Chemistry Handbook

Name: _____

Block: _____

2014-15

Mr. Everett

http://www.mrteverett.com/Chemistry/

Table of Contents

Rejection Quotient at Different Confidence Limits

Number of Observations	Q_{90}	Q_{95}	Q_{99}
3	0.941	0.970	0.994
4	0.765	0.829	0.926
5	0.642	0.710	0.821
6	0.560	0.625	0.740
7	0.507	0.568	0.680
8	0.468	0.526	0.634
9	0.437	0.493	0.598
10	0.412	0.466	0.568

$$Q = \frac{|gap|}{range}$$

If $Q > Q_{table}$ then the outlier is discarded.

Christian, Gary D. *Analytical Chemistry, 5th ed.*; John Wiley & Sons: New York, 1994; p 44.

Percent Error

$$Percent\ error = \frac{observed\ value - true\ value}{true\ value} \times 100\%$$

Percent Yield

$$Percent\ yield = \frac{actual\ yield}{theoretical\ yield} \times 100\%$$

Orders of Magnitude

10^{12}	10^{9}	10^{6}	10^{3}	10^{2}	10^{1}	10^{0}	10^{-1}	10^{-2}	10^{-3}	10^{-6}	10^{-9}	10^{-12}	10^{-15}
tera	giga	mega	kilo	hecto	deca	No prefix	deci	centi	milli	micro	nano	pico	femto
T	G	M	k	h	da		d	c	m	μ	n	p	f

Units of Measurement

SI base units are highlighted

Quantity	**Unit (Symbol)**	**Notes**
Acceleration	meters per second per second (m/s^2)	also m/s/s or $m \cdot s^{-2}$
Activity	becquerel (Bq)	$1/s = s^{-1}$
Capacitance	farad (F)	$C/V = kg^{-1} \cdot m^{-2} \cdot s^4 \cdot A^2$
Current	ampere (A)	
Electric Charge	coulomb (C)	$A \cdot s$
Electric Potential	volt (V)	$W/A = kg \cdot m^2 \cdot s^{-3} \cdot A^{-1}$
Energy	calorie (cal)	metric unit
Energy/Work	joule (J)	$J = kg \cdot m^2 \cdot s^{-2}$
Force	newton (N)	$N = kg \cdot m \cdot s^{-2}$
Frequency	hertz (Hz)	$waves/s = 1/s = s^{-1}$
Inductance	henry (H)	$kg \cdot m^2 \cdot s^{-2} \cdot A^{-2}$
Length	meter (m)	
Luminous Intensity	candela (cd)	

Quantity	**Unit (Symbol)**	**Notes**
Magnetic Field	tesla (T)	$T = kg \cdot s^{-2} \cdot A^{-1}$
Magnetic Flux	weber (Wb)	$Wb = kg \cdot m^2 \cdot s^{-2} \cdot A^{-1}$
Mass	gram (g)	Base unit is the kilogram (1000 g)
Momentum	newton second (N·s)	$N \cdot s = kg \cdot m \cdot s^{-1}$
Power	watt (W)	$J/s = kg \cdot m^2 \cdot s^{-3}$
Pressure	pascal (Pa)	$Pa = N/m^2 = kg \cdot m \cdot s^{-2}$
Quantity	mole (mol)	
Resistance	ohm (Ω)	$V/A = kg \cdot m^2 \cdot s^{-3} \cdot A^{-2}$
Temperature	degree Celsius (°C)	Metric unit based on T_f and T_b for water
Temperature	kelvin (K)	
Time	second (s)	
Velocity	meter per second (m/s)	
Volume	liter (L)	$1\ L = 1\ dm^3 = 0.001\ m^3$

Formulas

$$d = \frac{m}{V}$$

$$A = A_0 \frac{1}{2}^{(t/t_{half})}$$

$$c = \lambda \nu$$

$$E = h\nu$$

$$\frac{1}{\lambda} = R\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$$

$$M = \frac{n}{V}$$

$$b = \frac{n_{solute}}{m_{solvent}}$$

$$M_1V_1 = M_2V_2$$

$$pX = -\log[X]$$

$$P_1V_1 = P_2V_2$$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$\frac{n_1}{V_1} = \frac{n_2}{V_2}$$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$PV = nRT$$

$$\frac{rate_1}{rate_2} = \sqrt{\frac{M_2}{M_1}}$$

$$KE_{avg} = \frac{3}{2}RT = \frac{1}{2}mv^2$$

$$v_{rms} = \sqrt{\frac{3kT}{m}} = \sqrt{\frac{3RT}{M}}$$

$$\Delta T_f = iK_f m$$

$$\Delta T_b = iK_b m$$

$$q = mC_p\Delta T$$

$$\Delta G = \Delta H - T\Delta S$$

$$\Delta G_{rxn} = \Sigma\Delta G^\circ_{f\ prods} - \Sigma\Delta G^\circ_{f\ rxts}$$

$$\Delta H_{rxn} = \Sigma\Delta H^\circ_{f\ prods} - \Sigma\Delta H^\circ_{f\ rxts}$$

$$\Delta S_{rxn} = \Sigma\Delta S^\circ_{f\ prods} - \Sigma\Delta S^\circ_{f\ rxts}$$

$$\Delta G^\circ = RT\ln K$$

$$\Delta G^\circ = -nFE^\circ_{cell}$$

$$E_{cell} = E^\circ_{cell} - \frac{RT}{nF}\ln Q$$

Constants and Conversion Factors

Avogadro's Number = 6.022×10^{23}

Boltzmann's constant = 1.38×10^{-23} J K^{-1}

Coulomb's constant = 8.99×10^{9} N m^2 C^{-2}

Faraday constant = 96485 C/mol e^-

Gas law constant = 0.0821 atm L mol^{-1} K^{-1} = 8.314 J mol^{-1} K^{-1}

Gravitational constant = 6.67×10^{-11} N kg^{-2} m^2

Magnetic permeability = $4\pi \times 10^{-7}$ T m A^{-1}

Magnitude of electric charge = 1.60×10^{-19} C

Planck's constant = 6.626×10^{-34} J × s

Rydberg constant = 1.0974×10^{7} m^{-1}

Speed of light = 2.998×10^{8} m/s

Standard temperature and pressure is 0°C and 1 atm

At standard temperature and pressure, 1 mol of gas occupies 22.414 L

Stefan-Boltzmann constant = 5.6704×10^{-8} W m^{-2} K^{-4}

$m_{proton} = 1.673 \times 10^{-27}$ kg $m_{electron} = 9.109 \times 10^{-31}$ kg $m_{neutron} = 1.675 \times 10^{-27}$ kg

°F = 1.8(°C) + 32

K = °C + 273.15

Length
1 angstrom (Å) = 1×10^{-10} meters
1 inch = 2.54 centimeters
1 foot = 12 inches
1 meter = 3.2808 feet
1 yard = 3 feet
1 chain = 22 yards
1 furlong = 10 chains
1 mile = 5280 feet
1 mile = 1.609 kilometers
1 light year = 9.46×10^{15} meters
1 astronomical unit (AU) = 1.50×10^{11} m
1 parsec = 3.26 light years
1 degree = $\pi/180$ radians

Volume
1 gallon = 3.785 liters
1 gallon = 4 quarts
1 quart = 2 pints
1 pint = 2 cups
1 cup = 8 fluid ounces
1 fluid ounce = 29.575 mL

Mass/Weight
1 atomic mass unit = 1.6606×10^{-27} kilograms
1 ounce = 28.35 grams
1 troy ounce = 31.103 grams
1 pound = 16 ounces
1 kilogram = 2.2046 pounds
1 stone = 14 pounds

Pressure
1 atmosphere = 760 torr
1 atmosphere = 760 mm Hg
1 atmosphere = 101.325 kilopascals
1 atmosphere = 1013.25 millibars
1 atmosphere = 14.7 pounds per square inch (psi)

Energy
1 calorie = 4.184 J
1 eV = 1.602×10^{-19} J

Lide, David R. *CRC Handbook, 83rd ed.*; CRC Press: Boca Raton, Florida, 2004; inside back cover.

Characteristic Properties of Common Substances

Substance	State of Matter	Density (g/cm^3)	Specific Heat (J/g°C)	Melting Point (°C)	Boiling Point (°C)
Aluminum	Solid	2.6984	0.897	660.32	2519
Benzene	Liquid	0.879	1.74	5.49	80.09
Brass	Solid	8.875[a]	0.380	1040	
Bromine	Liquid	3.119	0.226	-7.2	58.8
Copper	Solid	8.92	0.385	1084.62	2562
Ethanol	Liquid	0.789	2.44	-114.14	78.29
Gold	Solid	19.3	0.129	1064.18	2856
Graphite	Solid	2.2	0.709	4489[c]	3825[d]
Iodine	Solid	4.660	0.145	113.7	184.4
Iron	Solid	7.86	0.449	1538	2861
Isopropyl (Rubbing) Alcohol	Liquid	0.785	2.61	-87.9	82.3
Lead	Solid	11.34	0.129	327.46	1749
Magnesium	Solid	1.74	1.023	650	1090
Manganese	Solid	7.30	0.479	1246	2061
Maple	Solid	0.62-0.75			
Mercury	Liquid	13.5336	0.140	-38.837[c]	356.73
Methanol	Liquid	0.7914	2.53	-97.6	64.6
Nickel	Solid	8.90	0.444	1455	2913
Oak	Solid	0.60-0.90			
(White) Pine	Solid	0.35-0.50			
Polyvinyl Chloride (PVC)	Solid	1.39-1.42			
Silicon	Solid	2.3290	0.705	1414	3265
Silver	Solid	10.50	0.235	961.78	2162
Stainless Steel	Solid	7.75		1510	
Tin	Solid	7.28[b]	0.228	231.93	2602
Titanium	Solid	4.507	0.523	1668	3287
Tungsten	Solid	19.35	0.132	3422	5555
Zinc	Solid	7.14	0.338	419.53	907

[a]– average value [b]– white [c]– triple point [d]–sublimation point

Dean, John A. *Lange's Handbook of Chemistry, 11th ed.*; McGraw-Hill: New York, New York, 1979; p 3-2 – 3-5, 7-54 –7-393, 11-19 – 11-26.

Giancoli, Douglas C. *Physics, Principles with Applications, 5th ed.*; Prentice Hall: Upper Saddle River, New Jersey, 1998: p 276.

Lide, David R. *CRC Handbook, 84th ed.*; CRC Press: Boca Raton, Florida, 2004; pp 4–132, 4–133, 5–5 – 5–60, 6-7, 6-13, 15-32.

Silberberg, Martin S. *Chemistry: The Molecular Nature of Matter and Change, 4th ed.*; McGraw-Hill: New York, 2006; p 235.

Tipler, Paul A. *Physics for Scientists and Engineers, 4th ed.*, W.H. Freeman, 1999

Properties of Water

Boiling Point (at 1 atm):	100°C = 373.15 K
Heat of Fusion:	335 J/g
Heat of Vaporization:	2259 J/g
Triple Point:	0.01°C/611.73 Pa
Critical Point:	373.99°C/22.064 MPa
Melting Point (at 1 atm):	0°C = 273.15 K
Molal Boiling Point Elevation Constant:	0.51°C/*m*
Molal Freezing Point Depression Constant:	-1.86°C/*m*
Molar Mass:	18.02 g
Specific Heat:	4.184 J/g°C = 1 cal/g°C
Ion product constant:	1.0×10^{14}
Density at 25°C:	1.00 g/mL (rounded)

Lide, David R. *CRC Handbook, 83rd ed.*; CRC Press: Boca Raton, Florida, 2004; p 6–4.

Vapor Pressure Approximation

The formula given below is acceptable for approximating the vapor pressure (in mm Hg) of water from 0 to 100°C. The temperature substituted into the formula must be in kelvin.

$$P = e^{(20.386 - \frac{5132}{T})}$$

Solubility Rules

- All common compounds of alkali metal ions and ammonium salts are soluble
- All common nitrates, acetates, and most perchlorates are soluble
- All common chlorides, bromides, and iodides are soluble, except those of Ag^{+}, Pb^{+2}, Cu^{+}, and Hg_2^{+2}
- All common fluorides are soluble, except Pb^{+2} and those of the alkali earth metals
- All common sulfates are soluble, except Ca^{+2}, Sr^{+2}, Ba^{+2}, Ag^{+}, and Pb^{+2}
- All common metal hydroxides are insoluble, except those of the alkali metals and the alkali earth metals greater than or equal to Ca^{+2}
- All common carbonates and phosphates are insoluble, except those of the alkali metals and NH_4^{+}
- All common sulfides are insoluble except those of the alkali metals, alkali earth metals, and NH_4^{+}

Silberberg, Martin S. *Chemistry: The Molecular Nature of Matter and Change, 4th ed.*; McGraw-Hill: New York, 2006; p 143.

Solubility Table

W – soluble in water
I – insoluble in water
d – decomposes in water
w – slightly soluble in water/soluble in acids
A – insoluble in water/soluble in acids
a – insoluble in water/slightly soluble in acids

	acetate	bromide	carbonate	chloride	cyanide	fluoride	hydroxide	iodide	oxalate	phosphate	sulfate	sulfide
aluminum	W	W	---	W	---	W	A	W	A	A	W	d
barium	W	W	w	W	W	w	W	W	w	A	a	d
cadmium	W	W	A	W	W	W	A	W	w	A	W	A
calcium	W	W	w	W	W	w	W	W	A	w	w	w
cobalt(II)	W	W	A	W	A	W	A	W	A	A	W	A
copper(II)	W	W	---	W	A	w	A	d	A	A	W	A
hydrogen	W	W	d	W	W	W	---	W	W	W	W	W
iron(II)	W	W	w	W	A	w	A	W	A	A	W	A
iron(III)	---	W	---	W	---	w	A	W	W	w	w	d
lead(II)	W	W	A	W	w	w	w	w	A	A	w	A
magnesium	W	W	w	W	W	w	A	W	w	w	W	d
manganese(II)	W	W	w	W	---	A	A	W	w	w	W	A
mercury(I)	w	A	A	a	A	d	---	A	a	A	w	I
mercury(II)	W	W	---	W	W	d	A	w	A	A	d	I
nickel(II)	W	W	w	W	a	w	w	W	A	A	W	A
silver	w	a	A	a	a	W	---	I	a	A	w	A
tin(II)	d	W	---	W	---	W	A	w	A	A	W	A
strontium	W	W	w	W	W	w	W	W	w	A	w	W
zinc	W	W	w	W	A	w	A	W	A	A	W	A

Lide, David R. *CRC Handbook, 83rd ed.*; CRC Press: Boca Raton, Florida, 2002; p 8-124 – 8-126.

Solubility Product Constants

Ag_3AsO_4	1.03E-22
$AlPO_4$	9.84E-21
$Be(OH)_2$	6.92E-22
$Ca_3(PO_4)_2$	2.07E-33
$Cd_3(AsO_4)_2$	2.2E-33
$Cd_3(PO_4)_2$	2.53E-33
$Co_3(AsO_4)_2$	6.8E-29
$Co_3(PO_4)_2$	2.05E-35
$Cu_3(AsO_4)_2$	7.95E-36
$Cu_3(PO_4)_2$	1.4E-37
$Eu(OH)_3$	9.38E-27
$Fe(OH)_3$	2.79E-39
$Ga(OH)_3$	7.28E-36
Hg_2Br_2	6.4E-23
Hg_2I_2	5.2E-29

HgI_2	2.9E-29
$Mg_3(PO_4)_2$	1.04E-24
$Nd_2(CO_3)_3$	1.08E-33
$Ni_3(PO_4)_2$	4.74E-32
$Pd(SCN)_2$	4.39E-23
$Pr(OH)_3$	3.39E-24
$Sc(OH)_3$	2.22E-31
ScF_3	5.81E-24
$Sn(OH)_2$	5.45E-27
$Tl(OH)_3$	1.68E-44
$Y(OH)_3$	1E-22
$Y_2(CO_3)_3$	1.03E-31
YF_3	8.62E-21
$Zn_3(AsO_4)_2$	2.8E-28
ZnSe	3.6E-26

Lide, David R. *CRC Handbook, 83rd ed.*; CRC Press: Boca Raton, Florida, 2002; pp 8:119-8:122..

Acid-Base Indicators

Indicator name	pH range	Color change
Alizarin yellow R	10.1 – 12.0	yellow – red
Bromothymol blue	6.0 – 7.6	yellow – blue
Clayton yellow	12.2 – 13.2	yellow – amber
Congo red	3.0 – 5.0	bue – red
Cresol red	7.0 – 8.8	yellow – red
Crystal violet	0.0 – 1.8	yellow – blue
Litmus	5.5 – 8.2	red – blue
Malachite green	0.2 – 1.8	yellow – blue/green
Methyl violet	0.0 – 1.6	yellow – blue
Methyl orange	3.2 – 4.4	red – yellow
Methyl red	4.8 – 6.0	red – yellow
Neutral red	6.8 – 8.0	red – amber
Phenolphthalein	8.2 – 10.0	colorless – pink
Quinaldine red	1.4 – 3.2	colorless – red
Resorcin blue	4.4 – 6.2	red - blue
Thymol blue	8.0 – 9.6	yellow – blue

Lide, David R. *CRC Handbook, 83rd ed.*; CRC Press: Boca Raton, Florida, 2002; pp 8–16 - 8–18.

Dissociation Constants for Acids at 25ºC

Name	Formula			K_a		
Acetic	CH_3COOH			1.7×10^{-5}		
Benzoic	C_6H_5COOH			6.3×10^{-5}		
Boric	H_3BO_3			5.9×10^{-10}		
Carbonic	H_2CO_3	HCO_3^-		4.3×10^{-7}	4.8×10^{-11}	
Cyanic	HNCO			3.5×10^{-4}		
Formic	HCOOH			1.7×10^{-4}		
Hydrocyanic	HCN			4.0×10^{-10}		
Hydrofluoric	HF			6.8×10^{-4}		
Hypochlorous	HOCl			3.5×10^{-8}		
Nitrous	HNO_2			4.5×10^{-4}		
Oxalic	HOOCCOOH	$HOOCCOO^-$		5.6×10^{-2}	5.1×10^{-5}	
Carbolic (Phenol)	C_6H_5OH			1.1×10^{-10}		
Phosphoric	H_3PO_4	$H_2PO_4^-$	HPO_4^{-2}	6.9×10^{-3}	6.2×10^{-8}	4.8×10^{-13}
Phosphorous	H_3PO_3	$H_2PO_3^-$		1.6×10^{-2}	7×10^{-7}	
Propionic	CH_3CH_2COOH			1.3×10^{-5}		
Pyruvic	$CH_3COCOOH$			1.4×10^{-4}		
Sulfurous	H_2SO_3	HSO_3^-		1.3×10^{-2}	6.3×10^{-8}	

Ebbing, Darrell D. *General Chemistry* 3rd ed.; Houghton Mifflin Company: Boston, MA, 1990; p 645.

Dissociation Constants for Bases at 25ºC

Name	Formula		K_b	
Ammonia	NH_3		1.75×10^{-5}	
Aniline	$C_6H_5NH_2$		4.0×10^{-10}	
Ethylamine	$CH_3CH_2NH_2$		4.3×10^{-4}	
Ethylenediamine	$NH_2C_2H_4NH_2$	$NH_2C_2H_4NH_3^+$	8.5×10^{-5}	7.1×10^{-8}
Hydrazine	H_2NNH_2		1.3×10^{-6}	
Methylamine	CH_3NH_2		4.8×10^{-4}	
Piperidine	$C_5H_{11}N$		1.3×10^{-3}	
Pyridine	C_5H_5N		1.7×10^{-9}	

Christian, Gary D. *Analytical Chemistry, 5th ed.*; John Wiley & Sons: New York, 1994; pp 775-776.

Half-Lives and Masses for Selected Nuclides

All masses (third column) are given in amu

^{1}n	614 s	1.00866
^{3}H	12.33 d	3.01605
^{4}H	1.9×10^{-22} s	4.02781
^{5}H	8×10^{-23} s	5.03531
^{6}H	3×10^{-22} s	6.04494
^{6}He	0.805 s	6.01889
^{7}Be	53.28 d	7.01693
^{8}Li	0.844 s	8.02249
^{9}B	8×10^{-19} s	9.01333
^{10}Be	1.52×10^{6} y	10.01353
^{10}C	19.3 s	10.01685
^{11}C	20.3 m	11.01143
^{12}B	0.0204 s	12.01435
^{14}C	5715 y	14.00324
^{15}C	2.45 s	15.01060
^{15}O	124 s	15.00307
^{18}F	1.82951 h	18.00094
^{22}Na	950.97 d	21.99444
^{24}Na	14.9512 h	23.99096
^{31}Si	2.62 h	30.97536
^{32}P	14.28 d	31.97391
^{33}Cl	2.511 s	32.97745
^{33}Ar	174 ms	32.98993
^{35}S	87.2 d	34.96903
^{40}K	1.26×10^{9} y	39.96400
^{41}Ar	1.82 h	40.96450
^{44}Ti	22154 d	43.95969
^{46}Sc	83.831 d	45.95517
^{51}Cr	27.7010 d	50.94477
^{54}Mn	312.028 d	53.94036
^{55}Fe	2.73 y	54.93829
^{57}Co	272.11 d	56.93629
^{58}Co	70.77 d	57.93575
^{59}Fe	44.5074 d	58.93488
^{59}Cu	1.36 m	58.93950
^{62}Cu	9.67 m	61.93258
^{64}Cu	12.701 h	63.92976
^{65}Zn	244.164 d	64.92924
^{67}Ga	3.26154 d	66.92820
^{74}As	17.8 d	73.92393

^{75}Se	119.809 d	74.92252
^{77}As	38.8 h	76.92065
^{77}Rb	3.8 m	76.93041
^{78}Y	5.8 s	77.94361
^{79}Se	1.1×10^{6} y	78.91850
^{82}Br	1.471 d	81.91680
^{82}Sr	25.36 d	81.91840
^{85}Kr	3934.4 d	84.91253
^{85}Sr	64.8530 d	84.91293
^{87}Rb	4.9×10^{10} y	86.90918
^{88}Y	106.626 d	87.90950
^{90}Sr	29.1 y	89.90774
^{98}Tc	4.2×10^{6} y	97.90722
^{99}Mo	65.9239 h	98.90771
^{101}Mo	14.6 m	100.91035
^{105}Nb	3.0 s	104.92394
^{109}Cd	463.26 d	108.90498
^{110}Ag	249.950 d	109.90611
^{111}In	2.80477 d	110.90510
^{113}Sn	115.079 d	112.90517
^{115}In	5×10^{14} y	114.90388
^{116}Ag	2.68 m	115.91137
^{117}Sn	14.00 d	116.90295
^{123}I	13.2235 h	122.90559
^{123}Te	2.4×10^{19} y	122.90427
^{125}I	59.49 d	124.90463
^{125}Sb	1007.56 d	124.90525
^{127}Xe	36.3446 d	126.90518
^{131}I	8.0197 d	130.90612
^{131}Xe	11.934 d	130.90508
^{133}Ba	3853.6 d	132.90601
^{133}La	3.91 h	132.90822
^{133}Xe	5.24747 d	132.90591
^{134}Cs	753.88 d	133.90672
^{137}Cs	11015 d	136.90709
^{139}Ba	1.396 h	138.90884
^{139}Ce	137.734 d	138.90665
^{140}Ba	12.7527 d	139.91061
^{140}La	40.293 h	139.90948
^{141}Ce	32.50 d	140.90828

^{144}Ce	284.558 d	143.91365
^{144}Nd	5×10^{15} y	143.91009
^{148}Dy	3.1 m	147.92715
^{149}Sm	4×10^{14} y	148.91718
^{152}Eu	4945.5 d	151.92174
^{153}Gd	239.472 d	152.92175
^{153}Sm	46.2853 h	152.92210
^{154}Eu	3138.2 d	153.92298
^{154}Tb	21.5 h	153.92469
^{155}Eu	1738.97 d	154.92289
^{166}Ho	26.7663 h	165.93228
^{169}Yb	32.0147 d	168.93519
^{176}Hg	21 ms	175.98736
^{177}Lu	6.64 d	176.94376
^{181}Au	11.4 s	180.97008
^{181}W	121.095 d	180.94820
^{183}Ir	57 m	182.95685
^{185}Pt	1.18 h	184.96062
^{186}Os	2×10^{15} y	185.95384
^{186}Re	89.248 h	185.95499
^{187}Re	7×10^{10} y	186.95575
^{188}Ir	1.72 d	187.95885
^{188}Re	17.021 h	187.95811
^{190}Pt	6.1×10^{11} y	189.95993
^{192}Ir	73.810 d	191.96261
^{195}Au	186.098 d	194.96503
^{198}Au	2.69517 d	197.96824
^{201}Tl	3.0456 d	200.97082
^{202}Tl	12.466 d	201.97211
^{203}Hg	46.619 d	202.97287
^{203}Pb	51.923 h	202.97339
^{204}Pb	1.4×10^{17} y	203.97304
^{205}Pb	1.51×10^{7} y	204.97448
^{207}Bi	11523 d	206.97847
^{208}Po	2.898 y	207.98125
^{212}Bi	60.6 m	211.99129
^{213}At	0.11 μs	212.99294
^{214}Po	1.637×10^{-4} s	213.99520
^{214}Pa	17 ms	214.02093
^{218}At	1.6 s	218.00869
^{218}Po	3.0 m	218.00897
^{218}Th	0.11 μs	218.01328
^{219}Pa	0.05 μs	219.01989
^{222}Rn	3.82 d	222.01758
^{223}Ra	11.7 d	223.01850
^{224}Ra	3.64 d	224.02021
^{225}Ra	14.8 d	225.02361
^{226}Ra	1620 y	226.02541
^{228}Ra	6.7 y	228.03107
^{228}Th	698.60 d	228.02874
^{230}Th	8×10^{4} y	230.03313
^{231}U	4.2 d	231.03629
^{232}Th	1.40×10^{10} y	232.03806
^{232}Pa	1.31 d	232.03859
^{232}U	72 y	232.03716
^{233}Pa	27 d	233.04025
^{233}U	1.6×10^{5} y	233.03964
^{233}Pu	20.9 m	233.04301
^{234}Pa	6.69 h	234.04331
^{234}U	2.4×10^{5} y	234.04095
^{235}Pa	24.4 m	235.04545
^{235}U	7.05×10^{8} y	235.04393
^{235}Np	1.085 y	235.04406
^{237}U	6.75 d	237.04873
^{237}Pu	45.7 d	237.04841
^{238}U	4.46×10^{9} y	238.05079
^{239}Np	2.355 d	239.05294
^{239}Pu	2.41×10^{4} y	239.05216
^{241}Am	432.7 y	241.05683
^{241}Cm	32.8 d	241.05765
^{242}Bk	7.0 m	242.06198
^{244}Bk	4.4 h	244.06518
^{245}Pu	10.5 h	245.06775
^{250}Bk	3.217 h	250.07832
^{251}Cf	9.0×10^{2} y	251.07959
^{255}Fm	20.1 h	255.08996
^{257}Fm	100.5 d	257.09511
^{258}Md	56 d	258.09843
^{260}Lr	3 m	260.10550
^{261}Bh	12 ms	261.12166
^{261}Rf	1.1 m	261.10877
^{268}Mt	0.07 s	268.13873

Lide, David R. *CRC Handbook, 83rd ed.*, CRC Press: Boca Raton, Florida, 2002; p 11-51 – 11-213.

Polyatomic Ions

acetate	CH_3COO^{-1}
acetylide	C_2^{-2}
americyl	AmO_2^{+2}
amide	NH_2^{-1}
ammonium	NH_4^{+1}
arsenate	AsO_4^{-3}
arsenite	AsO_3^{-3}
astatate	AtO_3^{-1}
azide	N_3^{-1}
benzoate	$C_6H_5COO^{-1}$
bicarbonate/hydrogen carbonate	HCO_3^{-1}
binoxalate/hydrogen oxalate	$HOOCCOO^{-1}$
bismuthate	BiO_3^{-1}
bisulfate/hydrogen sulfate	HSO_4^{-1}
bisulfite/hydrogen sulfite	HSO_3^{-1}
bitartrate/hydrogen tartrate	$HOOCCH(OH)CH(OH)COO^{-1}$
borate	BO_3^{-3}
bromate	BrO_3^{-1}
bromite	BrO_2^{-1}
butyl	$CH_3CH_2CH_2CH_2^{+1}$
caprylate	$C_7H_{15}COO^{-1}$
carbonate	CO_3^{-2}
carbonyl	CO^{+2}
chlorate	ClO_3^{-1}
chlorite	ClO_2^{-1}
chromate	CrO_4^{-2}
chromyl	CrO_2^{+2}
citrate	$OOCCH_2C(OH)COOCH_2COO^{-3}$
cyanate	OCN^{-1}
cyanide	CN^{-1}
dichromate	$Cr_2O_7^{-2}$
dihydrogen phosphate	$H_2PO_4^{-1}$
dithionate	$S_2O_6^{-2}$
dithionite	$S_2O_4^{-2}$
ethoxide	$CH_3CH_2O^{-1}$
ethyl	$CH_3CH_2^{+1}$
ferricyanide	$Fe(CN)_6^{-3}$
ferrocyanide	$Fe(CN)_6^{-4}$
formate	$HCOO^{-1}$
fulminate	ONC^{-1}
fumarate	$OOC(CH)_2COO^{-2}$
gallate	GaO_3^{-3}
germanate	GeO_3^{-2}
hexafluorosilicate	SiF_6^{-2}
hydrogen phosphate	HPO_4^{-2}
hydroxide	OH^{-1}
hypobromite	BrO^{-1}
hypochlorite	ClO^{-1}
hypoiodite	IO^{-1}
hypophosphite	$PH_2O_3^{-1}$
imide	NH^{-2}
iodate	IO_3^{-1}
iodyl	IO_2^{+1}
isocyanate	NCO^{-1}
isopropoxide	$OCH(CH_3)_2^{-1}$
lactate	$CH_3CH(OH)COO^{-1}$
mandelate	$C_6H_5CH(OH)COO^{-1}$
mercury(I)	Hg_2^{+2}
methyl	CH_3^{+1}
molybdate	MoO_4^{-2}
neptunyl	NpO_2^{+2}
nitrate	NO_3^{-1}
nitrite	NO_2^{-1}
nitrosyl	NO^{+1}
oleate	$CH_3(CH_2)_7CHCH(CH_2)_7COO^{-1}$

orthoplumbate	PbO_4^{-4}	salicylate	$C_6H_4(OH)COO^{-1}$
orthosilicate	SiO_4^{-4}	selenate	SeO_4^{-2}
orthotellurate	TeO_6^{-5}	seleninyl	SeO^{+2}
oxalate	$OOCCOO^{-2}$	selenite	SeO_3^{-2}
ozonide	O_3^{-1}	selenocyanate	$SeCN^{-1}$
palmitate	$CH_3(CH_2)_{14}COO^{-1}$	selenonyl	SeO_2^{+2}
paramolybdate	$Mo_7O_{24}^{-6}$	silicate	SiO_3^{-2}
perbromate	BrO_4^{-1}	stannate	SnO_3^{-2}
perchlorate	ClO_4^{-1}	stearate	$CH_3(CH_2)_{16}COO^{-1}$
periodate	IO_4^{-1}	sulfamate	$NH_2SO_3^{-1}$
permanganate	MnO_4^{-1}	sulfate	SO_4^{-2}
peroxide	O_2^{-2}	sulfinyl	SO^{+2}
peroxydisulfate	$S_2O_8^{-2}$	sulfite	SO_3^{-2}
perrhenate	ReO_4^{-1}	sulfonyl	SO_2^{+2}
pertechnetate	TcO_4^{-1}	superoxide	O_2^{-1}
perxenate	XeO_6^{-4}	tartrate	$OOCCH(OH)CH(OH)COO^{-2}$
phosphate	PO_4^{-3}	tellurate	TeO_4^{-2}
phosphite	PO_3^{-3}	tellurocyanate	$TeCN^{-1}$
phosphonium	PH_4^{+1}	thiocarbonyl	CS^{+2}
phosphoryl	PO^{+1}	thiocyanate	SCN^{-1}
phthalate	$OOCC_6H_4COO^{-2}$	thionitrosyl	NS^{+1}
plumbite	PbO_2^{-2}	thiophosphoryl	PS^{+1}
plutoryl	PuO_2^{+2}	thiosulfate	$S_2O_3^{-2}$
propionate	$CH_3CH_2COO^{-1}$	tripolyphosphate	$P_3O_{10}^{-5}$
propyl	$CH_3CH_2CH_2^{+1}$	tungstate	WO_4^{-2}
pyrophosphate	$P_2O_7^{-4}$	uranyl	UO^{+2}
pyruvate	CH_3COCOO^{-1}	vanadate	VO_3^{-1}
rhenate	ReO_4^{-2}	vanadyl	VO^{+1}

Polyatomic Ion Relationships

- The prefix **thio-** indicates an oxygen has been replaced by a sulfur (see sulfate and thiosulfate).
- The prefix **bi-** or **hydrogen** indicates that a hydrogen ion is added to the ion. Its charge is increased by one (see carbonate and bicarbonate).
- The suffix **–ate** has one more oxygen than the suffix **–ite** (see nitrate and nitrite).
- Furthermore, the prefix **per-** adds an extra oxygen and the prefix **hypo-** removes an oxygen (see perchlorate, chlorate, chlorite, and hypochlorite).

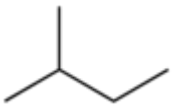
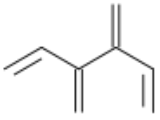
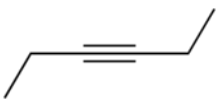
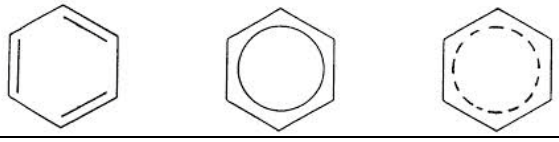
Monatomic Cations

antimony(V)	antimonic	copper(I)	cuprous
antimony(III)	antimonous	iron(III)	ferric
arsenic(V)	arsenic	iron(II)	ferrous
arsenic(III)	arsenous	manganese(III)	manganic
gold(III)	auric	manganese(II)	manganous
gold(I)	aurous	mercury(II)	mercuric
bismuth(V)	bismuthic	mercury(I)	mercurous
bismuth(III)	bismuthous	nickel(III)	nickelic
cerium(IV)	ceric	nickel(II)	nickelous
cerium(III)	cerous	lead(IV)	plumbic
chromium(III)	chromic	lead (II)	plumbous
chromium(II)	chromous	tin(IV)	stannic
cobalt(III)	cobaltic	tin(II)	stannous
cobalt(II)	cobaltous	titanium(IV)	titanic
copper(II)	cupric	titanium(III)	titanous

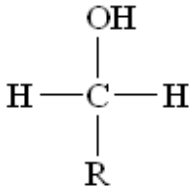
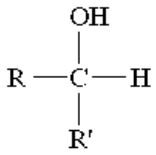
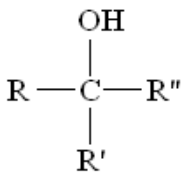
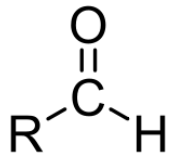
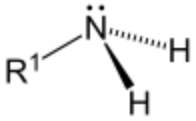
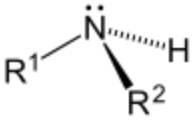
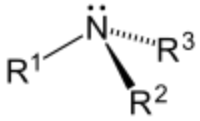
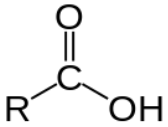
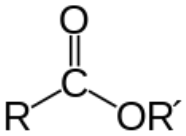
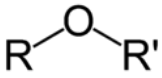
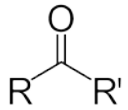
Organic Prefixes

# carbons	**prefix**	**# carbons**	**prefix**	**# carbons**	**prefix**
1	meth-	6	hex-	11	undec-
2	eth-	7	hept-	12	dodec-
3	prop-	8	oct-	13	tridec-
4	but-	9	non-	14	tetradec-
5	pent-	10	dec-	15	pentadec-

Types of Carbon Chains

Alkane	**Alkene**	**Alkyne**	**Aromatic**
C-C single bonds only	Contains at least one C=C double bond	Contains at least one C≡C triple bond	Benzene – may be substituted
			

Organic Functional Groups

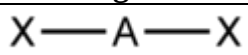
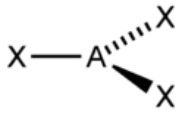
Class of Compound	**Functional Group**	**Suffix**	**Diagram**		
Alcohol	Hydroxyl	-ol			
			Primary (1°)	Secondary (2°)	Tertiary (3°)
Aldehyde	Formyl	-al			
Amine		-amine			
			Primary (1°)	Secondary (2°)	Tertiary (3°)
Carboxylic Acid	Carboxyl	-oic acid			
Ester		-oate			
Ether		[…] ether			
Ketone	Carbonyl	-one			

Bond Lengths and Enthalpies

Bond	Length (pm)	Enthalpy (kJ/mol)	Bond	Length (pm)	Enthalpy (kJ/mol)	Bond	Length (pm)	Enthalpy (kJ/mol)	Bond	Length (pm)	Enthalpy (kJ/mol)
H-H	74	436	N-S	168		Si-Br	216		Cl-Cl	199	242
H-F	92	567	N-F	139	272	Si-I	240		Cl-Br	214	218
H-Cl	127	431	N-Cl	191	200	P-H	142		Cl-I	243	208
H-Br	141	366	N-Br	214	243	P-Si	227		Br-Br	228	193
H-I	161	299	N-I	222		P-P	221		Br-I	248	175
C-H	109	413	O-H	96	463	P-F	156		I-I	266	151
C-C	154	348	O-P	160		P-Cl	204		C=C	134	614
C-Si	186	301	O-O	148	146	P-Br	222		C=N	127	615
C-N	147	293	O-S	151		P-I	243		C=O	123	799
C-O	143	358	O-F	142	190	S-H	134	339	N=N	122	418
C-P	187		O-Cl	164	203	S-P	210		N=O	120	607
C-S	181	259	O-Br	172		S-S	204	266	O=O	121	495
C-F	133	485	O-I	194	234	S-F	158	327	C≡C	121	839
C-Cl	177	328	Si-H	148	323	S-Cl	201	253	C≡N	115	891
C-Br	194	276	Si-Si	234	226	S-Br	225	218	C≡O	113	1072
C-I	213	240	Si-O	161	368	S-I	234		N≡N	110	941
N-H	101	391	Si-S	210		F-F	143	155	N≡O	106	
N-N	146	163	Si-N	172		F-Cl	166	253	S=O		523
N-P	177		Si-F	156		F-Br	178	237	S=S		418
N-O	144	201	Si-Cl	204		F-I	187				

Brown, LeMay, and Bursten. *Chemistry: The Central Science, 7th ed.*; Prentice Hall: Upper Saddle River, NJ, 1997; p280.
Silberberg, Martin S. *Chemistry: The Molecular Nature of Matter and Change, 4th ed.*; McGraw-Hill: New York, 2006; p 342.

Molecular Geometry

Geometry	Form	Bond Angle	Hybridization	Diagram
Linear	AX_2	180°	sp	
Trigonal Planar	AX_3	120°	sp^2	
Tetrahedral	AX_4	109.5°	sp^3	
Trigonal Pyramidal	AX_3E	107°	sp^3	
Bent	AX_2E_2	104.5°	sp^3	
Trigonal Bipyramidal	AX_5	90°, 120°, 180°	sp^3d	
Seesaw	AX_4E	90°, 173.1°, 101.6°	sp^3d	
Octahedral	AX_6	90°, 180°	sp^3d^2	
Square Pyramidal	AX_5E	84.8°, 180°	sp^3d^2	

Whitten, Davis, and Peck. *General Chemistry, 6th ed.*; Saunders College Publishing: Orlando, FL, 2000; pp 311, 338-9.

Table of Standard Reduction Potentials

Cathode (Reduction)	Half Reaction Standard Potential E^o (V)
$Li^+ (aq) + e^- \rightarrow Li (s)$	-3.0401
$Cs^+ (aq) + e^- \rightarrow Cs (s)$	-3.026
$Rb^+ (aq) + e^- \rightarrow Rb (s)$	-2.98
$K^+ (aq) + e^- \rightarrow K (s)$	-2.931
$Ba^{2+} (aq) + 2\ e^- \rightarrow Ba (s)$	-2.912
$Sr^{2+} (aq) + 2\ e^- \rightarrow Sr (s)$	-2.89
$Ca^{2+} (aq) + 2\ e^- \rightarrow Ca (s)$	-2.868
$Na^+ (aq) + e^- \rightarrow Na (s)$	-2.71
$Mg^{2+} (aq) + 2\ e^- \rightarrow Mg (s)$	-2.372
$Al^{3+} (aq) + 3\ e^- \rightarrow Al (s)$	-1.662
$Mn^{2+} (aq) + 2\ e^- \rightarrow Mn (s)$	-1.185
$2\ H_2O (\ell) + 2\ e^- \rightarrow H_2 (g) + 2\ OH^- (aq)$	-0.8277
$Zn^{2+} (aq) + 2\ e^- \rightarrow Zn (s)$	-0.7618
$Cr^{3+} (aq) + 3\ e^- \rightarrow Cr (s)$	-0.744
$Fe^{2+} + 2\ e^- \rightarrow Fe (s)$	-0.447
$Cd^{2+} (aq) + 2\ e^- \rightarrow Cd (s)$	-0.403
$Co^{2+} (aq) + 2\ e^- \rightarrow Co (s)$	-0.28
$Ni^{2+} (aq) + 2\ e^- \rightarrow Ni (s)$	-0.257
$Sn^{2+} (aq) + 2\ e^- \rightarrow Sn (s)$	-0.1375
$Pb^{2+} (aq) + 2\ e^- \rightarrow Pb (s)$	-0.1262
$Fe^{3+} + 3\ e^- \rightarrow Fe (s)$	-0.037
$2\ H^+ (aq) + 2\ e^- \rightarrow H_2 (g)$	0
$Sn^{4+} (aq) + 2\ e^- \rightarrow Sn^{2+} (aq)$	0.151
$Cu^{2+} (aq) + e^- \rightarrow Cu^+ (aq)$	0.153
$AgCl (s) + e^- \rightarrow Ag (s) + Cl^- (aq)$	0.22233
$ClO_3^- (aq) + H_2O (\ell) + 2\ e^- \rightarrow ClO_2^- (aq) + 2\ OH^- (aq)$	0.33
$Cu^{2+} (aq) + 2\ e^- \rightarrow Cu (s)$	0.3419
$ClO_4^- (aq) + H_2O (\ell) + 2\ e^- \rightarrow ClO_3^- (aq) + 2\ OH^- (aq)$	0.36
$Cu^+ (aq) + e^- \rightarrow Cu (s)$	0.521
$I_2 (s) + 2\ e^- \rightarrow 2\ I^- (aq)$	0.5355
$MnO_4^- (aq) + 2\ H_2O (\ell) + 3\ e^- \rightarrow MnO_2 (s) + 4\ OH^-$	0.595
$ClO_2^- (aq) + H_2O (\ell) + 2\ e^- \rightarrow ClO^- (aq) + 2\ OH^- (aq)$	0.66
$Fe^{3+} (aq) + e^- \rightarrow Fe^{2+} (aq)$	0.771
$Hg_2^{2+} (aq) + 2\ e^- \rightarrow 2Hg (\ell)$	0.7973
$Ag^+ (aq) + e^- \rightarrow Ag (s)$	0.7996
$ClO^- (aq) + H_2O (\ell) + 2\ e^- \rightarrow Cl^- (aq) + 2\ OH^- (aq)$	0.81
$Hg^{2+} (aq) + 2\ e^- \rightarrow Hg (\ell)$	0.851
$2\ Hg^{2+} (aq) + 2\ e^- \rightarrow Hg_2^{2+} (aq)$	0.92
$NO_3^- (aq) + 4\ H^+ (aq) + 3\ e^- \rightarrow NO (g) + 2\ H_2O (\ell)$	0.957
$Br_2 (\ell) + 2\ e^- \rightarrow 2\ Br^- (aq)$	1.066
$O_2 (g) + 4\ H^+ (aq) + 4\ e^- \rightarrow 2\ H_2O (\ell)$	1.229

$Cr_2O_7^{2-}$ (aq) + 14 H^+ (aq) + 6 e^- → 2 Cr^{3+} (aq) + 7 H_2O (ℓ)	1.232
Cl_2 (g) + 2 e^- → 2Cl^- (aq)	1.35827
MnO_4^- (aq) + 8 H^+ (aq) + 5 e^- → Mn^{2+} (aq) + 4 H_2O (ℓ)	1.507
MnO_4^- (aq) + 4 H^+ (aq) + 3 e^- → MnO_2 (s) + 2 H_2O (ℓ)	1.679
Ce^{4+} (aq) + e^- → Ce^{3+} (aq)	1.72
H_2O_2 (aq) + 2 H^+ (aq) + 2 e^- → 2 H_2O (ℓ)	1.776
Co^{3+} (aq) + e^- → Co^{2+} (aq)	1.92
$S_2O_8^{2-}$ (aq) + 2 e^- → 2 SO_4^{2-} (aq)	2.01
O_3 (g) + 2 H^+ (aq) + 2 e^- → O_2 (g) + H_2O (ℓ)	2.076
F_2 (g) + 2 e^- → 2 F^- (aq)	2.866

Lide, David R. *CRC Handbook, 83rd ed.*; CRC Press: Boca Raton, Florida, 2002; p 8-21–8-31.

Activity Series

Metals	**Nonmetals**
Li → Li^+	F_2 → 2F^-
Rb → Rb^+	Cl_2 → 2Cl^-
K → K^+	Br_2 → 2Br^-
Ba → Ba^{+2}	O_2 → 2O^{-2}
Sr → Sr^{+2}	I_2 → 2I^-
Ca → Ca^{+2}	S → S^{-2}
Na → Na^+	
Al → Al^{+3}	
Mn → Mn^{+2}	
Zn → Zn^{+2}	
Cr → Cr^{+3}	
Fe → Fe^{+2}	
Cd → Cd^{+2}	
Co → Co^{+2}	
Ni → Ni^{+2}	
Sn → Sn^{+2}	
Pb → Pb^{+2}	
H_2 → 2H^+	
Sb → Sb^{+3}	
Bi → Bi^{+3}	
Cu → Cu^{+2}	
Ag → Ag^+	
Hg → Hg^{+2}	
Pt → Pt^{+2}	
Au → Au^{+3}	

Brownlee, Raymond B., Fuller, Robert W., and Whitsit, Jesse E. *Elements of Chemistry*; Allyn and Bacon: Boston, Massachusetts, 1959; p 151.

The Electromagnetic Spectrum

EMR	Frequencies (Hz)		Wavelength (m)		Notes
Military communication	3.00E+03	3.00E+04	9993.33	99933.33	Radio
Navigation/Time	3.00E+04	3.00E+05	999.33	9993.33	
AM radio (long wave - Europe)	1.53E+05	2.79E+05	1074.55	1959.48	
AM radio (medium wave - North America)	5.35E+05	1.70E+06	176.35	560.37	
AM radio (short wave - international)	5.90E+06	2.61E+07	11.49	50.81	
Citizens band radio	2.696E+07	2.741E+07	10.94	11.12	
Garage door openers	4.000E+07		7.50		
Cordless phones	4.000E+07	5.000E+07	6.00	7.50	
Baby monitors	4.900E+07		6.12		
Television (network) stations 2 through 6*	5.40E+07	8.80E+07	3.41	5.55	
Radio controlled airplanes	7.200E+07		4.16		
Radio controlled cars	7.500E+07		4.00		
FM radio	8.80E+07	1.08E+08	2.78	3.41	
Television (network) stations 7 through 13*	1.74E+08	2.20E+08	1.36	1.72	
Wildlife tracking collars	2.150E+08	2.200E+08	1.36	1.39	
Cell phones	8.240E+08	8.490E+08	0.353	0.364	
Air traffic control	9.600E+08	1.215E+09	0.247	0.312	
GPS (Global Positioning System)	1.227E+09		0.24		
GPS (Global Positioning System)	1.58E+09		0.19		
Deep space radio communication	2.290E+09	2.300E+09	0.1303	0.1309	

EMR	**Frequencies (Hz)**		**Wavelength (m)**		**Notes**
Microwaves - microwave oven	2.450E+09		0.12		Microwave
Microwaves - ultra-high frequency (UHF)	3.000E+08	3.000E+09	0.0999	0.9993	
Microwaves - super high frequency (SHF)	3.000E+09	3.000E+10	0.0100	0.0999	
Microwaves - extremely high frequency (EHF)	3.000E+10	3.000E+11	0.0010	0.0100	
Far infrared (FIR)	3.00E+11	2.00E+13	1.5E-05	1.0E-03	Infrared
Long wavelength infrared (LWIR)	2.00E+13	3.75E+13	8.0E-06	1.5E-05	
Mid wavelength infrared (MWIR)	3.75E+13	9.99E+13	3.0E-06	8.0E-06	
Short wavelength infrared (SWIR)	9.99E+13	2.14E+14	1.4E-06	3.0E-06	
Near infrared (NIR)	2.14E+14	4.00E+14	7.5E-07	1.4E-06	
Red	4.00E+14	4.84E+14	6.20E-07	7.50E-07	Visible Light
Orange	4.84E+14	5.08E+14	5.90E-07	6.20E-07	
Yellow	5.08E+14	5.26E+14	5.70E-07	5.90E-07	
Green	5.26E+14	6.06E+14	4.95E-07	5.70E-07	
Blue	6.06E+14	6.66E+14	4.50E-07	4.95E-07	
Violet	6.66E+14	7.89E+14	3.80E-07	4.50E-07	
Near ultraviolet (UVA or long wave/"blacklight")	7.89E+14	9.52E+14	3.15E-07	3.80E-07	Ultraviolet
Near ultraviolet (UVB or medium wave)	9.52E+14	1.07E+15	2.80E-07	3.15E-07	
Near ultraviolet (UVC or short wave)	1.07E+15	1.50E+15	2.00E-07	2.80E-07	
Extreme or Vaccuum ultraviolet	1.50E+15	3.00E+16	1.00E-08	2.00E-07	
X-rays	3.00E+16	3.00E+18	1.00E-10	1.00E-08	X-rays
Gamma rays	2.42E+18	...and up	1.24E-10	…and shorter	Gamma rays

Standard Thermodynamic Values at 25°C

Please note that enthalpy and free energy values are given in kJ/mol while entropy values are given in J/(mol·K).

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
$(BOCl)_3$ (g)	-1633.4	380.7	-1550.2
$(CN)_2$ (g cyanogen)	309.0	242.3	297.2
$(NH_2)_2CO$ (s urea)	-333.5	104.6	-196.8
$(NH_4)_2O$ (ℓ)	-430.7	267.5	-267.1
$(NH_4)_2SiF_6$ (s hexagonal)	-2681.7	280.2	-2365.6
$(NH_4)_2SO_4$ (s)	-1180.9	220.1	-901.9
$[Co(NH_3)_5Cl]Cl_2$ (s)	-1017.1	366.1	-582.8
$[Co(NH_3)_5NO_2](NO_3)_2$ (s)	-1088.7	347.3	-418.4
$[Co(NH_3)_5NO_2]^{+2}$ (aq)	-613.4	179.9	-172.8
$[Co(NH_3)_6](ClO_4)_3$ (s)	-1034.7	615.1	-221.8
$[Co(NH_3)_6](NO_3)_3$ (s)	-1282.0	447.7	-516.7
$[Co(NH_3)_6]Br_3$ (s)	-1002.9	325.1	-501.2
$2CaO•B_2O_3$ (s)	-2734.4	145.1	-2596.7
$2CaO•Fe_2O_3$ (s)	-2139.3	188.8	-2001.8
$2CaO•MgO•SiO_2$ (s akermanite)	-3877.2	209.2	-3680.0
$2CaO•V_2O_5$ (s)	-3083.4	220.5	-2893.2
$2CuCl•C_2H_2$ (s)	-97.5	212.1	-31.9
$3BeO•B_2O_3$ (s)	-3104.5	100.4	-2938.8
$3CaO•2SiO_2$ (s)	-3961.0	210.8	-3761.4
$3CaO•2TiO_2$ (s)	-3950.5	234.7	-3751.4
$3CaO•Al_2O_3$ (s)	-3587.8	205.9	-3412.1
$3CaO•B_2O_3$ (s)	-3429.1	183.7	-3259.9
$3CaO•MgO•2SiO_2$ (s merwinite)	-4567.7	253.1	-4340.5
$3CaO•SiO_2$ (s)	-2929.2	168.6	-2784.0
$3CaO•V_2O_5$ (s)	-3777.9	274.9	-3561.1
$3CuCl•C_2H_2$ (s)	-236.0	297.1	-152.8
Ac (g)	406.0	188.1	366.0
Ac (s)	0.0	62.8	0.0
Ag (g)	284.9	173.0	246.0
Ag (s)	0.0	42.6	0.0
Ag^{+1} (aq)	105.6	72.7	77.1
Ag_2 (g)	410.0	257.0	358.8
$Ag_2C_2O_4$ (s)	-673.2	209.2	-584.1
Ag_2CO_3 (s)	-505.9	167.4	-436.8
Ag_2CrO_4 (s)	-731.7	217.6	-641.8
Ag_2MoO_4 (s)	-840.6	213.4	-748.1
Ag_2O (s)	-31.1	121.3	-11.2

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
Ag_2O_2 (s)	-24.3	117.2	27.6
Ag_2O_3 (s)	33.9	100.4	121.3
Ag_2S (s alpha orthorhombic)	-32.6	144.0	-40.7
Ag_2S (s beta)	-29.4	150.6	-39.5
Ag_2Se (s)	-37.7	150.7	-44.4
Ag_2SeO_3 (s)	-365.3	230.1	-304.2
Ag_2SeO_4 (s)	-420.5	248.5	-334.3
Ag_2SO_3 (s)	-490.8	158.2	-411.3
Ag_2SO_4 (s)	-715.9	200.4	-618.5
Ag_2Te (s)	-37.2	154.8	43.1
AgBr (s)	-100.4	107.1	-96.9
$AgBrO_3$ (s)	-10.5	151.9	71.3
AgCl (s)	-127.0	96.3	-109.8
$AgClO_2$ (s)	8.8	134.6	75.7
$AgClO_3$ (s)	-30.3	142.0	64.5
AgCN (s)	146.0	107.2	156.9
$AgF•2H_2O$ (s)	-800.8	174.9	-671.1
AgI (s)	-61.8	115.5	-66.2
$AgIO_3$ (s)	-171.1	149.4	-93.7
AgN_3 (s)	308.8	104.2	376.1
$AgNO_2$ (s)	-45.1	128.2	19.1
$AgNO_3$ (s)	-124.4	140.9	-33.5
AgO (s)	-11.4	57.8	14.2
AgOCN (s)	-95.4	121.3	-58.2
$AgReO_4$ (s)	-736.4	153.1	-635.6
AgSCN (s)	87.9	131.0	101.4
Al (ℓ)	8.7	35.2	6.6
Al (g)	326.4	164.4	285.8
Al (s)	0.0	28.3	0.0
$Al(BH_4)_3$ (ℓ)	-16.3	289.1	144.8
$Al(BH_4)_3$ (g)	12.6	379.1	146.4
$Al(CH_3)_3$ (ℓ)	-136.4	209.4	-10.0
$Al(NO_3)_3•6H_2O$ (s)	-2850.5	467.8	-2203.9
$Al(NO_3)_3•9H_2O$ (s)	-3757.1	569.0	-2929.6
$Al(OH)_3$ (s)	-1284.5	71.1	-1305.8
Al^{+3} (aq)	-531.4	-321.8	-485.3
$Al_2(CH_3)_6$ (g)	-230.9	524.7	-9.8

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
$Al_2(SO_4)_3$ (s)	-3435.1	239.3	-3506.6
Al_2Br_6 (g)	-1020.9	547.3	-947.3
Al_2Cl_6 (g)	-1295.4	475.5	-1220.9
Al_2F_6 (g)	-2631.7	387.0	-2539.7
Al_2I_6 (g)	-506.3	584.1	-560.7
Al_2O (g)	-131.4	259.4	-161.1
Al_2O_3 (ℓ)	-1581.1	89.6	-1499.3
Al_2O_3 (s alpha-corundum)	-1675.3	50.9	-1582.0
Al_2O_3 (s gamma-corundum)	-1656.9	59.8	-1562.7
$Al_2O_3•3H_2O$ (s gibbsite)	-2562.7	140.2	-2287.4
$Al_2O_3•H_2O$ (s diaspore)	-2000.0	70.5	-1841.0
$Al_2O_3•H_2O$ (s boehmite)	-1974.9	96.9	-1825.5
$Al_2Si_2O_7•2H_2O$ (s kaolinite)	-4098.7	202.9	-3778.2
$Al_2Si_2O_7•2H_2O$ (s halloysite)	-4079.8	203.3	-3759.3
Al_2SiO_5 (s kyanite)	-2596.2	83.8	-2443.9
Al_2SiO_5 (s andalusite)	-2592.0	93.3	-2444.7
Al_2SiO_5 (s sillimanite)	-2593.2	96.2	-2442.6
Al_4C_3 (g)	-215.9	89.1	-203.3
Al_4C_3 (s)	-207.3	104.6	-238.5
Al_6BeO_{10} (ℓ)	-5299.5	314.9	-5034.2
Al_6BeO_{10} (s)	-5624.1	175.6	-5317.5
$Al_6Si_2O_{13}$ (s mullite)	-6819.9	274.9	-6443.4
$AlBO_2$ (g)	-541.4	269.5	-550.6
$AlBr_3$ (ℓ)	-501.2	206.5	-486.3
$AlBr_3$ (g)	-410.9	349.1	-438.5
$AlBr_3$ (s)	-511.1	180.3	-488.3
AlC (g)	689.5	223.3	633.0
AlCl (g)	-51.5	227.9	-77.8
$AlCl_2$ (g)	-288.7	288.3	-299.6
$AlCl_3$ (ℓ)	-674.8	172.9	-618.2
$AlCl_3$ (g)	-584.5	314.3	-570.1
$AlCl_3$ (s)	-705.6	109.3	-630.1
$AlCl_3•6H_2O$ (s)	-2691.6	376.6	-2269.4
AlF (g)	-265.3	215.1	-290.8
AlF_2 (g)	-732.2	263.2	-740.6
AlF_3 (g)	-1209.2	276.8	-1192.9
AlF_3 (s)	-1510.4	66.5	-1430.9
$AlF_3•3H_2O$ (s)	-2297.4	209.2	-2051.8
AlH (g)	259.2	187.8	231.2
AlI_3 (ℓ)	-297.1	219.7	-301.3
AlI_3 (g)	-205.0	363.2	-251.0

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
AlI_3 (s)	-309.6	189.5	-305.4
AlN (g)	435.1	211.7	410.0
AlN (s)	-318.0	20.2	-287.0
AlO (g)	83.7	218.3	57.7
AlOCl (g)	-348.1	248.8	-350.2
AlOCl (s)	-793.3	54.4	-737.3
AlOF (g)	-586.6	234.3	-587.0
AlOH (g)	-179.9	216.3	-184.1
$AlPO_4$ (s berlinite)	-1692.0	90.8	-1601.2
AlS (g)	200.8	230.5	150.2
Am (c)	0.0	62.8	0.0
Am^{+3} (aq)	-682.8	-159.0	-671.5
Am^{+4} (aq)	-511.7	-372.4	-461.1
Am_2O_3 (s)	-1757.3	154.7	-1677.8
AmO_2 (s)	-1005.0	83.7	-950.2
Ar (g)	0.0	154.7	0.0
As (s alpha-gray)	0.0	35.2	0.0
As_2 (g)	222.2	239.3	172.0
As_2O_5 (s)	-924.9	105.4	-782.4
As_2S_3 (s)	-169.0	163.6	-168.6
As_4 (g)	143.9	313.8	92.5
As_4O_6 (g)	-1209.2	380.7	-1097.9
As_4O_6 (s monoclinic)	-1309.6	234.3	-1154.0
As_4O_6 (s octahedral)	-1313.9	214.2	-1152.5
$AsBr_3$ (g)	-129.7	363.8	-159.0
$AsCl_3$ (ℓ)	-305.0	216.3	-259.4
$AsCl_3$ (g)	-261.5	327.1	-249.0
AsH_3 (g)	66.4	222.7	68.9
AsI_3 (s)	-58.2	213.1	-59.4
AsN (g)	196.3	225.5	168.0
AsO_2^{-1} (aq)	-429.0	41.4	-350.0
AsO_4^{-3} (aq)	-888.1	-162.8	-648.4
At (s)	0.0	121.3	0.0
Au (g)	366.1	180.4	326.4
Au (s)	0.0	47.4	0.0
$Au(CN)_2^{-1}$ (aq)	242.3	171.5	285.8
$AuBr_4^{-1}$ (aq)	-191.6	336.0	-167.4
$AuCl_4^{-1}$ (aq)	-322.2	266.9	-237.3
AuH (g)	295.0	211.1	265.7
B (g)	562.8	153.3	518.8
B (s)	0.0	5.9	0.0

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
$B(CH_3)_3$ (ℓ)	-143.1	238.9	-32.2
$B(CH_3)_3$ (g)	-124.3	314.6	-36.0
$B(OH)_4^{-1}$ (aq)	-1344.0	102.5	-1153.3
B_2 (g)	830.5	201.8	774.0
B_2Cl_4 (ℓ)	-523.0	262.3	-464.8
B_2H_6 (g)	35.6	232.0	86.6
B_2O_2 (g)	-454.8	242.4	-462.3
B_2O_3 (g)	-843.8	279.7	-832.0
B_2O_3 (s)	-1272.8	54.0	-1193.7
$B_3N_3H_6$ (ℓ)	-541.0	199.6	-392.8
B_4C (s)	-71.1	27.1	-71.1
B_5H_9 (ℓ)	42.7	184.2	171.7
Ba (ℓ)	5.0	66.7	3.9
Ba (g)	179.1	170.0	146.9
Ba (s)	0.0	62.3	0.0
$Ba(BrO_3)_2$ (s)	-752.7	242.7	-577.4
$Ba(BrO_3)_2•H_2O$ (s)	-1054.8	292.5	-824.6
$Ba(ClO_3)_2$ (s)	-680.3	196.7	-531.4
$Ba(ClO_4)_2•3H_2O$ (s)	-1691.6	393.3	-1270.7
$Ba(IO_3)_2$ (s)	-1027.2	249.4	-864.8
$Ba(IO_3)_2•H_2O$ (s)	-1322.1	297.1	-1104.2
$Ba(N_3)_2•H_2O$ (s)	-308.4	188.3	-105.0
$Ba(NO_3)_2$ (s)	-992.1	213.8	-796.7
$Ba(OH)_2•8H_2O$ (s)	-3342.2	426.8	-2793.2
$Ba(ReO_4)_2•4H_2O$ (s)	-3368.1	376.6	-2918.3
Ba^{+2} (aq)	-537.6	9.6	-560.8
Ba_2TiO_4 (s)	-2243.0	196.7	-2133.0
$BaBr_2$ (g)	-439.3	330.5	-472.8
$BaBr_2$ (s)	-757.3	146.4	-736.8
$BaBr_2•2H_2O$ (s)	-1366.1	225.9	-1230.5
$BaCl_2$ (ℓ)	-832.5	143.5	-790.2
$BaCl_2$ (g)	-498.7	325.6	-510.7
$BaCl_2$ (s)	-858.1	123.7	-810.4
$BaCl_2•2H_2O$ (s)	-1460.1	202.9	-1296.5
$BaCO_3$ (s witherite)	-1216.3	112.1	-1137.6
$BaCrO_4$ (s)	-1446.0	158.6	-1345.3
BaF_2 (ℓ)	-1171.3	121.3	-1128.4
BaF_2 (g)	-803.8	301.2	-814.5
BaF_2 (s)	-1208.8	96.4	-1158.6
BaI_2 (ℓ)	-585.9	183.7	-587.4
BaI_2 (g)	-302.9	348.1	-353.4

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
BaI_2 (s)	-605.4	165.1	-601.4
$BaMoO_4$ (s)	-1548.1	138.1	-1439.7
BaO (ℓ)	-491.6	96.6	-471.2
BaO (g)	-123.9	235.4	-144.8
BaO (s)	-548.1	72.1	-520.4
BaS (s)	-460.2	78.2	-456.1
$BaSeO_3$ (s)	-1040.6	167.4	-968.2
$BaSeO_4$ (s)	-1146.4	175.7	-1044.7
$BaSiF_6$ (s)	-2952.2	163.2	-2794.1
$BaSiO_3$ (s)	-1623.6	109.6	-1540.3
$BaSO_4$ (s)	-1473.2	132.2	-1362.3
$BaTiO_3$ (s)	-1659.8	108.0	-1572.4
$BaZrO_3$ (s)	-1779.5	124.7	-1694.5
BBr (g)	238.1	224.9	195.4
BBr_3 (ℓ)	-239.7	229.7	-238.5
BBr_3 (g)	-205.6	324.1	-232.5
BCl (g)	149.5	213.1	120.9
BCl_2F (g)	-645.2	284.5	-631.4
BCl_3 (ℓ)	-427.2	206.3	-387.4
BCl_3 (g)	-403.8	290.0	-388.7
$BClF_2$ (g)	-890.4	272.0	-876.1
Be (ℓ)	12.1	16.5	10.0
Be (g)	324.3	136.2	286.6
Be (s)	0.0	9.5	0.0
$Be(OH)_2$ (s beta)	-905.8	46.0	-816.7
Be^{+2} (aq)	-382.8	-129.7	-379.7
Be_2C (s)	-117.2	16.3	-87.9
Be_2SiO_4 (s)	-2149.3	64.3	-2032.6
Be_3N_2 (s cubic)	-588.3	34.1	-533.0
$BeAl_2O_4$ (s)	-2300.8	66.3	-2178.6
$BeBr_2$ (s)	-369.9	106.3	-353.1
BeC_2 (g)	564.8	218.4	506.3
$BeCl_2$ (s beta)	-496.2	75.8	-449.5
BeF_2 (a alpha)	-1026.8	53.4	-979.5
BeH (g)	326.8	170.9	298.3
BeI_2 (s)	-192.5	120.5	-209.2
BeO (g)	129.7	197.5	104.2
BeO (s alpha)	-608.4	13.8	-579.1
BeO_2^{-2} (aq)	-790.8	159.0	-640.2
$BeSO_4$ (s alpha)	-1205.2	78.0	-1093.9
$BeSO_4•4H_2O$ (s)	-2423.8	233.0	-2080.7

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
$BeWO_4$ (s)	-1514.6	88.4	-1405.8
BF (g)	-122.2	200.4	-149.8
BF_3 (g)	-1137.0	254.0	-1120.4
BF_4^{-1} (aq)	-1574.9	179.9	-1487.0
BH (g)	449.6	171.8	419.6
BH_4^{-1} (aq)	48.2	110.5	114.3
Bi (g)	207.1	186.9	168.2
Bi (s)	0.0	56.7	0.0
Bi_2O_3 (s)	-573.9	151.5	-493.7
Bi_2S_3 (s)	-143.1	200.4	-140.6
Bi_2Te_3 (s)	-77.4	260.9	-77.0
BI_3 (g)	71.1	349.1	20.8
$BiBr_3$ (s)	263.6	225.9	234.3
$BiCl_3$ (g)	-265.7	358.7	-256.1
$BiCl_3$ (s)	-379.1	177.0	-315.1
BiOCl (s)	-366.9	120.5	-322.2
BiS (g)	179.9	284.5	121.3
BN (g)	647.5	212.2	614.5
BN (s)	-254.4	14.8	-228.5
BO (g)	25.1	203.4	-4.2
BO_2 (g)	-300.4	229.5	-305.9
BO_2^{-1} (aq)	-772.4	-37.2	-678.9
Br (g)	111.9	174.9	82.4
Br^{-1} (aq)	-121.6	82.4	-104.0
Br_2 (ℓ)	0.0	152.2	0.0
Br_2 (g)	30.9	245.4	3.1
Br_2Cl^{-1} (aq)	-170.3	188.7	-128.5
Br_3^{-1} (aq)	-130.4	215.5	-107.1
BrCl (g)	14.6	240.0	-1.0
BrF (g)	-93.9	228.9	-109.2
BrF_3 (ℓ)	-300.8	178.2	-240.6
BrF_3 (g)	-255.6	292.4	-229.5
BrF_5 (ℓ)	-458.6	225.1	-351.9
BrO (g)	125.8	237.4	108.2
BrO^{-1} (aq)	-94.1	41.8	-33.5
BrO_3^{-1} (aq)	-83.7	163.2	1.7
BrO_4^{-1} (aq)	13.0	199.6	118.1
C (g)	716.7	158.0	671.3
C (s diamond)	1.9	2.4	2.9
C (s graphite)	0.0	5.7	0.0
C^{-1} (g)	587.9	151.3	550.6

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
$C_{10}H_{18}$ (g 1-decyne)	41.2	524.5	252.2
$C_{10}H_{20}$ (ℓ 1-decene)	-174.6	425.0	105.0
$C_{10}H_{20}O$ (g decanal)	-330.9	578.6	-66.5
$C_{10}H_{22}O$ (ℓ 1-decanol)	-479.5	430.5	-132.2
$C_{10}H_{22}O$ (g 1-decanol)	-401.7	597.5	-104.2
$C_{10}H_8$ (g naphthalene)	150.6	333.1	224.1
$C_{10}H_8$ (s naphthalene)	78.5	167.4	201.6
$C_{11}H_{24}$ (ℓ undecane)	-326.6	458.1	22.8
$C_{11}H_{24}$ (g undecane)	-270.3	583.6	41.6
$C_{12}H_{10}$ (ℓ biphenyl)	119.2	250.2	259.7
$C_{12}H_{10}$ (s biphenyl)	100.5	205.9	254.2
$C_{12}H_{22}O_{11}$ (s sucrose)	-2225.5	360.2	-1544.7
$C_{12}H_{26}$ (ℓ 1-dodecane)	-352.1	490.6	28.1
C_2 (g)	837.6	199.3	781.6
C_2^{-1} (g)	443.5	196.5	393.3
C_2H_2 (g acetylene)	226.7	200.8	209.2
C_2H_3Cl (g vinyl chloride)	35.6	263.9	51.9
$C_2H_3Cl_3$ (g 1,1,1-trichloroethane)	-142.3	320.0	-76.2
C_2H_4 (g ethylene)	52.3	219.2	68.2
C_2H_5Br (ℓ ethyl bromide)	-90.5	198.7	-25.8
C_2H_5Br (g ethyl bromide)	-61.9	286.7	-23.9
$C_2H_5OC_2H_5$ (ℓ diethyl ether)	-273.2	253.1	-116.7
$C_2H_5OC_2H_5$ (g diethyl ether)	-252.1	342.7	-122.3
C_2H_5OH (ℓ ethanol)	-277.0	161.0	-174.2
C_2H_5OH (g ethanol)	-234.4	282.6	-167.9
C_2H_6 (g ethane)	-84.7	229.1	-32.8
$C_2H_6O_2$ (ℓ ethylene glycol)	-454.8	166.9	-323.2
$C_2H_6O_2$ (g ethylene glycol)	-389.3	323.6	-304.5
$C_2O_4^{-2}$ (aq)	-825.1	45.6	-673.9
C_3 (g)	820.1	237.2	754.4
C_3H_6 (g cyclopropane)	53.3	237.4	104.4
C_3H_7OH (ℓ 1-propanol)	-304.0	194.6	-170.6
C_3H_7OH (g 1-propanol)	-256.4	324.7	-161.8
C_3H_8 (g propane)	-103.9	270.2	-23.6
C_3O_2 (ℓ)	-117.3	181.1	-105.0
C_3O_2 (g)	-93.7	276.4	-109.8
C_4H_{10} (ℓ n-butane)	-147.7	231.0	-15.1
C_4H_{10} (g n-butane)	-126.2	310.1	-17.2
C_4H_4O (g furan)	-34.4	267.2	0.9
C_4H_6 (g 1,3-butadiene)	110.2	278.7	150.7
C_4H_8 (g cyclobutane)	26.7	265.4	110.0

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
C_4H_8 (g trans-2-butene)	-11.2	296.5	63.0
C_4H_8 (g cis-2-butene)	-7.0	300.8	65.9
C_4H_8O (ℓ 2-butanone)	-273.2	238.8	-151.4
C_4H_8O (g 2-butanone)	-235.4	338.1	-146.1
$C_4H_8O_2$ (ℓ 1,4-dioxane)	-353.4	195.3	-188.1
$C_4H_8O_2$ (g 1,4-dioxane)	-315.1	299.8	-180.8
C_4H_9OH (ℓ 1-butanol)	-327.1	226.4	-162.5
C_4H_9OH (g 1-butanol)	-274.7	362.8	-150.8
C_4N_2 (g)	533.5	290.0	510.9
C_5H_{10} (ℓ cyclopentane)	-105.8	204.3	36.4
C_5H_{10} (g cyclopentane)	-77.2	292.9	38.6
C_5H_{12} (ℓ pentane)	-173.1	262.7	-9.3
C_5H_{12} (g pentane)	-146.4	349.0	-8.4
C_6H_{10} (ℓ cyclohexene)	-38.8	216.2	101.6
C_6H_{10} (g cyclohexene)	-5.4	310.8	106.9
C_6H_{12} (ℓ cyclohexane)	-156.2	204.4	26.7
C_6H_{12} (g cyclohexane)	-123.1	298.2	31.8
$C_6H_{12}O$ (ℓ cyclohexanol)	-348.2	199.6	-133.3
C_6H_{14} (ℓ hexane)	-198.8	296.1	-3.8
C_6H_{14} (g 3-methylpentane)	-171.6	379.8	-2.1
C_6H_{14} (g 2-methylpentane)	-174.3	380.5	-5.0
C_6H_{14} (g hexane)	-167.2	388.4	-0.3
$C_6H_{14}O$ (ℓ 1-hexanol)	-379.5	289.5	-152.3
$C_6H_{14}O$ (g 1-hexanol)	-317.6	441.4	-135.6
C_6H_5COOH (s benzoic acid)	-385.1	167.6	-245.3
$C_6H_5NH_2$ (ℓ aniline)	31.6	191.3	149.1
$C_6H_5NH_2$ (g aniline)	86.9	319.2	166.7
C_6H_5OH (g phenol)	-96.4	315.6	-32.9
C_6H_5OH (s phenol)	-165.0	144.0	-50.4
C_6H_6 (ℓ benzene)	49.0	173.3	124.4
C_6H_6 (g benzene)	82.9	269.2	129.7
C_7H_{14} (ℓ cycloheptane)	-156.8	242.6	54.1
C_7H_{16} (ℓ 2-methylhexane)	-229.8	323.3	-2.9
C_7H_{16} (ℓ heptane)	-224.4	326.0	1.8
C_7H_{16} (g 3-ethylpentane)	-189.7	411.5	11.0
C_7H_{16} (g 2-methylhexane)	-194.9	420.0	3.2
C_7H_{16} (g heptane)	-187.8	427.9	8.0
C_7H_8 (ℓ toluene)	12.0	221.0	113.8
C_7H_8 (g toluene)	50.0	320.7	122.0
C_7H_8O (g p-cresol)	-125.4	347.7	-30.9
C_7H_8O (g m-cresol)	-132.3	356.8	-40.5

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
C_7H_8O (g o-cresol)	-128.6	357.6	-37.1
C_8H_{10} (ℓ ethylbenzene)	-12.5	255.2	119.7
C_8H_{10} (g ethylbenzene)	29.8	360.5	130.6
C_8H_{16} (ℓ cyclooctane)	-169.8	262.0	77.8
C_8H_{18} (ℓ 2-methylheptane)	-255.1	352.1	3.9
C_8H_{18} (ℓ octane)	-250.0	357.7	7.4
C_8H_{18} (g 2-methylheptane)	-215.5	455.3	12.8
C_8H_{18} (g octane)	-208.5	466.7	16.4
$C_8H_{20}Pb$ (ℓ tetraethyl lead)	53.1	472.5	336.4
C_8H_8 (ℓ styrene)	103.9	237.6	202.4
C_8H_8 (g styrene)	147.4	345.1	213.8
C_9H_{20} (ℓ nonane)	-275.5	393.7	11.8
C_9H_{20} (g nonane)	-229.0	505.7	24.8
Ca (ℓ)	10.9	50.7	8.2
Ca (g)	179.3	154.8	145.5
Ca (s)	0.0	41.4	0.0
$Ca(ClO_4)_2•4H_2O$ (s)	-1948.9	433.5	-1476.8
$Ca(H_2PO_4)_2•H_2O$ (s)	-3409.7	259.8	-3058.4
$Ca(IO_3)_2$ (s)	-1002.5	230.1	-839.3
$Ca(IO_3)_2•6H_2O$ (s)	-2780.7	451.9	-2267.7
$Ca(NO_3)_2$ (s)	-938.4	193.3	-743.2
$Ca(NO_3)_2•2H_2O$ (s)	-1540.8	269.5	-1229.3
$Ca(NO_3)_2•3H_2O$ (s)	-1838.0	319.2	-1471.9
$Ca(NO_3)_2•4H_2O$ (s)	-2132.3	375.3	-1713.5
$Ca(OH)_2$ (s)	-986.2	83.4	-898.5
$Ca[Mg(CO_3)_2]$ (s dolomite)	-2326.3	155.2	-2163.6
Ca^{+1} (g)	775.3	160.5	733.5
Ca^{+2} (aq)	-542.8	-53.1	-553.5
$Ca_{10}(PO_4)_6(OH)_2$ (s hydroxyapatite)	-13476.7	780.7	-12677.5
$Ca_{10}(PO_4)_6F_2$ (s fluorapatite)	-13744.4	775.7	-12983.0
$Ca_2P_2O_7$ (s beta)	-3338.8	189.2	-3132.1
Ca_2SiO_4 (s beta)	-2307.5	127.7	-2192.8
Ca_2SiO_4 (s gamma)	-2317.9	120.8	-2201.2
$Ca_3(AsO_4)_2$ (s)	-3298.7	225.9	-3063.1
$Ca_3(PO_4)_2$ (s alpha)	-4109.9	240.9	-3875.6
$Ca_3(PO_4)_2$ (s beta)	-4120.8	236.0	-3884.8
$CaBr_2$ (ℓ)	-663.0	147.9	-649.3
$CaBr_2$ (g)	-384.9	314.6	-421.0
$CaBr_2$ (s)	-683.3	129.7	-664.1
$CaBr_2•6H_2O$ (s)	-2506.2	410.0	-2153.1
CaC_2 (s)	-59.8	70.0	-64.9

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
$CaC_2O_4•H_2O$ (s)	-1674.9	156.5	-1514.0
$CaCl_2$ (ℓ)	-774.0	123.9	-732.2
$CaCl_2$ (g)	-471.5	290.0	-479.1
$CaCl_2$ (s)	-795.8	104.6	-748.1
$CaCO_3$ (s aragonite)	-1207.1	88.7	-1127.8
$CaCO_3$ (s calcite)	-1206.9	92.9	-1128.8
$CaCrO_4$ (s)	-1379.1	133.9	-1277.4
CaF_2 (ℓ)	-1184.1	92.6	-1142.2
CaF_2 (g)	-782.4	273.6	-795.0
CaF_2 (s)	-1219.6	68.9	-1167.3
CaH_2 (s)	-186.2	41.8	-147.3
$CaHPO_4$ (s)	-1814.4	111.4	-1681.3
$CaHPO_4•2H_2O$ (s)	-2403.6	189.5	-2154.8
CaI_2 (ℓ)	-500.2	179.0	-506.5
CaI_2 (g)	-258.2	327.4	-308.8
CaI_2 (s)	-536.8	145.3	-533.1
$CaMoO_4$ (s)	-1541.4	122.6	-1434.7
CaO (ℓ)	-557.4	62.3	-533.0
CaO (s)	-635.1	38.2	-603.5
$CaO•2Al_2O_3$ (s)	-3977.7	177.8	-3770.6
$CaO•2B_2O_3$ (s)	-3360.3	134.7	-3167.1
$CaO•Al_2O_3$ (s)	-2326.3	114.2	-2208.7
$CaO•B_2O_3$ (s)	-2031.0	104.9	-1924.1
$CaO•Fe_2O_3$ (s)	-1520.3	145.4	-1412.8
$CaO•MgO•2SiO_2$ (s diopside)	-3206.2	142.9	-3032.1
$CaO•V_2O_5$ (s)	-2329.3	179.1	-2169.7
CaS (s)	-474.9	56.5	-469.9
CaSe (s)	-368.2	66.9	-363.2
$CaSeO_4•2H_2O$ (s)	-1706.7	221.8	-1487.0
$CaSiO_3$ (s pseudowollastonite)	-1628.4	87.4	-1544.7
$CaSiO_3$ (s wollastonite)	-1634.9	81.9	-1549.7
$CaSO_3•H_2O$ (s)	-1752.7	184.1	-1555.2
$CaSO_4$ (s alpha soluble)	-1425.2	108.4	-1313.5
$CaSO_4$ (s anhydrite insoluble)	-1434.1	106.7	-1321.9
$CaSO_4$ (s beta soluble)	-1420.8	108.4	-1309.1
$CaSO_4$ (s)	-1434.5	106.5	-1322.0
$CaSO_4•0.5H_2O$ (s alpha macro)	-1576.7	130.5	-1436.8
$CaSO_4•0.5H_2O$ (s beta micro)	-1574.7	134.3	-1435.9
$CaSO_4•2H_2O$ (s)	-2022.6	194.1	-1797.5
$CaTiO_3$ (s perovskite)	-1660.6	93.6	-1575.3
$CaTiSiO_5$ (s sphene)	-2603.3	129.2	-2461.9

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
$CaWO_4$ (s)	-1645.2	126.4	-1538.5
$CaZrO_3$ (s)	-1766.9	100.1	-1681.1
CBr (g)	510.5	233.5	464.4
CCl (g)	502.1	224.3	468.6
CCl_2F_2 (g dichlorodifluoromethane)	-477.4	300.8	-439.4
Cd (g)	112.0	167.6	77.5
Cd (s alpha)	-0.6	51.8	-0.6
Cd (s gamma)	0.0	51.8	0.0
Cd^{+2} (aq)	-75.9	-73.2	-77.6
$Cd(CN)_4^{-2}$ (aq)	428.0	322.2	507.5
$Cd(NH_3)_4^{+2}$ (aq)	-450.2	336.4	-226.4
$CdBr_2$ (s)	-316.2	137.2	-296.3
$CdBr_2•4H_2O$ (s)	-1492.6	316.3	-1248.0
$CdCl_2$ (s)	-391.5	115.3	-344.0
$CdCl_2•2.5H_2O$ (s)	-1131.9	227.2	-944.1
$CdCl_3^{-1}$ (aq)	-561.1	202.9	-487.0
$CdCO_3$ (s)	-750.6	92.5	-669.4
CdF_2 (s)	-700.4	77.4	-647.7
CdI_2 (s)	-202.9	161.1	-201.4
CdI_4^{-2} (aq)	-341.8	326.4	-315.9
CdO (s)	-258.2	54.8	-228.5
CdS (s)	-161.9	64.9	-156.5
CdSb (s)	-14.4	92.9	-13.0
$CdSeO_3$ (s)	-575.3	142.3	-497.9
$CdSeO_4$ (s)	-633.0	164.4	-531.8
$CdSiO_3$ (s)	-1189.1	97.5	-1105.4
$CdSO_4$ (s)	-933.3	123.0	-822.8
$CdSO_4•8/_3H_2O$ (s)	-1729.4	229.6	-1465.3
$CdSO_4•H_2O$ (s)	-1239.6	154.0	-1068.8
CdTe (s)	-92.5	100.4	-92.1
Ce (g)	422.6	191.7	384.9
Ce (s)	0.0	72.0	0.0
Ce^{+3} (aq)	-696.2	-205.0	-672.0
Ce^{+4} (aq)	-537.2	-301.3	-503.8
$Ce_2(C_2O_4)_3•10H_2O$ (s)	-6782.3	799.1	-5903.6
Ce_2O_3 (s)	-1796.2	150.6	-1706.2
CeC_2 (g)	569.9	267.8	514.2
CeC_2 (s)	-62.8	83.7	-63.6
CeC_4 (g)	702.9	305.4	636.0
$CeCl_3$ (s)	-1053.5	150.6	-977.8
$CeCrO_3$ (s)	-1539.7	104.6	-1451.9

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
CeO_2 (s)	-1088.7	62.3	-1024.7
CeS (g)	131.4	260.2	84.5
CeS (s)	-459.4	78.2	-451.5
CeS_2 (g)	10.0	292.9	-36.8
CF (g)	255.2	212.9	221.8
CF^{+1} (g)	1149.3	201.3	1115.0
CF_2 (g)	-182.0	240.7	-191.6
CF_2^{+1} (g)	941.8	246.7	924.3
$CH_3CH_2CHOHCH_3$ (ℓ 2-butanol)	-342.6	225.1	-177.0
$CH_3CH_2CHOHCH_3$ (g 2-butanol)	-292.6	359.0	-167.6
CH_3CHO (ℓ acetaldehyde)	-192.3	160.3	-128.2
CH_3CHO (g acetaldehyde)	-166.4	264.2	-133.3
$CH_3CHOHCH_3$ (ℓ 2-propanol)	-317.9	180.6	-180.3
$CH_3CHOHCH_3$ (g 2-propanol)	-272.4	309.9	-173.4
CH_3COCH_3 (ℓ acetone)	-247.6	200.4	-155.7
CH_3COCH_3 (g acetone)	-216.7	294.9	-153.1
CH_3COO^{-1} (aq)	-486.0	86.6	-369.3
CH_3COOH (ℓ acetic acid)	-484.1	159.8	-390.0
CH_3COOH (g acetic acid)	-434.8	282.5	-376.7
CH_3OCH_3 (g dimethyl ether)	-184.1	267.1	-112.9
CH_3OH (ℓ methanol)	-239.0	127.2	-166.8
CH_3OH (g methanol)	-201.1	239.7	-162.4
CH_4 (g methane)	-74.9	186.3	-50.8
Cl (g)	121.3	165.1	105.3
Cl^{-1} (aq)	-167.2	56.5	-131.3
Cl_2 (g)	0.0	223.0	0.0
Cl_2F_6 (g)	-339.3	489.5	-237.2
Cl_2O (g)	80.3	267.9	97.5
ClF (g)	-54.5	217.8	-55.9
ClF_3 (g)	-159.0	281.5	-118.8
$ClF_3 \bullet HF$ (g)	-450.6	359.8	-384.1
ClF_5 (g)	-238.5	310.6	-146.4
ClO (g)	101.2	226.6	97.5
ClO^{-1} (aq)	-107.1	41.8	-36.8
ClO_2 (g)	102.5	256.8	120.3
ClO_2^{-1} (aq)	-66.5	101.3	17.2
ClO_3^{-1} (aq)	-99.2	162.3	-3.4
ClO_3F (g)	-27.2	278.9	44.9
ClO_4^{-1} (aq)	-129.3	182.0	-8.6
CN (g)	435.1	202.6	405.0
CN^{+1} (g)	1802.9	213.3	1763.1

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
CN^{-1} (aq)	150.6	94.1	172.4
CN^{-1} (g)	60.7	195.8	38.7
CN_2 (g)	581.6	231.6	573.2
CNBr (g)	181.4	247.2	160.6
CNCl (g)	132.2	235.5	125.5
CNI (g)	225.1	256.6	196.2
CNI (s)	160.3	128.9	169.4
CO (g)	-110.5	197.9	-137.3
Co (s face centered cubic)	0.5	30.7	0.3
Co (s hexagonal)	0.0	30.0	0.0
$Co(IO_3)_2 \bullet 2H_2O$ (s)	-1082.0	267.8	-795.8
$Co(NH_3)_6^{+3}$ (aq)	-584.9	146.4	-157.3
$Co(OH)_2$ (s pink)	-539.7	79.5	-454.4
Co^{+2} (aq)	-58.2	-113.0	-54.4
Co^{+3} (aq)	92.1	-305.4	133.9
CO_2 (aq undissoc)	-413.8	117.6	-386.0
CO_2 (g)	-393.5	213.7	-394.4
CO_3^{-2} (aq)	-677.1	-56.9	-527.9
Co_3O_4 (s)	-910.0	114.2	-795.0
$COBr_2$ (g)	-96.2	309.0	-110.9
$COCl_2$ (g)	-220.9	283.8	-206.8
$CoCl_2$ (s)	-312.5	109.2	-269.9
$CoCl_2 \bullet 2H_2O$ (s)	-923.0	188.3	-764.8
$CoCl_2 \bullet 6H_2O$ (s)	-2115.4	343.1	-1725.5
$CoCl_3$ (g)	-163.6	334.1	-154.5
COF_2 (g)	-640.2	258.7	-624.6
CoF_2 (s)	-692.0	82.0	-647.3
CoF_3 (s)	-790.8	94.6	-719.7
CoO (s)	-237.9	53.0	-214.2
COS (g)	-138.4	231.5	-165.6
CoSi (s)	-100.4	43.1	-98.7
$CoSO_4$ (s)	-888.3	118.0	-782.4
$CoSO_4 \bullet 6H_2O$ (s)	-2683.6	367.6	-2235.7
$CoSO_4 \bullet 7H_2O$ (s)	-2979.9	406.1	-2473.8
Cr (ℓ)	26.1	36.2	22.3
Cr (g)	397.5	174.2	352.6
Cr (s)	0.0	23.6	0.0
$Cr_{23}C_6$ (s)	-364.8	610.0	-373.6
Cr_2N (s)	-125.5	64.9	-102.2
Cr_2O_3 (ℓ)	-1018.4	125.6	-950.1
Cr_2O_3 (s)	-1134.7	81.2	-1053.1

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
$Cr_2O_7^{-2}$ (aq)	-1490.3	261.9	-1301.2
Cr_3C_2 (s)	-85.4	85.4	-86.3
Cr_7C_3 (s)	-161.9	200.8	-166.9
$CrCl_2$ (s)	-395.4	115.3	-356.1
$CrCl_3$ (s)	-556.5	123.0	-486.1
CrF_3 (s)	-1159.0	93.9	-1087.8
CrN (g)	505.0	230.5	471.9
CrN (s)	-117.2	37.7	-92.8
CrO (g)	188.3	239.2	154.6
CrO_2 (g)	-75.3	269.1	-87.4
CrO_2Cl_2 (ℓ)	-579.5	221.8	-510.9
CrO_2Cl_2 (g)	-538.1	329.7	-501.7
CrO_3 (g)	-292.9	266.1	-273.5
CrO_4^{-2} (aq)	-881.2	50.2	-727.9
Cs (ℓ)	2.1	92.1	0.0
Cs (g)	76.6	175.5	49.8
CS (g)	234.3	210.5	184.1
Cs (s)	0.0	85.1	0.0
Cs^{+1} (aq)	458.6	169.7	427.2
CS_2 (ℓ)	89.7	151.3	65.3
CS_2 (g)	117.1	237.8	66.9
Cs_2O (g)	-92.1	318.0	-104.6
$CsAl(SO_4)_2•12H_2O$ (s)	-6064.7	686.2	-5098.2
CsBr (s)	-405.7	113.4	-384.9
CsCl (ℓ)	-434.3	101.7	-406.3
CsCl (g)	-240.2	256.0	-257.7
CsCl (s)	-442.8	101.2	-414.2
CsF (ℓ)	-543.8	90.1	-515.1
CsF (g)	-356.5	243.1	-373.2
CsF (s)	-554.8	88.3	-525.5
CsH (g)	121.3	214.4	101.7
CsI (s)	-336.8	125.5	-333.7
CsOH (ℓ)	-406.0	118.5	-365.9
CsOH (g)	-259.4	255.1	-259.8
CsOH (s)	-416.7	98.7	-362.3
Cu (g)	338.3	166.3	298.6
Cu (s)	0.0	33.2	0.0
$Cu(C_2O_4)_2^{-2}$ (aq)	-1592.0	146.4	-1336.0
$Cu(IO_3)_2•H_2O$ (s)	-692.0	247.3	-468.6
$Cu(NH_3)^{+2}$ (aq)	-38.9	12.1	15.6
$Cu(NH_3)_2^{+2}$ (aq)	-142.3	111.3	-30.5
$Cu(NH_3)_3^{+2}$ (aq)	-245.6	199.6	-73.1
$Cu(NH_3)_4^{+2}$ (aq)	-348.5	273.6	-111.3
$Cu(OH)_2$ (s)	-450.2	108.4	-372.8
Cu^{+1} (aq)	71.7	40.6	50.0
Cu^{+2} (aq)	64.8	-99.6	65.5
Cu_2 (g)	484.2	241.5	432.0
Cu_2O (s)	-168.6	93.1	-146.0
Cu_2S (s alpha)	-79.5	120.9	-86.2
CuBr (s)	-104.6	96.1	-100.8
CuCl (s)	-137.2	86.2	-119.9
$CuCl_2$ (s)	-205.9	108.1	-161.9
$CuCl_2•2H_2O$ (s)	-821.3	167.4	-656.1
CuCN (s)	95.0	90.0	108.4
$CuCO_3•Cu(OH)_2$ (s malachite)	-1051.4	186.2	-893.7
CuF (s)	-192.5	64.9	-171.5
CuF_2 (s)	-548.9	68.6	-499.2
$CuFe_2O_4$ (s)	-965.2	141.0	-858.8
$CuFeO_2$ (s)	-532.6	88.7	-479.9
CuI (s)	-67.8	96.7	-69.5
CuN_3 (s)	279.1	100.4	344.8
CuO (s)	-157.3	42.6	-129.7
CuS (s)	-53.1	66.5	-53.6
$CuSO_4$ (s)	-771.4	108.8	-661.9
$CuSO_4•3H_2O$ (s)	-1684.3	221.3	-1400.2
$CuSO_4•5H_2O$ (s)	-2279.7	300.4	-1880.1
$CuSO_4•H_2O$ (s)	-1085.8	146.0	-918.2
Dy (g)	248.5	196.5	254.4
Dy (s)	0.0	75.3	0.0
Dy_2O_3 (s)	-1863.1	149.8	-1771.5
DyC_2 (s)	862.3	267.8	808.4
$DyCl_3•6H_2O$ (s)	-2870.2	401.7	-2451.8
Er (g)	317.2	195.5	281.2
Er (s)	0.0	73.2	0.0
Er^{+3} (aq)	-705.4	-244.3	-669.1
Er_2O_3 (s)	-1897.9	155.6	-1808.7
ErC_2 (g)	578.2	263.6	524.7
$ErCl_3•6H_2O$ (s)	-2874.4	398.7	-2454.3
Eu (g)	175.3	188.7	142.3
Eu (s)	0.0	77.8	0.0
Eu^{+2} (aq)	-523.0	4.2	-540.2
Eu^{+3} (aq)	-605.0	-221.8	-574.0

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
Eu_2O_3 (s monoclinic)	-1651.4	146.4	-1556.9
Eu_3O_4 (s)	-2271.9	205.0	-2142.2
EuC_2 (s)	-62.8	100.4	-66.9
$EuCl_3 \bullet 6H_2O$ (s)	-2784.9	407.1	-2366.1
EuO (s)	-592.0	62.8	-556.9
F (g)	79.0	158.7	61.9
F^{-1} (aq)	-332.6	-13.8	-278.8
F^{-1} (g)	-255.6	145.5	-262.3
F_2 (g)	0.0	202.7	0.0
Fe (ℓ)	13.1	34.3	11.1
Fe (s alpha)	0.0	27.3	0.0
$Fe(CN)_6^{-3}$ (aq)	561.9	270.3	729.3
$Fe(CN)_6^{-4}$ (aq)	455.6	95.0	694.9
$Fe(CO)_5$ (ℓ)	-774.0	338.1	-705.4
$Fe(CO)_5$ (g)	-733.9	445.2	-697.3
$Fe(OH)^{+2}$ (aq)	-290.8	-142.3	-229.4
Fe^{+2} (aq)	-89.1	-137.7	-78.9
Fe^{+3} (aq)	-48.5	-315.9	-4.6
$Fe_2(SO_4)_3$ (s)	-2581.5	307.5	-2263.1
Fe_2O_3 (s hematite)	-824.3	87.4	-742.2
Fe_2SiO_4 (s fayalite)	-1479.9	145.2	-1379.1
Fe_3C (s alpha-cementite)	25.1	104.6	20.1
Fe_3O_4 (s magnetite)	-1118.4	146.4	-1015.5
Fe_3Si (s)	-93.7	103.8	-94.6
Fe_4N (s)	-10.5	156.1	3.8
Fe_7S_8 (s pyrrhotite)	-736.4	485.8	-748.5
$FeAl_2O_4$ (s)	-1966.5	106.3	-1849.3
FeAsS (s)	-41.8	121.3	-50.2
$FeBr_2$ (s)	-249.8	140.7	-237.2
$FeCl_2$ (s)	-341.8	118.0	-302.3
$FeCl_3$ (s)	-399.5	142.3	-334.1
$FeCO_3$ (s siderite)	-740.6	92.9	-666.7
$FeCr_2O_4$ (s)	-1444.7	146.0	-1343.9
FeF_2 (s)	-702.9	87.0	-661.1
FeF_3 (s)	-1041.8	98.3	-970.7
FeI_2 (s)	-104.6	167.4	-113.0
$FeMoO_4$ (s)	-1075.3	129.3	-974.9
FeO (s)	-272.0	60.8	-251.5
$FeOH^{+1}$ (aq)	-324.7	-29.3	-277.4
$FePO_4 \bullet 2H_2O$ (s strengite)	-1888.2	171.3	-1657.7
FeS (s pyrrhotite)	-100.0	60.3	-100.4

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
FeS_2 (s pyrite)	-178.2	52.9	-166.9
FeSi (s)	-73.6	46.0	-73.6
$FeSi_2$ (s beta-lebanite)	-81.2	55.7	-78.2
$FeSO_4$ (s)	-928.4	120.9	-825.1
$FeSO_4 \bullet 7H_2O$ (s)	-3014.6	409.2	-2510.3
$FeWO_4$ (s)	-1154.8	131.8	-1054.4
FNO_3 (g)	10.5	292.9	73.6
Fr (g)	72.8	181.9	46.7
Fr (s)	0.0	94.1	0.0
Fr_2O (s)	-338.9	156.9	-299.2
Ga (g)	277.0	169.0	238.9
Ga (s)	0.0	40.9	0.0
$Ga(OH)_3$ (s)	-964.4	100.4	-831.4
Ga^{+3} (aq)	-211.7	-331.0	-159.0
Ga_2O_3 (s rhombic)	-1089.1	85.0	-998.3
GaAs (s)	-71.1	64.2	-67.8
GaBr (g)	-49.8	251.9	-90.0
$GaBr_3$ (s)	-386.6	179.9	-359.8
$GaBr_4^{-1}$ (aq)	-661.9	36.0	-550.2
GaCl (g)	-79.9	240.2	-106.3
$GaCl_3$ (s)	-524.7	142.3	-454.8
GaF_3 (s)	-1163.2	83.7	-1085.3
GaH (g)	220.5	195.4	193.7
GaN (g)	175.7	225.9	150.6
GaO (g)	279.5	231.0	253.6
GaSb (s)	-41.8	76.1	-38.9
Gd (g)	397.5	194.2	359.8
Gd (s)	0.0	68.1	0.0
Gd^{+3} (aq)	-686.2	-205.9	-661.1
$Gd_2(SO_4)_3 \bullet 8H_2O$ (s)	-6330.4	651.9	-5531.3
$GdCl_3 \bullet 6H_2O$ (s)	-2866.0	408.2	-2451.8
Ge (g)	376.6	167.8	336.0
Ge (s)	0.0	31.1	0.0
Ge_2 (g)	473.0	252.7	416.3
$GeBr_2$ (g)	-62.8	331.0	-106.7
$GeBr_4$ (ℓ)	-347.7	280.8	-331.4
$GeBr_4$ (g)	-300.0	396.1	-318.0
GeCl (g)	154.8	246.0	125.5
$GeCl_4$ (ℓ)	-531.8	245.6	-462.8
$GeCl_4$ (g)	-495.8	347.6	-457.3
GeF_4 (g)	90.8	217.0	113.4

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
GeI_2 (g)	46.9	318.0	-4.2
GeI_2 (s)	-87.9	133.9	-83.7
GeI_4 (g)	-56.9	428.8	-106.3
GeI_4 (s)	-141.8	271.1	-144.4
GeO (g)	-46.2	224.2	-73.2
GeO (s brown)	-212.1	50.2	-237.2
GeO_2 (s hexagonal)	-551.0	55.3	-497.1
GeP (s)	-20.9	62.8	-16.7
GeS (s)	-69.0	71.1	-71.6
H^{+1} (aq)	0.0	0.0	0.0
H_2 (g)	0.0	130.6	0.0
$H_2AsO_4^{-1}$ (aq)	-909.6	117.2	-753.3
H_2CS_3 (ℓ)	25.1	223.0	27.8
H_2MoO_4 (g)	-851.0	355.6	-787.4
H_2O (ℓ)	-285.8	69.9	-237.2
H_2O (g)	-241.8	188.7	-228.6
H_2O_2 (ℓ)	-187.8	109.6	-120.4
H_2O_2 (g)	-136.1	232.9	-105.5
$H_2PO_4^{-1}$ (aq)	-1296.3	90.4	-1130.4
H_2S (g)	-20.2	205.8	-33.1
H_2Se (g)	29.7	218.9	15.9
H_2SiO_3 (s)	-1188.7	133.9	-1092.4
H_2SO_4 (ℓ)	-814.0	156.9	-690.1
H_2SO_4 (g)	-740.6	289.1	-656.1
$H_2VO_4^{-1}$ (aq)	-1174.0	121.3	-1020.9
H_2WO_4 (g)	-905.4	351.5	-839.7
H_2WO_4 (s)	-1131.8	146.4	-1004.2
H_3BO_3 (s)	-1094.3	88.8	-969.0
H_3PO_4 (ℓ)	-1254.4	150.6	-1111.7
H_3PO_4 (s)	-1266.9	110.5	-1112.5
H_4SiO_4 (s)	-1481.1	192.5	-1333.0
$HAsO_4^{-2}$ (aq)	-906.3	-1.7	-714.7
HBO_2 (s monoclinic)	-794.3	37.7	-723.4
HBO_2 (s orthorhombic)	-788.8	50.2	-721.7
HBr (g)	-36.3	198.7	-53.4
HCl (g)	-92.3	186.8	-95.3
HClO (g)	-92.1	236.6	-79.5
HCN (ℓ)	108.9	112.8	124.9
HCN (g)	135.1	201.7	124.7
HCO_3^{-1} (aq)	-692.0	91.2	-586.9
$HCrO_4^{-1}$ (aq)	-878.2	184.1	-764.8

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
He (g)	0.0	126.0	0.0
HF (g)	-271.1	173.7	-273.2
Hf (g)	619.2	186.8	576.6
Hf (s hexagonal)	0.0	43.6	0.0
HfB_2 (s)	-336.0	42.7	-332.2
$HfCl_4$ (s)	-990.4	190.8	-901.3
HfF_4 (s monoclinic)	-1930.5	113.0	-1830.5
HfO_2 (s)	-1144.7	59.3	-1027.2
Hg (ℓ)	0.0	76.0	0.0
Hg (g)	61.3	174.9	31.9
Hg^{+1} (aq)	171.1	-32.2	164.4
Hg_2^{+2} (aq)	172.4	84.5	153.5
$Hg(CH_3)_2$ (ℓ)	59.8	209.2	140.2
$Hg(CH_3)_2$ (g)	94.4	305.4	146.0
$Hg_2(N_3)_2$ (s)	594.1	205.0	746.4
Hg_2Br_2 (s)	-206.9	218.7	-181.1
Hg_2Cl_2 (s)	-265.2	192.5	-210.8
Hg_2CO_3 (s)	-553.5	179.9	-468.2
Hg_2F_2 (s)	-485.3	159.0	-426.8
Hg_2I_2 (s)	-121.3	242.7	-111.0
Hg_2SO_4 (s)	-743.1	200.7	-625.9
$HgBr_2$ (s)	-170.7	170.3	-153.1
HgCl (g)	84.1	259.8	62.8
$HgCl_2$ (s)	-224.3	146.0	-178.7
HgF_2 (s)	-422.6	116.3	-372.4
HgH (g)	240.0	219.5	216.0
HgI (g)	132.4	281.4	88.5
HgI_2 (g)	-17.2	336.0	-59.8
HgI_2 (s red)	-105.4	181.2	-101.7
HgO (s red hexagonal)	-89.5	71.1	-58.2
HgO (s red orthorhombic)	-90.8	70.3	-58.6
HgO (s yellow)	-90.5	71.1	-58.4
HgS (s black)	-53.6	88.3	-47.7
HgS (s red)	-58.2	82.4	-50.6
HgSe (g)	75.7	267.0	31.4
HgSe (s)	-46.0	94.1	-38.1
HgTe (s)	-33.9	106.7	-28.0
HI (g)	26.5	206.5	1.7
$HN_2O_2^{-1}$ (aq)	-39.3	142.3	76.2
HN_3 (g)	294.1	238.9	328.0
HNCO (g)	-116.7	238.1	-107.4

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
HNCS (g)	127.6	247.7	113.0
HNO_2 (g cis)	-76.6	249.3	-41.8
HNO_2 (g trans)	-78.7	249.2	-43.9
HNO_3 (ℓ)	-173.2	155.6	-79.9
HNO_3 (g)	-135.1	266.3	-74.8
Ho (g)	300.8	195.5	264.9
Ho (s)	0.0	75.3	0.0
Ho^{+3} (aq)	-705.0	-226.8	-673.6
Ho_2O_3 (s)	-1880.7	158.2	-1791.2
HoC_2 (s)	-108.8	96.2	-111.7
$HoCl_3•6H_2O$ (s)	-2878.2	406.2	-2460.2
HOF (g)	-98.3	226.7	-85.7
HPO_4^{-2} (aq)	-1292.1	-33.5	-1089.3
$HReO_4$ (s)	-762.3	158.2	-664.8
HS^{-1} (aq)	-17.6	62.8	12.1
HSe^{-1} (aq)	15.9	79.5	43.9
$HSeO_3^{-1}$ (aq)	-514.6	135.1	-411.5
$HSeO_4^{-1}$ (aq)	-581.6	149.4	-452.3
HSO_3^{-1} (aq)	-626.2	139.8	-527.8
HSO_4^{-1} (aq)	-887.3	131.8	-755.9
HSO_3F (g)	-753.1	297.1	-690.4
HVO_4^{-2} (aq)	-1159.0	16.7	-974.9
I (g)	106.8	180.7	70.3
I^{-1} (aq)	-55.2	111.3	-51.6
I_2 (g)	62.4	260.6	19.4
I_2 (s)	0.0	116.1	0.0
IBr (g)	40.8	258.7	3.7
ICl (ℓ)	-23.9	135.1	-13.6
ICl (g)	17.8	247.4	-5.4
ICl_3 (s)	-89.5	167.4	-22.3
IF (g)	-95.7	236.1	-118.5
IF_5 (g)	-840.2	334.7	-771.5
IF_7 (g)	-943.9	346.4	-818.4
In (g)	243.3	173.7	208.7
In (s)	0.0	57.8	0.0
$In(OH)^{+2}$ (aq)	-370.3	-87.9	-313.0
$In(OH)_2^{+2}$ (aq)	-619.2	25.1	-525.1
$In_2(SO_4)_3$ (s)	-2786.5	272.0	-2439.3
In^{+3} (aq)	-105.0	-151.0	-98.0
In_2O_3 (s)	-925.8	104.2	-830.7
In_2S (g)	62.8	318.0	13.0

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
In_2S_3 (s)	-426.8	163.6	-412.5
InAs (s)	-58.6	75.7	-53.6
InBr (g)	-56.9	259.4	-94.3
InBr (s)	-175.3	113.0	-169.0
InH (g)	215.5	207.5	190.3
InI (g)	7.5	267.2	-37.7
InI (s)	-116.3	129.7	-120.5
InO (g)	387.0	236.4	364.4
InP (s)	-88.7	59.8	-77.0
InS (s)	-138.1	66.9	-131.8
InSb (s)	-30.5	86.2	-25.5
IO (g)	175.1	245.4	149.8
IO^{-1} (aq)	-107.5	-5.4	-38.5
IO_3^{-1} (aq)	-221.3	118.4	-128.0
IO_4^{-1} (aq)	-151.5	222.0	-58.5
Ir (g)	665.3	193.5	20.8
Ir (s)	0.0	35.5	0.0
$IrCl_3$ (g)	104.6	376.6	100.4
$IrCl_3$ (s)	-245.6	113.0	-179.9
IrF_6 (g)	-543.9	357.7	-460.2
IrF_6 (s)	-579.7	247.7	-461.7
K (ℓ)	2.3	71.5	0.3
K (g)	89.1	90.0	60.7
K (s)	0.0	64.7	0.0
K^{+1} (aq)	-252.4	102.5	-283.3
$K_2B_4O_7$ (s)	-3334.2	208.4	-3136.7
K_2CO_3 (s)	-1150.2	155.5	-1064.4
K_2O (s)	-363.2	94.1	-322.2
K_2O_2 (s)	-495.8	113.0	-429.7
K_2SiO_3 (s)	-1548.1	146.2	-1455.6
K_2SO_4 (s)	-1433.7	175.7	-1316.4
K_3AlCl_6 (s)	-2092.0	376.6	-1938.5
$KAl(SO_4)_2$ (s)	-2465.4	204.6	-2235.5
$KAl(SO_4)_2•12H_2O$ (s)	-6057.3	687.4	-5137.1
$KAlCl_4$ (s)	-1196.6	196.7	-1096.2
KBF_4 (s)	-1887.0	133.9	-1784.9
KBH_4 (s)	-226.8	106.6	-159.8
KBO_2 (s)	-995.0	80.0	-978.6
KBr (s)	-392.2	96.4	-379.2
$KBrO_3$ (s)	-332.2	149.2	-243.5
KCl (g)	-215.9	239.5	-235.1

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
KCl (s)	-435.9	82.7	-408.3
$KClO_3$ (s)	-391.2	143.0	-289.9
$KClO_4$ (s)	-430.1	151.0	-300.4
KCN (s)	-113.5	127.8	-102.1
KF (s)	-568.6	66.6	-538.9
$KF•2H_2O$ (s)	-1159.0	150.6	-1015.5
KH (s)	-57.8	50.2	-34.1
KH_2AsO_4 (s)	-1136.0	155.1	-991.6
KHF_2 (s)	-931.4	104.3	-863.2
KI (s)	-327.7	106.4	-322.3
KIO_3 (s)	-508.4	151.5	-425.5
$KMnO_4$ (s)	-813.4	171.7	-713.8
KNO_3 (s)	-492.7	132.9	-393.1
KO_2 (s)	-284.5	122.6	-240.6
KOH (s)	-425.9	78.9	-379.1
Kr (g)	0.0	164.0	0.0
La (g)	431.0	182.3	393.6
La (s)	0.0	56.9	0.0
$La(IO_3)_3$ (s)	-1397.5	259.4	-1131.4
La^{+3} (aq)	-707.1	-217.6	-683.7
$La_2(SeO_4)_3$ (s)	-2879.4	338.9	-2633.8
La_2O_3 (s)	-1793.7	127.3	-1705.8
La_2Te_3 (s)	-723.8	231.6	-714.6
LaC_2 (g)	587.4	255.2	531.8
LaC_2 (s)	-71.1	71.1	-72.4
$LaCl_3•7H_2O$ (s)	-3178.6	462.8	-2713.3
LaS (s)	-456.1	73.2	-451.5
Li (ℓ)	2.4	33.9	0.9
Li (g)	160.7	138.7	128.0
Li (s)	0.0	29.1	0.0
Li^{+1} (aq)	-278.5	13.4	-293.3
$Li_2B_4O_7$ (s)	-3363.9	155.6	-3171.5
Li_2BeF_4 (s)	-2273.6	130.5	-2171.5
Li_2CO_3 (s)	-1216.0	90.2	-1132.2
Li_2O (s)	-598.7	37.9	-561.9
Li_2O_2 (s)	-632.6	56.5	-571.1
$Li_2Si_2O_5$ (s)	-2561.0	125.5	-2417.1
Li_2SiO_3 (s)	-1649.3	80.3	-1559.0
Li_2SO_4 (s)	-1436.5	115.1	-1321.7
Li_2TiO_3 (s)	-1670.7	91.8	-1579.9
Li_3AlF_6 (s)	-3383.6	187.9	-3223.8

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
Li_3N (s)	-197.5	37.7	-154.0
$LiAlF_4$ (g)	-1853.5	326.4	-1811.7
$LiAlH_4$ (s)	-117.2	87.9	-48.5
$LiAlO_2$ (s)	-1189.5	53.4	-1127.2
$LiBeF_3$ (s)	-1651.8	89.1	-1576.1
$LiBH_4$ (s)	-190.5	75.8	-124.8
$LiBO_2$ (s)	-1019.2	51.7	-963.2
LiBr (s)	-350.9	74.1	-341.6
LiCl (s)	-408.3	59.3	-384.1
$LiCl•H_2O$ (s)	-712.6	103.8	-632.6
$LiClO_4$ (s)	-380.7	125.5	-254.0
LiF (s)	-616.9	35.7	-588.7
LiH (s)	-90.6	20.0	-68.5
LiI (s)	-270.1	85.8	-269.7
LiO (g)	83.7	210.9	60.5
LiOH (s)	-484.9	42.8	-438.9
$LiOH•H_2O$ (s)	-789.8	92.1	-689.5
Lu (g)	427.6	184.7	404.6
Lu (s)	0.0	51.0	0.0
Lu^{+3} (aq)	-665.3	-263.6	-627.6
Lu_2O_3 (s)	-1878.2	110.0	-1789.1
$LuCl_3•6H_2O$ (s)	-2830.9	376.1	-2411.2
Mg (ℓ)	9.0	42.5	6.1
Mg (g)	147.6	148.5	113.1
Mg (s)	0.0	32.7	0.0
$Mg(ClO_4)_2•6H_2O$ (s)	-2445.6	520.9	-1863.1
$Mg(NO_3)_2$ (s)	-790.7	164.0	-589.5
$Mg(NO_3)_2•6H_2O$ (s)	-2613.3	451.9	-2080.7
$Mg(OH)_2$ (s)	-924.7	63.2	-833.9
$Mg(VO_3)_2$ (s)	-2201.6	160.7	-2039.4
Mg^{+1} (g)	891.6	154.3	848.9
Mg^{+2} (aq)	-466.9	-138.1	-454.8
$Mg_2Al_4Si_5O_{19}$ (s cordierite)	-9108.6	407.1	-8598.1
Mg_2Ge (s)	-108.8	86.5	-105.9
Mg_2Si (s)	-77.8	66.9	-75.3
Mg_2SiO_4 (s forsterite)	-2174.0	95.1	-2055.2
Mg_2TiO_4 (s)	-2164.4	109.3	-2047.7
$Mg_2V_2O_7$ (s)	-2835.9	200.4	-2645.3
$Mg_3(PO_4)_2$ (s)	-3780.7	189.2	-3538.8
Mg_3N_2 (s)	-460.7	87.9	-400.8
$Mg_3Si_2O_5(OH)_4$ (s chrysotile)	-4365.6	221.3	-4038.0

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
$Mg_3Si_4O_{10}(OH)_2$ (s talc)	-5922.5	260.7	-5543.0
$MgAl_2O_4$ (s)	-2312.9	88.7	-2190.3
$MgBr_2$ (s)	-524.3	117.2	-503.8
$MgBr_2 \bullet 6H_2O$ (s)	-2410.0	397.5	-2056.0
$MgCl_2$ (s)	-641.6	89.6	-592.1
$MgCO_3$ (s)	-1095.8	65.7	-1012.1
$MgCr_2O_4$ (s)	-1783.6	106.0	-1669.0
MgF_2 (s)	-1124.2	57.2	-1071.1
$MgFe_2O_4$ (s)	-1428.4	123.9	-1317.1
MgH_2 (s)	-75.3	31.1	-36.0
MgI_2 (s)	-364.0	129.7	-358.2
$MgMoO_4$ (s)	-1400.9	118.8	-1295.7
MgO (s microcrystal)	-598.0	27.9	-566.0
MgO (s periclase)	-601.7	26.9	-569.0
MgS (s)	-346.0	50.3	-341.8
$MgSiO_3$ (s clinoenstatite)	-1549.0	67.8	-1462.1
$MgSO_4$ (s)	-1284.9	91.6	-1170.7
$MgSO_4 \bullet 6H_2O$ (s)	-3087.0	348.1	-2632.2
$MgSO_4 \bullet 7H_2O$ (s)	-3388.7	372.4	-2871.9
$MgSO_4 \bullet H_2O$ (s)	-1602.1	126.4	-1428.8
$MgTi_2O_5$ (s)	-2509.6	127.3	-2366.9
$MgTiO_3$ (s)	-1572.8	74.6	-1484.1
$MgWO_4$ (s)	-1532.6	101.2	-1420.9
Mn (g)	280.8	173.6	238.5
Mn (s alpha)	0.0	32.0	0.0
Mn (s gamma)	1.6	32.4	1.4
$Mn(IO_3)_2$ (s)	-669.4	263.6	-520.5
$Mn(OH)_2$ (s precipitate/amorphous)	-695.4	99.2	-615.1
Mn^{+2} (aq)	-220.8	-73.6	-228.0
Mn_2O_3 (s)	-959.0	110.5	-881.2
Mn_2SiO_4 (s)	-1730.5	163.2	-1632.2
Mn_3C (s)	4.6	98.7	5.4
Mn_3O_4 (s)	-1387.8	155.6	-1283.2
$MnC_2O_4 \bullet 2H_2O$ (s)	-1628.4	200.8	-1415.0
$MnCl_2$ (s)	-481.3	118.2	-440.5
$MnCl_2 \bullet 2H_2O$ (s)	-1092.0	218.8	-942.2
$MnCl_2 \bullet 4H_2O$ (s)	-1687.4	303.3	-1423.8
$MnCl_2 \bullet H_2O$ (s)	-789.9	174.1	-696.2
$MnCO_3$ (s natural)	-894.1	85.8	-816.7
$MnCO_3$ (s precipitated)	-882.8	113.0	-811.7
MnF_2 (s)	-790.8	-748.9	92.3

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
MnO (s)	-385.2	59.7	-362.9
MnO_2 (s)	-520.0	53.1	-465.2
MnO_4^{-1} (aq)	-541.4	191.2	-447.3
MnO_4^{-2} (aq)	-652.7	58.6	-500.8
MnS (s green)	-214.2	78.2	-218.4
MnSe (s)	-106.7	90.8	-111.7
$MnSiO_3$ (s)	-1320.9	89.1	-1240.6
$MnSO_4$ (s)	-1065.3	112.1	-957.4
Mo (g)	658.1	181.8	612.5
Mo (s)	0.0	28.7	0.0
$Mo(CO)_6$ (g)	-912.1	489.5	-856.1
$Mo(CO)_6$ (s)	-982.8	325.9	-877.8
Mo_3Si (s)	-96.2	106.3	-96.2
$MoCl_4$ (s)	-480.3	223.8	-401.7
$MoCl_5$ (s)	-527.2	238.5	-422.6
$MoCl_6$ (s)	-523.0	255.2	-389.1
MoF_6 (ℓ)	-1585.5	259.7	-1473.1
MoF_6 (g)	-1557.7	350.4	-1472.3
MoO_2 (s)	-588.9	46.3	-533.0
MoO_2Cl_2 (g)	-634.3	337.7	-598.3
MoO_3 (g)	-359.8	280.3	-343.1
MoO_3 (s)	-745.1	77.7	-668.0
MoO_4^{-2} (aq)	-997.9	27.2	-836.4
$MoOF_4$ (g)	-1255.2	330.5	-1192.4
MoS_2 (s)	-235.1	62.6	-225.9
N (g)	472.7	153.2	455.6
N_2 (g)	0.0	191.5	0.0
N_2F_2 (g cis)	66.9	259.8	108.8
N_2F_2 (g trans)	81.2	262.6	120.5
N_2H_2 (g cis diimide)	213.4	218.4	243.1
N_2H_2 (g trans)	182.4	220.1	213.0
N_2H_4 (ℓ)	50.6	121.2	149.2
N_2H_4 (g)	95.4	238.4	159.3
N_2O (g)	82.1	219.7	104.2
N_2O_2 (g)	170.4	287.5	202.9
$N_2O_2^{-2}$ (aq)	-17.2	27.6	138.9
N_2O_3 (g)	83.7	312.2	139.4
N_2O_4 (ℓ)	-19.6	209.2	97.4
N_2O_4 (g)	9.2	304.2	97.8
N_2O_4 (s)	-35.0	150.3	99.5
N_2O_5 (s)	11.3	347.2	117.7

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
N_3^{-1} (aq)	275.1	108.0	348.1
Na (ℓ)	2.4	57.9	0.5
Na (g)	107.7	153.6	77.3
Na (s)	0.0	51.5	0.0
Na^{+1} (aq)	-240.1	59.0	-261.9
$Na_2B_4O_7$ (s)	-3276.1	189.5	-3083.6
Na_2CO_3 (s)	-1130.9	136.0	-1047.7
Na_2O (s)	-415.9	72.8	-376.6
Na_2O_2 (s)	-513.4	94.8	-449.8
Na_2S (s)	-373.2	97.9	-359.8
Na_2SiO_3 (s)	-1518.8	113.8	-1426.7
Na_2SO_3 (s)	-1090.4	146.0	-1002.1
Na_2SO_4 (s)	-1384.5	149.5	-1266.8
$Na_2SO_4•10H_2O$ (s)	-4324.1	592.9	-3644.0
Na_2WO_4 (s)	-1543.9	160.3	-1430.9
Na_3AlCl_6 (s)	-1979.0	347.3	-1828.4
Na_3AlF_6 (ℓ)	-3238.4	286.6	-3088.2
Na_3AlF_6 (s cryolite)	-3309.5	238.5	-3142.2
$NaAlCl_4$ (s)	-1142.2	188.3	-1041.8
$NaAlO_2$ (s)	-1133.0	70.4	-1069.4
$NaBH_4$ (s)	-191.8	101.4	-127.1
$NaBO_2$ (s)	-975.7	73.5	-919.2
NaBr (s)	-361.4	86.8	-349.3
NaCl (s)	-411.0	72.4	-384.1
$NaClO_4$ (s)	-382.8	142.3	-254.4
NaF (s)	-575.3	51.2	-545.2
NaH (g)	125.0	188.0	103.7
NaH (s)	-56.4	40.0	-33.6
$NaHCO_3$ (s)	-947.7	102.1	-851.9
NaI (s)	-288.0	98.3	-284.5
$NaNO_3$ (s)	-466.7	116.3	-365.9
NaOH (ℓ)	-416.9	75.9	-374.1
NaOH (s)	-426.7	64.4	-379.1
$NaOH•H_2O$ (s)	-732.9	84.5	-623.4
Nb (g)	725.9	186.2	681.2
Nb (s)	0.0	36.4	0.0
Nb_2C (s)	-190.0	64.0	-185.8
Nb_2O_5 (s high-temp. form)	-1899.5	137.2	-1766.1
NbC (s)	-138.9	35.4	-136.8
$NbCl_5$ (g)	-703.8	400.5	-646.0
$NbCl_5$ (s)	-797.5	210.5	-683.3

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
$NbCO_2$ (s)	-57.3	92.1	-55.2
$NbCO_3$ (s)	-59.0	121.3	-57.3
$NbCr_2$ (s)	-20.9	83.6	-20.9
NbF_5 (g)	-1739.7	321.8	-1678.2
NbF_5 (s)	-1813.8	160.3	-1699.1
$NbFe_2$ (s)	-46.4	100.4	-49.4
NbN (s)	-235.1	34.5	-201.7
NbO (g)	213.4	238.9	184.1
NbO (s)	-405.9	48.1	-378.7
NbO_2 (g)	-214.6	255.2	-218.8
NbO_2 (s)	-796.2	54.5	-740.6
Nd (g)	327.6	189.3	292.5
Nd (s)	0.0	71.6	0.0
Nd^{+3} (aq)	-696.2	-206.7	-671.5
$Nd_2(C_2O_4)_3•10H_2O$ (s)	-6782.3	-799.1	-5907.8
Nd_2O_3 (s hexagonal)	-1807.9	154.4	-1720.9
Nd_2S_3 (s)	-1188.3	185.3	-1172.4
NdC_2 (g)	547.1	26.4	493.3
$NdCl_3•6H_2O$ (s)	-2874.4	417.1	-2460.6
Ne (g)	0.0	146.2	0.0
NF_3 (g)	-131.4	260.7	-90.0
NH (g imidogen)	377.2	181.1	371.3
NH_2 (g amidogen)	190.4	194.6	199.8
NH_3 (g)	-46.1	192.3	-16.5
NH_4 (s carbamate)	-645.1	133.5	-448.1
NH_4^{+1} (aq)	-132.5	113.4	-79.4
$NH_4Al(SO_4)_2$ (s)	-2352.2	216.3	-2038.4
NH_4Br (s)	-270.8	113.0	-175.3
NH_4Cl (s)	-314.4	94.6	-203.0
NH_4ClO_4 (s)	-295.3	184.2	-88.9
NH_4F (s)	-464.0	72.0	-348.8
$NH_4H_2AsO_4$ (s)	-2189.5	172.1	-833.0
$NH_4H_2PO_4$ (s)	-1445.1	152.0	-1210.6
NH_4HCO_3 (s)	-849.4	120.9	-666.1
NH_4HF_2 (s)	-802.9	115.5	-651.0
NH_4HS (s)	-156.9	97.5	-50.6
NH_4HSe (s)	-133.1	96.7	-23.4
NH_4I (s)	-201.4	117.2	-112.6
NH_4N_3 (s)	115.5	112.6	274.1
NH_4NO_3 (s)	-365.6	151.1	-184.0
NH_4OH (ℓ)	-361.2	165.6	-254.1

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
NH_4ReO_4 (s)	-945.6	232.6	-774.9
NH_4VO_3 (s)	-1053.1	140.6	-888.3
Ni (g)	429.7	182.1	384.5
Ni (s)	0.0	29.9	0.0
$Ni(CN)_4^{-2}$ (aq)	367.8	217.6	472.0
$Ni(CO)_4$ (ℓ)	-633.0	313.4	-588.3
$Ni(CO)_4$ (g)	-602.9	410.5	-587.3
$Ni(IO_3)_2$ (s)	-489.1	213.4	-326.4
Ni^{+2} (aq)	-54.0	-128.9	-45.6
Ni_3S_2 (s)	-202.9	133.9	-197.1
$NiCl_2$ (s)	-305.3	97.7	-259.1
$NiCl_2•2H_2O$ (s)	-922.2	175.7	-760.2
$NiCl_2•4H_2O$ (s)	-1516.7	242.7	-1235.1
$NiCl_2•6H_2O$ (s)	-2103.2	344.3	-1713.5
NiF_2 (s)	-651.5	73.6	-604.2
NiO (s)	-239.7	38.0	-211.7
NiS (s)	-82.0	53.0	-79.5
$NiSO_4$ (s)	-872.9	97.1	-759.8
$NiSO_4•6H_2O$ (s tetrahedral)	-2682.8	332.2	-2225.0
$NiSO_4•7H_2O$ (s)	-2976.3	378.9	-2462.2
NO (g)	90.3	210.7	86.6
NO_2 (g)	33.2	240.0	51.3
NO_2^{-1} (aq)	-104.6	140.2	-37.2
NO_2Cl (g)	12.6	272.0	54.4
NO_2F (g)	-79.5	260.2	-37.2
NO_3 (g)	70.9	252.6	114.5
NO_3^{-1} (aq)	-207.4	146.4	-111.3
NOBr (g)	82.2	273.6	82.4
NOCl (g)	51.7	261.6	66.1
NOF (g)	-65.7	248.0	-50.3
NOF_3 (g)	-163.2	278.4	-96.2
NpO_2 (s)	-1029.3	80.3	-979.1
O (g)	249.2	161.0	231.8
O_2 (g)	0.0	205.0	0.0
O_2F_2 (g)	19.8	268.1	61.4
O_3 (g)	142.7	238.8	163.2
OCN^{-1} (aq)	-146.0	106.7	-97.5
OF (g)	124.3	217.7	120.1
OF_2 (g)	24.5	247.3	41.8
OH^{-1} (aq)	-230.0	-10.8	-157.3
Os (g)	790.8	192.5	744.8

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
Os (s)	0.0	32.6	0.0
$OsCl_3$ (s)	-190.4	129.7	-121.3
$OsCl_4$ (s)	-254.8	154.8	-159.0
OsO_4 (g)	-337.2	293.7	-292.9
OsO_4 (s white)	-385.8	167.8	-303.8
OsO_4 (s yellow)	-394.1	143.9	-305.0
OsS_2 (s)	-146.0	54.4	-133.9
P (g red V)	333.9	163.1	292.0
P (l red V)	18.1	42.9	12.1
P (s alpha white)	17.5	41.1	12.0
P (s red V)	0.0	22.8	0.0
P_2 (g)	146.2	218.0	103.8
P_2H_4 (ℓ)	-5.0	167.4	66.9
$P_2O_7^{-4}$ (aq)	-2271.1	-117.2	-1919.2
P_4 (g)	128.9	128.9	72.4
P_4O_{10} (s hexagonal)	-2940.1	228.9	-2675.3
P_4S_3 (ℓ)	-151.0	207.1	-156.9
P_4S_3 (g)	-81.2	319.2	-120.5
P_4S_3 (s)	-154.8	200.8	-159.0
Pb (ℓ)	4.3	71.7	2.2
Pb (g)	195.6	175.3	162.6
Pb (s)	0.0	64.8	0.0
Pb^{+2} (aq)	-1.7	10.5	-24.4
$Pb(IO_3)_2$ (s)	-495.4	313.0	-351.5
$Pb(N_3)_2$ (s monoclinic)	478.2	148.1	624.7
$Pb(N_3)_2$ (s orthorhombic)	476.1	149.4	622.2
$Pb(ReO_4)_2•2H_2O$ (s)	-2234.3	309.6	-1903.7
Pb_2SiO_4 (s)	-1376.5	187.0	-1267.8
$Pb_3(PO_4)_2$ (s)	-2595.3	353.1	-2432.6
Pb_3O_4 (s)	-718.8	212.1	-601.7
PbB_2O_4 (s)	-1556.5	130.5	-1450.2
PbB_4O_7 (s)	-2857.7	166.9	-2667.3
PbBr (g)	71.1	272.4	31.8
$PbBr_2$ (ℓ)	-267.4	173.9	-254.6
$PbBr_2$ (g)	-104.4	339.3	-140.8
$PbBr_2$ (s)	-277.4	161.1	-260.8
$PbBr_4$ (g)	-456.4	426.1	-473.3
PbC_2O_4 (s)	-851.4	146.0	-750.2
PbCl (g)	15.1	259.5	-9.6
$PbCl_2$ (ℓ)	-344.3	153.2	-304.2
$PbCl_2$ (g)	-174.1	317.1	-182.8

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
$PbCl_2$ (s)	-359.4	136.0	-314.2
$PbCl_4$ (g)	-552.4	381.5	-513.9
PbClF (s)	-534.7	121.8	-488.3
$PbCO_3$ (s)	-699.2	131.0	-625.5
PbF (g)	-80.3	249.8	-105.0
PbF_2 (s alpha)	-677.0	113.0	-631.0
PbF_2 (s beta)	-676.1	114.4	-631.2
PbF_4 (g)	-1133.5	333.5	-1092.7
PbI_2 (ℓ)	-157.7	198.9	-161.9
PbI_2 (s)	-175.4	174.9	-173.6
PbI_4 (g)	-224.5	466.1	-274.9
$PbMoO_4$ (s)	-1051.9	166.1	-951.4
PbO (s red)	-219.0	66.5	-189.2
PbO (s yellow)	-218.1	68.7	-188.7
$PbO•PbCO_3$ (s)	-918.4	204.2	-816.7
PbO_2 (s)	-274.5	71.8	-215.5
PBr_3 (ℓ)	-184.5	240.2	-175.7
PBr_3 (g)	-139.3	348.0	-162.8
PbS (s)	-98.3	91.3	-96.7
PbSe (s)	-102.9	102.5	-101.7
$PbSeO_4$ (s)	-609.2	167.8	-505.0
$PbSiO_3$ (s)	-1145.2	110.0	-1061.1
$PbSiO_4$ (s)	-2023.8	84.0	-1909.6
$PbSO_4$ (s)	-919.9	148.6	-813.2
PbTe (s)	-70.7	110.0	-69.5
PCl_3 (ℓ)	-319.7	217.2	-272.4
PCl_3 (g)	-287.0	311.7	-267.8
PCl_5 (g)	-374.9	364.6	-305.0
Pd (g)	378.2	166.9	339.7
Pd (s)	0.0	37.8	0.0
Pd^{+2} (aq)	169.5	-117.2	176.6
Pd_2H (s)	-19.7	91.6	-5.0
$PdBr_4^{-2}$ (aq)	-371.5	292.9	-318.0
$PdCl_2$ (s)	-171.5	104.6	-125.1
PdI_2 (s)	-63.6	150.6	-62.8
PdS (s)	-75.3	46.0	-66.9
PdS_2 (s)	-81.2	79.5	-74.5
PF_3 (g)	-918.8	273.1	-897.5
PF_5 (g)	-1577.0	300.8	-1508.8
PH (g)	255.2	196.2	221.8
PH_3 (g)	23.0	210.2	25.5

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
PH_4Br (s)	-127.6	110.0	-47.7
PH_4I (s)	-69.9	123.0	0.8
PN (g)	32.5	211.1	10.3
Po (g)	145.6	188.8	108.0
PO (g)	-12.1	222.7	-41.2
Po (s)	0.0	62.8	0.0
PO_4^{-3} (aq)	-1277.4	-221.8	-1018.8
$POBr_3$ (g)	-389.1	359.7	-390.9
$POCl_2F$ (g)	-748.9	320.3	-711.3
$POCl_3$ (ℓ)	-597.1	222.5	-520.9
$POCl_3$ (g)	-542.3	325.4	-502.5
$POClF_2$ (g)	-954.0	301.6	-912.1
POF_3 (g)	-1236.8	285.3	-1193.7
PoO_2 (s)	-251.0	71.1	196.7
Pr (g)	355.6	189.7	320.9
Pr (s)	0.0	73.2	0.0
Pr^{+3} (aq)	-704.6	-209.2	-679.1
PrC_2 (s)	549.4	261.9	496.6
PrH_2 (s)	-198.3	56.9	-154.4
$PSBr_3$ (g)	-263.6	372.7	-288.7
$PSCl_3$ (g)	-363.2	337.2	-347.7
PSF_3 (g)	-991.6	298.0	-973.6
Pt (g)	565.3	192.3	520.5
Pt (s)	0.0	41.6	0.0
$PtCl_4^{-2}$ (aq)	-503.3	167.4	-368.6
$PtCl_6^{-2}$ (aq)	-673.6	220.1	-489.5
PtO_2 (g)	171.5	259.4	167.8
PtS (s)	-81.6	55.1	-76.2
PtS_2 (s)	-108.8	74.7	-99.6
Pu (s)	0.0	51.5	0.0
$Pu(SO_4)_2$ (s)	-2200.8	163.2	-1969.5
Pu^{+3} (aq)	-579.9	-163.2	-587.9
Pu_2C_3 (s)	-7.1	169.5	-19.7
Pu_2O_3 (s alpha)	-1799.1	138.9	-1720.5
Pu_2O_3 (s beta)	-1715.4	152.3	-1632.3
Pu_2S_3 (s)	-989.5	192.5	-985.5
$PuBr_3$ (s)	-831.8	192.9	-804.6
$PuCl_3$ (s)	-961.5	159.0	-892.7
PuF_3 (s)	-1552.3	113.0	-1478.8
PuF_4 (s)	-1732.2	161.9	-1644.7
PuF_6 (s)	25.5	222.6	27.2

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
PuH_2 (s)	-139.3	59.8	-101.7
PuH_3 (s)	-138.1	64.9	-82.5
PuI_3 (s)	-648.5	214.2	-644.0
PuN (s)	-316.7	59.4	-289.5
PuO (s)	-564.8	70.7	-538.9
PuO_2 (s)	-1058.1	82.4	-1005.8
PuOBr (s)	-888.7	119.2	-854.5
PuOCl (s)	-931.8	108.8	-884.0
PuOF (s)	-1128.8	91.6	-1078.9
PuOI (s)	-827.6	126.4	-800.9
PuS (s)	-439.3	78.2	-436.7
Ra (g)	159.0	176.4	129.7
Ra (s)	0.0	71.1	0.0
Ra^{+2} (aq)	-527.6	54.0	-561.5
$Ra(IO_3)_2$ (s)	-1026.8	272.0	-868.6
$Ra(NO_3)_2$ (s)	-991.6	221.8	-796.2
$RaCl_2 \bullet 2H_2O$ (s)	-1464.4	213.4	-1302.9
$RaSO_4$ (s)	-1471.1	138.1	-1365.7
Rb (g)	85.8	170.0	55.9
Rb (s)	0.0	69.5	0.0
Rb^{+1} (aq)	-251.2	121.5	-284.0
RbBr (s)	-389.2	104.9	-378.2
RbCl (s)	-435.1	94.6	-412.0
$RbClO_3$ (s)	-392.5	151.9	-292.0
$RbClO_4$ (s)	-434.6	160.7	-306.2
RbI (s)	-328.4	118.0	-325.5
Re (g)	769.9	188.8	724.7
Re (s)	0.0	36.9	0.0
Re^{-1} (aq)	46.0	230.1	10.0
Re_2O_7 (g)	-1184.1	451.9	-994.1
Re_2O_7 (s)	-1240.1	207.1	-1066.1
$ReCl_3$ (s)	-263.6	123.9	-188.3
$ReCl_6^{-2}$ (aq)	-761.5	251.0	-589.9
ReO_2 (s)	-422.6	171.5	-368.2
ReO_3 (s)	-605.0	257.3	-531.4
Rh (g)	556.9	185.7	510.9
Rh (s)	0.0	31.6	0.0
Rh_2O_3 (s)	-285.8	110.9	-272.0
Rn (g)	0.0	176.1	0.0
Ru (g)	642.7	186.4	595.8
Ru (s)	0.0	28.5	0.0

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
RuO_4 (ℓ)	-228.5	183.3	-152.3
RuO_4 (g)	-184.1	290.0	-139.8
RuO_4 (s)	-239.3	146.4	-152.3
S (ℓ)	1.4	35.2	0.4
S (g)	277.4	167.7	236.9
S (s rhombic)	0.0	31.9	0.0
S_2 (g)	129.0	228.1	80.1
S^{-2} (aq)	33.1	-14.6	85.8
S_2Cl_2 (g)	-19.5	319.5	-29.3
$S_2O_4^{-2}$ (aq)	-753.5	92.1	-600.4
$S_2O_8^{-2}$ (aq)	-1338.9	248.1	-1110.4
S_8 (g)	101.3	430.2	49.2
Sb (g)	262.3	180.2	222.2
Sb (s)	0.0	45.7	0.0
Sb_2 (g)	235.6	254.8	187.0
Sb_2O_4 (s)	-907.5	127.2	-795.8
Sb_2O_5 (s)	-971.9	125.1	-829.3
Sb_2S_3 (s black)	-174.9	182.0	-173.6
Sb_2Te_3 (s)	-56.5	234.3	-55.2
Sb_4 (g)	205.0	351.5	141.4
Sb_4O_6 (s cubic)	-1440.6	220.9	-1268.2
Sb_4O_6 (s orthorhombic)	-1417.1	246.0	-1253.1
$SbBr_3$ (s)	-259.4	179.9	-239.3
$SbCl_3$ (g)	-313.8	337.7	-301.3
$SbCl_3$ (s)	-382.2	184.1	-323.7
$SbCl_5$ (ℓ)	-440.2	301.3	-350.2
$SbCl_5$ (g)	-394.3	401.8	-334.3
SbH_3 (g)	145.1	232.7	232.7
Sc (g)	377.8	174.7	336.1
Sc (s)	0.0	34.6	0.0
$Sc(OH)_2Cl$ (s)	-1267.8	108.8	-1156.0
$Sc(OH)_3$ (s)	-1363.6	100.4	-1233.4
Sc^{+3} (aq)	-614.2	-255.2	-586.6
Sc_2 (g)	648.1	255.2	592.5
Sc_2O_3 (s)	-1908.8	77.0	104.0
ScCl (g)	112.6	234.3	86.2
ScF (g)	-138.9	222.2	-164.4
ScF_2 (g)	-642.2	280.3	-655.2
ScF_3 (g)	-1246.8	300.4	-1234.3
ScF_3 (s)	-1629.3	92.1	-1555.6
SCN^{-1} (aq)	76.4	144.4	92.7

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
ScO (g)	-57.2	224.5	-83.3
ScS (g)	174.9	235.6	124.3
Se (g)	227.1	176.6	187.1
Se (s hexagonal black)	0.0	42.4	0.0
Se_2 (g)	146.0	251.9	96.2
SeF_6 (g)	-1117.1	313.8	-1016.7
SeO (g)	53.4	233.9	26.8
SeO_3^{-2} (aq)	-509.2	12.6	-369.9
SeO_4^{-2} (aq)	-599.2	54.0	-441.4
SF_2Cl (g)	-1048.1	319.1	-949.4
SF_4 (g)	-728.4	291.1	-684.8
SF_6 (g)	-1220.9	291.7	-1115.9
Si (g)	455.6	167.9	411.3
Si (s)	0.0	18.8	0.0
Si_2 (g)	594.1	229.8	535.6
Si_2H_6 (g)	80.3	272.6	127.2
Si_3N_4 (s)	-743.5	113.0	-581.6
$SiBr_4$ (ℓ)	-457.3	277.8	-443.9
$SiBr_4$ (g)	-415.5	377.8	-431.8
SiC (g)	615.1	236.6	552.3
SiC (s alpha hexagonal)	-71.6	16.5	-69.0
SiC (s beta cubic)	-73.2	16.6	-70.7
$SiCl_2$ (g)	-165.6	280.3	-177.2
$SiCl_4$ (ℓ)	-687.0	239.7	619.9
$SiCl_4$ (g)	-662.8	330.6	-622.6
SiF (g)	7.1	225.7	-24.3
SiF_2 (g)	-587.9	256.8	-598.3
SiF_4 (g)	-1614.9	282.4	-1572.7
SiH_3Cl (g)	-200.8	250.5	-179.9
SiH_3F (g)	-439.3	238.3	-418.4
SiH_4 (g)	30.5	204.5	56.9
$SiHCl_3$ (ℓ)	-539.3	227.6	-482.6
SiN (g)	486.5	216.7	456.1
SiO_2 (c amorphous)	-903.5	46.9	-850.7
SiO_2 (s cristobalite)	-909.5	42.7	-855.9
SiO_2 (s quartz)	-910.9	41.8	-856.7
SiO_2 (s tridymite)	-909.1	43.5	-855.3
$SiOF_2$ (g)	-966.5	271.2	-949.8
SiS (g)	112.5	223.6	60.9
SiS_2 (s)	-213.4	80.3	-212.6
Sm (g)	206.7	182.9	172.8

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
Sm (s)	0.0	69.6	0.0
Sm^{+3} (aq)	-691.6	-211.7	-666.5
$Sm_2(SO_4)_3 \bullet 8H_2O$ (s)	-6330.8	672.4	-5538.8
Sm_2O_3 (s monoclinic)	-1823.0	151.0	-1734.7
SmC_2 (s)	-71.1	96.2	-75.7
$SmCl_3 \bullet 6H_2O$ (s)	-2870.2	414.2	-2456.4
Sn (g)	302.1	168.4	267.4
Sn (s gray)	-2.1	44.1	0.1
Sn (s white)	0.0	51.6	0.0
Sn^{+2} (aq)	-8.8	-17.0	-27.2
$SnBr_4$ (g)	-314.6	411.8	-331.4
$SnBr_4$ (s)	-377.4	264.4	-350.2
$SnCl_4$ (ℓ)	-511.3	258.6	-440.2
SnH_4 (g)	162.8	227.6	188.3
SnO (s)	-285.8	56.5	-256.9
SnO_2 (s)	-580.7	52.3	-519.7
SnS (s)	-100.4	77.0	-98.3
SO (g)	4.9	221.8	-21.2
SO_2 (g)	-296.8	248.1	-300.2
SO_2Cl_2 (g)	-354.8	311.8	-310.5
SO_2F_2 (g)	-758.6	283.9	-712.1
SO_3 (ℓ)	-441.0	95.6	-368.4
SO_3 (g)	-395.7	256.7	-371.1
SO_3 (s beta)	-454.5	52.3	-369.0
SO_3^{-2} (aq)	-635.6	-29.3	-486.6
SO_4^{-2} (aq)	-909.3	20.1	-744.6
$SOCl_2$ (g)	-212.6	309.7	-198.3
Sr (ℓ)	7.6	57.2	6.2
Sr (g)	164.0	164.5	130.5
Sr (s)	0.0	52.3	0.0
Sr^{+2} (aq)	-545.8	-32.6	-559.5
$Sr(BrO_3)_2 \bullet H_2O$ (s)	-1104.6	280.3	-791.2
$Sr(IO_3)_2$ (s)	-1019.2	234.3	-855.2
$Sr(IO_3)_2 \bullet 6H_2O$ (s)	-2789.9	456.1	-2274.8
$Sr(NO_3)_2$ (s)	-978.2	194.6	-780.2
$Sr(NO_3)_2 \bullet 4H_2O$ (s)	-2154.8	369.0	-1730.7
Sr_2SiO_4 (s)	-2304.6	153.1	-2191.2
Sr_2TiO_4 (s)	-2287.4	159.0	-2178.6
$Sr_3(AsO_4)_2$ (s)	-3317.1	255.2	-3080.3
$SrBr_2$ (s)	-718.0	143.4	-699.8
$SrBr_2 \bullet 6H_2O$ (s)	-2531.3	405.9	-2174.4

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
$SrCl_2$ (s)	-828.9	114.9	-781.1
$SrCl_2 \bullet 2H_2O$ (s)	-1438.0	217.6	-1282.0
$SrCl_2 \bullet 6H_2O$ (s)	-2623.8	390.8	-2241.2
$SrCO_3$ (s strontianite)	-1220.1	97.1	-1140.1
SrF_2 (s)	-1217.1	82.1	-1165.6
$SrHPO_4$ (s)	-1821.7	121.3	-1688.7
SrI_2 (s)	-561.5	159.1	-558.7
SrO (s)	-592.0	55.5	-562.4
SrS (s)	-453.1	68.2	-448.5
$SrSiO_3$ (s)	-1633.9	96.7	-1549.8
$SrSO_4$ (s)	-1453.1	117.6	-1341.0
$SrTiO_3$ (s)	-1672.4	108.8	-1588.4
$SrWO_4$ (s)	-1639.7	138.1	-1531.3
$SrZrO_3$ (s)	-1767.3	115.1	-1682.8
Ta (g)	782.0	185.1	739.3
Ta (s)	0.0	41.5	0.0
Ta_2C (s)	-213.4	86.6	-212.6
Ta_2H (s)	-32.6	79.1	-69.0
Ta_2O_5 (s beta)	-2046.0	143.1	-1911.3
TaC (s)	-146.4	42.3	-144.8
TaO (g)	251.0	241.8	221.8
TaO_2 (g)	-200.8	280.3	-209.2
Tb (g)	388.7	203.5	349.8
Tb (s)	0.0	73.2	0.0
Tb^{+3} (aq)	-682.8	-225.9	-651.9
TbC_2 (s)	885.8	267.8	831.4
$TbCl_3 \bullet 6H_2O$ (s)	-2859.4	403.3	-2441.0
Tc (s)	0.0	33.5	0.0
Te (g)	196.7	182.6	157.1
Te (s)	0.0	49.7	0.0
Te_2 (g)	168.2	268.0	118.0
TeO (g)	65.3	241.4	38.5
TeO_2 (s)	-322.6	79.5	-270.3
TeSe (g)	159.0	265.7	108.8
Th (s)	0.0	56.9	0.0
Th_3N_4 (s)	-1288.7	178.7	-1179.9
ThO_2 (s)	-1221.7	65.3	-1171.9
Ti (s alpha)	0.0	30.7	0.0
Ti (s beta)	6.0	36.4	4.3
Ti_2O_3 (s)	-1520.9	78.8	-1434.3
Ti_3O_5 (s alpha)	-2459.4	129.3	-2317.5

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
Ti_4O_7 (s)	-3404.5	198.7	-3213.3
TiB (s)	-160.3	34.7	-159.8
TiB_2 (s)	-280.3	28.5	-272.0
$TiBr_2$ (s)	-405.9	108.4	-383.3
$TiBr_3$ (s)	-550.2	176.4	-525.5
$TiBr_4$ (ℓ)	-605.4	284.2	-589.9
$TiBr_4$ (g)	-550.2	398.9	-569.0
$TiBr_4$ (s)	-618.0	243.6	-590.8
TiC (s)	-184.1	24.2	-180.3
$TiCl_2$ (s)	-513.8	87.5	-464.4
$TiCl_3$ (s)	-720.9	139.8	-653.5
$TiCl_4$ (ℓ)	-804.2	252.3	-737.2
$TiCl_4$ (g)	-763.2	354.8	-726.8
$TiCl_4$ (s)	-815.0	208.8	-735.1
TiF_2 (g)	-686.2	255.2	-694.5
TiF_3 (s)	-1435.1	87.9	-1362.3
TiF_4 (g)	-1551.4	314.6	-1515.4
TiF_4 (s)	-1649.3	134.0	-1559.4
TiH_2 (s)	-144.4	29.7	-105.0
TiI_2 (s)	-267.8	121.3	-259.4
TiI_3 (s)	-322.2	192.5	-318.0
TiI_4 (ℓ)	-348.3	311.8	-362.9
TiI_4 (s)	-375.7	246.0	-370.7
TiN (s)	-338.1	30.3	-309.6
TiO (s alpha)	-542.7	34.8	-513.4
TiO_2 (s anatase)	-938.7	49.9	-883.3
TiO_2 (s rutile)	-944.8	50.3	-889.5
$TiOCl_2$ (g)	-545.6	320.9	-535.1
$TiOF_2$ (g)	-924.7	284.6	-907.9
Tl (g)	182.2	180.9	147.4
Tl (s)	0.0	64.2	0.0
Tl^{+1} (aq)	5.4	125.5	-32.4
Tl^{+3} (aq)	196.6	-192.0	214.6
Tl_2CO_3 (s)	-700.0	155.2	-614.6
Tl_2CrO_4 (s)	-944.8	282.4	-861.5
Tl_2O (s)	-178.7	125.5	-147.3
Tl_2S (s)	-97.1	150.6	-93.7
Tl_2Se (s)	-58.6	171.5	-59.0
Tl_2SeO_4 (s)	-631.8	234.3	-528.9
Tl_2SO_4 (s)	-931.8	230.5	-830.5
TlBr (s)	-173.2	120.5	-167.4

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
$TlBrO_3$ (s)	-136.4	168.6	-53.1
TlCl (s)	-204.1	111.3	-184.9
TlCNS (s thiocyanate)	28.5	163.2	38.5
TlI (s)	-123.9	127.6	-125.4
TlN_3 (s)	233.5	146.9	294.5
$TlNO_3$ (s)	-243.9	160.7	-152.5
TlO_3 (s)	-267.4	176.6	-191.9
TlOH (s)	-238.9	87.9	-195.8
Tm (g)	232.2	190.0	197.5
Tm (s)	0.0	74.0	0.0
Tm^{+3} (aq)	-697.9	-242.7	-661.9
Tm_2O_3 (s)	-1888.7	139.8	-1794.5
U (s)	0.0	50.3	0.0
U^{+3} (aq)	-489.1	-188.0	-476.2
U^{+4} (aq)	-591.2	-410.0	-531.9
U_2N_3 (s)	-891.2	121.3	-811.7
UBr_3 (s)	-711.7	205.0	-689.1
UBr_4 (s)	-822.6	234.3	-788.7
UCl_3 (s)	-891.2	159.0	-823.8
UCl_4 (s)	-1051.0	198.3	-962.3
UCl_5 (s)	-1096.6	242.7	-993.3
UCl_6 (s)	-1139.7	285.8	-1010.4
UF_3 (s)	-1493.7	117.2	-1418.4
UF_4 (s)	-1853.5	151.0	-1761.5
UF_5 (s)	-2041.8	197.9	-1928.8
UF_6 (g)	-2147.4	377.9	-2063.7
UF_6 (s)	-2197.0	227.6	-2068.5
UH_3 (s)	-127.2	63.9	-72.6
UI_3 (s)	-479.9	234.3	-482.4
UI_4 (s)	-531.4	280.3	-527.6
$UICl_3$ (s)	-920.1	225.9	-855.2
UN (s)	-334.7	62.3	-313.8
UO_2 (s)	-1129.7	77.8	-1075.3
$UO_2(NO_3)_2$ (s)	-1377.4	276.1	-1142.7
$UO_2(NO_3)_2•2H_2O$ (s)	-2008.3	355.6	-1659.4
$UO_2(NO_3)_2•3H_2O$ (s)	-2310.4	393.3	-1902.5
$UO_2(NO_3)_2•6H_2O$ (s)	-3197.8	505.6	-2615.0
$UO_2(NO_3)_2•H_2O$ (s)	-1693.7	318.0	-1402.9
$UO_2SO_4•3H_2O$ (s)	-2789.9	263.6	-2451.8
UO_3 (s)	-1263.6	98.6	-1184.1
V (g)	514.2	182.2	453.2

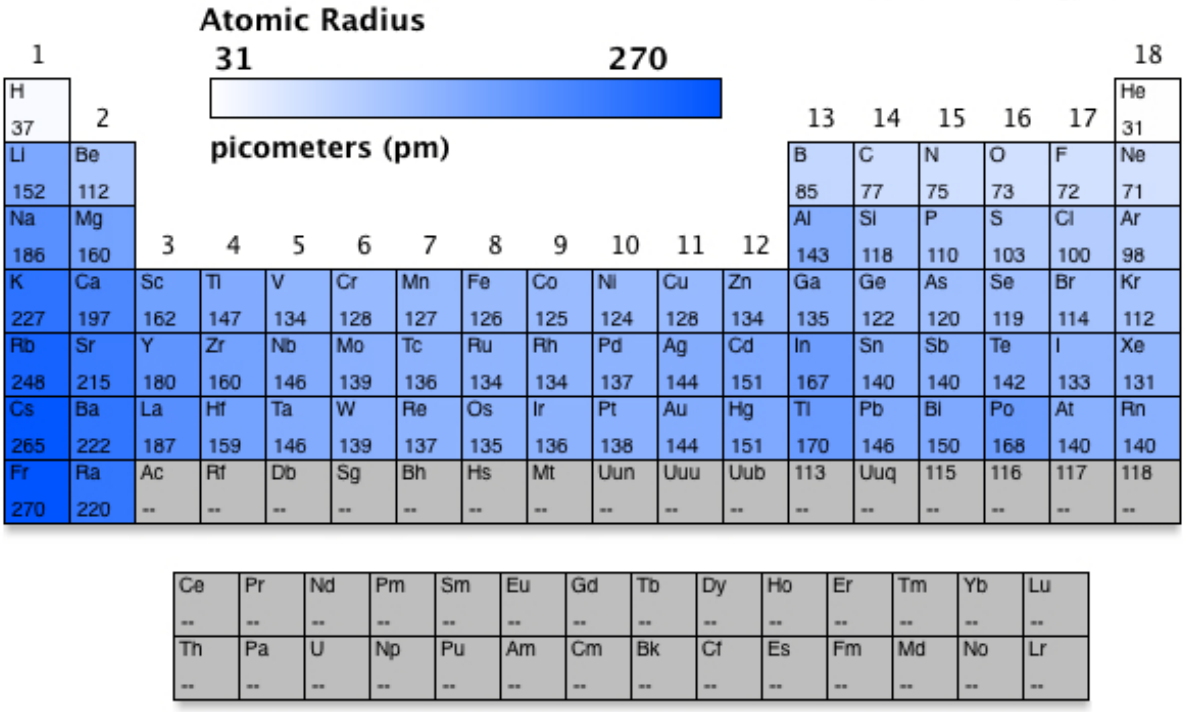
Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
V (s)	0.0	28.9	0.0
V_2O_3 (s)	-1228.0	98.3	-1139.3
V_2O_4 (s alpha)	-1427.2	102.5	-1318.4
V_2O_5 (s)	-1550.6	131.0	-1419.6
V_3O_5 (s)	-1945.6	163.2	-1815.9
V_4O_7 (s)	-2656.8	217.6	-2472.7
VCl_2 (s)	-451.9	97.1	-405.9
VCl_3 (s)	-580.7	131.0	-511.3
VCl_4 (ℓ)	-569.4	255.2	-503.8
VCl_4 (g)	-525.5	362.3	-492.0
VF_5 (ℓ)	-1480.3	175.7	-1373.2
VF_5 (g)	-1433.9	320.8	-1369.8
VN (s)	-217.2	37.3	-191.2
VO (g)	104.6	233.5	75.3
VO (s)	-431.8	38.9	-404.2
VO^{+2} (aq)	-486.6	-133.9	-446.4
VO_2 (s)	-717.6	62.6	51.5
VO_2^{+1} (aq)	-649.8	-42.3	-587.0
VO_3^{-1} (aq)	-888.3	50.2	-783.7
$VOCl_3$ (ℓ)	-734.7	205.0	-668.6
$VOCl_3$ (g)	-695.6	344.2	-659.3
$VOSCN^{+1}$ (aq)	-410.0	33.5	-359.8
$VOSO_4$ (s)	-1309.2	108.8	-1169.9
W (ℓ)	46.9	45.7	40.4
W (g)	851.0	173.9	808.8
W (s)	0.0	32.7	0.0
W_3O_8 (g)	-1711.3	493.7	-1581.6
WBr_5 (s)	-311.7	272.0	-269.5
WBr_6 (s)	-343.1	313.8	-288.7
WCl_2 (s)	-257.3	130.5	-220.1
WCl_4 (s)	-443.5	198.3	-359.8
WCl_5 (s)	-514.6	217.6	-401.7
WCl_6 (s)	-594.1	238.5	-456.1
WF_6 (ℓ)	-1748.5	249.4	-1631.8
WF_6 (g)	-961.1	347.7	-836.0
WO_2 (s)	-589.7	50.5	-533.9
WO_2Cl_2 (s)	-780.3	200.8	-702.9
WO_3 (s)	-842.9	75.9	-764.0
$WOCl_4$ (g)	-573.2	377.0	-510.5
$WOCl_4$ (s)	-671.1	172.8	-549.4
WOF_4 (g)	-1334.7	334.7	-1276.1

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
Xe (g)	0.0	169.6	0.0
Y (g)	421.3	179.4	381.2
Y (s)	0.0	44.4	0.0
$Y(ReO_4)_3$ (s)	-2936.8	368.2	-2633.4
Y^{+3} (aq)	-723.4	-251.0	-656.1
Y_2 (g)	684.1	267.8	630.5
Y_2O_3 (s)	-1905.3	99.1	-1816.7
Yb (g)	152.3	173.0	118.4
Yb (s)	0.0	59.9	0.0
Yb^{+3} (aq)	-674.5	238.5	-643.9
Yb_2O_3 (s)	-1814.6	133.1	-1726.7
YbC_2 (s)	-74.9	79.5	-77.4
$YbCl_3•6H_2O$ (s)	-2846.0	395.8	-2429.2
YBr^{+2} (aq)	-852.7	-179.9	-801.7
YC_2 (g)	596.6	255.2	537.2
YC_2 (s)	-108.8	54.4	-108.8
YCl (g)	200.0	244.1	173.6
YCl^{+2} (aq)	-895.4	-192.5	-831.4
$YCl_3•6H_2O$ (s)	-2892.4	384.9	-2477.4
YF (g)	-138.1	231.7	-163.2
YF_3 (g)	-1288.7	311.7	-1277.8
YF_3 (s)	-1718.8	100.4	-1644.7
YH_2 (s)	-156.9	38.4	-116.3
YH_3 (s)	-197.9	41.9	-138.9
YO (g)	-38.9	233.8	-64.9
YS (g)	174.5	242.7	124.3
Zn (g)	130.7	160.9	95.2
Zn (s)	0.0	41.6	0.0
Zn^{+2} (aq)	-153.9	-112.1	-147.1
$Zn(ClO_4)_2•6H_2O$ (s)	-2133.4	545.6	-1555.6
$Zn(NO_3)_2•6H_2O$ (s)	-2306.6	456.9	-1773.1
$Zn(OH)_2$ (s beta)	-641.9	81.2	-553.2
$Zn(OH)_2$ (s epsilon)	-639.1	81.6	-555.1
Zn_2SiO_4 (s)	-1636.7	131.4	-1523.2
$ZnBr_2$ (s)	-328.7	138.5	-312.1
$ZnBr_2•2H_2O$ (s)	-937.2	198.7	-799.6
$ZnC_2O_4•2H_2O$ (s)	-1564.8	195.4	-1346.0

Compound	$\Delta H_f°$	$\Delta S°$	$\Delta G_f°$
$ZnCl_2$ (s)	-415.1	108.4	-369.4
$ZnCO_3$ (s)	-812.8	82.4	-731.6
ZnF_2 (s)	-764.4	73.7	-713.4
ZnI_2 (s)	-208.0	161.1	-209.0
ZnO (s)	-348.3	43.6	-318.3
ZnS (s sphalerite)	-206.0	57.7	-201.3
ZnSe (s)	-163.0	84.0	-163.0
$ZnSeO_3•H_2O$ (s)	-930.9	163.2	-792.9
$ZnSO_4$ (s)	-982.8	128.0	-874.5
$ZnSO_4•6H_2O$ (s)	-2777.5	363.6	-2324.8
$ZnSO_4•7H_2O$ (s)	-3077.8	388.7	-2563.1
$ZnSO_4•H_2O$ (s)	-1304.5	138.5	-1132.0
Zr (s alpha hexagonal)	0.0	39.0	0.0
Zr (s beta)	7.2	46.7	4.9
ZrB_2 (s)	-322.6	35.9	-318.0
$ZrBr_3$ (s)	-636.0	172.1	-606.7
$ZrBr_4$ (s)	-759.8	224.7	-724.3
ZrC (s)	-196.7	33.3	-193.3
$ZrCl_2$ (s)	-431.0	108.8	-384.9
$ZrCl_3$ (s)	-715.5	145.6	-644.3
$ZrCl_4$ (s)	-980.5	181.6	-889.9
ZrF_2 (s)	-962.3	75.3	-912.1
ZrF_3 (s)	-1401.6	87.9	-1326.3
ZrF_4 (s)	-1911.3	104.7	-1810.0
ZrH_2 (s)	-169.0	35.0	-128.9
ZrI_2 (s)	-259.4	150.2	-258.2
ZrI_3 (s)	-397.5	204.6	-394.6
ZrI_4 (s)	-484.9	256.9	-480.7
ZrN (s)	-364.8	38.9	-336.4
ZrO_2 (s monoclinic)	-1097.5	50.4	-1039.7

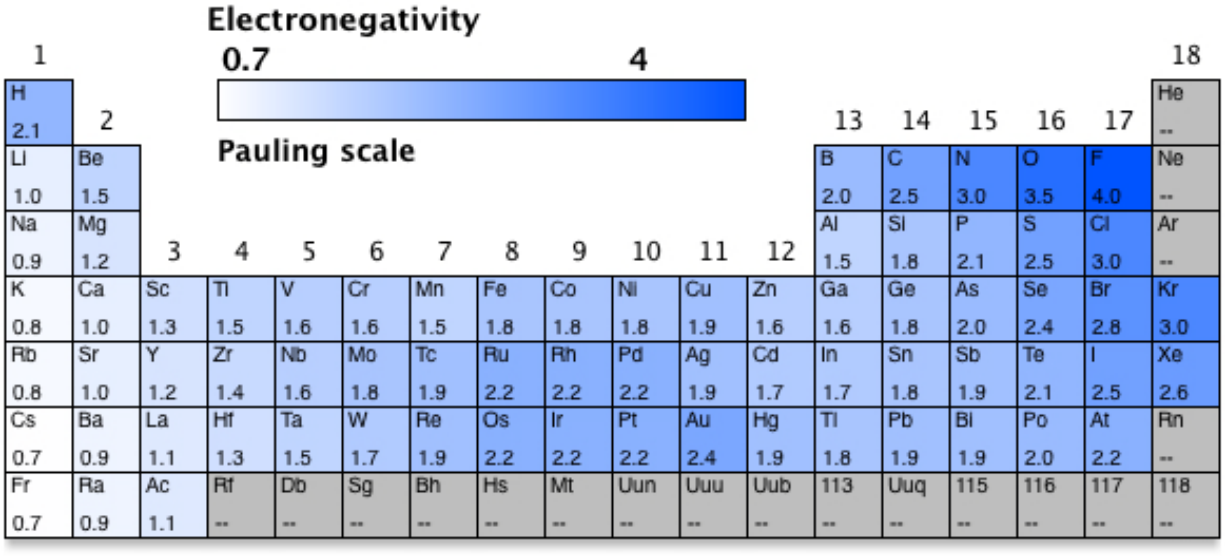
Dean, John A. *Lange's Handbook of Chemistry, 11th ed.*; McGraw-Hill: New York, New York, 1979; pp 9:4-9:128.
Lide, David R. *CRC Handbook, 84th ed.*; CRC Press: Boca Raton, Florida, 2003; pp 5:5-5:60, 5:85-5:86.

Periodic Tables



1																	18
H 37	2											13	14	15	16	17	He 31
Li 152	Be 112											B 85	C 77	N 75	O 73	F 72	Ne 71
Na 186	Mg 160	3	4	5	6	7	8	9	10	11	12	Al 143	Si 118	P 110	S 103	Cl 100	Ar 98
K 227	Ca 197	Sc 162	Ti 147	V 134	Cr 128	Mn 127	Fe 126	Co 125	Ni 124	Cu 128	Zn 134	Ga 135	Ge 122	As 120	Se 119	Br 114	Kr 112
Rb 248	Sr 215	Y 180	Zr 160	Nb 146	Mo 139	Tc 136	Ru 134	Rh 134	Pd 137	Ag 144	Cd 151	In 167	Sn 140	Sb 140	Te 142	I 133	Xe 131
Cs 265	Ba 222	La 187	Hf 159	Ta 146	W 139	Re 137	Os 135	Ir 136	Pt 138	Au 144	Hg 151	Tl 170	Pb 146	Bi 150	Po 168	At 140	Rn 140
Fr 270	Ra 220	Ac --	Rf --	Db --	Sg --	Bh --	Hs --	Mt --	Uun --	Uuu --	Uub --	113 --	Uuq --	115 --	116 --	117 --	118 --

Ce --	Pr --	Nd --	Pm --	Sm --	Eu --	Gd --	Tb --	Dy --	Ho --	Er --	Tm --	Yb --	Lu --
Th --	Pa --	U --	Np --	Pu --	Am --	Cm --	Bk --	Cf --	Es --	Fm --	Md --	No --	Lr --



1																	18
H 2.1	2											13	14	15	16	17	He --
Li 1.0	Be 1.5											B 2.0	C 2.5	N 3.0	O 3.5	F 4.0	Ne --
Na 0.9	Mg 1.2	3	4	5	6	7	8	9	10	11	12	Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0	Ar --
K 0.8	Ca 1.0	Sc 1.3	Ti 1.5	V 1.6	Cr 1.6	Mn 1.5	Fe 1.8	Co 1.8	Ni 1.8	Cu 1.9	Zn 1.6	Ga 1.6	Ge 1.8	As 2.0	Se 2.4	Br 2.8	Kr 3.0
Rb 0.8	Sr 1.0	Y 1.2	Zr 1.4	Nb 1.6	Mo 1.8	Tc 1.9	Ru 2.2	Rh 2.2	Pd 2.2	Ag 1.9	Cd 1.7	In 1.7	Sn 1.8	Sb 1.9	Te 2.1	I 2.5	Xe 2.6
Cs 0.7	Ba 0.9	La 1.1	Hf 1.3	Ta 1.5	W 1.7	Re 1.9	Os 2.2	Ir 2.2	Pt 2.2	Au 2.4	Hg 1.9	Tl 1.8	Pb 1.9	Bi 1.9	Po 2.0	At 2.2	Rn --
Fr 0.7	Ra 0.9	Ac 1.1	Rf --	Db --	Sg --	Bh --	Hs --	Mt --	Uun --	Uuu --	Uub --	113 --	Uuq --	115 --	116 --	117 --	118 --

Ce 1.1	Pr 1.1	Nd 1.1	Pm 1.2	Sm 1.2	Eu 1.1	Gd 1.2	Tb 1.2	Dy 1.2	Ho 1.2	Er 1.2	Tm 1.2	Yb 1.2	Lu 1.3
Th 1.3	Pa 1.5	U 1.7	Np 1.3	Pu 1.3	Am 1.3	Cm 1.3	Bk 1.3	Cf 1.3	Es 1.3	Fm 1.3	Md 1.3	No 1.5	Lr --

The Periodic Table of the Elements

1 **H** Hydrogen 1.00794																	2 **He** Helium 4.003
3 **Li** Lithium 6.941	4 **Be** Beryllium 9.012182											5 **B** Boron 10.811	6 **C** Carbon 12.0107	7 **N** Nitrogen 14.00674	8 **O** Oxygen 15.9994	9 **F** Fluorine 18.9984032	10 **Ne** Neon 20.1797
11 **Na** Sodium 22.989770	12 **Mg** Magnesium 24.3050											13 **Al** Aluminum 26.981538	14 **Si** Silicon 28.0855	15 **P** Phosphorus 30.973761	16 **S** Sulfur 32.066	17 **Cl** Chlorine 35.4527	18 **Ar** Argon 39.948
19 **K** Potassium 39.0983	20 **Ca** Calcium 40.078	21 **Sc** Scandium 44.955910	22 **Ti** Titanium 47.867	23 **V** Vanadium 50.9415	24 **Cr** Chromium 51.9961	25 **Mn** Manganese 54.938049	26 **Fe** Iron 55.845	27 **Co** Cobalt 58.933200	28 **Ni** Nickel 58.6934	29 **Cu** Copper 63.546	30 **Zn** Zinc 65.39	31 **Ga** Gallium 69.723	32 **Ge** Germanium 72.61	33 **As** Arsenic 74.92160	34 **Se** Selenium 78.96	35 **Br** Bromine 79.904	36 **Kr** Krypton 83.80
37 **Rb** Rubidium 85.4678	38 **Sr** Strontium 87.62	39 **Y** Yttrium 88.90585	40 **Zr** Zirconium 91.224	41 **Nb** Niobium 92.90638	42 **Mo** Molybdenum 95.94	43 **Tc** Technetium (98)	44 **Ru** Ruthenium 101.07	45 **Rh** Rhodium 102.90550	46 **Pd** Palladium 106.42	47 **Ag** Silver 107.8682	48 **Cd** Cadmium 112.411	49 **In** Indium 114.818	50 **Sn** Tin 118.710	51 **Sb** Antimony 121.760	52 **Te** Tellurium 127.60	53 **I** Iodine 126.90447	54 **Xe** Xenon 131.29
55 **Cs** Cesium 132.90545	56 **Ba** Barium 137.327	57 **La** Lanthanum 138.9055	72 **Hf** Hafnium 178.49	73 **Ta** Tantalum 180.9479	74 **W** Tungsten 183.84	75 **Re** Rhenium 186.207	76 **Os** Osmium 190.23	77 **Ir** Iridium 192.217	78 **Pt** Platinum 195.078	79 **Au** Gold 196.96655	80 **Hg** Mercury 200.59	81 **Tl** Thallium 204.3833	82 **Pb** Lead 207.2	83 **Bi** Bismuth 208.98038	84 **Po** Polonium (209)	85 **At** Astatine (210)	86 **Rn** Radon (222)
87 **Fr** Francium (223)	88 **Ra** Radium (226)	89 **Ac** Actinium (227)	104 **Rf** Rutherfordium (261)	105 **Db** Dubnium (262)	106 **Sg** Seaborgium (263)	107 **Bh** Bohrium (262)	108 **Hs** Hassium (265)	109 **Mt** Meitnerium (266)	110 (269)	111 (272)	112 (277)	113	114				

58 **Ce** Cerium 140.116	59 **Pr** Praseodymium 140.90765	60 **Nd** Neodymium 144.24	61 **Pm** Promethium (145)	62 **Sm** Samarium 150.36	63 **Eu** Europium 151.964	64 **Gd** Gadolinium 157.25	65 **Tb** Terbium 158.92534	66 **Dy** Dysprosium 162.50	67 **Ho** Holmium 164.93032	68 **Er** Erbium 167.26	69 **Tm** Thulium 168.93421	70 **Yb** Ytterbium 173.04	71 **Lu** Lutetium 174.967
90 **Th** Thorium 232.0381	91 **Pa** Protactinium 231.03588	92 **U** Uranium 238.0289	93 **Np** Neptunium (237)	94 **Pu** Plutonium (244)	95 **Am** Americium (243)	96 **Cm** Curium (247)	97 **Bk** Berkelium (247)	98 **Cf** Californium (251)	99 **Es** Einsteinium (252)	100 **Fm** Fermium (257)	101 **Md** Mendelevium (258)	102 **No** Nobelium (259)	103 **Lr** Lawrencium (262)

1995 IUPAC masses and Approved Names from http://www.chem.qmw.ac.uk/iupac/AtWt/
masses for 107-111 from C&EN, March 13, 1995, p. 35
112 from http://www.gsi.de/z112e.html

Periodic Table of the Elements

1 H 1.00794																1 H 1.00794	2 He 4.002602
3 Li 6.941	4 Be 9.012182											5 B 10.811	6 C 12.0107	7 N 14.00674	8 O 15.9994	9 F 18.9984032	10 Ne 20.1797
11 Na 22.989770	12 Mg 24.3050											13 Al 26.981538	14 Si 28.0855	15 P 30.973761	16 S 32.066	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.955910	22 Ti 47.867	23 V 50.9415	24 Cr 51.9961	25 Mn 54.938049	26 Fe 55.845	27 Co 58.933200	28 Ni 58.6934	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.92160	34 Se 78.96	35 Br 79.904	36 Kr 83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.90585	40 Zr 91.224	41 Nb 92.90638	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.90550	46 Pd 106.42	47 Ag 107.8682	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.90447	54 Xe 131.29
55 Cs 132.90545	56 Ba 137.327	57 La 138.9055	72 Hf 178.49	73 Ta 180.9479	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.217	78 Pt 195.078	79 Au 196.96655	80 Hg 200.59	81 Tl 204.3833	82 Pb 207.2	83 Bi 208.98038	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 (269)	111 (272)	112 (277)		114 (289) (287)		116 (289)		118 (293)

58 Ce 140.116	59 Pr 140.90765	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.964	64 Gd 157.25	65 Tb 158.92534	66 Dy 162.50	67 Ho 164.93032	68 Er 167.26	69 Tm 168.93421	70 Yb 173.04	71 Lu 174.967
90 Th 232.0381	91 Pa 231.03588	92 U 238.0289	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)

S.E. Van Bramer, 7/22/99

1995 IUPAC masses and Approved Names from http://www.chem.qmw.ac.uk/iupac/AtWt/

masses for 107-111 from C&EN, March 13, 1995, P 35

112 from http://www.gsi.de/z112e.html

114 from C&EN July 19, 1999

116 and 118 from http://www.lbl.gov/Science-Articles/Archive/elements-116-118.html