

Wired Chemist

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Standard Heats and Free Energies of Formation and Absolute Entropies of Elements and Inorganic Compounds

Name	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol K)
H ₂ (g)	0	0	130.5
H(g)	218	203.3	114.6
Li(s)	0	0	28
Li(g)	155.2	122.2	138.5

Name	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol K)
SiO ₂ (s)	-859.4	-856.7	41.8
SiH ₄ (g)	34.3	57	203.8
SiCl ₄ (g)	-609.6	-569.9	331.4

Name	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol K)
Li ₂ O(s)	-595.8	-560.7	37.9
Li ₂ O ₂ (s)	-634.7	-564.8	56.5
LiH(s)	-90.4	-69.9	24.7
LiCl(s)	-408.8	-383.7	55.2
LiF(s)	-612.1	-584.1	36
LiI(s)	-271.1	-270.3	86.8
Na(s)	0	0	51
Na(g)	108.8	78.2	153.6
NaH(s)	-57.3	-33.5	40
NaF(s)	-569	-541	58.6
NaCl(s)	-410.9	-384.1	72.4
NaBr(s)	-359.8	-347.7	86.8
NaI(s)	-287.9	-286.1	98.5
Na ₂ SO ₄ (s)	-1384.5	-1266.9	149.4
NaNO ₃ (s)	-466.5	-365.7	116.3
NaNO ₂ (s)	-359.4	-284.6	103.8
Na ₂ CO ₃ (s)	-1130.9	-1047.7	136
Na ₂ O(s)	-415.9	-376.6	72.8
Na ₂ O ₂ (s)	-504.6	-430.1	95
NaO ₂ (s)	-260.7	-218.8	115.9
NaC ₂ H ₃ O ₂ (s)	-710.4	-607.3	123
NaOH(s)	-430.5	-377	52.3
K(s)	0	0	63.6

Name	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol K)
SiCl ₄ (l)	-640.2	-572.8	239.3
Ge(s)	0	0	42.2
GeCl ₄ (l)	-543.9	-462.8	245.6
Sn(s)	0	0	51.5
SnO(s)	-286.2	-257.3	56.5
SnO ₂ (s)	-580.7	-520.5	52.3
SnCl ₂ (s)	-349.8	0	129.7
SnCl ₄ (l)	-545.2	-440.1	258.6
N ₂ (g)	0	0	191.6
NH ₃ (g)	-45.6	-16.3	192.5
N ₂ H ₄ (g)	95	159	238.5
NO(g)	90.4	86.6	210.5
NO ₂ (g)	33.9	51.9	239.7
N ₂ O(g)	81.6	103.8	220.1
N ₂ O ₄ (g)	9.6	98.3	304.2
NH ₄ Cl(s)	-315.5	-203.8	94.6
NH ₄ NO ₃ (s)	-365.3	-184	151.1
NH ₄ NO ₂ (s)	-264		
HNO ₃ (l)	-173.2	-79.9	155.6
P ₄ (s, white)	0	0	44.4
P ₄ (s, red)	-18.4	13.8	29.3
P ₄ (s, black)	-43.1		
P ₄ O ₁₀ (s)	-3012.5	-2697.8	228.9

Name	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol K)
K(g)	90	61.1	160.2
KF(s)	-562.7	-533	66.5
KCl(s)	-436	-408.4	83
KClO ₃ (s)	-391.2	-290	143.1
K ₂ O(s)	-361.5	-318.8	94.1
K ₂ O ₂ (s)	-493.7	-418.4	102.1
KO ₂ (s)	-282.8	-248.5	116.7
KOH(s)	-425.9	-374.5	79
KNO ₃ (s)	-492.9	-393.3	133
KClO ₄ (s)	-433.5	-304.2	151
Rb(s)	0	0	69.5
Rb(g)	85.8	56.5	169.9
RbF(s)	-549.4		75.3
RbCl(s)	-430.5	-407.8	95.9
Rb ₂ O(s)	-330.1	-292.9	
Rb ₂ O ₂ (s)	-425.5	-351.5	
RbO ₂ (s)	-263.6		
Cs(s)	0	0	82.8
Cs(g)	78.7	51	175.3
CsF(s)	-530.9	-525.5	92.8
CsCl(s)	-433	-414.5	101.2
CsI(s)	-336.8	-333.5	123
Cs ₂ O(s)	-317.6	-326.4	146.8

Name	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol K)
PH ₃ (g)	9.2	18.4	210
PCl ₃ (g)	-278.7	-258.6	311.7
PCl ₅ (g)	-371.1	-296.6	352.7
As(s)	0	0	35.1
AsH ₃ (g)	66.4	68.9	222.7
Sb(s)	0	0	45.6
SbCl ₃ (s)	-382	-323.8	184.1
SbCl ₅ (l)	-440.2	-350.2	301.2
O ₂ (g)	0	0	205
O ₃ (g)	142.3	163.6	237.7
H ₂ O(g)	-241.8	-228.4	188.7
H ₂ O(l)	-285.8	-237.2	69.9
H ₂ O ₂ (l)	-187.4	-120.4	109.6
OCl ₂ (g)	76.1	93.7	266.5
S ₈ (s, rhombic)	0	0	31.8
H ₂ S(g)	-20.1	-33.1	205.9
SF ₆ (g)	-1096.2	-991.6	290.8
SO ₂ (g)	-296.2	-300.4	248.5
SO ₃ (g)	-395.4	-370.3	256.1
H ₂ SO ₄ (l)	-811.3	-690.1	156.9
Se(s)	0	0	42.3
SnCl ₂ (s)	-349.8	0	129.7
H ₂ Se(g)	85.8	71.1	221.3

Name	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol K)
Cs2O2(s)	-402.5	-359.8	
CsO2O(s)	-259.4		
Be(s)	0	0	9.6
Be(g)	320.5	282.8	136
BeCl2(s)	-511.7	-449.5	75.8
Mg(s)	0	0	32.6
Mg(g)	150.2	115.5	148.5
MgF2(s)	-1102.5	1049.3	57.3
MgCl2(s)	-641.8	-592.5	89.5
MgO(s)	-601.7	-559.4	26.8
MgSO4(s)	-1278.2	-1173.6	91.6
Mg(NO3)2(s)	-789.5	-588.3	164
Ca(s)	0	0	41.6
Ca(g)	192.5	167.4	154.8
CaH2(s)	-188.7	-149.8	41.8
CaO(s)	-635.5	-604.2	39.7
Ca(OH)2(s)	-986.6	-896.6	76.1
CaF2(s)	-1214.6	-1161.9	69
CaCl2(s)	-795	-750.2	113.8
CaCO3(s)	-1207.1	-1128.8	92.9
Sr(s)	0	0	54.4
Sr(g)	164	110	164.4
SrCl2(s)	-828.4	-781.2	117.2

Name	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol K)
SeO2(s)	-236		
Te(s)			49.8
H2Te(g)	154.4	138.5	243.2
F2(g)	0	0	203.3
HF(g)	-268.6	-270.7	173.6
Cl2(g)	0	0	223
HCl(g)	-92.5	-95.4	186.6
Br2(l)	0	0	152.3
Br2(g)	30.5	3.3	245.2
HBr(g)	-36.4	-53.1	198.3
BrF(g)	-46	-61.5	229.3
BrF3(g)	-313.8	-288.7	292.5
I2(s)	0	0	116.7
I2(g)	62.3	19.2	260.7
HI(g)	25.9	1.3	206.3
IF5(g)	-816.3	-746	329.3
ICl3(s)	-88.3	-22.6	172
Co(s)	0	0	30.1
CoCl2(s)	-312.5	-269.9	109.2
Cr(s)	0	0	23.8
Cr2O3(s)	-1139.7	-1058.1	81.2
CrCl2(s)	-395.4	-356.1	115.5
CrCl3(s)	-556.5	-486.2	123

Name	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol K)
Ba(s)	0	0	66.9
Ba(g)	175.7	144.8	170.3
BaCl ₂ (s)	-860.2	-810.9	125.5
BaCl ₂ ·2H ₂ O(s)	-1461.9	-1295.8	202.9
BaCO ₃ (s)	-1218.8	-1138.9	112.1
B(s)	0	0	6.7
B ₂ O ₃ (s)	-1263.6	-1184.1	54
BF ₃ (g)	-1136.8	-1120.5	254
BCl ₃ (g)	-402.9	-387.9	290
B ₂ H ₆ (g)	31.4	82.8	233
Al(s)	0	0	28.5
Al ₂ O ₃ (s)	-1669.8	-1576.5	51
Al ₂ (SO ₄) ₃ (s)	-3440.9	-3506.6	239.3
C(s, graphite)	0	0	5.9
C(s, diamond)	2.1	2.9	2.5
C(g)	718.4	672.8	158.2
CF ₄ (g)	-933	-888.3	261.5
CCl ₄ (g)	-100.4	-58.2	310
CCl ₄ (l)	-132.6	-62.8	216.3
Cl ₂ CO(g)	-220.9	-206.7	283.7
CO(g)	-110.5	-137.2	197.9
CO ₂ (g)	-393.3	-394.6	213.8
OCS(g)	-138.5	-165.7	231.4

Name	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol K)
Fe(s)	0	0	27.2
FeO(s)	-266.5	-244.3	54
Fe ₂ O ₃ (s)	-822.2	-741	90
Ni(s)	0	0	30.1
NiCl ₂ ·6H ₂ O(s)	-2103.3	-1713.3	344.3
Ti(s)	0	0	30.5
TiCl ₄ (l)	-802.1	-737.2	252.3
TiO ₂ (s)	-944.7	-889.1	50.2
Cu(s)	0	0	33.5
CuO(s)	-157.3	-129.7	42.7
CuCl ₂ ·2H ₂ O(s)	-821.3	-656.1	167.4
CuSO ₄ (s)	-769.9	-661.9	113.4
Zn(s)	0	0	41.4
ZnO(s)	-348.1	-318.4	43.5
ZnCl ₂ (s)	-415.5	-369.4	111.7
Cd(s)	0	0	51.9
CdS(s)	-161.9	-156.5	64.9
Hg(l)	0	0	77.4
HgCl ₂ (s)	-230.1	-185.8	144.3
Hg ₂ Cl ₂ (s)	-264.8	-210.9	195.8
HgO(s)	-90.4	-58.6	72
Ag(s)	0	0	42.7
AgF(s)	-204.6	-229.6	84

Name	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol K)
CS ₂ (g)	117.2	66.9	237.7
HCN(g)	130.5	120.1	201.7
Si(s)	0	0	19

Name	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol K)
AgCl(s)	-127.2	-109.6	96.2
AgBr(s)	-100.4	-96.9	107.1
AgI(s)	-61.8	-66.2	115.5
AgNO ₃ (s)	-123	-32.2	141

Reference: Lange's Handbook, pps. 6-1 to 6-147

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