

Annexe 1

<http://chemtables.tk/>

Thermodynamic Values at Standard State (298K)

Data Retrieved From: Kots, Treichal, Weaver *Chemistry & Chemical Reactivity (Sixth Edition)* COPYRIGHT 2006

Species	Name	Enthalpy " ΔH° " (kJ/mol)	Entropy " S° " (J/mol*K)	Gibbs energy " ΔG° " (kJ/mol)
<i>Water</i>				
H ₂ O (l)	liquid water	-285.83	69.95	-237.15
H ₂ O (g)	water vapor	-241.83	188.84	-228.59
<i>Aluminum</i>				
Al(s)	Aluminum solid	0	28.3	0
AlCl ₃ (s)	Aluminum Chloride	-705.63	109.29	-630.0
Al ₂ O ₃ (s)	Aluminum Oxide	-1675.7	50.92	-1582.3
<i>Barium</i>				
BaCl ₂ (s)	Barium Chloride	-858.6	123.68	-810.4
BaCO ₃ (s)	Barium Carbonate	-1213	112.1	-1134.41
BaO (s)	Barium Oxide	-548.1	72.05	-520.38
BaSO ₄ (s)	Barium Sulfate	-1473.2	132.2	-1362.2
<i>Beryllium</i>				
Be (s)	Beryllium solid	0	9.5	0
Be(OH) ₂ (s)	Beryllium Hydroxide	-902.5	51.9	-815.0
<i>Boron</i>				
BCl ₃ (g)	Boron Trichloride	-402.96	290.17	-387.95
<i>Bromine</i>				
Br (g)	Bromine gas	111.884	175.022	82.396
Br ₂ (l)	Bromine liquid	0	152.2	0
Br ₂ (g)	Bromine gas	30.91	245.47	3.12
BrF ₃ (g)	Bromine Trifluoride	-255.60	292.53	-229.43
HBr (g)	Hydrogen Bromide gas	-36.29	198.70	-53.45
<i>Calcium</i>				
Ca (s)	Calcium	0	41.59	0
Ca (g)	Calcium	178.2	158.884	144.3
Ca ²⁺ (g)	Calcium (II) ion	1925.90	----	----

Species	Name	Enthalpy " ΔH° " (kJ/mol)	Entropy " S° " (J/mol*K)	Gibbs energy " ΔG° " (kJ/mol)
CaC ₂ (s)	Calcium Carbide	-59.8	70	-64.93
CaCO ₃ (s, calcite)	Calcium Carbonate	-1207.6	91.7	-1129.16
CaCl ₂ (s)	Calcium Chloride	-795.8	104.6	-748.1
CaF ₂ (s)	Calcium Flouride	-1219.6	68.87	-1167.3
CaH ₂ (s)	Calcium Hydride	-186.2	42	-147.2
CaO (s)	Calcium Oxide	-635.09	38.2	-603.42
CaS (s)	Calcium Sulfide	-482.4	56.5	-477.4
Ca(OH) ₂ (s)	Calcium Hydroxide solid	-986.09	83.39	-898.43
Ca(OH) ₂ (aq)	Calcium Hydroxide aqueous	-1002.82	----	-868.07
CaSO ₄ (s)	Calcium Sulfate	-1434.52	106.5	-1322.02

Species	Name	Enthalpy " ΔH° " (kJ/mol)	Entropy " S° " (J/mol*K)	Gibbs energy " ΔG° " (kJ/mol)
<i>Carbon</i>				
C (s)	graphite	0	5.6	0
C (s)	diamond	1.8	2.377	2.900
C (g)	Carbon gas	716.67	158.1	671.2
CCl ₄ (l)	Carbon Chloride liquid	-128.4	214.39	-57.63
CCl ₄ (g)	Carbon Chloride gas	-95.98	309.65	-53.61
CHCl ₃ (l)	Trichloromethane liquid	-134.47	201.7	-73.66
CHCl ₃ (g)	Trichloromethane gas	-103.18	295.61	-70.4
CH ₄ (g)	Methane	-74.87	186.26	-50.8
C ₂ H ₂ (g)	Ethyne	226.73	200.94	209.20
C ₂ H ₄ (g)	Ethene	52.47	219.36	68.35
C ₂ H ₆ (g)	Ethane	-83.85	229.2	-31.89
C ₃ H ₈ (g)	Propane	-104.7	270.3	-24.4
C ₆ H ₆ (l)	Benzene	48.95	173.26	124.21
CH ₃ OH (l)	Methanol liquid	-238.4	127.19	-166.14
CH ₃ OH (g)	Methanol gas	-201.0	239.7	-162.5
C ₂ H ₅ OH (l)	Ethanol liquid	-277.0	160.7	-174.7

Species	Name	Enthalpy " ΔH° " (kJ/mol)	Entropy " S° " (J/mol*K)	Gibbs energy " ΔG° " (kJ/mol)
C ₂ H ₅ OH (g)	Ethanol gas	-235.3	282.70	-168.49
CO (g)	Carbon Monoxide	-110.525	197.674	-137.168
CO ₂ (g)	Carbon Dioxide	-393.509	213.74	-394.359
CS ₂ (l)	Carbon Disulfide liquid	89.41	151	65.2
CS ₂ (g)	Carbon Disulfide gas	116.7	237.8	66.61
COCl ₂ (g)	Carbonyl Chloride	-218.8	283.53	-204.6
<i>Cesium</i>				
Cs (s)	Cesium solid	0	85.23	0
Cs ⁺ (g)	Cesium (I) ion	457.964	----	----
CsCl (s)	Cesium Chloride	-443.04	101.17	-414.53
<i>Chlorine</i>				
Cl (g)	Chlorine gas	121.3	165.19	105.3
Cl ⁻ (g)	Chlorine ion	-233.13	----	----
Cl ₂ (g)	Chlorine gas	0	223.08	0
HCl (g)	Hydrogen Chloride gas	-92.31	186.2	-95.09
HCl (aq)	Hydrochloric acid	-167.159	56.5	-131.26
<i>Chromium</i>				
Cr (s)	Chromium solid	0	23.62	0
Cr ₂ O ₃ (s)	Chromate	-1134.7	80.65	-1052.95
CrCl ₃ (s)	Chromium Trichloride	-556.5	123.0	-486.1
<i>Copper</i>				
Cu (s)	Copper solid	0	33.17	0
CuO (s)	Copper Monoxide	-156.06	42.59	-128.3
CuCl ₂ (s)	Copper Chloride	-220.1	108.07	-175.7
CuSO ₄ (s)	Copper Sulfate	-769.98	109.05	-660.75

Species	Name	Enthalpy " ΔH° " (kJ/mol)	Entropy " S° " (J/mol*K)	Gibbs energy " ΔG° " (kJ/mol)
<i>Fluorine</i>				
F ₂ (g)	Fluorine gas	0	202.8	0
F (g)	Fluorine gas	78.99	158.754	61.91
F ⁻ (g)	Flourine Ion gas	-255.39	----	----

Species	Name	Enthalpy " ΔH° " (kJ/mol)	Entropy " S° " (J/mol*K)	Gibbs energy " ΔG° " (kJ/mol)
F ⁻ (aq)	Fluoride Ion solution	-332.63	----	-178.79
HF (g)	Hydrogen Fluoride gas	-273.3	173.779	-273.2
HF (aq)	Hydrofluoric acid	-332.63	88.7	-278.79
<i>Hydrogen</i>				
H ₂ (g)	Hydrogen gas	0	130.7	0
H (g)	Hydroden gas	217.965	114.713	203.247
H ⁺ (g)	Hydrogen Ion gas	1536.202	----	----
H ₂ O ₂ (l)	Hydrogen Peroxide liquid	-187.78	109.6	-120.35
<i>Iodine</i>				
I ₂ (s)	Iodine solid	0	116.135	0
I ₂ (g)	Iodine gas	62.438	260.69	19.327
I (g)	Iodine gas	106.838	180.791	70.250
I ⁻ (g)	Iodine Ion gas	-197	----	----
ICl (g)	Iodine Monochloride	17.51	247.56	-5.73
<i>Iron</i>				
Fe (s)	Iron solid	0	27.78	0
FeO (s)	Iron (II) Oxide	-272	----	----
Fe ₂ O ₃ (s)	Hematite	-825.5	87.40	-742.2
Fe ₃ O ₄ (s)	Magnetite	-1118.4	146.4	-1015.4
FeCl ₂ (s)	Iron (II) Chloride	-341.79	117.95	- 302.30
FeCl ₃ (s)	Iron (III) Chloride	-399.49	142.3	-344.00
FeS ₂ (s)	Pyrite (fools gold)	-178.2	52.93	-166.9
Fe(CO) ₅ (l)	Iron Pentacarbonyl	-774.0	338.1	-705.3
<i>Lead</i>				
Pb (s)	Lead solid	0	64.81	0
PbCl ₂ (s)	Lead Chlorid	-359.41	136.0	-314.1
PbO (s)	Lead (II) Oxide	-219	66.5	-196
PbO ₂ (s)	Lead (IV) Oxide	-277.4	68.6	-217.39
PbS (s)	Lead (II) Sulfide	-100.4	91.2	-98.7
<i>Lithium</i>				
Li (s)	Lithium solid	0	29.12	0
Li ⁺ (g)	Lithium Ion gas	685.783	----	----
LiOH (s)	Lithium Hydroxide solid	-484.93	42.81	-438.96

Species	Name	Enthalpy " ΔH° " (kJ/mol)	Entropy " S° " (J/mol*K)	Gibbs energy " ΔG° " (kJ/mol)
LiOH (aq)	Lithium Hydroxide solution	-508.48	2.80	-450.58
LiCl (s)	Lithium Chloride solid	-408.701	59.33	- 384.37

Species	Name	Enthalpy " ΔH° " (kJ/mol)	Entropy " S° " (J/mol*K)	Gibbs energy " ΔG° " (kJ/mol)
<i>Magnesium</i>				
Mg (s)	Magnesium solid	0	32.67	0
MgCl ₂ (s)	Magnesium Chloride	-641.62	89.62	-592.09
MgCO ₃ (s)	Magnesium Carbonate	-111.69	65.84	-1028.2
MgO (s)	Magnesium Oxide	-601.24	26.85	-568.93
Mg(OH) ₂ (s)	Magnesium Hydroxide	-924.54	63.18	-833.51
MgS (s)	Magnesium Sulfide	-346.0	50.33	-341.8
<i>Mercury</i>				
Hg (l)	Mercury liquid	0	76.2	0
HgCl ₂ (s)	Mercuric Chloride	-224.3	146.0	-178.6
HgO (s, red)	Mercuric Oxide	-90.83	70.29	-58.539
HgS (s, red)	Mercuric Sulfide	-58.2	82.4	-50.6
<i>Nickel</i>				
Ni (s)	Nickel solid	0	29.87	0
NiO (s)	Nickel (II) Oxide	-239.7	37.99	-211.7
NiCl ₂ (s)	Nickel (II) Chloride	-305.332	97.65	-259.032
<i>Nitrogen</i>				
N ₂ (g)	Nitrogen gas	0	191.56	0
N (g)	Nitrogen gas	472.704	153.298	455.563
NH ₃ (g)	Ammonia	-45.90	192.77	- 16.37
N ₂ H ₄ (l)	Hydrazine	50.63	121.52	149.45
NH ₄ Cl (s)	Ammonium Chloride solid	-314.55	94.85	-203.08
NH ₄ Cl (aq)	Ammonium Chloride solution	-299.66	169.9	-210.57
NH ₄ NO ₃ (s)	Ammonium Nitrate solid	-365.56	151.08	- 183.84
NH ₄ NO ₃ (aq)	Ammonium Nitrate	-339.87	259.8	-190.57

Species	Name	Enthalpy " ΔH° " (kJ/mol)	Entropy " S° " (J/mol*K)	Gibbs energy " ΔG° " (kJ/mol)
	solution			
NO (g)	Nitrogen Monoxide	90.29	210.76	86.58
NO ₂ (g)	Nitrogen Dioxide	33.1	240.04	51.23
N ₂ O (g)	Dinitrogen Oxide (Nitrous Oxide)	82.05	219.85	104.20
N ₂ O ₄ (g)	Dinitrogen Tetroxide	9.08	304.38	97.73
NOCl (g)	Nitrocyll Chloride	51.71	261.8	66.08
HNO ₃ (l)	Nitric Acid	-174.10	155.60	-80.71
HNO ₃ (g)	Hydrogen Nitrate gas	-135.06	266.38	- 74.72
HNO ₃ (aq)	Nitric Acid	-207.36	146.4	-111.25
Oxygen				
O ₂ (g)	Oxygen gas	0	205.07	0
O (g)	Monoatomic Oxygen	249.170	161.055	231.731
O ₃ (g)	Ozone gas	142.67	238.92	163.2
Phosphorus				
P ₄ (s, white)	White Phosphorus	0	41.1	0
P ₄ (s, red)	Red Phosphorus	- 17.6	22.80	- 12.1
P (g)	Phosphorus gas	314.64	163.193	278.25
PH ₃ (g)	Phosphine	22.89	210.24	30.91
PCl ₃ (g)	Phosphorus Trichloride	-287.0	311.78	- 267.8
P ₄ O ₁₀ (s)	Tetraphosphorus Decoxide	-2984.0	228.86	- 2697.7
H ₃ PO ₄ (l)	Phosphoric Acid	-1279.0	110.5	- 1119.1

Species	Name	Enthalpy " ΔH° " (kJ/mol)	Entropy " S° " (J/mol*K)	Gibbs energy " ΔG° " (kJ/mol)
Potassium				
K (s)	Potassium solid	0	64.63	0
KCl (s)	Potassium Chloride	- 436.68	82.56	- 408.77
KClO ₃ (s)	Potassium Chlorate	-397.73	143.1	- 296.25
KI (s)	Potassium Iodide	-327.90	106.32	-342.892
KOH (s)	Potassium Hydroxide solid	-424.72	78.9	- 378.92
KOH (aq)	Potassium Hydroxide	-482.37	91.6	- 440.50

Species	Name	Enthalpy " ΔH° " (kJ/mol)	Entropy " S° " (J/mol*K)	Gibbs energy " ΔG° " (kJ/mol)
	solution			
<i>Silicon</i>				
Si (s)	Silicon solid	0	18.82	0
SiBr ₄ (l)	Silicon Tetrabromide	-457.3	277.8	-443.9
SiC (s)	Silicon Carbide	-65.3	16.61	-62.8
SiCl ₄ (g)	Silicon Tetrachloride	- 662.75	330.86	-622.76
SiH ₄ (g)	Silicon Tetrahydride	34.31	204.65	56.84
SiF ₄ (g)	Silicon Tetrafluoride	-1614.94	282.49	-1572.65
SiO ₂ (s)	Quartz	-910.86	41.46	- 856.97
<i>Silver</i>				
Ag (s)	Silver solid	0	42.55	0
Ag ₂ O (s)	Silver Oxide	- 31.1	121.3	- 11.32
AgCl (s)	Silver Chloride	-127.01	96.25	- 109.76
AgNO ₃ (s)	Silver Nitrate	- 124.39	140.92	-33.41
<i>Sodium</i>				
Na (s)	Sodium solid	0	51.21	0
Na (g)	Sodium gas	107.3	153.765	76.83
Na ⁺ (g)	Sodium Ion gas	609.358	----	----
NaBr (s)	Sodium Bromide	- 361.02	86.82	- 348.983
NaCl (s)	Sodium Chloride solid (Table Salt)	- 411.12	72.11	- 384.04
NaCl (g)	Sodium Chloride gas	- 181.42	229.79	-201.33
NaCl (aq)	Sodium Chloride solution	-407.27	115.5	-393.133
NaOH (s)	Sodium Hydroxide solid	-425.93	64.46	-379.75
NaOH (aq)	Sodium Hydroxide solution	-469.15	48.1	-418.09
Na ₂ CO ₃ (s)	Sodium Carbonate	- 1130.77	134.79	-1048.08
<i>Sulfur</i>				
S (s)	Sulfur solid	0	32.1	0
S (g)	Sulfur gas	278.98	167.83	236.51
S ₂ Cl ₂ (g)	Sulfur Chloride	- 18.4	331.5	- 31.8

Species	Name	Enthalpy " ΔH° " (kJ/mol)	Entropy " S° " (J/mol*K)	Gibbs energy " ΔG° " (kJ/mol)
SF ₆ (g)	Sulfur Hexafluoride	- 1209	291.82	-1105.3
H ₂ S (g)	Dihydrogen Sulfide gas	- 20.63	205.79	-33.56
SO ₂ (g)	Sulfur Dioxide	-296.84	248.21	-300.13
SO ₃ (g)	Sulfur Trioxide	- 395.77	256.77	-371.04
SOCl ₂ (g)	Thionyl Chloride	- 212.5	309.77	-198.3
H ₂ SO ₄ (l)	Sulfuric Acid liquid	- 814	156.9	- 689.96
H ₂ SO ₄ (aq)	Sulfuric Acid solution	- 909.27	20.1	- 744.53
<i>Tin</i>				
Sn (s, white)	White Tin	0	51.08	0
Sn (s, gray)	Grey Tin	- 2.09	44.14	0.13
SnCl ₄ (l)	Tin Tetrachloride liquid	- 511.3	258.6	- 440.15
SnCl ₄ (g)	Tin Tetrachloride gas	-471.5	365.8	-432.31
SnO ₂ (s)	Tin Dioxide	-577.63	49.04	-515.88
<i>Titanium</i>				
Ti (s)	Titanium solid	0	30.72	0
TiCl ₄ (l)	Titanium Tetrachloride liquid	- 804.2	252.34	- 737.2
TiCl ₄ (g)	Titanium Tetrachloride gas	-763.16	354.84	-726.7
TiO ₂ (s)	Titanium Dioxide	- 939.7	49.92	- 884.5
<i>Zinc</i>				
Zn (s)	Zinc solid	0	41.63	0
ZnCl ₂ (s)	Zinc Dichloride	-415.05	111.46	-369.398
ZnO (s)	Zinc Oxide	-348.28	43.64	-318.30
ZnS (s)	Sphalerite	-205.98	57.7	- 201.29