Average Bond Lengths

bond	r_{bond} (pm)
C–H	109
C–C	154
C=C	134
C≡C	120.
C–N	147
C=N	129
C≡N	116
C–O	143
C=O	120.
C≡O	113
C–F	135
C–Cl	177
C–Br	194
C–I	214
C–Si	185
C–P	184
C–S	182
C=S	160.

bond	r_{bond} (pm)
N–H	101
N–N	145
N=N	125
N≡N	110.
N–O	140.
N=O	121
N–F	141
N–Cl	175
N–Br	184

bond	r_{bond} (pm)
O–H	96
O–O	148
O=O	121
O–F	133
O–Cl	142
O–Br	158
O–S	157
O=S	149
O–P	163
O=P	151

bond	r_{bond} (pm)
H–H	74
H–F	92
H–Cl	127
H–Br	141
H–I	161
F–F	142
Cl–Cl	199
Br–Br	228
I–I	267

bond	r_{bond} (pm)
Si–H	148
Si–Si	233
Si–O	163
Si–F	160.
Si–Cl	202
Si–Br	215

bond	r_{bond} (pm)
P–H	144
P–P	221
P–F	151
P–Cl	201
P–Br	237

bond	r_{bond} (pm)
S–H	134
S–S	205
S=S	149
S–F	164
S–Cl	207
S–Br	232

Average Bond Enthalpies

bond	ΔH_{bond} (kJ/mol)
C–H	413
C–C	347
C=C	614
C≡C	839
C–N	305
C=N	613
C≡N	891
C–O	358
C=O	743
C≡O	1072
C–F	485
C–Cl	339
C–Br	276
C–I	238
C–Si	318
C–P	264
C–S	259
C=S	573

bond	ΔH_{bond} (kJ/mol)
N–H	391
N–N	163
N=N	418
N≡N	941
N–O	201
N=O	607
N–F	272
N–Cl	200.
N–Br	243

bond	ΔH_{bond} (kJ/mol)
O–H	467
O–O	146
O=O	495
O–F	185
O–Cl	203
O–Br	156
O–S	364
O=S	522
O–P	335
O=P	544

bond	ΔH_{bond} (kJ/mol)
H–H	432
H–F	565
H–Cl	427
H–Br	363
H–I	295
F–F	154
Cl–Cl	239
Br–Br	193
I–I	149

bond	ΔH_{bond} (kJ/mol)
Si–H	393
Si–Si	340.
Si–O	452
Si–F	565
Si–Cl	381
Si–Br	310.

bond	ΔH_{bond} (kJ/mol)
P–H	322
P–P	201
P–F	490.
P–Cl	326
P–Br	264

bond	ΔH_{bond} (kJ/mol)
S–H	347
S–S	266
S=S	425
S–F	327
S–Cl	253
S–Br	218

Properties of Water				
properties of water	K_w	**ρ (g/cm^3)**	P_{vap} **(kPa)**	C_p **(J/g·K)**
0°C	1.15×10^{-15}	0.99984	0.61129	4.2176
5°C	1.87×10^{-15}	0.99997	0.87260	4.2049
10°C	2.96×10^{-15}	0.99970	1.2281	4.1921
15°C	4.57×10^{-15}	0.99910	1.7056	4.1870
20°C	6.87×10^{-15}	0.99821	2.3388	4.1818
25°C	1.01×10^{-14}	0.99705	3.1690	4.1801
30°C	1.46×10^{-14}	0.99565	4.2455	4.1784
35°C	2.06×10^{-14}	0.99404	5.6267	4.1785
40°C	2.87×10^{-14}	0.99222	7.3814	4.1786
45°C	3.94×10^{-14}	0.99013	9.5898	4.1796
50°C	5.31×10^{-14}	0.98803	12.344	4.1806
55°C	7.05×10^{-14}	0.98562	15.752	4.1825
60°C	9.25×10^{-14}	0.98320	19.932	4.1843
65°C	1.20×10^{-13}	0.98049	25.022	4.1869
70°C	1.53×10^{-13}	0.97778	31.176	4.1895
75°C	1.94×10^{-13}	0.97480	38.563	4.1929
80°C	2.44×10^{-13}	0.97182	47.373	4.1963
85°C	3.02×10^{-13}	0.96859	57.815	4.2007
90°C	3.73×10^{-13}	0.96535	70.117	4.2050
95°C	4.52×10^{-13}	0.96188	84.529	4.2105
100°C	5.43×10^{-13}	0.95840	101.325	4.2159

properties of ice	**ρ (g/cm^3)**	ΔH_{fus} **(J/g)**	C_p **(J/g·K)**
0°C	0.9167	333.6	2.108

properties of steam	**ρ (g/cm^3)**	ΔH_{vap} **(kJ/g)**	C_p **(J/g·K)**
100°C	5.974×10^{-4}	2.2567	2.0784

Properties of Other Substances (condensed phase)

substance (TSS)	ρ (g/cm^3)	C_p (J/g·K)
Ag	10.48	0.235
Al	2.70	0.904
As	5.75	0.328
Au	19.30	0.129
B	2.34	1.027
Ba	3.62	0.205
Be	1.85	1.820
Ca	1.54	0.646
Cd	8.69	0.231
Co	8.86	0.421
Cr	7.15	0.450
Cs	1.93	0.242
Cu	8.96	0.384
Fe	7.87	0.449
Ga	5.91	0.374
Ge	5.32	0.321
Hg	13.5336	0.140
In	7.31	0.233
Ir	22.52	0.131
K	0.862	0.757
Li	0.534	3.573
Mg	1.74	1.024
Mn	7.34	0.479
Mo	10.18	0.251
Na	0.971	1.227
Nb	8.57	0.265
Ni	8.90	0.445
Os	22.59	0.130
P	2.16	0.685
Pb	11.30	0.127
Pd	12.00	0.244
Pt	21.43	0.133
Rb	1.53	0.364
Re	20.81	0.137
Rh	12.42	0.243
Ru	12.16	0.238
S	2.07	0.705
Sb	6.68	0.207
Sc	2.99	0.567
Se	4.81	0.322
Si	2.33	0.712
Sn	7.27	0.227
Sr	2.64	0.306
Ta	16.47	0.140
Te	6.24	0.201
Ti	4.51	0.522
U	19.08	0.116
V	6.07	0.489
W	19.31	0.132
Zn	7.14	0.388
Zr	6.52	0.278

Properties of Other Substances (gas phase)				
substance (TSS)	**ρ (kg/m^3)**	**C_p (J/g·K)**	**k_H (mol/L·atm)**	**% (v/v) of dry air**
air	1.185	1.007		
N_2	1.145	1.039	6.1×10^{-4}	78.0840
O_2	1.308	0.919	1.3×10^{-3}	20.9476
Ar	1.632	0.521	1.4×10^{-3}	0.9340
CO_2	1.805	0.843	3.6×10^{-2}	0.0314
Ne	0.8242	1.031	4.5×10^{-4}	0.001818
He	0.1637	5.196	3.8×10^{-4}	0.000524
CH_4	0.6585	2.225	1.4×10^{-3}	0.000173
Kr	3.429	0.248	2.5×10^{-3}	0.000114
H_2	0.08228	14.286	7.8×10^{-4}	0.000053
Xe	5.486	0.158	4.3×10^{-3}	0.0000087
B_2H_6	1.131	2.049		
CF_4	3.588	0.694	1.9×10^{-4}	
CHF_3	2.876	0.728	1.3×10^{-2}	
CH_2F_2	2.126	0.825	8.7×10^{-2}	
CH_3Br	3.872	0.447	1.5×10^{-1}	
CH_3Cl	2.070	0.808	9.4×10^{-2}	
CH_3F	1.391	1.102	7.2×10^{-2}	
CO	1.145	1.039	9.9×10^{-4}	
C_2H_2	1.070	1.690	3.9×10^{-2}	
C_2H_4	1.169	1.529	4.8×10^{-3}	
C_2H_6	1.234	1.746	1.9×10^{-3}	
C_3H_4	1.628	1.515	9.4×10^{-2}	
C_3H_6	1.710	1.528	4.8×10^{-3}	
C_3H_8	1.818	1.669	1.5×10^{-3}	
Cl_2	2.919	0.478	9.5×10^{-2}	
F_2	1.553	0.824		
H_2S	1.402	1.003	8.7×10^{-2}	
NO	1.227	0.996	1.9×10^{-3}	
NO_2	1.896	0.809	1.2×10^{-2}	
N_2O	1.805	0.877	2.5×10^{-2}	
O_3	1.946	0.817	9.4×10^{-3}	
SO_2	2.650	0.623	1.4×10^{0}	

Acid Dissociation Constants				
name	**formula**	K_{a1}	K_{a2}	K_{a3}
2,3-dihydroxypropanoic acid	$HC_3H_5O_4$	3.0×10^{-4}		
2,4,6-trihydroxybenzoic acid		2.1×10^{-2}		
2-acetoxybenzoic acid	$HC_9H_7O_4$	3.3×10^{-4}		
2-chlorobenzoic acid		1.3×10^{-3}		
2-hydroxyethanoic acid	$HC_2H_3O_3$	1.5×10^{-4}		
2-hydroxypropanoic acid	$HC_3H_5O_3$	1.4×10^{-4}		
2-oxopropanoic acid	$HC_3H_3O_3$	4.1×10^{-3}		
2-propenoic acid	$HC_3H_3O_2$	5.6×10^{-5}		
3,4,5-trihydroxybenzoic acid		3.9×10^{-5}		
3-chlorobenzoic acid		1.4×10^{-4}		
4-chlorobenzoic acid		1.0×10^{-4}		
acetic acid	HCH_3CO_2	1.7×10^{-5}		
acetic acid	$HC_2H_3O_2$	1.7×10^{-5}		
acetylsalicylic acid	$HC_9H_7O_4$	3.3×10^{-4}		
acrylic acid	$HC_3H_3O_2$	5.6×10^{-5}		
adipic acid	$H_2C_6H_8O_4$	3.9×10^{-5}	3.9×10^{-6}	
ammonia	NH_3	5.6×10^{-10}		
aniline	$C_6H_5NH_2$	1.3×10^{-5}		
arsenic acid	H_3AsO_4	5.5×10^{-3}	1.7×10^{-7}	5.1×10^{-12}
arsenous acid	H_3AsO_3	5.1×10^{-10}		
ascorbic acid	$H_2C_6H_6O_6$	9.1×10^{-5}	2.0×10^{-12}	
barbituric acid	$HC_4H_3N_2O_3$	9.8×10^{-5}		
benzoic acid	$HC_7H_5O_2$	6.3×10^{-5}		
boric acid	H_3BO_3	5.4×10^{-10}		
bromoacetic acid	$HC_2H_2BrO_2$	1.3×10^{-3}		
butanedioic acid	$H_2C_4H_4O_4$	6.2×10^{-5}	2.3×10^{-6}	
butanoic acid	$HC_4H_7O_2$	1.5×10^{-5}		
butyric acid	$HC_4H_7O_2$	1.5×10^{-5}		
caproic acid	$HC_6H_{11}O_2$	1.4×10^{-5}		
carbonic acid	H_2CO_3	4.5×10^{-7}	4.7×10^{-11}	
chloroacetic acid	$HC_2H_2ClO_2$	1.3×10^{-3}		
chloroacetic acid	$HC_2H_2O_2Cl$	1.3×10^{-3}		
chromic acid	H_2CrO_4	1.8×10^{-1}	3.2×10^{-7}	

Acid Dissociation Constants				
name	**formula**	K_{a1}	K_{a2}	K_{a3}
cinnamic acid	$HC_8H_7O_2$	3.6×10^{-5}		
citric acid	$H_3C_6H_5O_7$	7.4×10^{-4}	1.7×10^{-5}	4.0×10^{-7}
cyanoacetic acid	$HC_3H_2NO_2$	3.4×10^{-3}		
dichloroacetic acid	$HC_2HCl_2O_2$	4.5×10^{-2}		
ethanedioic acid	$H_2C_2O_4$	5.6×10^{-2}	1.5×10^{-4}	
ethanoic acid	$HC_2H_3O_2$	1.7×10^{-5}		
ethanol	HC_2H_5O	3.2×10^{-16}		
fluoroacetic acid	$HC_2H_2FO_2$	2.6×10^{-3}		
formic acid	$HCHO_2$	1.8×10^{-4}		
fumaric acid		9.5×10^{-4}	4.2×10^{-5}	
gallic acid		3.9×10^{-5}		
glutaric acid	$H_2C_5H_6O_4$	4.8×10^{-5}	3.8×10^{-6}	
glyceric acid	$HC_3H_5O_4$	3.0×10^{-4}		
glycolic acid	$HC_2H_3O_3$	1.5×10^{-4}		
hexanedioic acid	$H_2C_6H_8O_4$	3.9×10^{-5}	3.9×10^{-6}	
hexanoic acid	$HC_6H_{11}O_2$	1.4×10^{-5}		
hydrazine	N_2H_4	7.9×10^{-9}		
hydrazoic acid	HN_3	2.5×10^{-5}		
hydroazoic acid	HN_3	2.5×10^{-5}		
hydrocyanic acid	HCN	6.2×10^{-10}		
hydrofluoric acid	HF	6.3×10^{-4}		
hydrogen peroxide	H_2O_2	2.4×10^{-12}		
hydrogen selenide	H_2Se	1.3×10^{-4}	1.0×10^{-11}	
hydrogen sulfide	H_2S	8.9×10^{-8}	1.0×10^{-19}	
hydroxyacetic acid	$HC_2H_3O_3$	1.5×10^{-4}		
hydroxybutanedioic acid	$H_2C_4H_4O_5$	4.0×10^{-4}	7.8×10^{-6}	
hydroxylamine	$HONH_2$	1.1×10^{-6}		
iodoacetic acid	$HC_2H_2IO_2$	6.6×10^{-4}		
isophthalic acid		2.0×10^{-4}	2.5×10^{-5}	
lactic acid	$HC_3H_5O_3$	1.4×10^{-4}		
m-toluic acid		5.6×10^{-5}		
maleic acid		1.2×10^{-2}	5.9×10^{-7}	
malic acid	$H_2C_4H_4O_5$	4.0×10^{-4}	7.8×10^{-6}	

Acid Dissociation Constants				
name	**formula**	K_{a1}	K_{a2}	K_{a3}
malonic acid	$H_2C_3H_2O_4$	1.4×10^{-3}	2.0×10^{-6}	
mandelic acid	$HC_8H_7O_3$	4.3×10^{-4}		
methanoic acid	$HCHO_2$	1.8×10^{-4}		
methanol	HCH_3O	3.2×10^{-16}		
nitroacetic acid	$HC_2H_2NO_4$	3.3×10^{-2}		
o-toluic acid		1.2×10^{-4}		
oxalic acid	$H_2C_2O_4$	5.6×10^{-2}	1.5×10^{-4}	
oxaloacetic acid	$H_2C_4H_2O_5$	2.8×10^{-3}	4.3×10^{-5}	
oxobutanedioic acid	$H_2C_4H_2O_5$	2.8×10^{-3}	4.3×10^{-5}	
p-toluic acid		4.3×10^{-5}		
pentandedioic acid	$H_2C_5H_6O_4$	4.8×10^{-5}	3.8×10^{-6}	
pentanoic acid	$HC_5H_9O_2$	1.5×10^{-5}		
phenol	HC_6H_5O	1.0×10^{-10}		
phenylamine	$C_6H_5NH_2$	1.3×10^{-5}		
phloroglucinic acid		2.1×10^{-2}		
phosphoric acid	H_3PO_4	6.9×10^{-3}	6.2×10^{-8}	4.8×10^{-13}
phosphorous acid	H_3PO_3	5.0×10^{-2}	2.0×10^{-7}	
phthalic acid		1.1×10^{-3}	3.7×10^{-6}	
propanedioic acid	$H_2C_3H_2O_4$	1.4×10^{-3}	2.0×10^{-6}	
propanoic acid	$HC_3H_5O_2$	1.3×10^{-5}		
propionic acid	$HC_3H_5O_2$	1.3×10^{-5}		
pyruvic acid	$HC_3H_3O_3$	4.1×10^{-3}		
succinic acid	$H_2C_4H_4O_4$	6.2×10^{-5}	2.3×10^{-6}	
tartaric acid	$H_2C_4H_4O_6$	9.3×10^{-4}	4.3×10^{-5}	
terephthalic acid		2.9×10^{-4}	4.6×10^{-5}	
thioacetic acid	HC_2H_3OS	4.7×10^{-4}		
trichloroacetic acid	$HC_2Cl_3O_2$	2.2×10^{-1}		
trifluoroacetic acid	$HC_2F_3O_2$	3.0×10^{-1}		
uric acid	$HC_5H_3N_4O_3$	1.3×10^{-4}		
valeric acid	$HC_5H_9O_2$	1.5×10^{-5}		

Acid Dissociation Constants				
name	**formula**	K_{a1}	K_{a2}	K_{a3}
bromic acid	$HBrO_3$	2.0×10^{-1}		
bromous acid	$HBrO_2$	3.7×10^{-4}		
chloric acid	$HClO_3$	$1.0 \times 10^{+1}$		
chlorous acid	$HClO_2$	1.1×10^{-2}		
cyanic acid	$HCNO$	3.5×10^{-4}		
germanic acid	H_2GeO_3	9.8×10^{-10}	5.0×10^{-13}	
hydriodic acid	HI	$2.0 \times 10^{+9}$		
hydrobromic acid	HBr	$5.0 \times 10^{+8}$		
hydrochloric acid	HCl	$1.3 \times 10^{+6}$		
hydroiodic acid	HI	$2.0 \times 10^{+9}$		
hypobromous acid	$HBrO$	2.8×10^{-9}		
hypochlorous acid	$HClO$	4.0×10^{-8}		
hypoiodous acid	HIO	3.2×10^{-11}		
iodic acid	HIO_3	1.7×10^{-1}		
iodous acid	HIO_2	3.2×10^{-5}		
methanesulfonic acid	HCH_3SO_3	4.0×10^{0}		
nitric acid	HNO_3	$2.4 \times 10^{+1}$		
nitrous acid	HNO_2	5.6×10^{-4}		
p-toluenesulfonic acid	$HCH_3C_6H_4SO_3$	$6.3 \times 10^{+2}$		
perchloric acid	$HClO_4$	$4.0 \times 10^{+1}$		
selenic acid	H_2SeO_4	$1.0 \times 10^{+2}$	2.0×10^{-2}	
selenous acid	H_2SeO_3	2.4×10^{-3}	4.8×10^{-9}	
sulfuric acid	H_2SO_4	$1.0 \times 10^{+3}$	1.0×10^{-2}	
sulfurous acid	H_2SO_3	1.4×10^{-2}	6.3×10^{-8}	
thiocyanic acid	$HSCN$	$6.3 \times 10^{+1}$		
triflic acid	HCF_3SO_3	$7.9 \times 10^{+14}$		
trifluoromethanesulfonic acid	HCF_3SO_3	$7.9 \times 10^{+14}$		

Acid Dissociation Constants				
name	**formula**	K_{a1}	K_{a2}	K_{a3}
aluminum(III) ion	Al^{3+}	1.2×10^{-5}		
barium ion	Ba^{2+}	4.0×10^{-14}		
beryllium ion	Be^{2+}	3.0×10^{-7}		
calcium ion	Ca^{2+}	2.5×10^{-13}		
chromium(III) ion	Cr^{3+}	1.6×10^{-4}		
cobalt(II) ion	Co^{2+}	1.3×10^{-9}		
iron(II) ion	Fe^{2+}	3.2×10^{-10}		
iron(III) ion	Fe^{3+}	6.2×10^{-3}		
lithium ion	Li^{+}	1.6×10^{-14}		
magnesium ion	Mg^{2+}	4.0×10^{-12}		
nickel(II) ion	Ni^{2+}	2.5×10^{-11}		
potassium ion	K^{+}	7.9×10^{-16}		
sodium ion	Na^{+}	1.6×10^{-15}		
strontium ion	Sr^{2+}	6.3×10^{-14}		
zinc(II) ion	Zn^{2+}	2.5×10^{-10}		

Base Dissociation Constants

name	formula	K_b
2,3-dimethylpyridine		3.8×10^{-8}
2,4-dimethylpyridine		9.9×10^{-8}
2,5-dimethylpyridine		2.5×10^{-8}
2,6-dimethylpyridine		4.5×10^{-8}
2-chloropyridine		3.1×10^{-14}
3,4-dimethylpyridine		2.9×10^{-8}
3,5-dimethylpyridine		1.4×10^{-8}
3-chloropyridine		6.5×10^{-12}
4-chloropyridine		6.8×10^{-11}
ammonia	NH_3	1.8×10^{-5}
aniline	$C_6H_5NH_2$	7.5×10^{-10}
codeine	$C_{18}H_{21}NH_2$	1.6×10^{-6}
decylamine	$(C_{10}H_{21})NH_2$	4.4×10^{-4}
diethylamine	$(C_2H_5)_2NH$	7.0×10^{-4}
diisopropylamine	$(C_3H_7)_2NH$	1.1×10^{-3}
dimethylamine	$(CH_3)_2NH$	5.4×10^{-4}
ethanolamine	$HOC_2H_4NH_2$	3.2×10^{-5}
ethylamine	$C_2H_5NH_2$	4.5×10^{-4}
heptylamine	$(C_7H_{15})NH_2$	4.7×10^{-4}
hexylamine	$(C_6H_{13})NH_2$	3.7×10^{-4}
hydrazine	H_2NNH_2	1.3×10^{-6}
hydroxylamine	$HONH_2$	8.8×10^{-9}
imidazole		9.9×10^{-8}
isopropylamine		4.3×10^{-4}
methylamine	$(CH_3)NH_2$	4.6×10^{-4}
methylamine	CH_3NH_2	4.6×10^{-4}
morphine	$C_{17}H_{19}NO_3$	1.6×10^{-6}
morpholine		3.2×10^{-6}
n-butylamine	$(C_4H_9)NH_2$	4.0×10^{-4}
nonylamine	$(C_9H_{19})NH_2$	4.4×10^{-4}
octylamine	$(C_8H_{17})NH_2$	4.5×10^{-4}
pentylamine	$(C_5H_{11})NH_2$	4.3×10^{-4}
piperidine	$C_5H_{10}NH$	1.3×10^{-3}
propylamine	$(C_3H_7)NH_2$	3.5×10^{-4}
propylamine	$C_3H_7NH_2$	3.5×10^{-4}
pyrazole		3.1×10^{-12}
pyridazine		1.8×10^{-12}
pyridine	C_5H_5N	1.7×10^{-9}
pyrimidine		1.7×10^{-13}
pyrrolidine	C_4H_8NH	2.1×10^{-3}
sec-butylamine		3.7×10^{-4}
strychnine	$C_{21}H_{22}N_2O_2$	1.8×10^{-6}
tert-butylamine	$(CH_3)_3CNH_2$	4.8×10^{-4}
triethylamine	$(C_2H_5)_3N$	5.7×10^{-4}
trimethylamine	$(CH_3)_3N$	6.4×10^{-5}
barium hydroxide	$Ba(OH)_2$	2.5×10^{-1}
calcium hydroxide	$Ca(OH)_2$	4.0×10^{-2}
lithium hydroxide	LiOH	6.4×10^{-1}
magnesium hydroxide	$Mg(OH)_2$	2.5×10^{-3}
nickel(II) hydroxide	$Ni(OH)_2$	4.0×10^{-4}
potassium hydroxide	KOH	$1.3 \times 10^{+1}$
sodium hydroxide	NaOH	6.4×10^{0}
strontium hydroxide	$Sr(OH)_2$	1.6×10^{-1}

Solubility-Product Constants

name	formula	K_{sp}
aluminum hydroxide	$Al(OH)_3$	1.9×10^{-33}
aluminum phosphate	$AlPO_4$	9.8×10^{-21}
barium carbonate	$BaCO_3$	2.6×10^{-9}
barium chromate	$BaCrO_4$	1.2×10^{-10}
barium fluoride	BaF_2	1.8×10^{-7}
barium hydroxide	$Ba(OH)_2$	2.6×10^{-4}
barium sulfate	$BaSO_4$	1.1×10^{-10}
barium sulfite	$BaSO_3$	5.0×10^{-10}
beryllium hydroxide	$Be(OH)_2$	6.9×10^{-22}
cadmium carbonate	$CdCO_3$	1.0×10^{-12}
cadmium hydroxide	$Cd(OH)_2$	7.2×10^{-15}
cadmium phosphate	$Cd_3(PO_4)_2$	2.5×10^{-33}
cadmium sulfide	CdS	7.2×10^{-28}
calcium carbonate	$CaCO_3$	3.4×10^{-9}
calcium fluoride	CaF_2	3.5×10^{-11}
calcium hydroxide	$Ca(OH)_2$	5.0×10^{-6}
calcium phosphate	$Ca_3(PO_4)_2$	2.1×10^{-33}
calcium sulfate	$CaSO_4$	4.9×10^{-5}
calcium sulfite	$CaSO_3$	3.1×10^{-7}
chromium(II) hydroxide	$Cr(OH)_2$	2.0×10^{-16}
chromium(III) hydroxide	$Cr(OH)_3$	6.3×10^{-31}
cobalt(II) carbonate	$CoCO_3$	1.4×10^{-13}
cobalt(II) hydroxide	$Co(OH)_2$	5.9×10^{-15}
cobalt(II) phosphate	$Co_3(PO_4)_2$	2.1×10^{-35}
cobalt(II) sulfide	CoS	4.0×10^{-21}
cobalt(III) hydroxide	$Co(OH)_3$	1.6×10^{-44}
copper(I) bromide	$CuBr$	6.3×10^{-9}
copper(I) chloride	$CuCl$	1.7×10^{-7}
copper(I) cyanide	$CuCN$	3.5×10^{-20}
copper(I) iodide	CuI	1.3×10^{-12}
copper(II) carbonate	$CuCO_3$	1.4×10^{-10}
copper(II) hydroxide	$Cu(OH)_2$	2.2×10^{-20}
copper(II) phosphate	$Cu_3(PO_4)_2$	1.4×10^{-37}
copper(II) sulfide	CuS	5.4×10^{-37}
gallium(III) hydroxide	$Ga(OH)_3$	7.3×10^{-36}
iron(II) carbonate	$FeCO_3$	3.1×10^{-11}
iron(II) hydroxide	$Fe(OH)_2$	4.9×10^{-17}
iron(II) sulfide	FeS	3.7×10^{-19}
iron(III) hydroxide	$Fe(OH)_3$	2.8×10^{-39}
lead(II) bromide	$PbBr_2$	6.6×10^{-6}
lead(II) carbonate	$PbCO_3$	7.4×10^{-14}
lead(II) chloride	$PbCl_2$	1.7×10^{-5}
lead(II) chromate	$PbCrO_4$	2.8×10^{-13}
lead(II) fluoride	PbF_2	3.3×10^{-8}
lead(II) hydroxide	$Pb(OH)_2$	1.4×10^{-20}
lead(II) iodate	$Pb(IO_3)_2$	3.7×10^{-13}
lead(II) iodide	PbI_2	9.8×10^{-9}
lead(II) sulfate	$PbSO_4$	2.5×10^{-8}
lead(II) sulfide	PbS	2.7×10^{-28}
magnesium carbonate	$MgCO_3$	6.8×10^{-6}
magnesium fluoride	MgF_2	5.2×10^{-11}
magnesium hydroxide	$Mg(OH)_2$	5.6×10^{-12}
magnesium phosphate	$Mg_3(PO_4)_2$	1.0×10^{-24}
manganese(II) carbonate	$MnCO_3$	2.2×10^{-11}
manganese(II) hydroxide	$Mn(OH)_2$	1.9×10^{-9}
manganese(II) sulfide	MnS	2.4×10^{-14}
mercury(I) bromide	Hg_2Br_2	6.4×10^{-23}
mercury(I) carbonate	Hg_2CO_3	3.6×10^{-17}
mercury(I) chloride	Hg_2Cl_2	1.4×10^{-18}
mercury(I) fluoride	Hg_2F_2	3.1×10^{-6}
mercury(I) iodide	Hg_2I_2	5.2×10^{-29}
mercury(I) sulfate	Hg_2SO_4	6.5×10^{-7}
mercury(II) sulfide	HgS	1.8×10^{-53}
nickel(II) carbonate	$NiCO_3$	1.4×10^{-7}
nickel(II) hydroxide	$Ni(OH)_2$	5.5×10^{-16}
nickel(II) sulfide	NiS	3.0×10^{-19}

Solubility-Product Constants

name	formula	K_{sp}
silver bromate	$AgBrO_3$	5.4×10^{-5}
silver bromide	$AgBr$	5.4×10^{-13}
silver carbonate	Ag_2CO_3	8.5×10^{-12}
silver chloride	$AgCl$	1.8×10^{-10}
silver chromate	Ag_2CrO_4	1.1×10^{-12}
silver cyanide	$AgCN$	6.0×10^{-17}
silver iodide	AgI	8.5×10^{-17}
silver phosphate	Ag_3PO_4	8.9×10^{-17}
silver sulfate	Ag_2SO_4	1.2×10^{-5}
silver sulfide	Ag_2S	5.4×10^{-51}
silver sulfite	Ag_2SO_3	1.5×10^{-14}
strontium carbonate	$SrCO_3$	5.6×10^{-10}
strontium hydroxide	$Sr(OH)_2$	3.0×10^{-3}
strontium sulfate	$SrSO_4$	3.4×10^{-7}
thallium(I) bromate	$TlBrO_3$	1.1×10^{-4}
thallium(I) bromide	$TlBr$	3.7×10^{-6}
thallium(I) chloride	$TlCl$	1.9×10^{-4}
thallium(I) iodate	$TlIO_3$	3.1×10^{-6}
thallium(I) iodide	TlI	5.5×10^{-8}
tin(II) hydroxide	$Sn(OH)_2$	5.5×10^{-27}
tin(II) sulfide	SnS	9.0×10^{-27}
zinc carbonate	$ZnCO_3$	1.5×10^{-10}
zinc hydroxide	$Zn(OH)_2$	3.0×10^{-17}
zinc sulfide	ZnS	1.8×10^{-25}

Ion Formation Constants		
name	**formula**	K_f
diamminesilver(I)	$Ag(NH_3)_2^+$	1.7×10^7
dicyanoargentate(I)	$Ag(CN)_2^-$	5.6×10^{18}
dicyanocuprate(I)	$Cu(CN)_2^-$	1.0×10^{16}
dithiosulfateargentate(I)	$Ag(S_2O_3)_2^{3-}$	2.9×10^{13}
hexaamminenickel(II)	$Ni(NH_3)_6^{2+}$	5.6×10^8
hexacyanoferrate(II)	$Fe(CN)_6^{4-}$	7.7×10^{36}
hexacyanoferrate(III)	$Fe(CN)_6^{3-}$	4.1×10^{42}
tetraamminecopper(II)	$Cu(NH_3)_4^{2+}$	5.6×10^{11}
tetraamminenickel(II)	$Ni(NH_3)_4^{2+}$	3.0×10^7
tetraamminezinc(II)	$Zn(NH_3)_4^{2+}$	5.1×10^8
tetracyanocuprate(I)	$Cu(CN)_4^{3-}$	2.0×10^{30}
tetracyanocuprate(II)	$Cu(CN)_4^{2-}$	1.0×10^{25}
tetracyanonickelate(II)	$Ni(CN)_4^{2-}$	1.7×10^{30}
tetracyanozincate(II)	$Zn(CN)_4^{2-}$	4.2×10^{19}
tetrahydroxoaluminate(III)	$Al(OH)_4^-$	2.3×10^{33}
tetrahydroxoberrylate(II)	$Be(OH)_4^{2-}$	4.0×10^{18}
tetrahydroxochromate(III)	$Cr(OH)_4^-$	8.0×10^{29}
tetrahydroxocuprate(II)	$Cu(OH)_4^{2-}$	4.0×10^{15}
tetrahydroxoferrate(II)	$Fe(OH)_4^{2-}$	1.0×10^{10}
tetrahydroxoferrate(III)	$Fe(OH)_4^-$	2.5×10^{34}
tetrahydroxogallate(III)	$Ga(OH)_4^-$	2.5×10^{39}
tetrahydroxonickel(II)	$Ni(OH)_4^{2-}$	2.0×10^{28}
tetrahydroxozincate(II)	$Zn(OH)_4^{2-}$	3.2×10^{15}
trihydroxoplumbate(II)	$Pb(OH)_3^-$	7.9×10^{13}
trihydroxostannate(II)	$Sn(OH)_3^-$	2.5×10^{25}

Phase Transition Thermodynamic Data						
formula	T_m (°C)	ΔH_{fus} (kJ/mol)	E_f (K·kg/mol)	T_b (°C)	ΔH_{vap} (kJ/mol)	E_b (K·kg/mol)
$(CH_3)_2CO$				56.05	29.10	1.80
$(CH_3)_2SO$	17.89	14.37	3.85	189	43.1	3.22
$(C_2H_5)O$				34.5	26.52	2.20
$(C_6H_5)_2CO$	47.9	18.19	8.58			
$(C_6H_5CH_2)_2O$			6.17			
Ag	961.78	11.28				
AgBr	432	9.12		1502	198	
AgCl	455	13.2		1547	199	
$AgNO_3$	212	11.5				
Ag_2S	825	14.1				
Al	660.32	10.789		2519	294	
$AlBr_3$	97.5	11.25		255	23.5	
$AlCl_3$	192.6	35.4				
Al_2O_3	2053	111.4				
Au	1064.18	12.72		2856	324	
B	2075	50.2		4000	480.	
BBr_3				91	30.5	
BCl_3	−107	2.10		12.65	23.77	
B_2H_6				−92.4	14.28	
B_2O_3	450	24.56				
Ba	727	7.12		1897	140.	
$BaBr_2$	857	32.2				
$BaCl_2$	962	15.85				
BaO	1972	46				
BaS	2229	63				
$BaSO_4$	1580	40.				
Be	1287	7.895				
$BeBr_2$	508	18				
$BeCl_2$	415	8.66		482	105	
BeO	2577	86				
BrF_3	8.77	12.03		125.8	47.57	
BrF_5	−60.5	5.67		40.76	30.6	
Br_2	−7.2	10.57		58.8	29.96	

Phase Transition Thermodynamic Data						
formula	T_m (°C)	ΔH_{fus} (kJ/mol)	E_f (K·kg/mol)	T_b (°C)	ΔH_{vap} (kJ/mol)	E_b (K·kg/mol)
C	4489	117				
CBr_4	92.3	3.76				
CCl_4	−22.62	2.56		76.8	29.82	
$CHCl_3$	−63.41	9.5		61.17	29.24	
CH_2Cl_2	−97.2	4.60		49.6	28.06	2.42
CH_3CN				81.65	29.75	1.44
$CH_3COC_6H_5$			5.16			
CH_3CONH_2	80.16	15.59	3.92			
$CH_3CO_2C_2H_5$				77.11	31.94	2.82
CH_3Cl	−97.7	6.43		−24.09	21.40	
CH_3NO	2.49	8.44	4.25			
CH_3OH	−97.53	3.215		64.6	35.21	0.86
CH_4	−182.47	0.94		−161.48	8.19	
CO	−205.02	0.833		−191.5	6.04	
CO_2	−56.56	9.02				
CS_2	−112.1	4.39		46.0	26.74	
$C_{10}H_{16}O$	214.4	6.82	37.8			
$C_{10}H_8$	80.26	19.01	7.45			
$C_{13}H_{10}O$	47.9	18.19	8.58			
$C_{14}H_{14}O$			6.17			
C_2H_4	−169.15	3.35		−103.77	13.53	
C_2H_5NO	80.16	15.59	3.92			
C_2H_5OH	−114.14	4.931		78.29	38.56	1.23
C_2H_6	−182.79	2.72		−88.6	14.69	
$C_2H_6O_2$	−12.69	9.96	3.11	197.3	50.5	2.26
C_2H_6SO	17.89	14.37	3.85	189	43.1	3.22
C_3H_6O				56.05	29.10	1.80
C_3H_8	−187.63	3.50		−42.1	19.04	
$C_3H_8O_3$	18.1	18.3	3.56			
C_4H_{10}	−138.3	4.66		−0.5	22.44	
$C_4H_{10}O$				117.73	43.29	2.17
$C_4H_8O_2$	11.85	12.84	4.63	101.5	34.16	3.01
C_4H_9OH				117.73	43.29	2.17

Phase Transition Thermodynamic Data						
formula	T_m (°C)	ΔH_{fus} (kJ/mol)	E_f (K·kg/mol)	T_b (°C)	ΔH_{vap} (kJ/mol)	E_b (K·kg/mol)
C_5H_{12}	−129.67	8.40		36.06	25.79	
C_5H_5N	−41.70	8.28	4.26	115.23	35.09	2.83
$C_6H_{11}OH$	25.93	1.78	42.2			
C_6H_{12}	6.59	2.68	20.8	80.73	29.97	2.92
C_6H_{14}	−95.35	13.08		68.73	28.85	2.90
$C_6H_4(CH_3)_2$	13.25	17.12	4.31	138.37	35.67	4.25
$C_6H_5CH_3$	−94.95	6.64	3.55	110.63	33.18	3.40
C_6H_5CN	−13.99	9.10	5.35			
$C_6H_5NH_2$	−6.02	10.54	5.23	184.17	42.44	3.82
$C_6H_5NO_2$	5.7	12.12	6.87	210.8	55.01	5.20
C_6H_5OH	40.89	11.51	6.84	181.87	45.69	3.54
C_6H_6	5.49	9.87	5.07	80.09	30.72	2.64
C_7H_8	−94.95	6.64	3.55	110.63	33.18	3.40
C_8H_{10}	13.25	17.12	4.31	138.37	35.67	4.25
$C_8H_{17}OH$				195.16	70.98	5.06
C_8H_8O			5.16			
Ca	842	8.54				
$CaBr_2$	742	29.1				
$CaCl_2$	775	28.05				
CaO	2898	80.				
$CaSO_4$	1460	28				
Cl_2	−101.5	6.40		−34.04	20.41	
Cr	1907	21.0				
$CrCl_2$	814	32.2				
Cr_2O_3	2329	130.				
Cs	28.5	2.09				
CsCl	645	15.9				
Cu	1084.62	12.93				
CuCl	430	10.2				
$CuCl_2$	630	20.4				
CuO	1446	11.8				
F_2	−219.66	0.51		−188.12	6.62	
Fe	1538	13.81				

Phase Transition Thermodynamic Data						
formula	T_m (°C)	ΔH_{fus} (kJ/mol)	E_f (K·kg/mol)	T_b (°C)	ΔH_{vap} (kJ/mol)	E_b (K·kg/mol)
$FeBr_2$	691	50.2				
$FeCl_2$	677	43.01				
$FeCl_3$	304	43.1				
FeO	1377	24				
FeS	1188	31.5				
Fe_3O_4	1597	138				
HBr	−86.80	2.41		−66.38	12.69	
$HCHO_2$	8.3	12.68	2.38			
$HCONH_2$	2.49	8.44	4.25			
$HC_2H_3O_2$	16.64	11.73	3.63	117.9	23.70	3.22
HCl	−114.17	2.00				
HF	−83.35	4.58				
HI	−50.76	2.87		−35.55	19.76	
HNO_3				83	39.1	
H_2	−259.34	0.12		−252.87	0.90	
H_2O	0	6.010	1.86	100	40.657	0.513
H_2O_2				150.2	51.6	
H_2S				−59.55	18.67	
H_2Se				−41.25	19.7	
H_3PO_3	74.4	12.8				
H_3PO_4	42.4	13.4				
Hg	−38.83	2.29		356.73	59.11	
$HgBr_2$	236	17.9				
$HgCl_2$	276	19.41				
I_2	113.7	15.52		184.4	41.57	
K	63.5	2.33				
KBr	734	25.5				
KCl	771	26.53				
KNO_3	337	10.1				
Li	180.50	3.00				
LiBr	552	17.6				
LiCl	610	19.9				
Mg	650	8.48				

Phase Transition Thermodynamic Data						
formula	T_m (°C)	ΔH_{fus} (kJ/mol)	E_f (K·kg/mol)	T_b (°C)	ΔH_{vap} (kJ/mol)	E_b (K·kg/mol)
$MgBr_2$	711	39.3				
$MgCl_2$	714	43.1				
MgO	2825	77				
$MgSO_4$	1127	14.6				
Mn	1246	12.91				
$MnCl_2$	650	30.7				
MnO	1839	54.4				
NH_3	−77.73	5.66		−33.33	23.33	
NH_4NO_3	210	6.40				
NO	−163.6	2.30		−151.74	13.83	
N_2	−210.0	0.71		−195.79	5.57	
N_2H_4	1.4	12.6		113.55	41.8	
N_2O	−90.8	6.54		−88.48	16.53	
N_2O_4	−9.3	14.65		21.15	38.12	
Na	97.80	2.60				
NaBr	747	26.11				
NaCl	800.7	28.16				
$NaClO_3$	248	22.1				
$NaNO_3$	307	15				
NaOH	323	6.60		1388	175	
Na_2O	1132	48				
Na_2S	1172	19				
Na_2SO_4	884	23.6				
Ni	1455	17.04				
$NiCl_2$	1009	71.2				
O_2	−218.79	0.44		−182.95	6.82	
P	44.15	0.66		280.5	12.4	
PCl_3	−112	7.10				
PH_3				−87.75	14.6	
P_2O_5	562	27.2				
Pb	327.46	4.782		1749	179.5	
$PbBr_2$	371	16.44				
$PbCl_2$	501	21.75				

Phase Transition Thermodynamic Data						
formula	T_m (°C)	ΔH_{fus} (kJ/mol)	E_f (K·kg/mol)	T_b (°C)	ΔH_{vap} (kJ/mol)	E_b (K·kg/mol)
PbS	1113	49.4				
Rb	39.3	2.19				
S				444.60	45	
SO_2				−10.05	24.94	
SO_3	16.8	8.60		45	40.69	
Se	220.5	6.69		685	95.48	
Si	1414	50.21				
$SiCl_4$	−68.74	7.60				
SiO_2	1722	9.6				
Sn	231.93	7.173				
$SnCl_4$	−34.07	9.20				
Ti	1668	14.15				
$TiCl_4$	−24.12	9.97				
Zn	419.53	7.068				
$ZnBr_2$	394	16.7				
ZnO	1974	52.3				

Standard State Thermodynamic Data

formula	ΔH_f^0 (kJ/mol)	S^0 (J/mol·K)	ΔG_f^0 (kJ/mol)
Ag(g)	284.9	173.0	233.3
Ag(s)	0	42.6	−12.7
AgBr(s)	−100.4	107.1	−132.3
$AgBrO_3$(s)	−10.5	151.9	−55.8
AgCl(s)	−127.0	96.3	−155.7
$AgClO_3$(s)	−30.3	142.0	−72.6
AgI(s)	−61.8	115.5	−96.2
$AgNO_3$(s)	−124.4	140.9	−166.4
Ag_2O(s)	−31.1	121.3	−67.3
Ag_2S(s)	−32.6	144.0	−75.5
Ag_2SO_4(s)	−715.9	200.4	−775.6
Al(g)	330.0	164.6	280.9
Al(s)	0	28.3	−8.4
$AlBr_3$(s)	−527.2	180.2	−580.9
$AlCl_3$(s)	−704.2	109.3	−736.8
AlH_3(s)	−46.0	30.0	−54.9
Al_2O_3(s)	−1675.7	50.9	−1690.9
Au(g)	366.1	180.5	312.3
Au(s)	0	47.4	−14.1
B(g)	565.0	153.4	519.3
B(s)	0	5.9	−1.8
BBr_3(g)	−205.6	324.2	−302.3
BBr_3(l)	−239.7	229.7	−308.2
BCl_3(g)	−403.8	290.1	−490.3
BCl_3(l)	−427.2	206.3	−488.7
BH_3(g)	89.2	188.2	33.1
BO_2(g)	−300.4	229.6	−368.9
B_2H_6(g)	36.4	232.1	−32.8
B_2O_3(s)	−1273.5	54.0	−1289.6
Ba(g)	180.0	170.2	129.3
Ba(s)	0	62.5	−18.6
$BaBr_2$(s)	−757.3	146.0	−800.8
$BaCO_3$(s)	−1213.0	112.1	−1246.4
$BaCl_2$(s)	−855.0	123.7	−891.9
BaF_2(s)	−1207.1	96.4	−1235.8
BaI_2(s)	−605.4	165.1	−654.6
BaO(s)	−548.0	72.1	−569.5
BaS(s)	−460.0	78.2	−483.3
$BaSO_4$(s)	−1473.2	132.2	−1512.6
$Be(OH)_2$(s)	−902.5	45.5	−916.1
Be(g)	324.0	136.3	283.4
Be(s)	0	9.5	−2.8
$BeBr_2$(s)	−353.5	108.0	−385.7
$BeCl_2$(s)	−490.4	75.8	−513.0
BeO(s)	−609.4	13.8	−613.5
BeS(s)	−234.3	34.0	−244.4
$BeSO_4$(s)	−1205.2	77.9	−1228.4
Bi(g)	207.1	187.0	151.3
Bi(s)	0	56.7	−16.9
Bi_2O_3(s)	−573.9	151.5	−619.1
Br(g)	111.9	175.0	59.7
BrCl(g)	14.6	240.1	−57.0
BrF_3(g)	−255.6	292.5	−342.8
BrF_3(l)	−300.8	178.2	−353.9
BrF_5(g)	−428.9	320.2	−524.4
BrF_5(l)	−458.6	225.1	−525.7
Br_2(g)	30.9	245.5	−42.3
Br_2(l)	0	152.2	−45.4
C(diamond)	1.9	2.4	1.2
C(g)	716.7	158.1	669.6
C(graphite)	0	5.7	−1.7
C(s)	0	5.7	−1.7
CBr_4(g)	83.9	358.1	−22.9
CBr_4(s)	29.4	212.5	−34.0
CCl_4(g)	−95.7	309.7	−188.0
CCl_4(l)	−128.2	214.4	−192.1

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formula	ΔH_f^0 (kJ/mol)	S^0 (J/mol·K)	ΔG_f^0 (kJ/mol)
$CHCl_3(g)$	−102.7	295.7	−190.9
$CHCl_3(l)$	−134.1	201.7	−194.2
$CH_2Cl_2(g)$	−95.4	270.2	−176.0
$CH_2Cl_2(l)$	−124.2	177.8	−177.2
$CH_3CH(CH_3)OH(l)$	−318.1	181.1	−372.1
$CH_3CHO(g)$	−166.2	263.8	−244.9
$CH_3CHO(l)$	−192.2	160.2	−240.0
$CH_3Cl(g)$	−81.9	234.6	−151.8
$CH_3OH(g)$	−201.0	239.9	−272.5
$CH_3OH(l)$	−239.2	126.8	−277.0
$CH_4(g)$	−74.6	186.3	−130.1
$CO(g)$	−110.5	197.7	−169.4
$COBr_2(g)$	−96.2	309.1	−188.4
$COCl_2(g)$	−219.1	283.5	−303.6
$CO_2(g)$	−393.5	213.8	−457.2
$CS_2(g)$	116.7	237.8	45.8
$CS_2(l)$	89.0	151.3	43.9
$C_2H_2(g)$	227.4	200.9	167.5
$C_2H_4(g)$	52.4	219.3	−13.0
$C_2H_4O(g)$	−52.6	242.5	−124.9
$C_2H_4O(l)$	−78.0	153.9	−123.9
$C_2H_4O_2(g)$	−432.2	283.5	−516.7
$C_2H_4O_2(l)$	−484.3	159.8	−531.9
$C_2H_5OH(g)$	−234.8	281.6	−318.8
$C_2H_5OH(l)$	−277.6	160.7	−325.5
$C_2H_6(g)$	−84.0	229.2	−152.3
$C_3H_6(g)$	20.4	266.6	−59.1
$C_3H_6O(g)$	−217.1	295.3	−305.1
$C_3H_6O(l)$	−248.4	199.8	−308.0
$C_3H_7OH(l)$	−302.6	193.6	−360.3
$C_3H_8(g)$	−103.8	270.3	−184.4
$C_4H_{10}(g)$	−125.7	310.0	−218.1
$C_4H_{10}(l)$	−147.3	226.8	−214.9

formula	ΔH_f^0 (kJ/mol)	S^0 (J/mol·K)	ΔG_f^0 (kJ/mol)
$C_4H_{10}O(g)$	−252.1	342.7	−354.3
$C_4H_{10}O(l)$	−279.5	172.4	−330.9
$C_4H_8O(g)$	−184.1	302.4	−274.3
$C_4H_8O(l)$	−216.2	204.3	−277.1
$C_5H_{12}(l)$	−173.5	263.5	−252.1
$C_5H_5N(l)$	100.2	177.9	47.2
$C_6H_{12}O_6(s)$	−1273.3	209.2	−1335.7
$C_6H_{14}(l)$	−198.7	296.1	−287.0
$C_6H_5Br(l)$	60.9	219.2	−4.5
$C_6H_5CH(CH_3)_2(l)$	−41.1	277.6	−123.9
$C_6H_5CHO(l)$	−87.0	221.2	−153.0
$C_6H_5CH_3(l)$	12.4	220.1	−53.2
$C_6H_5C_2H_3(l)$	103.8	240.5	32.1
$C_6H_5C_2H_5(l)$	−12.3	255.0	−88.3
$C_6H_5C_3H_7(l)$	−38.3	287.8	−124.1
$C_6H_5Cl(l)$	11.1	197.5	−47.8
$C_6H_5F(l)$	−150.6	205.9	−212.0
$C_6H_5I(l)$	117.2	205.4	56.0
$C_6H_5NH_2(l)$	31.6	191.3	−25.4
$C_6H_5NO_2(l)$	12.5	224.3	−54.4
$C_6H_5OH(s)$	−165.1	144.0	−208.0
$C_6H_6(g)$	82.9	269.2	2.6
$C_6H_6(l)$	49.1	173.4	−2.6
$C_7H_{16}(l)$	−224.2	328.6	−322.2
$C_7H_8(l)$	12.4	220.1	−53.2
$C_8H_{18}(l)$	−250.1	361.2	−357.8
$Ca(NO_3)_2(s)$	−938.2	193.2	−995.8
$Ca(OH)_2(s)$	−985.2	83.4	−1010.1
$Ca(g)$	177.8	154.9	131.6
$Ca(s)$	0	41.6	−12.4
$CaBr_2(s)$	−682.8	130.0	−721.6
$CaCO_3(s)$	−1207.6	91.7	−1234.9
$CaC_2(s)$	−59.8	70.0	−80.7

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formula	ΔH_f^0 (kJ/mol)	S^0 (J/mol·K)	ΔG_f^0 (kJ/mol)
$CaCl_2(s)$	−795.4	108.4	−827.7
$CaF_2(s)$	−1228.0	68.5	−1248.4
$CaH_2(s)$	−181.5	41.4	−193.8
$CaI_2(s)$	−533.5	142.0	−575.8
$CaO(s)$	−634.9	38.1	−646.3
$CaS(s)$	−482.4	56.5	−499.2
$CaSO_4(s)$	−1434.5	106.5	−1466.3
$Cd(g)$	111.8	167.7	61.8
$Cd(s)$	0	51.8	−15.4
$CdBr_2(s)$	−316.2	137.2	−357.1
$CdCl_2(s)$	−391.5	115.3	−425.9
$CdF_2(s)$	−700.4	77.4	−723.5
$CdI_2(s)$	−203.3	161.1	−251.3
$Cl(g)$	121.3	165.2	72.0
$ClNO(g)$	51.7	261.7	−26.3
$ClNO_2(g)$	12.6	272.2	−68.6
$Cl_2(g)$	0	223.1	−66.5
$Co(OH)_2(s)$	−539.7	79.0	−563.3
$Co(g)$	424.7	179.5	371.2
$Co(s)$	0	30.0	−8.9
$CoF_2(s)$	−647.2	82.0	−671.6
$CoO(s)$	−237.9	53.0	−253.7
$CoSO_4(s)$	−888.3	118.0	−923.5
$Cr(g)$	396.6	174.5	344.6
$Cr(s)$	0	23.8	−7.1
$CrCl_2(s)$	−395.4	115.3	−429.8
$CrCl_3(s)$	−556.5	123.0	−593.2
$Cr_2O_3(s)$	−1139.7	81.2	−1163.9
$Cs(g)$	76.5	175.6	24.1
$Cs(s)$	0	85.2	−25.4
$CsBr(s)$	−405.8	113.1	−439.5
$CsCl(s)$	−443.0	101.2	−473.2
$CsF(s)$	−553.3	92.8	−581.0

formula	ΔH_f^0 (kJ/mol)	S^0 (J/mol·K)	ΔG_f^0 (kJ/mol)
$CsI(s)$	−346.6	123.1	−383.3
$Cs_2O(s)$	−345.8	146.9	−389.6
$Cu(g)$	337.4	166.4	287.8
$Cu(s)$	0	33.2	−9.9
$CuBr(s)$	−104.6	96.1	−133.3
$CuCl(s)$	−137.2	86.2	−162.9
$CuCl_2(s)$	−220.1	108.1	−252.3
$CuO(s)$	−157.3	42.6	−170.0
$CuS(s)$	−53.6	66.5	−73.4
$CuSO_4(s)$	−771.4	109.2	−804.0
$Cu_2O(s)$	−168.6	93.1	−196.4
$Cu_2S(s)$	−79.5	120.9	−115.5
$F(g)$	79.4	158.8	32.1
$F_2(g)$	0	202.8	−60.5
$Fe(g)$	416.3	180.5	362.5
$Fe(s)$	0	27.3	−8.1
$FeBr_2(s)$	−249.8	140.6	−291.7
$FeCl_2(s)$	−341.8	118.0	−377.0
$FeCl_3(s)$	−399.5	142.3	−441.9
$FeO(s)$	−272.0	60.8	−290.1
$FeS(s)$	−100.0	60.3	−118.0
$FeSO_4(s)$	−928.4	107.5	−960.5
$FeS_2(s)$	−178.2	52.9	−194.0
$Fe_2O_3(s)$	−824.2	87.4	−850.3
$Fe_3O_4(s)$	−1118.4	146.4	−1162.0
$H(g)$	218.0	114.7	183.8
$HBr(g)$	−36.3	198.7	−95.5
$HCN(g)$	135.1	201.8	74.9
$HC_2H_3O_2(g)$	−432.2	283.5	−516.7
$HC_2H_3O_2(l)$	−484.3	159.8	−531.9
$HCl(g)$	−92.3	186.9	−148.0
$HF(g)$	−273.3	173.8	−325.1
$HI(g)$	26.5	206.6	−35.1

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formula	ΔH_f^0 (kJ/mol)	S^0 (J/mol·K)	ΔG_f^0 (kJ/mol)
$HNO_3(g)$	−133.9	266.9	−213.5
$HNO_3(l)$	−174.1	155.6	−220.5
$H_2(g)$	0	130.7	−39.0
$H_2O(g)$	−241.8	188.8	−298.1
$H_2O(l)$	−285.8	70.0	−306.7
$H_2O_2(g)$	−136.3	232.7	−205.7
$H_2O_2(l)$	−187.8	109.6	−220.5
$H_2S(g)$	−20.6	205.8	−82.0
$H_2SO_4(l)$	−814.0	156.9	−860.8
$H_2Se(g)$	29.7	219.0	−35.6
$H_3PO_3(s)$	−964.4		
$H_3PO_4(l)$	−1271.7	150.8	−1316.7
Hg(g)	61.4	175.0	9.2
Hg(l)	0	75.9	−22.6
$HgBr_2(s)$	−170.7	172.0	−222.0
$HgCl_2(s)$	−224.3	146.0	−267.8
HgO(s)	−90.8	70.3	−111.8
HgS(s)	−58.2	82.4	−82.8
$Hg_2(g)$	108.8	288.1	22.9
$Hg_2Br_2(s)$	−206.9	218.0	−271.9
$Hg_2Cl_2(s)$	−265.4	191.6	−322.5
I(g)	106.8	180.8	52.9
IBr(g)	40.8	258.8	−36.4
ICl(g)	17.8	247.6	−56.0
ICl(l)	−23.9	135.1	−64.2
$I_2(g)$	62.4	260.7	−15.3
$I_2(s)$	0	116.1	−34.6
K(g)	89.0	160.3	41.2
K(s)	0	64.7	−19.3
KBr(s)	−393.8	95.9	−422.4
$KBrO_3(s)$	−360.2	149.2	−404.7
KCl(s)	−436.5	82.6	−461.1
$KClO_3(s)$	−397.7	143.1	−440.4
$KClO_4(s)$	−432.8	151.0	−477.8
KF(s)	−567.3	66.6	−587.2
KI(s)	−327.9	106.3	−359.6
$KMnO_4(s)$	−837.2	171.7	−888.4
$KNO_2(s)$	−369.8	152.1	−415.1
$KNO_3(s)$	−494.6	133.1	−534.3
KOH(s)	−424.6	81.2	−448.8
$KO_2(s)$	−284.9	116.7	−319.7
$K_2CO_3(s)$	−1150.2	155.4	−1196.5
$K_2O_2(s)$	−494.1	102.1	−524.5
Li(g)	159.3	138.8	117.9
Li(s)	0	29.1	−8.7
LiBr(s)	−351.2	74.3	−373.4
LiCl(s)	−408.6	59.3	−426.3
LiF(s)	−616.0	35.7	−626.6
LiI(s)	−270.4	86.8	−296.3
LiOH(s)	−487.5	42.8	−500.3
$Li_2CO_3(s)$	−1215.9	90.4	−1242.9
$Li_2O(s)$	−597.9	37.6	−609.1
Mg(g)	147.1	148.6	102.8
Mg(s)	0	32.7	−9.7
$MgBr_2(s)$	−524.3	117.2	−559.2
$MgCO_3(s)$	−1095.8	65.7	−1115.4
$MgCl_2(s)$	−641.3	89.6	−668.0
MgO(s)	−601.6	27.0	−609.7
MgS(s)	−346.0	50.3	−361.0
$MgSO_4(s)$	−1284.9	91.6	−1312.2
Mn(g)	280.7	173.7	228.9
Mn(s)	0	32.0	−9.5
$MnCl_2(s)$	−481.3	118.2	−516.5
MnO(s)	−385.2	59.7	−403.0
$MnO_2(s)$	−520.0	53.1	−535.8
MnS(s)	−214.2	78.2	−237.5

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formula	ΔH_f^0 (kJ/mol)	S^0 (J/mol·K)	ΔG_f^0 (kJ/mol)
$Mn_2O_3(s)$	−959.0	110.5	−991.9
Mo(g)	658.1	182.0	603.8
Mo(s)	0	28.7	−8.6
$MoCl_2(s)$	−481.3	118.2	−516.5
$MoO_2(s)$	−588.9	46.3	−602.7
$MoO_3(s)$	−745.1	77.7	−768.3
$MoS_2(s)$	−235.1	62.6	−253.8
N(g)	472.7	153.3	427.0
$NH_2CH_2CO_2H(s)$	−527.5	103.5	−558.4
$NH_2OH(s)$	−57.1	236.2	−127.5
$NH_3(g)$	−45.9	192.8	−103.4
$NH_4Cl(s)$	−314.4	94.6	−342.6
$NH_4NO_3(s)$	−365.6	151.1	−410.7
NO(g)	91.3	210.8	28.4
NOCl(g)	51.7	261.7	−26.3
$NO_2(g)$	33.2	240.1	−38.4
$N_2(g)$	0	191.6	−57.1
$N_2H_4(g)$	95.4	238.5	24.3
$N_2H_4(l)$	50.6	121.2	14.5
$N_2O(g)$	81.6	220.0	16.0
$N_2O_3(g)$	86.6	314.7	−7.2
$N_2O_4(g)$	11.1	304.4	−79.7
$N_2O_4(l)$	−19.5	209.2	−81.9
$N_2O_5(g)$	13.3	355.7	−92.8
$N_2O_5(s)$	−43.1	178.2	−96.2
Na(g)	107.5	153.7	61.7
Na(s)	0	51.3	−15.3
NaBr(s)	−361.1	86.8	−387.0
NaCl(s)	−411.2	72.1	−432.7
$NaClO_3(s)$	−365.8	123.4	−402.6
$NaClO_4(s)$	−383.3	142.3	−425.7
NaF(s)	−576.6	51.1	−591.8
NaH(s)	−56.3	40.0	−68.2

formula	ΔH_f^0 (kJ/mol)	S^0 (J/mol·K)	ΔG_f^0 (kJ/mol)
$NaHCO_3(s)$	−950.8	101.7	−981.1
NaI(s)	−287.8	98.5	−317.2
$NaNO_2(s)$	−358.7	103.8	−389.6
$NaNO_3(s)$	−467.9	116.5	−502.6
NaOH(s)	−425.8	64.4	−445.0
$NaO_2(s)$	−260.2	115.9	−294.8
$Na_2CO_3(s)$	−1130.7	135.0	−1171.0
$Na_2O(s)$	−414.2	75.1	−436.6
$Na_2O_2(s)$	−510.9	95.0	−539.2
$Na_2S(s)$	−364.8	83.7	−389.8
$Na_2SO_3(s)$	−1100.8	145.9	−1144.3
$Na_2SO_4(s)$	−1387.1	149.6	−1431.7
Ni(g)	429.7	182.2	375.4
Ni(s)	0	29.9	−8.9
$NiCl_2(s)$	−305.3	97.7	−334.4
$NiF_2(s)$	−651.4	73.6	−673.3
$NiSO_4(s)$	−872.9	92.0	−900.3
O(g)	249.2	161.1	201.2
$O_2(g)$	0	205.2	−61.2
$O_3(g)$	142.7	238.9	71.5
P(g)	316.5	163.2	267.8
P(red)	−17.6	22.8	−24.4
P(s)	0	41.1	−12.3
P(white)	0	41.1	−12.3
$PBr_3(g)$	−139.3	348.1	−243.1
$PBr_3(l)$	−184.5	240.2	−256.1
$PCl_3(g)$	−287.2	311.8	−380.2
$PCl_3(l)$	−319.7	217.1	−384.4
$PCl_5(g)$	−374.9	364.6	−483.6
$PH_3(g)$	5.4	210.2	−57.3
$POCl_3(g)$	−558.5	325.5	−655.5
$POCl_3(l)$	−597.1	222.5	−663.4
$P_4(g)$	58.9	280.0	−24.6

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formula	ΔH_f^0 (kJ/mol)	S^0 (J/mol·K)	ΔG_f^0 (kJ/mol)
P_4O_{10}(s)	−3009.9	228.8	−3078.1
Pb(g)	195.2	175.4	142.9
Pb(s)	0	64.8	−19.3
$PbBr_2$(s)	−278.7	161.5	−326.9
$PbCO_3$(s)	−699.1	131.0	−738.2
$PbCl_2$(s)	−359.4	136.0	−399.9
PbF_2(s)	−664.0	110.5	−696.9
PbI_2(s)	−175.5	174.9	−227.6
PbO(s)	−217.3	68.7	−237.8
PbS(s)	−100.4	91.2	−127.6
$PbSO_4$(s)	−920.0	148.5	−964.3
Rb(g)	80.9	170.1	30.2
Rb(s)	0	76.8	−22.9
RbBr(s)	−394.6	110.0	−427.4
RbCl(s)	−435.4	95.9	−464.0
S(g)	277.2	167.8	227.2
S(monoclinic)	0.3	33.2	−9.6
S(rhombic)	0	32.1	−9.6
S(s)	0	32.1	−9.6
SO(g)	6.3	222.0	−59.9
$SOCl_2$(g)	−212.5	309.8	−304.9
SO_2(g)	−296.8	248.2	−370.8
SO_2Cl_2(g)	−364.0	311.9	−457.0
SO_3(g)	−395.7	256.8	−472.3
S_2Cl_2(g)	−16.7	327.2	−114.3
S_2Cl_2(l)	−58.2	223.8	−124.9
Se(g)	227.1	176.7	174.4
Se(s)	0	42.4	−12.6
Si(g)	450.0	168.0	399.9
Si(s)	0	18.8	−5.6
$SiBr_4$(l)	−457.3	277.8	−540.1
SiC(s)	−65.3	16.6	−70.2
$SiCl_4$(g)	−657.0	330.7	−755.6
$SiCl_4$(l)	−687.0	239.7	−758.5
SiO_2(s)	−910.7	41.5	−923.1
Sn(g)	301.2	168.5	251.0
Sn(s)	0	51.2	−15.3
$SnCl_4$(g)	−471.5	365.8	−580.6
$SnCl_4$(l)	−511.3	258.6	−588.4
SnO_2(s)	−577.6	49.0	−592.2
Ti(g)	473.0	180.3	419.2
Ti(s)	0	30.7	−9.2
$TiCl_2$(s)	−513.8	87.4	−539.9
$TiCl_3$(s)	−720.9	139.7	−762.6
$TiCl_4$(g)	−763.2	353.2	−868.5
$TiCl_4$(l)	−804.2	252.3	−879.4
TiO_2(s)	−944.0	50.6	−959.1
Zn(g)	130.4	161.0	82.4
Zn(s)	0	41.6	−12.4
$ZnBr_2$(s)	−328.7	138.5	−370.0
$ZnCO_3$(s)	−812.8	82.4	−837.4
$ZnCl_2$(s)	−415.1	111.5	−448.3
ZnF_2(s)	−764.4	73.7	−786.4
ZnI_2(s)	−208.0	161.1	−256.0
ZnO(s)	−350.5	43.7	−363.5
ZnS(s)	−206.0	57.7	−223.2
$ZnSO_4$(s)	−982.8	110.5	−1015.7

Standard Aqueous Thermodynamic Data			
formula	**ΔH_f^0 (kJ/mol)**	**ΔS^0 (J/mol·K)**	**ΔG_f^0 (kJ/mol)**
$C_2H_4O_2$(aq)	−486.0	86.6	−511.8
$Ca(NO_3)_2$(aq)	−957.6	239.7	−1029.1
$CaCl_2$(aq)	−877.1	59.8	−894.9
$CaSO_4$(aq)	−1452.1	−33.1	−1442.2
HBr(aq)	−121.6	82.4	−146.2
HCN(aq)	150.6	94.1	122.5
$HC_2H_3O_2$(aq)	−486.0	86.6	−511.8
HCl(aq)	−167.2	56.5	−184.0
HF(aq)	−332.6	−13.8	−328.5
HI(aq)	−55.2	111.3	−88.4
HNO_3(aq)	−207.4	146.4	−251.0
H_2SO_4(aq)	−909.3	20.1	−915.3
H_3PO_3(aq)	−964.8		
H_3PO_4(aq)	−1277.4	220.5	−1343.1
KOH(aq)	−482.4	91.7	−509.7
NH_3(aq)	−80.3	111.3	−113.5
NaCl(aq)	−407.3	115.5	−441.7
NaOH(aq)	−470.1	48.2	−484.5

Enthalpies of Solution

formula	ΔH_{sol} (kJ/mol)	formula	ΔH_{sol} (kJ/mol)	formula	ΔH_{sol} (kJ/mol)
$AgClO_4$	+7.36	$KMnO_4$	+43.56	$NaNO_3$	+20.50
$AgNO_2$	+36.94	KNO_2	+13.35	NaOH	−44.51
$AgNO_3$	+22.59	KNO_3	+34.89	RbBr	+21.88
$Ca(NO_3)_2$	−19.40	KOH	−57.61	RbCl	+17.28
$Ca(OH)_2$	−17.60	LiBr	−48.83	$RbClO_3$	+47.74
$CaCl_2$	−81.80	LiCl	−37.03	$RbClO_4$	+56.74
CaF_2	+20.00	$LiClO_4$	−26.55	RbF	−26.11
$CaSO_4$	−17.60	LiF	+4.73	RbI	+25.10
CsBr	+25.98	LiI	−63.30	$RbNO_3$	+36.48
CsCl	+17.78	$LiNO_2$	−11.00	RbOH	−62.34
$CsClO_4$	+55.44	$LiNO_3$	−2.51		
CsF	−36.86	LiOH	−23.56		
CsI	+33.35	NH_3	−30.50		
$CsNO_3$	+40.00	NH_4Br	+16.78		
CsOH	−71.55	NH_4CN	+17.57		
HBr	−85.14	$NH_4C_2H_3O_2$	−2.38		
HCO_2H	−0.86	NH_4Cl	+14.78		
$HC_2H_3O_2$	−1.51	NH_4ClO_4	+33.47		
HCl	−74.84	NH_4I	+13.72		
$HClO_4$	−88.76	NH_4IO_3	+31.80		
HF	−61.50	NH_4NO_2	+19.25		
HI	−81.67	NH_4NO_3	+25.69		
HIO_3	+8.79	NaBr	−0.60		
HNO_3	−33.28	NaCN	+1.21		
KBr	+19.87	$NaC_2H_3O_2$	−17.32		
KCN	+11.72	NaCl	+3.88		
$KC_2H_3O_2$	−15.33	$NaClO_2$	+0.33		
KCl	+17.22	$NaClO_3$	+21.72		
$KClO_3$	+41.38	$NaClO_4$	+13.88		
$KClO_4$	+51.04	NaF	+0.91		
KF	−17.73	NaI	−7.53		
KI	+20.33	$NaIO_3$	+20.29		
KIO_3	+27.74	$NaNO_2$	+13.89		

Lattice Enthalpies

formula	ΔH_{latt} (kJ/mol)	formula	ΔH_{latt} (kJ/mol)	formula	ΔH_{latt} (kJ/mol)
$(NH_4)_2SO_4$	1777	$FeCl_3$	5436	NH_4CN	691
AgBr	905	KBr	691	NH_4HCO_3	577
AgCl	918	KCN	686	NaBr	754
$AgNO_3$	832	$KC_2H_3O_2$	726	NaCN	759
$Al(OH)_3$	5627	KCl	720.	$NaC_2H_3O_2$	807
$AlBr_3$	5360.	KF	829	NaCl	790.
$AlCl_3$	5513	KH	713	NaF	930.
AlF_3	6252	$KHCO_3$	573	NaH	807
AlH_3	5969	KI	650.	$NaHCO_3$	656
AlI_3	5227	KNO_2	687	NaI	705
AuBr	1059	KNO_3	694	$NaNO_2$	772
AuCl	1066	KN_3	697	$NaNO_3$	763
$Ca(NO_3)_2$	2247	KOH	796	NaN_3	784
$Ca(OH)_2$	2637	K_2CO_3	1846	NaOH	892
$CaBr_2$	2132	K_2SO_4	1796	Na_2CO_3	2016
$CaCO_3$	2811	LiBr	820.	Na_2SO_4	1938
$CaCl_2$	2271	LiCN	874	$Ni(NO_3)_2$	2729
CaF_2	2651	$LiC_2H_3O_2$	843	$Ni(OH)_2$	3186
CaH_2	2406	LiCl	864	$NiBr_2$	2721
CaI_2	2087	LiF	1049	$NiCl_2$	2786
$CaSO_4$	2480.	LiH	918	$Pb(NO_3)_2$	2208
$Cr(OH)_3$	6299	LiI	764	$PbBr_2$	2230.
$CrBr_3$	5355	$LiNO_3$	854	$PbCO_3$	2750.
$CrCl_3$	5529	LiN_3	875	$PbCl_2$	2282
$Cu(NO_3)_2$	2739	LiOH	1028	$SnCl_2$	2310.
CuBr	978	Li_2SO_4	2142	$SnCl_4$	8930.
$CuBr_2$	2774	$Mg(NO_3)_2$	2521	$TiBr_4$	9288
$CuCO_3$	3494	$Mg(OH)_2$	2998	$TiCl_4$	9431
CuCl	996	$MgBr_2$	2451	$Zn(NO_3)_2$	2649
$CuCl_2$	2824	$MgCO_3$	3122	$Zn(OH)_2$	3151
$Fe(OH)_2$	3044	$MgCl_2$	2540.	$ZnBr_2$	2689
$FeBr_2$	2577	MgF_2	2978	$ZnCO_3$	3273
$FeBr_3$	5347	MgH_2	2718	$ZnCl_2$	2748
$FeCO_3$	3169	MgI_2	2340.		
$FeCl_2$	2641	$MnCO_3$	3095		

Standard Electrode Potentials

half-reaction	E^0 (V)
$F_2(g) + 2\ e^- \rightarrow 2\ F^-(aq)$	+2.866
$O_3(g) + 2\ H^+(aq) + 2\ e^- \rightarrow O_2(g) + H_2O(l)$	+2.076
$Co^{3+}(aq) + e^- \rightarrow Co^{2+}(aq)$	+1.920
$H_2O_2(aq) + 2\ H^+(aq) + 2\ e^- \rightarrow 2\ H_2O(l)$	+1.776
$PbO_2(s) + SO_4^{2-}(aq) + 4\ H^+(aq) + 2\ e^- \rightarrow PbSO_4(s) + 2\ H_2O(l)$	+1.691
$MnO_4^-(aq) + 4\ H^+(aq) + 3\ e^- \rightarrow MnO_2(s) + 2\ H_2O(l)$	+1.679
$2\ HClO(aq) + 2\ H^+(aq) + 2\ e^- \rightarrow Cl_2(g) + 2\ H_2O(l)$	+1.611
$2\ NO(g) + 2\ H^+(aq) + 2\ e^- \rightarrow N_2O(g) + H_2O(l)$	+1.591
$MnO_4^-(aq) + 8\ H^+(aq) + 5\ e^- \rightarrow Mn^{2+}(aq) + 4\ H_2O(l)$	+1.507
$Au^{3+}(aq) + 3\ e^- \rightarrow Au(s)$	+1.498
$HClO(aq) + H^+(aq) + 2\ e^- \rightarrow Cl^-(aq) + H_2O(l)$	+1.482
$2\ ClO_3^-(aq) + 12\ H^+(aq) + 10\ e^- \rightarrow Cl_2(g) + 6\ H_2O(l)$	+1.470
$PbO_2(s) + 4\ H^+(aq) + 2\ e^- \rightarrow Pb^{2+}(aq) + 2\ H_2O(l)$	+1.455
$Cl_2(g) + 2\ e^- \rightarrow 2\ Cl^-(aq)$	+1.358
$HCrO_4^-(aq) + 7\ H^+(aq) + 3\ e^- \rightarrow Cr^{3+}(aq) + 4\ H_2O(l)$	+1.350
$2\ HNO_2(aq) + 4\ H^+(aq) + 4\ e^- \rightarrow N_2O(g) + 3\ H_2O(l)$	+1.297
$Cr_2O_7^{2-}(aq) + 14\ H^+(aq) + 6\ e^- \rightarrow 2\ Cr^{3+}(aq) + 7\ H_2O(l)$	+1.232
$O_2(g) + 4\ H^+(aq) + 4\ e^- \rightarrow 2\ H_2O(l)$	+1.229
$MnO_2(s) + 4\ H^+(aq) + 2\ e^- \rightarrow Mn^{2+}(aq) + 2\ H_2O(l)$	+1.224
$ClO_3^-(aq) + 3\ H^+(aq) + 2\ e^- \rightarrow HClO_2(aq) + H_2O(l)$	+1.214
$ClO_4^-(aq) + 2\ H^+(aq) + 2\ e^- \rightarrow ClO_3^-(aq) + H_2O(l)$	+1.189
$ClO_3^-(aq) + 2\ H^+(aq) + e^- \rightarrow ClO_2(g) + H_2O(l)$	+1.152
$Br_2(aq) + 2\ e^- \rightarrow 2\ Br^-(aq)$	+1.087
$Br_2(l) + 2\ e^- \rightarrow 2\ Br^-(aq)$	+1.066
$N_2O_4(g) + 2\ H^+(aq) + 2\ e^- \rightarrow 2\ HNO_2(aq)$	+1.065
$N_2O_4(g) + 4\ H^+(aq) + 4\ e^- \rightarrow 2\ NO(g) + 2\ H_2O(l)$	+1.035
$HNO_2(aq) + H^+(aq) + e^- \rightarrow NO(g) + H_2O(l)$	+0.983
$NO_3^-(aq) + 4\ H^+(aq) + 3\ e^- \rightarrow NO(g) + 2\ H_2O(l)$	+0.957
$2\ Hg^{2+}(aq) + 2\ e^- \rightarrow Hg_2^{2+}(aq)$	+0.920
$N_2O_4(g) + 2\ e^- \rightarrow 2\ NO_2^-(aq)$	+0.867
$Hg^{2+}(aq) + 2\ e^- \rightarrow Hg(l)$	+0.851
$ClO^-(aq) + H_2O(l) + 2\ e^- \rightarrow Cl^-(aq) + 2\ OH^-(aq)$	+0.841
$Ag^+(aq) + e^- \rightarrow Ag(s)$	+0.800
$Hg_2^{2+}(aq) + 2\ e^- \rightarrow 2\ Hg(l)$	+0.797
$Fe^{3+}(aq) + e^- \rightarrow Fe^{2+}(aq)$	+0.771
$2\ NO(g) + H_2O(l) + 2\ e^- \rightarrow N_2O(g) + 2\ OH^-(aq)$	+0.760
$Tl^{3+}(aq) + 3\ e^- \rightarrow Tl(s)$	+0.741
$O_2(g) + 2\ H^+(aq) + 2\ e^- \rightarrow H_2O_2(aq)$	+0.695
$ClO_3^-(aq) + 3\ H_2O(l) + 6\ e^- \rightarrow Cl^-(aq) + 6\ OH^-(aq)$	+0.620
$MnO_4^-(aq) + 2\ H_2O(l) + 3\ e^- \rightarrow MnO_2(s) + 4\ OH^-(aq)$	+0.595
$S_2O_6^{2-}(aq) + 4\ H^+(aq) + 2\ e^- \rightarrow 2\ H_2SO_3(aq)$	+0.564
$I_3^-(aq) + 2\ e^- \rightarrow 3\ I^-(aq)$	+0.536
$I_2(s) + 2\ e^- \rightarrow 2\ I^-(aq)$	+0.535
$Cu^+(aq) + e^- \rightarrow Cu(s)$	+0.521
$O_2(g) + 2\ H_2O(l) + 4\ e^- \rightarrow 4\ OH^-(aq)$	+0.401
$ClO_4^-(aq) + H_2O(l) + 2\ e^- \rightarrow ClO_3^-(aq) + 2\ OH^-(aq)$	+0.360
$Cu^{2+}(aq) + 2\ e^- \rightarrow Cu(s)$	+0.342
$PbO_2(s) + H_2O(l) + 2\ e^- \rightarrow PbO(s) + 2\ OH^-(aq)$	+0.247
$AgCl(s) + e^- \rightarrow Ag(s) + Cl^-(aq)$	+0.222
$SO_4^{2-}(aq) + 4\ H^+(aq) + 2\ e^- \rightarrow H_2SO_3(aq) + H_2O(l)$	+0.172
$Cu^{2+}(aq) + e^- \rightarrow Cu^+(aq)$	+0.153
$Sn^{4+}(aq) + 2\ e^- \rightarrow Sn^{2+}(aq)$	+0.151
$2\ NO_2^-(aq) + 3\ H_2O(l) + 4\ e^- \rightarrow N_2O(g) + 6\ OH^-(aq)$	+0.150
$S_4O_6^{2-}(aq) + 2\ e^- \rightarrow 2\ S_2O_3^{2-}(aq)$	+0.080
$NO_3^-(aq) + H_2O(l) + 2\ e^- \rightarrow NO_2^-(aq) + 2\ OH^-(aq)$	+0.010
$2\ H^+(aq) + 2\ e^- \rightarrow H_2(g)$	0.000

Standard Electrode Potentials

half-reaction	E^0 (V)
$2\ H^+(aq) + 2\ e^- \rightarrow H_2(g)$	0.000
$Fe^{3+}(aq) + 3\ e^- \rightarrow Fe(s)$	−0.037
$Se(s) + 2\ H^+(aq) + 2\ e^- \rightarrow H_2Se(g)$	−0.082
$SnO_2(s) + 4\ H^+(aq) + 2\ e^- \rightarrow Sn^{2+}(aq) + 2\ H_2O(l)$	−0.094
$SnO_2(s) + 4\ H^+(aq) + 4\ e^- \rightarrow Sn(s) + 2\ H_2O(l)$	−0.117
$Pb^{2+}(aq) + 2\ e^- \rightarrow Pb(s)$	−0.126
$Sn^{2+}(aq) + 2\ e^- \rightarrow Sn(s)$	−0.138
$O_2(g) + 2\ H_2O(l) + 2\ e^- \rightarrow H_2O_2(aq) + 2\ OH^-(aq)$	−0.146
$MoO_2(s) + 4\ H^+(aq) + 4\ e^- \rightarrow Mo(s) + 2\ H_2O(l)$	−0.152
$CO_2(g) + 2\ H^+(aq) + 2\ e^- \rightarrow HCHO_2(aq)$	−0.199
$Ni^{2+}(aq) + 2\ e^- \rightarrow Ni(s)$	−0.257
$Co^{2+}(aq) + 2\ e^- \rightarrow Co(s)$	−0.280
$Tl^+(aq) + e^- \rightarrow Tl(s)$	−0.336
$In^{3+}(aq) + 3\ e^- \rightarrow In(s)$	−0.338
$PbSO_4(s) + 2\ e^- \rightarrow Pb(s) + SO_4^{2-}(aq)$	−0.359
$Cd^{2+}(aq) + 2\ e^- \rightarrow Cd(s)$	−0.403
$Fe^{2+}(aq) + 2\ e^- \rightarrow Fe(s)$	−0.447
$NO_2^-(aq) + H_2O(l) + e^- \rightarrow NO(g) + 2\ OH^-(aq)$	−0.460
$S(s) + 2\ e^- \rightarrow S^{2-}(aq)$	−0.476
$2\ SO_3^{2-}(aq) + 3\ H_2O(l) + 4\ e^- \rightarrow S_2O_3^{2-}(aq) + 6\ OH^-(aq)$	−0.571
$Cr^{3+}(aq) + 3\ e^- \rightarrow Cr(s)$	−0.744
$Zn^{2+}(aq) + 2\ e^- \rightarrow Zn(s)$	−0.762
$2\ H_2O(l) + 2\ e^- \rightarrow H_2(g) + 2\ OH^-(aq)$	−0.828
$Se(s) + 2\ e^- \rightarrow Se^{2-}(aq)$	−0.924
$SO_4^{2-}(aq) + H_2O(l) + 2\ e^- \rightarrow SO_3^{2-}(aq) + 2\ OH^-(aq)$	−0.930

half-reaction	E^0 (V)
$Mn^{2+}(aq) + 2\ e^- \rightarrow Mn(s)$	−1.185
$Ti^{3+}(aq) + 3\ e^- \rightarrow Ti(s)$	−1.370
$Zr^{4+}(aq) + 4\ e^- \rightarrow Zr(s)$	−1.450
$Al^{3+}(aq) + 3\ e^- \rightarrow Al(s)$	−1.662
$Be^{2+}(aq) + 2\ e^- \rightarrow Be(s)$	−1.847
$Sc^{3+}(aq) + 3\ e^- \rightarrow Sc(s)$	−2.077
$Mg^{2+}(aq) + 2\ e^- \rightarrow Mg(s)$	−2.372
$Na^+(aq) + e^- \rightarrow Na(s)$	−2.710
$Ca^{2+}(aq) + 2\ e^- \rightarrow Ca(s)$	−2.868
$Sr^{2+}(aq) + 2\ e^- \rightarrow Sr(s)$	−2.889
$Ba^{2+}(aq) + 2\ e^- \rightarrow Ba(s)$	−2.912
$K^+(aq) + e^- \rightarrow K(s)$	−2.931
$Li^+(aq) + e^- \rightarrow Li(s)$	−3.040

Aqueous Solubility Rules		
Category	***Ions***	***Except In Combination With***
Soluble Cations	Li^+, Na^+, K^+, Rb^+, Cs^+	none
	NH_4^+	none
Soluble Anions	NO_3^-, NO_2^-	none
	$C_2H_3O_2^-$ or $CH_3CO_2^-$	none
	ClO_4^-, ClO_3^-	none
	HCO_3^-	none
Usually Soluble Anions	Cl^-, Br^-, I^-, CN^-	Ag^+, Hg_2^{2+}, Pb^{2+}
	SO_4^{2-}, SO_3^{2-}	Ag^+, Hg_2^{2+}, Pb^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}
Usually Insoluble Anions	PO_4^{3-}, PO_3^{3-}	Li^+, Na^+, K^+, Rb^+, Cs^+, NH_4^+
	CO_3^{2-}, S^{2-}	Li^+, Na^+, K^+, Rb^+, Cs^+, NH_4^+
	F^-	Li^+, Na^+, K^+, Rb^+, Cs^+, NH_4^+
	OH^-	Li^+, Na^+, K^+, Rb^+, Cs^+, Ca^{2+}, Sr^{2+}, Ba^{2+}
	CrO_4^{2-}, $Cr_2O_7^{2-}$	Li^+, Na^+, K^+, Rb^+, Cs^+, NH_4^+

Semi-Quantitative Categorization	
Soluble	> 0.10 *M*
Moderately Soluble	0.01 – 0.10 *M*
Insoluble or Slightly Soluble	< 0.01 *M*