.97	10549	09245	10146	3165
60	2827.43	0.01091	0.00956	0.01049	0.003273
61	2922.47	1128	0988	1085	3383
62	3019.07	1165	1021	1120	3495
63	3117.25	1203	1054	1157	3608
64	3216.99	1241	1088	1194	3724
65	3318.31	0.01280	0.01122	0.01231	0.003841
66	3421.19	1320	1157	1270	3960
67	3525.65	1360	1192	1308	4081
68	3631.68	1401	1228	1348	4204
69	3739.28	1443	1264	1388	4328
70	3848.45	0.01485	0.01302	0.01429	0.004456
71	3959.19	1528	1339	1469	4583
72	4071.50	1571	1377	1511	4713
73	4185.39	1615	1415	1553	4845
74	4300.84	1660	1454	1596	4978
75	4417.86	0.01705	0.01494	0.01639	0.005114
76	4536.46	1751	1534	1684	5251
77	4656.63	1797	1575	1728	5390
78	4778.36	1844	1616	1773	5531
79	4901.67	1892	1658	1819	5674
80	5026.55	0.01939	0.01700	0.01865	0.005818
81	5153.00	1988	1743	1912	5965
82	5281.02	2038	1786	1960	6113
83	5410.61	2088	1830	2008	6263
84	5541.77	2138	1874	2057	6415
85	5674.50	0.02189	0.01919	0.02106	0.006568
86	5808.80	2241	1964	2156	6724
87	5944.68	2294	2010	2206	6881
88	6082.12	2347	2057	2257	7040
89	6221.14	2400	2104	2309	7201
90	6361.73	0.02455	0.02151	0.02360	0.007364
91	6503.88	2509	2199	2414	7528
92	6647.61	2565	2248	2467	7695
93	6792.91	2621	2297	2521	7863
94	6939.78	2678	2347	2575	8033
95	7088.22	0.02735	0.02397	0.02630	0.008205
96	7238.23	2793	2448	2686	8378
97	7389.81	2851	2499	2742	8554
98	7542.96	2910	2551	2799	8731
99	7697.69	2970	2603	2857	8910
100	7853.98	0.03030	0.02656	0.02915	0.009091

CROSS-SECTION AND MASS OF WIRES (Continued)

Metric Measure

Diameters are given in thousandths of a centimeter and area of section in square thousandths of a centimeter. 1 (cm./1000)^2 = .000001 sq. cm. For sections and masses for diameters 1/10 or 10 times those of the table, divide or multiply by 100.

Diam. in thousandths of a cm.	Cross-section in square thousandths of a cm.	Grams per meter.			
		Copper, density 8.90.	Iron, density 7.80.	Brass, density 8.56.	Aluminum, density 2.67.
10	78.54	0.06990	0.06126	0.06723	0.02097
11	95.03	.08458	.07412	.08135	.02537
12	113.10	.10065	.08822	.09681	.03020
13	132.73	.11813	.10353	.11362	.03544
14	153.94	.13701	.12008	.13177	.04110
15	176.71	0.1573	0.1378	0.1513	0.04718
16	201.06	.1789	.1568	.1721	.05368
17	226.98	.2020	.1770	.1943	.06060
18	254.47	.2265	.1985	.2178	.06794
19	283.53	.2523	.2212	.2427	.07570
20	314.16	0.2796	0.2450	0.2689	0.08388
21	346.36	.3083	.2702	.2965	.09248
22	380.13	.3383	.2965	.3254	.10149
23	415.48	.3698	.3241	.3557	.11093
24	452.39	.4026	.3529	.3872	.12079
25	490.87	0.4369	0.3829	0.4202	0.1311
26	530.93	.4725	.4141	.4545	.1418
27	572.56	.5096	.4466	.4901	.1529
28	615.75	.5480	.4803	.5271	.1644
29	660.52	.5879	.5152	.5654	.1764
30	706.86	0.6291	0.5514	0.6051	0.1887
31	754.77	.6717	.5887	.6461	.2015
32	804.25	.7158	.6273	.6884	.2147
33	855.30	.7612	.6671	.7321	.2284
34	907.92	.8081	.7082	.7772	.2424
35	962.11	0.856	0.7504	0.8236	0.2569
36	1017.88	.906	.7939	.8713	.2718
37	1075.21	.957	.8387	.9204	.2871
38	1134.11	1.012	.8866	.9730	.3035
39	1194.59	.063	.9318	1.0230	.3190
40	1256.64	1.118	0.980	1.076	0.3355
41	1320.25	.175	1.030	.130	.3525
42	1385.44	.233	.081	.186	.3699
43	1452.20	.292	.133	.243	.3877
44	1520.53	.353	.186	.302	.4060
45	1590.43	1.415	1.241	1.361	0.4246
46	1661.90	.479	.296	.423	.4437
47	1734.94	.544	.353	.485	.4632
48	1809.56	.611	.411	.549	.4832
49	1885.74	.678	.471	.614	.5035
50	1963.50	1.748	1.532	1.681	.5243
51	2042.82	.818	.593	.753	.5454
52	2123.72	.890	.657	.818	.5670
53	2206.18	.964	.721	.888	.5891
54	2290.22	2.038	.786	.960	.6115

CROSS-SECTION AND MASS OF WIRES (Continued)
Metric Measure (Continued)

Diameters are given in thousandths of a centimeter and area of section in square thousandths of a centimeter. 1 (cm. /1000)^2 = .000001 sq. cm. For sections and masses for diameters 1/10 or 10 times those of the table, divide or multiply by 100.

Diam. in thousandths of a cm.	Cross-section in square thousandths of a cm.	Grams per meter.			
		Copper, density 8.90.	Iron, density 7.80.	Brass, density 8.56.	Aluminum, density 2.67.
55	2375.83	2.114	1.853	2.034	0.6343
56	2463.01	.192	.921	.108	.6576
57	2551.76	.271	.990	.184	.6813
58	2642.08	.351	2.061	.262	.7054
59	2733.97	.433	.132	.340	.7300
60	2827.43	2.516	2.205	2.420	0.7549
61	2922.47	.601	.280	.502	.7803
62	3019.07	.687	.355	.584	.8061
63	3117.25	.774	.431	.668	.8323
64	3216.99	.863	.509	.760	.8589
65	3318.31	2.953	2.588	2.840	0.8860
66	3421.19	3.045	.669	.929	.9135
67	3525.65	.138	.750	3.018	.9413
68	3631.68	.232	.833	.109	.9697
69	3739.28	.328	.917	.201	.9984
70	3848.45	3.426	3.003	3.295	1.028
71	3959.19	.524	.088	.389	.057
72	4071.50	.624	.176	.485	.087
73	4185.39	.725	.265	.583	.117
74	4300.84	.828	.355	.682	.148
75	4417.86	3.932	3.446	3.782	1.180
76	4536.46	4.037	.538	.883	.211
77	4656.63	.144	.632	.986	.243
78	4778.36	.253	.727	4.090	.276
79	4901.67	.362	.823	.177	.309
80	5026.55	4.474	3.921	4.303	1.342
81	5153.00	.586	4.019	.411	.376
82	5281.02	.700	.119	.521	.410
83	5410.61	.815	.220	.631	.445
84	5541.77	.932	.323	.744	.480
85	5674.50	5.050	4.426	4.857	1.515
86	5808.80	.170	.531	.972	.551
87	5944.68	.291	.637	5.089	.587
88	6082.12	.413	.744	.206	.624
89	6221.14	.537	.852	.325	.661
90	6361.73	5.662	4.962	5.446	1.699
91	6503.88	.788	5.073	.567	.737
92	6647.61	.916	.185	.690	.775
93	6792.91	6.046	.298	.815	.814
94	6939.78	.176	.413	.940	.853
95	7088.22	6.309	5.529	6.068	1.893
96	7238.23	.442	.646	.196	.933
97	7389.81	.577	.764	.326	.973
98	7542.96	.713	.884	.457	2.014
99	7697.69	.851	6.004	.589	.055
100	7853.98	6.990	6.126	6.723	2.097

APPROXIMATE RESISTANCE OF WIRES

Giving the resistance in ohms of one centimeter length at 20°C. Owing to varying composition and physical condition, these values can be considered only as approximations.

Gauge No. B. & S.	Diam. in cms.	Brass	Con-stantin	German silver	Iron	Manganin
10	.2588	.00014	.00093	.00056	.00023	.00080
12	.2053	.00023	.00148	.00089	.00036	.00127
14	.1628	.00037	.0024	.00142	.00058	.0020
16	.1291	.00058	.0037	.0023	.00092	.0032
18	.1024	.00091	.0059	.0036	.00146	.0051
20	.08118	.00147	.0095	.0057	.0023	.0081
22	.06438	.0023	.0150	.0090	.0037	.0129
24	.05106	.0037	.024	.0144	.0059	.021
26	.04049	.0059	.038	.023	.0093	.033
27	.03606	.0075	.048	.029	.0118	.041
28	.03211	.0093	.061	.036	.0148	.052
30	.02546	.0147	.096	.058	.024	.083
32	.02019	.024	.153	.092	.038	.131
34	.01601	.038	.24	.148	.060	.209
36	.01270	.060	.39	.23	.094	.33
40	.00799	.15	.98	.59	.24	.84

PROBLEMS

THE METHOD OF SOLVING CHEMICAL PROBLEMS

(From Talbot's Quantitative Analysis, by permission.)

Detailed solutions of a few typical problems are given below. The student should study these carefully, and assure himself that they are fully understood.

1. A "chemical factor" expresses the ratio between a specific quantity of a chemical compound and the *equivalent* quantity of some other body. For example, if it is wished to determine the weight of sulphur which corresponds to a specific weight of barium sulphate, the latter is multiplied by the factor, or ratio, represented by the fraction $\frac{S}{BaSO_4}$, or $\frac{32.07}{233.50} = 0.1373$. It may also be expressed by the proportion $\overset{233.5}{BaSO_4} : \overset{32.07}{S} = \text{wt. } BaSO_4 : x$, from which it is plain that $x = \frac{32.07}{233.50} \cdot \text{wt. } BaSO_4$.

Again, if the weight of FeO in Fe_2O_3 is desired, the factor becomes $\frac{2\,FeO}{Fe_2O_3} = \frac{144.04}{160.04} = 0.9000$. Similarly, the factor for the conversion of KCl to K_2O is $\frac{K_2O}{2\,KCl} = \frac{94.22}{149.12} = 0.6320$. The logarithmic equivalents of these values are called log factors.

In the calculation of these factors, the atomic or molecular relations of the two substances must be kept clearly in mind; thus, it is plainly *incorrect* to express the ratio of ferrous to ferric oxide by the fraction $\frac{FeO}{Fe_2O_3}$, since each molecule of the higher oxide must correspond to two molecules of the lower. Carelessness in this respect is one of the most frequent sources of error.

2. To calculate the volume of a reagent required for a specific operation, it is necessary to know the exact reaction which is to be brought about, and, as with the calculation of factors, to keep in mind the molecular relations between the reagent and the substance reacted upon. For example, to estimate the weight of barium chloride necessary to precipitate the sulphur from 0.1 gram of pure pyrite (FeS_2), the proportion should stand $\overset{488.70}{2BaCl_2 . 2\,H_2O} : \overset{120.16}{FeS_2} = x : 0.1$, where x represents the weight of the chloride

*Talbot's "Quantitative Analysis."

required. Each of the two atoms of sulphur will form a molecule of sulphuric acid upon oxidation, which, in turn, will require a molecule of the barium chloride for precipitation. To determine the quantity of the barium chloride required, it is necessary to include in its molecular weight the water of crystallization, since this is inseparable from the chloride when it is weighed. This applies equally to other similar instances.

If the strength of an acid is expressed in percentage by weight, due regard must be paid to its specific gravity. For example, hydrochloric acid (sp. gr. 1.12) contains 23.8 per cent HCl by weight; *i.e.*, 0.2666 gram.

3. No rules for universal application to "indirect gravimetric analyses" can be laid down. A single example will be explained. Given a mixture of KCl + NaCl weighing 0.15 gram, which contains 53 per cent chlorine, to calculate the weight of KCl and NaCl in the mixture.

The weight of chlorine in the mixture is (0.15×0.53) or 0.0795 gram. Assuming that this chlorine was all in combination with potassium, the corresponding weight of KCl would be 0.1672 gram (Cl : KCl = 0.0795 : 0.1672). This is an excess of 0.0172 gram over the actual weight of the mixture, and it is plain that this difference is occasioned by the replacement of certain of the molecules of potassium chloride, weighing 74.56 units, by molecules of sodium chloride weighing 58.50 units. To express this, let it be supposed that the mixture is made up of n molecules KCl and n' molecules NaCl; then it may be said that $n\,\overset{74.56}{\mathrm{KCl}} + n'\,\overset{58.50}{\mathrm{NaCl}} = 0.15$ gram, and $n\,\overset{74.56}{\mathrm{KCl}} + n'\,\overset{74.56}{\mathrm{KCl}} = 0.1672$ gram, then by subtracting the first equation from the second it is shown that $n'\,(\overset{74.56}{\mathrm{KCl}} - \overset{58.50}{\mathrm{NaCl}}) = 0.0172$ gram. That is, the difference in weight is equal to n' times the difference in the molecular weights of the two chlorides. The actual weight of NaCl present (x) is equal to $58.50n'$, or, since $n' = \dfrac{0.0172}{74.56 - 58.50}$, $x = 58.50\left(\dfrac{0.0172}{74.56 - 58.50}\right)$. This may be expressed in the form $(74.56 - 58.50) : 58.50 = 0.0172 : x$, from which $x = 0.0626$. The weight of NaCl subtracted from that of the mixture gives the weight of KCl.

The weights of the chlorides may also be calculated algebraically by solving the equations $x + y = 0.15$ and $\dfrac{35.45}{74.56}x + \dfrac{35.45}{58.50}y = 0.0795$, where x is the weight of KCl and y is the weight of NaCl in the mixture.

4. It is sometimes desirable to weigh out such a quantity of substance for analysis, that the number of cubic centimeters of standard solution entering into the reaction shall represent directly the percentage of the desired constituent. This may be readily done, by considering the relation of the solution to a normal solution and the atomic or molecular weight of the desired component. For example, suppose it is desired to calculate such a weight for K_2CO_3 in pearl ash, when a half-normal acid solution

is used. Since half-normal acid and alkali solutions are equivalent, and since by definition the half-normal K_2CO_3 solution contains 34.55 grams per liter, each cubic centimeter of the acid solution must be equivalent to 0.03455 gram K_2CO_3. Hence, 100 cc. would neutralize 3.455 grams pure K_2CO_3 and this becomes the desired weight of the pearl ash. Similarly the required weight of limonite where the iron (Fe) is to be determined by means of a deci-normal $K_2Cr_2O_7$ solution is 0.5602 gram.

5. One of the most frequently recurring cases in volumetric analysis is that in which it is wished to express the value of a specific solution in terms of some substance other than that against which it has been standardized as for instance, the value of a permanganate solution which has been standardized against oxalic acid, in terms of iron. Although such problems apparently vary widely, there are common principles which can be applied to them all. These are stated below, and the student should assure himself that they are fully understood.

Suppose, for example, it is desired to find the iron value (Fe) of a permanganate solution, of which 1 cc. is equivalent to 0.006302 gram $C_2H_2O_4 . 2H_2O$.

From a comparison of the reactions it is seen that 10 molecules of ferrous sulphate and 5 molecules of oxalic acid each react with the same amount (2 molecules) of the permanganate. These two quantities being, then, equivalent to the same third quantity, must be equivalent to each other; in other words, 10 molecules of ferrous sulphate and 5 molecules of oxalic acid have the same reducing power. But, as stated above, the value is desired in terms of metallic iron (Fe), not $FeSO_4$, but as it is plain that $10FeSO_4$ are equivalent to 10Fe, it is proper to make the proportion

$$\overset{560.2}{10\,Fe} : \overset{630.25}{5C_2H_2O_4 . 2\,H_2O} = x : 0.006302$$

in which $x = 0.005602$ gram. Here, again, as in example 2, it is necessary to include the water of crystallization in the molecular weight of the oxalic acid, as it is weighed with it.

The same conclusion is arrived at, if we consider the relation of the solution to the normal. As given, it is deci-normal and must, therefore, be equivalent to a deci-normal solution of iron. From the equations cited, it is seen that $10FeSO_4$, unite with 5O, therefore each molecule is equivalent to 1 hydrogen atom in reducing power. The normal solution must, then, contain 1 gram-molecule of ferrous sulphate, or 56.02 grams Fe, and each cubic centimeter of the deci-normal solution would contain 0.005602 gram, the value obtained above.

Again, suppose the value of the same permanganate solution were desired in terms of molybdenum (Mo), the reactions with permanganate being

$$5Mo_{12}O_{19} + 17Mn_2O_7 = 60MoO_3 + 34MnO, \text{ and}$$
$$5C_2H_2O_4 . 2H_2O + Mn_2O_7 = 2MnO + 10CO_2 + 15H_2O.$$
(Mn_2O_7 is the anhydride of $HMnO_4$.)

It is plain that in these equations as they stand, the molecular quantities of oxidizing agent are not equal. They can be made so by simply multiplying the second equation by 17, and they then become,

$$5Mo_{12}O_{19} + 17Mn_2O_7 = 34MnO + 60MoO_3, \text{ and}$$
$$85C_2H_2O_4 . 2H_2O + 17Mn_2O_7 = 34MnO + 170\ CO_2 + 255\ H_2O.$$

It is now possible to reason in the same way as before, and to conclude that 85 molecules of the oxalic acid have the same reducing power as 5 molecules of the oxide $Mo_{12}O_{19}$, or 60 atoms of molybdenum. Accordingly,

$$\overset{5758.8}{60Mo} : \overset{10714.25}{85C_2H_2O_4.2H_2O} : : x : 0.006302$$

in which x 0.003387 gram.

Since $5Mo_{12}O_{19}$ unite with 85O, a normal solution of the former as a reducing agent, would contain 1/170 of the 5 gram-molecules or 33.87 grams Mo, and the deci-normal solution 3.387 grams per liter. This agrees with the values already obtained.

6. It is sometimes necessary to calculate the value of solutions according to the principles just explained, when several successive reactions are involved. Such problems may be solved by a series of proportions, but it is usually possible, after stating these to eliminate the common factors and solve but a single one.

For example, suppose it is desired to express the value of a permanganate solution, of which 1 cc. = 0.008 gram iron (Fe), in terms of calcium oxide (CaO). The reactions involved in the volumetric determination of calcium are the following; $CaCl_2 + (NH_4)_2C_2O_4 = CaC_2O_4 + 2NH_4Cl$; $CaC_2O_4 + H_2SO_4 + 2H_2O = CaSO_4 + C_2H_2O_4 . 2H_2O$; $5C_2H_2O_4 . 2H_2O + 2KMnO_4 + 3H_2SO_4 = K_2SO_4 + MnSO_4 + 10CO_2 + 18H_2O$.

From the considerations stated under 5, the following proportions may be made.

$$10Fe : 5C_2H_2O_4 . 2H_2O = 0.008 : x$$
$$5C_2H_2O_4 . 2H_2O : 5CaC_2O_4 = x : y$$
$$5CaC_2O_4 : 5CaO = y : x$$

Canceling the common factors, there remains simply

$$\overset{560.2}{10Fe} : \overset{280.4}{5\ CaO} = 0.008 : z$$

Similarly, from the reactions, the equivalent of the iodine liberated may be calculated in terms of MnO_2 as follows: Supposing the weight of iodine to be 0.5 gram then

$$2I : 2KI = 0.5 : x$$
$$2KI : 2Cl = x : y$$
$$2Cl : 2HCl = y : z$$
$$2HCl : MnO_2 = z : w$$

Canceling the common factors, there remains

$$2I : MnO_2 = 0.5 : w$$

To solve such problems as 5 and 6, it is necessary to know the reactions involved, and the way in which the various components break up; then to compare the reactions and to search for those molecular quantities of the compounds in question, which are *equivalent* in their action upon a common agent. Having found these, as shown above, express the molecular ratio between them in the form of a proportion; as, for example, $\overset{253.7}{2\,I} : \overset{86.99}{MnO_2} = 0.5 : w$. Expressed in the form $w = \frac{86.99}{253.7}\,0.5$, it is plain that this ratio is in no way different in principle from the chemical factor mentioned in paragraph 1; indeed, it is the factor for the conversion of iodine to manganese dioxide.

PROBLEMS IN ELEMENTARY PHYSICS

1. A map is drawn to the scale 1 mile to the inch. What area on the map in square centimeters represents 10 square miles? Ans. 64.5 sq.cm.

2. Express a velocity of 2500 cm. per second in feet per minute. Ans. 4921.2 feet per minute.

3. A rectangular tank 15 cm.×163 mm.×6 meters, inside measurements, is filled with water. Express the mass of the water in kilograms. One c.cm. of water weighs 1 gram (approximately). Ans. 146.7 kg.

4. The radius of a circle is 12 cm., what is the angle in degrees subtended by an arc of 16 cm.? Ans. 76.39°.

5. The pitch of the screw in a micrometer caliper is 0.5 mm.; the rotating head of the instrument carries 50 divisions; the vernier of the shank over which the head turns has 10 divisions which occupy the space of 9 smallest divisions on the head. What is the smallest distance which can be measured without estimation? Ans. 0.001 mm.

6. How far from the point of observation must a scale be placed in order that 1 cm. on the scale will subtend an angle of 1 minute? Ans. 3438 cm.

7. A river is 1 kilometer in width, and the current has a velocity of 4 km. per hour. What direction must be taken by a launch moving at 8 km. per hour in order to land directly opposite the starting point? What will be the total time for the trip? Ans. The launch must steer 30° upstream; 8.7 minutes.

8. A pendulum having a period of 1 second and a pendulum of nearly the same period are arranged so that it is possible to observe when the two reach the mid point of their respective oscillations at the same instant going in the same direction. The time elapsing between coincidences is 106 seconds. If the unknown is shorter than the known pendulum, what is its period? Ans. 0.9906 sec.

9. A body starts from rest and moves for 10 seconds with a uniform acceleration of 5 cm./sec.^{2}, for the next 20 seconds it moves uniformly at the velocity acquired and is finally brought to rest with a uniform acceleration of -5. cm./sec.^{2}, what is

the total space covered and the time occupied? Ans. 1500 cm., 40 sec.

10. Find the value of a constant force which, acting on a mass of 500 grams for 2 seconds, produces an increase in velocity of 10 cm./sec. Ans. 2500 dynes.

11. What is the weight in dynes of a sphere whose mass is 100 grams? If a spherical mass of 1000 kg. is placed vertically beneath the body so that their centers are separated by a distance of 50 cm., what is the apparent increase in weight? ($g. = 980.$ cm./sec.^{2}, the gravitational constant $= 6.66 \times 10^{-8}$, C. G. S.) Ans. 98,000 dynes; .0026 dyne.

12. A uniform bar, 100 cm. long, is supported on a knife edge 30 cm. from one end. A mass of 500 g. is suspended at a distance of 5 cm. and a mass of 200 g. at a distance of 60 cm from the same end. If the system is in equilibrium, what is the mass of the bar? Ans. 325 g.

13. The beam of a balance is 25 cm. long and weighs 50 g. If the center of gravity is 0.05 cm. below the central knife edge through what angle will the beam be deflected by the addition of 0.001 gram to one of the pans? Ans. $0° \ 17.2'$.

14. The mean radius of the earth is about 6,370,000 meters. What is the acceleration toward the center of a point on the equator due to the rotation of the earth? Ans. 2910.3 meters per sec. per sec.

15. If the period of simple harmonic motion is 10 seconds and the amplitude 20 cm., what is the displacement, velocity and acceleration 2 seconds after the particle has passed its mid point in a positive direction? Ans. Displacement 19.02 cm., velocity 3.88 cm./sec., acceleration -7.51 cm./sec.^{2}.

16. A body of 60 g. mass falls freely from rest for 6 seconds, what is its momentum and kinetic energy at the end of the period? ($g. = 980$ cm./sec.^{2}.) How far does the body fall? How much work would be done in raising it to its original position? Ans. Momentum, 352,800 g. cm./sec.; kinetic energy, 1.037×10^9 ergs; space passed over 17,640 cm.; potential energy (mgh) 1.037×10^9 ergs.

17. What power is delivered by a hoisting engine in pulling a mass of 200 kg., (1) Upward against gravity, 5 meters per second; (2) along a horizontal plane whose coefficient of friction with the block is 0.20 at the rate of 2 meters per second; (3) along a perfectly smooth (frictionless) horizontal plane at any velocity; (4) up an incline of 45° with the horizontal with a coefficient of friction of 0.1 at the rate of 1 meter (measured along the incline) per second? (The hoisting apparatus is to be considered frictionless.) Ans. (1) 980 watts. (2) 784 watts. (3) No work is done. (4) 15,240 watts.

18. A bullet fired from a gun 1 cm. in internal diameter and 75 cm. long has a muzzle velocity of 500 meters per second. What uniform pressure in the barrel would cause this velocity if the bullet weighs 25 g.? Ans. 1.061×10^9 dynes per sq. cm.

19. The pitch of a jack screw is 1 cm; the power is applied at the end of a lever 24 cm. long. When force of 30,000 dynes is applied at the lever the lifting force is 1,200,000 dynes, what

portion of the force applied is used to overcome friction? What is the efficiency? Ans. 22,040 dynes; 34.1%.

20. It is required to find the density of a cylinder of alloy. A ballast load is placed on one pan of the balance, which requires 292.560 g. to counterbalance. The sample is added to the pan containing the weights and the amount to effect equilibrium is reduced to 88.480 g. When the sample is suspended below the pan in water (density 0.9977) the mass necessary in the pan is 148.627 g. The density of the brass weights was 8.45, the density of air at the temperature and pressure of the experiment 0.00115. Find the true density, making correction for buoyancy of the air. Ans. 3.383.

21. The cross-section of the stem of an hydrometer has an area of 0.2 sq.cm. The total volume immersed when the instrument floats in water at 4° C. is 6. cu.cm. If in another liquid the hydrometer sinks until 8 cm. additional length of stem is immersed, what is the specific gravity the liquid? Ans. 0.7894.

22. The volume of the cylinder of an air pump cleared at each stroke of the piston is 2000 cc. If the volume of the vessel to be exhausted with connecting tubes is 4000 cc., what pressure should be obtained by 10 strokes? Ans. 0.0173 the original pressure.

23. Water at a temperature of 20.3° C. rises to a height of 6.128 cm. in a tube whose radius is 0.0247. Compute the surface tension, taking g.=980. Ans. 74.15 dynes/cm.

24. A glass tube closed at one end is 100 cm. long. A column of mercury 91 cm. long is poured into the tube and it is then inverted with the lower (open) end in a dish of mercury. The air now fills 40 cm. at the top of the tube and a column of mercury 58 cm. long is supported below. What is the barometric pressure? Ans. 74.84 cm.

25. A wire 100 cm. long and 0.3 mm. in radius is stretched 2 mm. by the addition of a weight of 10 kilos. Compute the value of Young's Modulus. Ans. 17.3×10^{11} dynes/sq.cm.

26. The thermal coefficient of linear expansion of brass is 0.000018. A cylindrical bar is 100 cm. long at 20° C. and has a density of 8.450, what is the length and density at 0° C? Ans. Length 99.964 cm., density 8.451 g./cm.^{3}.

27. A steel rod is measured with a brass scale at 15° C. The rod appears to be 200 cm. long. The scale is correct at 0° C. What is the true length of the rod at 0°? The coefficient of expansion for steel is .000011. Ans. 200.021 cm.

28. If the volume of a portion of gas is 1000 ccm. under a pressure of 30.5 cm. of mercury and at a temperature 0° C., what will be the volume under a pressure of 29.5 cm. and a temperature of 20° C.? Ans. 1109 c. cm.

29. The mass of a copper calorimeter is 110 grams. It contains 400 grams of water at a temperature of 16° C. A solid mass of 60 grams at a temperature of 98° C. is placed in the water. The temperature reaches equilibrium at 21° C. Neglecting radiation, find the specific heat of the solid. Ans. 0.443 cal./g.

30. Two hollow brass cones fit together and are arranged so that the outer cone can be rotated while the inner cone may be held stationary by the application of a force sufficient to overcome the friction between the cones. A horizontal pulley 30 cm. in diameter is attached to the inner cone and a cord wrapped around this pulley and passing over another pulley at the side supports a weight of 100 grams. The mass of the two cones is 400 g., and 25 cc. of water is placed in the inner cone. The outer cone is rotated rapidly enough to keep the weight suspended and makes 1500 revolutions. What temperature change will occur in the cones, neglecting radiation? (The mechanical equivalent of heat is 4.18×10^7 ergs.) Ans. 5.33° C.

31. A source of sound whose frequency is 2000 per sec. is moving toward the observer at the rate of 7200 kilometers per hour. The temperature of the air is 20° C. What is the apparent pitch? Ans. 2116.4 per sec.

32. What are the relative potentials of two insulated conducting spheres charged with equal quantities of electricity if their radii are 5 and 10 cm. respectively? Ans. 2 to 1.

33. What is the force acting between two concentrated positive charges of 6 and 8 units, separated by a distance of 4 cm. in air? Ans. 3 dynes.

34. What is the resistance of 48,500 cm. of copper wire 1 millimeter in diameter at 0° C.? The specific resistance of copper is .0000017. Ans. 0.26 ohm.

35. A circuit is composed of 8 cells in two groups. The two groups are in parallel and each consists of 4 cells in series. The electromotive force of each cell is 1.4 volts and the internal resistance 0.1 ohm. The external circuit consists of a series of 5 coils, each having a resistance of 200 ohms. If a galvanometer whose resistance is 1000 ohms is placed in parallel with one of the coils, what current will flow through the galvanometer? Ans. 0.0011 amp.

36. A cell whose electromotive force is 1 volt and internal resistance 5 ohms is connected in series with a resistance of 2000 ohms and a galvanometer whose resistance is 98 ohms. The galvanometer terminals are connected by a shunt having a resistance of 1 ohm and the scale is 25 cm. from the mirror. The deflection, observed by a telescope, is 0.55 cm. What is the figure of merit—that is, the current which would cause a scale deflection of 1 mm. if the scale were 1 meter from the mirror? Ans. 0.000000229 amp.

37. The horizontal intensity of the earth's magnetism at a certain locality is 0.20 gauss and the dip is 70°; what is the value of the total intensity? Ans. 0.585 gauss.

38. A standard candle and an electric incandescent of unknown intensity are 500 cm. apart. A photometer screen shows even illumination when placed 100 cm. from the candle. The standard candle is found to have consumed spermaceti at the rate of 124 grains per hour during the test. If the intensity of the candle is 1 international candle when burning 120 grains per hour, what is the horizontal candle power of the unknown? Ans. 15.47 international candles.

39. An object 43.6 cm. from a concave spherical mirror gives a sharp image 66.5 cm. from the mirror; find the principal focus and radius of curvature of the mirror. Ans. Focus 26.33 cm., radius of curvature, 52.6 cm.

40. Light divergent from a point source 20.5 cm. from a double concave lens has its divergence increased by the lens so that it appears to come from a point 113.9 cm. from the lens (on the same side as the source). The radius of curvature of both faces is 25.1 cm., what is the principal focus and index of refraction of the lens? Ans. Principal focus −25.0 cm.; index of refraction 1.50.

41. The angle of minimum deviation of a prism is observed and found to be 60° 2.5′. If the angle of the prism is 59° 54′, what is the index of refraction of the material of the prism? Ans. 1.734.

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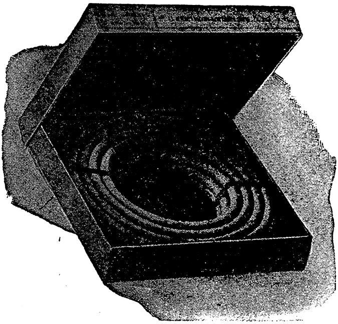
RUBBER TUBING



Rubber tubing suitable for chemical laboratory work must be of special composition to withstand the hard usage and particular requirements.

Serious difficulty and embarrassment will result should it give out unexpectedly in the midst of an important experiment.

The various grades of tubing herein listed are especially compounded to meet the demands of the Chemical Laboratory—a selection based upon the recommendation of Professors in charge of some of the largest high schools and colleges throughout the United States.

Several years of successful use of these tubings in the largest and most important laboratories of the country has convinced us of their superiority for the work.

The same high standard of quality will be maintained, as we realize the importance of supplying the trade with such goods as will prove satisfactory and add to our long list of patrons.

The compounds of our various tubings are carefully made and contain no foreign substance which might cause rubber to deteriorate.

The various materials are chosen with the object of supplying a product of low specific gravity. The compound is not adulterated in order to accomplish this, therefore we are able to give an unusual number of feet of tubing per pound. All grades of tubing are of the lowest specific gravity consistent with good quality of stock.

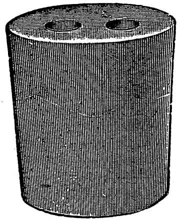
Rubber tubing may be had in five different grades which are especially adapted to the various laboratory work. We also give a list showing the approximate number of feet per pound of tubing from which the cost per foot can be quickly computed for the various sizes and grades.

No. 423 White Wrapped Tubing
No. 435 White Wrapped Pressure Tubing
No. 462 Antimony Tubing
No. 508 Antimony Tubing, hand made
No. 572 Pure Gum Tubing, hand made

Inside Measurements.	Approximate Number of Feet per Pound Tubing.				
	No. 572.	No. 508.	No. 462.	No. 435.	No. 423.
$\frac{1}{8}$ inch.......	150	110	77	20	64
$\frac{3}{16}$ "	65	53	39	13	33
$\frac{1}{4}$ "	48	36	25	10	22
$\frac{5}{16}$ "	32	25	19	8	17
$\frac{3}{8}$ "	22	16	14	6	13
$\frac{1}{2}$ "	17	13	9	5	8

Pure Gum Tubing carried in stock in $\frac{5}{8}$ and $\frac{3}{4}$ in. All other sizes not listed, made to order.

RUBBER STOPPERS



The compound used in our rubber Stoppers has received the same consideration and careful selection as our Rubber Tubing. The points considered were to obtain a compound of exceptional wearing quality, at the same time have a maximum flexibility which would be retained as long as the life of the stopper, the lasting qualities of the stock being of most importance.

These stoppers are made in the sizes termed "The New Chemists' Style." The taper is such as will make a most suitable and tight joint. Three styles of stoppers are carried in stock in all sizes mentioned with one-hole, two-hole and without holes. In addition three-hole stopper can be furnished when ordered in quantities which permit of special manufacture and can be had in two weeks from date of order.

The holes are of different size, depending upon size of stopper, graduated from $\frac{3}{32}''$ in the No. 00 to a $\frac{5}{16}''$ hole in the No. 13 stopper. This is essential on account of the larger tubing required where large stoppers are used, also on account of impracticability of a large hole in small stopper.

The approximate number of stoppers per pound is shown on the list, from which the cost per dozen can be readily computed. You will note that all prices on rubber material are per pound. This we find most satisfactory, as it does not burden certain sizes with additional charge to overcome a lower quotation on other sizes. You can readily realize the impossibility of figuring the prices accurately and giving a just price on all the various sizes due to slight fluctuations in weight.

No. 483 Chemists' Stoppers

Carried in stock in sizes Nos. 00 to 13. Solid, One Hole or Two Holes.

Order by No.	Approximate No. of Stoppers per Pound.	Diameter at Top.	Diameter at Bottom.	Length.
00	150 per lb.	$\frac{17}{32}$ in.	$\frac{11}{32}$ in.	$\frac{7}{8}$ in.
0	80 "	$\frac{21}{32}$ "	$\frac{15}{32}$ "	1 "
1	65 "	$\frac{3}{4}$ "	$\frac{9}{16}$ "	1 "
2	50 "	$\frac{25}{32}$ "	$\frac{19}{32}$ "	1 "
3	40 "	$\frac{29}{32}$ "	$\frac{23}{32}$ "	1 "
4	33 "	1 "	$\frac{25}{32}$ "	1 "
5	26 "	$1\frac{1}{16}$ "	$\frac{29}{32}$ "	1 "
6	20 "	$1\frac{1}{4}$ "	1 "	1 "
7	15 "	$1\frac{1}{2}$ "	$1\frac{5}{32}$ "	1 "
8	12 "	$1\frac{5}{8}$ "	$1\frac{9}{32}$ "	1 "
9	10 "	$1\frac{23}{32}$ "	$1\frac{7}{16}$ "	1 "
10	7 "	$1\frac{15}{16}$ "	$1\frac{21}{32}$ "	$1\frac{1}{32}$ "
11	6 "	$2\frac{1}{4}$ "	$1\frac{29}{32}$ "	1 "
12	$5\frac{1}{2}$ "	$2\frac{1}{2}$ "	$2\frac{3}{32}$ "	$1\frac{7}{32}$ "
13	5 "	$2\frac{11}{16}$ "	$2\frac{1}{4}$ "	$1\frac{1}{8}$ "

R = in liter atmosphere $= \frac{pv}{TN} = \frac{1 \times 22.4}{273 \times 1}$

$= .08207$

R = in Gram centimeters $= 84.760$

R = in " Calories $= 1.985$

R = " Joules $= 8.3162$

R = " Ergs $= 8.3162 \times 10^7$