ENV-413: Thermodynamics of the Earth systems

Exercise session for Lecture 7

1. Calcite ($CaCO_3$) is in equilibrium with water in which the carbonate ion activity is 10^{-5}. What is the activity of calcium ions Ca^{2+} in the water? Ksp of calcite is $10^{-8.3}$.

2. Using the thermodynamic data sheets calculate the solubility product of brucite, $Mg(OH)_2$ at 25 C, 1 bar. What would be the activity of divalent magnesium Mg^{2+} in a solution in equilibrium with brucite that had an activity of OH^- = 10^{-9}.

3. Asbestos minerals are considered to be a health hazard. The most common type of asbestos is chrysotile, and this mineral comprises about 95% of the asbestos in the US. Small asbestos fibers can be taken into the lung, where they can damage its lining. This problem deals with the solubility of asbestos in the lung.

The dissolution reaction for chrysotile can be written:

$$Mg_3Si_2O_5(OH)_4 + 6H^+ = 3Mg^{2+} + 2H_4SiO_{4\,(aq)} + H_20$$

a) Calculate the equilibrium constant for this reaction at T=37, the average temperature of the human body. Keq at 25 C = 7.11×10^{33}.

b) For fluid in the lung tissues pH = 4 and activity of $Mg^{2+} = 8.7 \times 10^{-4}$, and activity of $H_4SiO_4 = 1.5 \times 10^{-6}$. Are the lung fluids under or oversaturated with respect to chrysotile?

3. 1 mol of $NH_{3(g)}$ is placed in a container with 1 mol of $H_2SO_{4(g)}$ to form $(NH_4)_2SO_{4(s)}$, according to the following reaction:

$$2\ NH_{3(g)} + H_2SO_{4(g)} = (NH_4)_2SO_{4(s)}$$

Calculate the amount of NH_3, H_2SO_4 and $(NH_4)_2SO_4$ you have at equilibrium. The equilibrium constant $K_{eq} = 1.406\times10^{-10}$. You might need to consult an equation solver to obtain you solution (e.g., http://home.sc.rr.com/nbhsa/freeonlinealgebraicequationsolver.htm).

Name and formula	Formula weight g	Entropy S^o_{298} J/mol·K	Molar volume cm³	$\Delta H^o_{f,298}$ J/mol	$\Delta G^o_{f,298}$ J/mol	Log K_f	References S	References ΔH^o_f ΔG^o_f	References C^o_p
ELEMENTS									
SILVER (REFERENCE STATE) Ag	107.868	42.55 0.21	10.272 0.002	0	0	0	107		107
Ag^+ AQUEOUS ION STD. STATE, m = 1	107.868	73.38 0.40		105750 85	77077 100	-13.504 0.018	35	35	
ALUMINUM (REFERENCE STATE) Al	26.982	28.35 0.08	9.999 0.001	0	0	0	107		107
Al^{+++} AQUEOUS ION STD. STATE, m = 1	26.982	-308.00 15.00		-531000 4000	-489400 1400	85.741 0.245	94	94	
ARGON (REFERENCE STATE) Ar (IDEAL GAS)	39.948	154.84 0.02	24789.2 3.4	0	0	0	107		107
ARSENIC (REFERENCE STATE) As	74.922	35.69 0.84	12.963 0.015	0	0	0	107		107
GOLD (REFERENCE STATE) Au	196.966	47.49 0.21	10.215 0.002	0	0	0	107		107
BORON (REFERENCE STATE) B	10.810	5.90 0.08	4.386 0.007	0	0	0	107		107
BARIUM (REFERENCE STATE) Ba	137.340	62.42 0.84	38.21 0.02	0	0	0	107		107
Ba^{++} AQUEOUS ION STD. STATE, m = 1	137.340	9.60 0.85		-537640 120	-560740 120	98.240 0.021	214	214	
BERYLLIUM (REFERENCE STATE) Be	9.012	9.54 0.08	4.880 0.002	0	0	0	107		107
Be^{++} AQUEOUS ION STD. STATE, m = 1	9.012	-130.00 0.85		-383000 850	-379700 850	66.522 0.149	214	214	
BISMUTH (REFERENCE STATE) Bi	208.980	56.74 0.42	21.309 0.011	0	0	0	107		76
Bi^{+++} AQUEOUS ION STD. STATE, m = 1	208.980				82800 850	-14.506 0.149		262	
BROMINE (REFERENCE STATE) Br_2 (LIQUID)	159.808	152.32 0.04	54.58 0.20	0	0	0	107		107
BROMINE (IDEAL GAS) Br_2	159.808	245.46 0.05	24789.2 3.4	30910 200	3140 300	-0.550 0.053	35	35	107
Br^- AQUEOUS ION STD. STATE, m = 1	79.904	82.84 0.20		-121500 150	-104010 170	18.222 0.030	35	35	
CARBON (REFERENCE STATE) C	12.011	5.74 0.01	5.298 0.001	0	0	0	107		107
DIAMOND C	12.011	2.38 0.01	3.417 0.001	1895 42	2900 84	-0.508 0.015	107	87	107
CALCIUM (REFERENCE STATE) Ca	40.080	41.63 0.42	26.19 0.04	0	0	0	107		107
Ca^{++} AQUEOUS ION STD. STATE, m = 1	40.080	-53.10 2.00		-542830 1200	-553540 1200	96.978 0.021	214	214	
CADMIUM (REFERENCE STATE) Cd	112.400	51.80 0.17	13.005 0.003	0	0	0	107		107
Cd^{++} AQUEOUS ION STD. STATE, m = 1	112.400	-73.20 0.85		-75900 120	-77580 120	13.592 0.021	262	262	
CERIUM (REFERENCE STATE) Ce	140.120	69.46 8.37	20.77 0.02	0	0	0	107		107
Ce^{+++} AQUEOUS ION STD. STATE, m = 1	140.120	-205.00 5.00		-696200 850	-672000 850	117.732 0.149	262	262	
Ce^{++++} AQUEOUS ION STD. STATE, m = 1	140.120	-301.00 5.00		-537200 850	-503800 850	88.264 0.149	262	262	
CHLORINE (REFERENCE STATE) Cl_2 (IDEAL GAS)	70.906	223.08 0.04	24789.2 3.4	0	0	0	107		107
Cl^- AQUEOUS ION STD. STATE, m = 1	35.453	56.73 0.16		-167080 88	-131270 110	22.999 0.019	35	35	

Name and formula	Formula weight g	Entropy S^o_{298} J/mol·K	Molar volume cm³	$\Delta H^o_{f,298}$ J/mol	$\Delta G^o_{f,298}$ J/mol	Log K_f	References S	References ΔH^o_f ΔG^o_f	References C^o_p
ELEMENTS									
COBALT (REFERENCE STATE) Co	58.933	30.04 0.42	6.670 0.002	0	0	0	107		107
Co^{++} AQUEOUS ION STD. STATE, m = 1	58.933	-113.00 5.00		-58200 500	-54400 500	9.531 0.088	263	263	
Co^{+++} AQUEOUS ION STD. STATE, m = 1	58.933	-305.00 5.00		92000 5000	134000 5000	-23.476 0.876	263	263	
CHROMIUM (REFERENCE STATE) Cr	51.996	23.64 0.21	7.231 0.001	0	0	0	107		107
Cr^{++} AQUEOUS ION STD. STATE, m = 1	51.996			-144000 1000				263	
CESIUM (REFERENCE STATE) Cs	132.905	85.23 0.40	69.73 0.10	0	0	0	107		107
Cs^+ AQUEOUS ION STD. STATE, m = 1	132.905	132.84 0.40		-258040 130	-283625 150	49.690 0.026	35	35	
COPPER (REFERENCE STATE) Cu	63.546	33.15 0.08	7.113 0.003	0	0	0	107		107
Cu^+ AQUEOUS ION STD. STATE, m = 1	63.546	41.00 0.42		71670 100	50000 100	-8.760 0.018	263	263	
Cu^{++} AQUEOUS ION STD. STATE, m = 1	63.546	-99.60 0.42		64770 100	65520 100	-11.479 0.018	263	263	
DYSPROSIUM (REFERENCE STATE) Dy	162.500	74.89 0.84	19.01 0.02	0	0	0	107		107
ERBIUM (REFERENCE STATE) Er	167.260	73.18 0.15		0	0	0	107		107
EUROPIUM (REFERENCE STATE) Eu	151.960	80.79 0.16	28.97 0.02	0	0	0	107		107
FLUORINE (REFERENCE STATE) F_2 (IDEAL GAS)	37.997	202.79 0.04	24789.2 3.4	0	0	0	107		107
F^- AQUEOUS ION STD. STATE, m = 1	18.998	-13.18 0.54		-335350 650	-281705 670	49.354 0.117	35	35	
IRON (REFERENCE STATE) Fe	55.847	27.28 0.13	7.092 0.004	0	0	0	107		107
Fe^{++} AQUEOUS ION STD. STATE, m = 1	55.847	-138.00 0.85		-89100 1000	-78870 1000	13.818 0.021	263	263	
Fe^{+++} AQUEOUS ION STD. STATE, m = 1	55.847	-316.00 0.85		-48500 1000	-4600 1000	0.806 0.021	263	263	
GALLIUM (REFERENCE STATE) Ga	69.720	40.83 0.21	11.79 0.01	0	0	0	107		107
GADOLINIUM (REFERENCE STATE) Gd	157.250	68.45 1.25	19.89 0.02	0	0	0	107		107
GERMANIUM (REFERENCE STATE) Ge	72.590	31.09 0.21	13.63 0.005	0	0	0	107		107
HYDROGEN (REFERENCE STATE) H_2 (IDEAL GAS)	2.016	130.68 0.04	24789.2 3.4	0	0	0	107		107
H^+ AQUEOUS ION STD. STATE, m = 1	1.008			0	0	0	35	35	
HELIUM (REFERENCE STATE) He (IDEAL GAS)	4.003	126.15 0.01	24789.2 3.4	0	0	0	107		107
HAFNIUM (REFERENCE STATE) Hf	178.490	43.56 0.21	13.479 0.010	0	0	0	107		107
MERCURY (REFERENCE STATE) Hg (LIQUID)	200.590	75.90 0.08	14.822 0.002	0	0	0	107		107
Hg^{++} AQUEOUS ION STD. STATE, m = 1	200.590	-32.00 0.85		171000 850	164400 120	-28.802 0.021	263	263	
Hg_2^{++} AQUEOUS ION STD. STATE, m = 1	401.180	84.50 0.85		172000 850	153600 120	-26.910 0.021	263	263	

Name and formula	Formula weight g	Entropy S^o_{298} J/mol·K	Molar volume cm³	$\Delta H^o_{f,298}$ J/mol	$\Delta G^o_{f,298}$ J/mol	Log K_f	References S	ΔH^o ΔG^o_f	C^o_p
			ELEMENTS						
HOLMIUM (REFERENCE STATE) Ho	164.930	75.02 1.67	18.74 0.01	0	0	0	107		107
IODINE (REFERENCE STATE) I_2	253.809	116.15 0.08	51.29 0.06	0	0	0	107		107
IODINE I_2 (IDEAL GAS)	253.809	260.68 0.06	24789.2 3.4	62420 80	19329 80	-3.386 0.001	32	32	107
I^- AQUEOUS ION STD. STATE, m = 1	126.905	106.70 0.20		-56900 840	-51915 860	9.096 0.151	35	35	
INDIUM (REFERENCE STATE) In	114.820	57.84 0.84	15.753 0.005	0	0	0	107		107
IRIDIUM (REFERENCE STATE) Ir	192.220	35.48 0.17	8.519 0.005	0	0	0	107		107
POTASSIUM (REFERENCE STATE) K	39.098	64.68 0.20	45.36 0.09	0	0	0	107		107
K^+ AQUEOUS ION STD. STATE, m = 1	39.098	101.04 0.25		-252170 100	-282490 120	49.492 0.021	35	35	
KRYPTON (REFERENCE STATE) Kr (IDEAL GAS)	83.800	164.08 0.02	24789.2 3.4	0	0	0	107		107
LANTHANUM (REFERENCE STATE) La	138.906	56.90 2.51	22.47 0.01	0	0	0	107		107
LITHIUM (REFERENCE STATE) Li	6.940	29.12 0.02	13.017 0.007	0	0	0	107		107
Li^+ AQUEOUS ION STD. STATE, m = 1	6.941	11.30 0.35		-278455 90	-292620 110	51.267 0.019	35	35	
LUTETIUM (REFERENCE STATE) Lu	174.970	50.96 0.84	17.77 0.01	0	0	0	107		107
MAGNESIUM (REFERENCE STATE) Mg	24.305	32.68 0.13	13.996 0.007	0	0	0	107		107
Mg^{++} AQUEOUS ION STD. STATE, m = 1	24.305	-138.00 4.20		-466850 840	-454800 1670	79.679 0.149	214	214	
MANGANESE (REFERENCE STATE) Mn	54.938	32.01 0.08	7.354 0.007	0	0	0	107		107
Mn^{++} AQUEOUS ION STD. STATE, m = 1	54.938	-73.60 0.85		-220700 120	-228000 850	39.945 0.149	263	263	
MOLYBDENUM (REFERENCE STATE) Mo	95.940	28.66 0.21	9.387 0.005	0	0	0	107		107
NITROGEN (REFERENCE STATE) N_2 (IDEAL GAS)	28.013	191.61 0.02	24789.2 3.4	0	0	0	107		107
SODIUM (REFERENCE STATE) Na	22.990	51.30 0.02	23.812 0.010	0	0	0	107		107
Na^+ AQUEOUS ION STD. STATE, m = 1	22.990	58.41 0.20		-240300 65	-261900 85	45.884 0.015	35	35	
NIOBIUM (REFERENCE STATE) Nb	92.906	36.40 0.42	10.828 0.005	0	0	0	107		107
NEODYMIUM (REFERENCE STATE) Nd	144.240	71.09 4.18	20.57 0.01	0	0	0	107		107
NEON (REFERENCE STATE) Ne (IDEAL GAS)	20.179	146.32 0.02	24789.2 3.4	0	0	0	107		107
NICKEL (REFERENCE STATE) Ni	58.700	29.87 0.08	6.588 0.003	0	0	0	107		107
Ni^{++} AQUEOUS ION STD. STATE, m = 1	58.700	-129.00 0.85		-54000 850	-45600 850	7.989 0.149	263	263	
OXYGEN (REFERENCE STATE) O_2 (IDEAL GAS)	31.999	205.15 0.04	24789.2 3.4	0	0	0	35		107
OSMIUM (REFERENCE STATE) Os	190.200	32.64 0.06	8.423 0.005	0	0	0	107		107
PHOSPHORUS (REFERENCE STATE) P	30.974	22.85 0.08	17.2 0.3	0	0	0	107		107

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			ELEMENTS						
LEAD (REFERENCE STATE) Pb	207.200	65.06 0.42	18.267 0.086	0	0	0	107		107
Pb^{++} AQUEOUS ION STD. STATE, m = 1	207.200	10.00 0.85		-1700 850	-24400 120	4.275 0.021	262	262	
PALLADIUM (REFERENCE STATE) Pd	106.400	37.82 0.21	8.862 0.005	0	0	0	107		107
PRASEODYMIUM (REFERENCE STATE) Pr	140.908	73.93 4.18	20.80 0.01	0	0	0	107		107
PLATINUM (REFERENCE STATE) Pt	195.090	41.63 0.21	9.091 0.004	0	0	0	107		107
PLUTONIUM (REFERENCE STATE) Pu	244.002	51.46 8.37	12.04 0.01	0	0	0	107		107
RUBIDIUM (REFERENCE STATE) Rb	85.468	76.78 0.30	55.85 0.10	0	0	0	107		107
Rb^+ AQUEOUS ION STD. STATE, m = 1	85.468	120.46 0.40		-251120 130	-291715 150	51.108 0.026	35	35	
RHENIUM (REFERENCE STATE) Re	186.207	36.53 0.38	8.860 0.004	0	0	0	107		107
RHODIUM (REFERENCE STATE) Rh	102.906	31.54 0.21	8.282 0.002	0	0	0	107		107
RADON (REFERENCE STATE) Rn (IDEAL GAS)	222.000	176.23 0.00	24789.2 3.3	0	0	0	107		107
RUTHENIUM (REFERENCE STATE) Ru	101.070	28.53 0.21	8.171 0.004	0	0	0	107		107
SULFUR (REFERENCE STATE) S	32.060	31.80 0.21	15.511 0.005	0	0	0	107		107
S^{--} AQUEOUS ION STD. STATE, m = 1	32.060	-15.00 0.85		33000 850	85800 850	-15.032 0.149	262	262	
DIATOMIC SULFUR S_2 (IDEAL GAS)	64.120	228.17 0.05	24789.2 3.4	128490 500	79453 669	-13.920 0.117	107		107
OCTA-ATOMIC SULFUR S_8 (IDEAL GAS)	256.480	430.32 1.67	24789.2 3.4	101250 630	48835 920	-8.556 0.161	107		107
ANTIMONY (REFERENCE STATE) Sb	121.750	45.52 0.21	18.178 0.009	0	0	0	107		107
SCANDIUM (REFERENCE STATE) Sc	44.956	34.64 0.21	15.038 0.008	0	0	0	107		107
SELENIUM (REFERENCE STATE) Se	78.960	42.27 0.05	16.42 0.007	0	0	0	30		75
Se^{--} AQUEOUS ION STD. STATE, m = 1	78.960				129000 850	-22.600 0.149		262	
SILICON (REFERENCE STATE) Si	28.086	18.81 0.08	12.056 0.002	0	0	0	107		107
SAMARIUM (REFERENCE STATE) Sm	150.400	69.50 2.09	19.98 0.03	0	0	0	107		107
TIN (REFERENCE STATE) Sn	118.690	51.20 0.42	16.289 0.005	0	0	0	107		107
STRONTIUM (REFERENCE STATE) Sr	87.620	55.40 0.17	33.921 0.020	0	0	0	124		107
Sr^{++} AQUEOUS ION STD. STATE, m = 1	87.620	-33.00 0.85		-545800 120	-559440 120	98.012 0.021	214	214	
TANTALUM (REFERENCE STATE) Ta	180.948	41.51 0.17	10.851 0.005	0	0	0	107		107
TERBIUM (REFERENCE STATE) Tb	158.925	73.30 0.84	19.29 0.03	0	0	0	107		107
TELLURIUM (REFERENCE STATE) Te	127.600	49.50 0.42	20.476 0.008	0	0	0	107		107

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SULFIDES, ARSENIDES, TELLURIDES, SELENIDES, AND SULFOSALTS							
WURTZITE ZnS	97.440	58.84 0.12	23.846 0.013	-194570 1520	-190220 1520	33.326 0.266	248 215 208 2
OXIDES AND HYDROXIDES							
CORUNDUM Al_2O_3	101.962	50.92 0.10	25.575 0.007	-1675700 1300	-1582228 1320	277.201 0.231	50 35 285 66 159 50
ALUMINUM OXIDE (GAMMA) Al_2O_3	101.962	59.83 6.28		-1653517 1260	-1562702 1300	273.780 0.228	32 32 32
BOEHMITE $AlO(OH)$	59.989	48.45 0.21	19.535 0.026	-993054 2110	-918400 2090	160.900 0.366	120 94 115 216
DIASPORE $AlO(OH)$	59.989	35.27 0.17	17.76 0.026	-1000585 5000	-922000 5000	161.530 0.513	120 94 135 216
GIBBSITE $Al(OH)_3$	78.004	68.44 0.14	31.956 0.015	-1293128 1192	-1154889 1213	202.333 0.213	95 93 95
ARSENOLITE As_2O_3	197.841	107.41 0.13	51.118 0.069	-656970 1674	-575964 1883	100.907 0.330	29 262
CLAUDETITE As_2O_3	197.841	113.33 0.13	47.26 0.03	-654795 1715	-575554 1046	100.835 0.183	29 262
BORIC OXIDE B_2O_3	69.618	53.97 0.03	27.22 0.06	-1273500 1400	-1194325 1715	209.242 0.300	35 35 247 262
BARIUM OXIDE BaO	153.339	72.07 0.38	25.59 0.01	-548100 2090	-520394 2100	91.171 0.368	33 33 33 58 155
BROMELLITE BeO	25.012	13.77 0.04	8.309 0.03	-609400 2500	-580078 2500	101.628 0.438	215 215 32 261
BERYLLIUM OXIDE (BETA) BeO	25.012	16.54 0.03		-601785 3500	-573289 3500	100.438 0.613	32 32 32
BISMITE Bi_2O_3	465.959	151.46 2.09	49.73 0.06	-573877 1255	-493453 1464	86.451 0.256	262 262 115 161
CARBON MONOXIDE CO (IDEAL GAS)	28.010	197.67 0.03	24789.2 3.4	-110530 170	-137171 170	24.032 0.030	215 215 247
CARBON DIOXIDE CO_2 (IDEAL GAS)	44.010	213.79 0.04	24789.2 3.4	-393510 130	-394375 167	69.093 0.029	215 215 247 96
$CO_3^{=}$ AQUEOUS ION STD. STATE, m = 1	60.009	-56.90 0.85		-677140 120	-527900 120	92.486 0.021	262 262
HCO_3^- AQUEOUS ION STD. STATE, m = 1	61.017	91.20 0.85		-691990 120	-586850 120	102.814 0.021	262 262
H_2CO_3 UN-IONIZED STD. STATE, m = 1	62.025	187.00 0.85		-699650 120	-623170 120	109.177 0.021	262 262
CALCIUM OXIDE CaO	56.079	38.21 0.13	16.764 0.005	-635089 879	-603487 900	105.729 0.158	33 33 33
PORTLANDITE $Ca(OH)_2$	74.095	83.39 0.42	33.056 0.016	-986085 1255	-898408 1300	157.398 0.228	32 32 32 86 86
MONTEPONITE CdO	128.399	54.81 1.25	15.585 0.010	-258200 837	-228515 920	40.035 0.161	120 262 158
CERIANITE CeO_2	172.119	62.30 0.08	23.853 0.026	-1088680 1464	-1025380 2929	179.643 0.513	279 235 130 8
CERIUM SESQUIOXIDE (HEXAGONAL, α) Ce_2O_3	328.238	150.62 4.18	47.75 0.05	-1796200 8400	-1707940 8400	299.225 1.472	113 235 202 105
CERIUM SESQUIOXIDE (HEXAGONAL, β) Ce_2O_3	328.238						202
COBALTOUS OXIDE CoO	74.933	52.97 0.34	11.64 0.02	-237940 1255	-214194 1297	37.526 0.227	120 263 129
ESKOLAITE Cr_2O_3	151.990	81.17 1.25	29.09 0.032	-1134700 8370	-1053056 8400	184.492 1.472	33 33 33 158

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OXIDES AND HYDROXIDES							
DICESIUM MONOXIDE Cs_2O	281.810	146.87 0.44	59.62 0.07	-345975 1170	-308360 1190	54.023 0.208	59 236 59
CESIUM HYDROXIDE $CsOH$	149.913	98.74 4.18		-416726 837	-370690 850	64.944 0.149	32 32 32
TENORITE CuO	79.545	42.63 0.21	12.22 0.03	-157320 1255	-129564 1297	22.699 0.227	120 263 164 164
CUPRITE Cu_2O	143.091	93.14 1.67	23.437 0.016	-168610 6276	-146030 6318	25.584 1.107	263 263 164 164
DYSPROSIUM SESQUIOXIDE (CUBIC) Dy_2O_3	372.998	149.79 0.85	45.683 0.010	-1863130 3930	-1771385 4000	310.341 0.701	235 235 202 103
ERBIUM SESQUIOXIDE (CUBIC) Er_2O_3	382.518	155.64 0.85	44.171 0.010	-1897860 1920	-1808879 2000	316.909 0.350	235 235 207
EUROPIUM OXIDE EuO	167.959	62.76 0.85	20.475 0.008	-592040 8370	-556082 8370	97.424 1.466	235 235 166
EUROPIUM SESQUIOXIDE (MONOCLINIC) Eu_2O_3	351.918	146.44 8.50	44.02 0.05	-1651420 8400	-1555158 8400	272.458 1.472	281 235 210 57
EUROPIUM SESQUIOXIDE (CUBIC) Eu_2O_3	351.918		48.29 0.03				210
WUSTITE $Fe_{.947}O$	68.887	57.59 0.42	12.04 0.04	-266270 837	-245155 879	42.950 0.154	120 109 44 247 247
FERROUS OXIDE (STOICHIOMETRIC) FeO	71.846	59.80 1.67	12.00 0.05	-272043 2092	-251156 2176	44.001 0.381	247 247 247
HEMATITE Fe_2O_3	159.692	87.40 0.21	30.274 0.012	-824640 1255	-742683 1297	130.267 0.227	78 46 44 247 84 78
MAGNETITE Fe_3O_4	231.539	146.14 0.42	44.524 0.008	-1115726 2092	-1012566 2134	177.398 0.374	79 84 44 247 79
GOETHITE $FeO(OH)$	88.854	60.38 0.63	20.82 0.04	-559330 730	-488550 750	85.591	139 13
GALLIUM SESQUIOXIDE Ga_2O_3	187.438	84.98 0.42	28.941 0.006	-1089100 850	-998342 850	174.906 0.149	120 262 203 145
GADOLINIUM SESQUIOXIDE (MONOCLINIC) Gd_2O_3	362.498	151.88 0.85	43.4 0.04	-1819620 3600	-1732338 3600	303.500 0.631	281 235 210
GADOLINIUM SESQUIOXIDE (CUBIC) Gd_2O_3	362.498		47.585 0.008				210
GERMANIUM DIOXIDE (QUARTZ TYPE) GeO_2	104.589	55.27 0.27	24.44 0.04	-551030 800	-497074 900	87.086 0.158	120 262 119 83 5
GERMANIUM DIOXIDE GLASS GeO_2	104.589	64.50 0.30	28.6 0.1	-526350 630	-475180 710	83.250 0.124	163 119
WATER H_2O (LIQUID)	18.015	69.95 0.08	18.069 0.003	-285830 42	-237141 84	41.546 0.015	35 35 247 196
OH^- AQUEOUS ION STD. STATE, m = 1	17.007	-10.71 0.20		-230025 45	-157328 90	27.563 0.016	35 35
STEAM H_2O (IDEAL GAS)	18.015	188.72 0.04	24789.2 3.4	-241814 42	-228569 84	40.044 0.015	35 35 247 196
HAFNIUM DIOXIDE HfO_2	210.489	59.33 0.42	20.823 0.008	-1144740 1255	-1088276 1297	190.662 0.227	120 264 188
MONTROYDITE HgO	216.589	70.27 0.34	19.32 0.02	-90789 50	-58528 60	10.254 0.011	247 247 247 258
HOLMIUM SESQUIOXIDE (CUBIC) Ho_2O_3	377.859	158.16 0.32	44.90 0.02	-1880700 4850	-1791373 5000	313.842 0.876	235 235 207
DIPOTASSIUM MONOXIDE K_2O	94.195	94.14 6.28	40.38 0.20	-363171 2092	-322087 2845	56.429 0.498	247 247 247
POTASSIUM SUPEROXIDE KO_2	71.097	122.50 4.18	32.84 0.04	-284512 2092	-240586 2800	42.150 0.491	32 32 32
POTASSIUM HYDROXIDE KOH	56.105	78.91 0.84	27.45 0.02	-424676 418	-378932 500	66.388 0.088	32 32 32

Name and formula	Formula weight g	Entropy S^o_{298} J/mol·K	Molar volume cm³	$\Delta H^o_{f,298}$ J/mol	$\Delta G^o_{f,298}$ J/mol	Log K_f	References S	ΔH^o ΔG^o_f	C^o_p
OXIDES AND HYDROXIDES									
LANTHANUM SESQUIOXIDE La_2O_3	325.809	127.32 0.84	49.56 0.02	-1793680 1590	-1705963 1600	298.879 0.280	235	235	142
DILITHIUM MONOXIDE Li_2O	29.879	37.57 0.08	14.76 0.01	-598730 2092	-561985 2134	98.458 0.374	247	247	247
LITHIUM HYDROXIDE $LiOH$	23.947	42.80 0.21	16.44 0.05	-484926 159	-438941 159	76.901 0.028	215	215	32
LUTETIUM SESQUIOXIDE (CUBIC) Lu_2O_3	397.938	109.96 0.85	42.22 0.01	-1878200 7530	-1788849 6280	313.400 1.100	281	235	202
PERICLASE MgO	40.304	26.94 0.17	11.248 0.004	-601490 290	-569196 300	99.721 0.053	215	215 ~~247~~	261 ~~208~~
BRUCITE $Mg(OH)_2$	58.320	63.18 0.13	24.63 0.07	-924540 440	-833506 440	146.027 0.077	214	214 102	131
MANGANOSITE MnO	70.937	59.71 0.42	13.221 0.004	-385220 460	-362896 502	63.578 0.088	120	263	242
PYROLUSITE MnO_2	86.937	53.05 0.42	16.61 0.02	-520030 837	-465138 879	81.491 0.154	120	263	168
BIXBYITE Mn_2O_3	157.874	110.46 2.09	31.37 0.05	-958970 2092	-881068 2218	154.360 0.389	120	263 197	115 191
HAUSMANNITE Mn_3O_4	228.812	153.97 4.18	46.95 0.06	-1387830 1674	-1282774 2092	224.738 0.367	197	263 197	241
MOLYBDENUM DIOXIDE MoO_2	127.939	50.02 0.30	19.58 0.02	-587850 2090	-533053 2510	93.389 0.440	247	247 159	247
MOLYBDITE MoO_3	143.938	77.74 0.42	30.56 0.04	-745170 418	-668055 460	117.041 0.081	247	247 159	247 140
NITROGEN DIOXIDE NO_2 (IDEAL GAS)	46.005	240.06 0.08	24789.2 3.4	33095 418	51251 460	-8.979 0.081	247	247	247
NO_3^- AQUEOUS ION STD. STATE, m = 1	62.005	146.94 0.85		-207400 420	-111500 400	19.534 0.070	35	35	
DISODIUM MONOXIDE Na_2O	61.979	75.27 0.84	25.88 0.08	-414820 280	-376089 290	65.890 0.051	247	183 265	247 63
SODIUM HYDROXIDE $NaOH$	39.997	64.43 0.84	18.78 0.06	-425800 85	-379651 125	66.514 0.022	32	215 32	32
NIOBIUM MONOXIDE NbO	108.906	46.02 8.40	14.97 0.01	-419660 12550	-391945 12550	68.667 2.199	33	33	33
NIOBIUM DIOXIDE NbO_2	124.905	54.51 0.30	45.02 0.04	-794960 8370	-739194 8370	129.504 1.466	33	33	33 130
DINIOBIUM PENTOXIDE Nb_2O_5	265.810	137.32 1.26	93.42 0.10	-1899536 4184	-1765859 4200	309.373 0.736	33	33	189
NEODYMIUM SESQUIOXIDE (HEXAGONAL) Nd_2O_3	336.478	158.57 4.20	45.92 0.02	-1807910 1000	-1721048 1020	301.522 0.179	235	235	210
BUNSENITE NiO	74.699	37.99 0.17	10.97 0.02	-239743 418	-211581 460	37.068 0.081	120	23 263	129
PHOSPHORUS MONOXIDE PO (IDEAL GAS)	46.973	222.77 0.02	24789.2 3.4	-12134 4184	-41157 4200	7.211 0.736	32	32	32
PHOSPHORUS PENTOXIDE P_2O_5	141.945	115.50 0.40	59.4 0.2	-1470000 4200	-1337897 4200	234.396 0.736	215	215	247
PHOSPHORUS PENTOXIDE (DIMERIC) $(P_2O_5)_2$	283.889	231.00 0.80	118.8 0.4	-2940000 8400	-2675794 8400	468.791 1.470	215	215	247
PO_4^{---} AQUEOUS ION STD. STATE, m = 1	94.971	-222.00 4.20		-1259550 850	-1001550 850	175.469 0.749	262	262	
ORTHOPHOSPHORIC ACID (CRYSTAL) H_3PO_4	97.995	110.54 0.42	48.52 0.01	-1266920 2090	-1112290 2510	194.869 0.440	32	32	32
ORTHOPHOSPHORIC ACID (LIQUID) H_3PO_4	97.995	150.78 4.20		-1254200 2090	-1111700 2510	194.766 0.440	32	32	32
LITHARGE (RED) PbO	223.199	66.32 0.84	23.91 0.05	-219409 830	-189202 900	33.148 0.158	32	32	32

Name and formula	Formula weight g	Entropy S^o_{298} J/mol·K	Molar volume cm³	$\Delta H^o_{f,298}$ J/mol	$\Delta G^o_{f,298}$ J/mol	Log K_f	References S	ΔH^o ΔG^o_f	C^o_p
OXIDES AND HYDROXIDES									
MASSICOT (YELLOW) PbO	223.199	68.70 0.21	23.15 0.03	-218070 630	-188573 700	33.037 0.123	32	32	32
PLATTNERITE PbO_2	239.199	71.80 0.42	25.01 0.01	-274470 2929	-215314 3000	37.722 0.526	32	32	32
MINIUM Pb_3O_4	686.598	211.96 6.69	76.81 0.09	-718686 6276	-601358 6300	105.356 1.104	32	32	32
PRASEODYMIUM SESQUIOXIDE (HEX) Pr_2O_3	329.814	158.57 4.20	46.53 0.05	-1809580 6690	-1721025 6700	301.518 1.174	281	235	200
PRASEODYMIUM OXIDE $PrO_{1.833}$	170.235	79.91 4.20	24.6 0.2	-1904560 6690	-1796610 6700	314.760 1.174	281	281	200
RHENIUM DIOXIDE (ORTHORHOMBIC) ReO_2	218.206	47.82 0.05	18.80 0.01	-451870 3350	-394070 3360	69.040 0.589	249	133	249
RHENIUM TRIOXIDE ReO_3	234.205	69.24 0.09	31.78 0.01	-593710 2930	-511700 2940	89.648 0.515	249	133	249
DIRHENIUM HEPTOXIDE Re_2O_7	484.410	207.30 0.40	77.95 0.09	-1274030 6280	-1099980 6290	192.713 1.102	249	133	249
SULPUR DIOXIDE SO_2 (IDEAL GAS)	64.059	248.22 0.06	24789.2 3.4	-296810 200	-300170 251	52.589 0.044	35	35	247
SULPUR TRIOXIDE SO_3 (IDEAL GAS)	80.058	256.76 0.84	24789.2 3.4	-395722 711	-371046 795	65.006 0.139	247	247	247
SO_3^{--} AQUEOUS ION STD. STATE, m = 1	80.058	-29.00 4.20		-635600 850	-486600 850	85.251 0.149	262	262	
SO_4^{--} AQUEOUS ION STD. STATE, m = 1	96.058	20.00 0.85		-909270 120	-744630 120	130.457 0.021	262	262	
VALENTINITE Sb_2O_3	291.498	123.01 2.51	50.01 0.05	-708560 2930	-626345 3054	109.733 0.535	262 120	262	
SCANDIUM SESQUIOXIDE Sc_2O_3	137.910	76.99 0.42	35.91 0.01	-1908820 2510	-1819371 2520	318.748 0.441	281	264 162	203
SILICON MONOXIDE SiO (IDEAL GAS)	44.085	211.57 0.84	24789.2 3.4	-100416 8368	-127305 8500	22.304 1.489	247	247	247
QUARTZ SiO_2	60.085	41.46 0.20	22.688 0.001	-910700 1000	-856288 1100	150.019 0.193	35 278	35 284	247
H_4SiO_4 UN-IONIZED STD. STATE, m = 1	96.115	180.00 4.20		-1460000 1700	-1308000 1700	229.157 0.298	262	171 259	
CRISTOBALITE SiO_2	60.085	43.40 0.13	25.739 0.033	-908346 2090	-854512 2130	149.708 0.373	247 278	247	247 172
TRIDYMITE SiO_2	60.085	43.93 0.42	26.53 0.20	-907488 2385	-853812 2427	149.585 0.425	285	148	172
COESITE SiO_2	60.085	40.38 0.42	20.641 0.001	-905584 2092	-850850 2134	149.066 0.374	101	101	285
STISHOVITE SiO_2	60.085	27.78 0.42	14.014 0.009	-861318 2092	-802827 2134	140.653 0.374	101	101	285
SILICON DIOXIDE GLASS SiO_2	60.085	47.40 0.21	27.27 0.10	-903200 2092	-850559 2134	149.015 2780.374	285 278	148 284	52
SAMARIUM SESQUIOXIDE (MONOCLINIC) Sm_2O_3	348.798	151.04 4.20	45.04 0.02	-1822970 2010	-1796690 2020	314.774 0.354	235	235	210
SAMARIUM SESQUIOXIDE (CUBIC) Sm_2O_3	348.798		49.10 0.01					7	193
CASSITERITE SnO_2	150.689	52.30 1.25	21.55 0.03	-580740 628	-519902 753	91.085 0.132	120	262	115
STRONTIUM OXIDE SrO	103.619	55.52 0.42	20.686 0.005	-590490 920	-560353 930	98.172 0.163	33	24	33 155
DITANTALUM PENTOXIDE (BETA) Ta_2O_5	441.893	143.13 1.26	53.17 0.05	-2045976 4184	-1910984 4200	334.798 0.736	33	33	33 189

Name and formula	Formula weight g	Entropy S^o_{298} J/mol·K	Molar volume cm³	$\Delta H^o_{f,298}$ J/mol	$\Delta G^o_{f,298}$ J/mol	Log K_f	References S	ΔH^o ΔG^o_f	C^o_p
HALIDES									
SYLVITE	74.551	82.59	37.524	-436470	-408554	71.577	215	215	247
KCl		0.20	0.004	140	140	0.025			173
CHLOROMAGNESITE	95.211	89.62	40.81	-641320	-591785	103.679	120	214	169
$MgCl_2$		0.84	0.10	460	544	0.095		247	247
SCACCHITE	125.844	118.24	42.11	-481290	-440488	77.172	34	214	169
$MnCl_2$		0.27	0.17	837	879	0.154		147	
SALAMMONIAC	53.491	95.02	35.06	-315190	-203776	35.701	215	215	247
NH_4Cl		0.40	0.05	290	290	0.051			
HALITE	58.443	72.12	27.015	-411260	-384212	67.313	215	215	247
$NaCl$		0.21	0.003	110	110	0.019			
NICKEL CHLORIDE	129.606	97.66	36.7	-305330	-259030	45.381	263	263	40
$NiCl_2$		0.21	0.07	80	80	0.014			
COTUNNITE	278.106	135.98	47.09	-359400	-314033	55.018	120	247	115
$PbCl_2$		2.09	0.05	293	711	0.125	215	215	
TITANIUM TRICHLORIDE	154.259	139.75	57.3	-721740	-654507	114.667	247	247	141
$TiCl_3$		1.26	0.3	4180	5020	0.879			
URANIUM TRICHLORIDE	344.388	158.95	62.04	-891190	-823820	144.330	70	89	70
UCl_3		0.40	0.06	4000	5000	0.876		233	
URANIUM TETRACHLORIDE	379.841	196.60	77.6	-1018390	-928850	162.731	70	89	70
UCl_4		0.50	0.03	3000	3000	0.526		233	
VANADIUM DICHLORIDE	121.847	97.07		-451870	-405681	71.074	120	264	125
VCl_2		1.26		8500	8500	1.489			
VANADIUM TRICHLORIDE	157.300	130.96	54.48	-580740	-511399	89.595	120	264	125
VCl_3		1.70	0.1	850	850	0.149			
ALUMINUM TRIFLUORIDE	83.977	66.48	26.15	-1510400	-1431076	250.720	247	247	51
AlF_3		0.42	0.1	1300	1300	0.228	215	215	181
FLUORITE	78.077	68.87	24.542	-1229260	-1176920	206.192	120	215	175
CaF_2		0.34	0.007	420	420	0.074			
HYDROGEN FLUORIDE	20.006	173.78	24789.2	-273300	-275400	48.249	35	35	247
HF (IDEAL GAS)		0.04	3.4	700	700	0.123			
SELLAITE	62.302	57.25	19.61	-1124200	-1071064	187.647	247	215	175
MgF_2		0.42	0.01	1200	1200	0.210			
VILLIAUMITE	41.988	51.30	14.984	-576550	-546319	95.713	215	215	181
NaF		0.08	0.005	670	670	0.117			
CRYOLITE	209.942	238.45	70.81	-3309544	-3144915	550.978	247	247	181
Na_3AlF_6		1.67	0.20	4180	4300	0.753			
URANIUM TETRAFLUORIDE	314.023	151.67	46.88	-1853500	-1762800	308.837	70	233	70
UF_4		0.17	0.08	5000	5100	0.894			
IODARGYRITE	234.772	115.48	41.301	-61840	-66254	11.607	120	263	115
AgI		1.67	0.04	1674	1757	0.308	263		
COCCINITE	454.399	181.33	71.84	-105437	-102203	17.906	263	263	115
HgI_2		6.28	0.10	1674	2552	0.447	32	247	32
CARBONATES AND NITRATES									
WITHERITE	197.349	112.13	45.81	-1210850	-1132210	198.359	120	4	155
$BaCO_3$		2.09	0.06	2230	2240	0.392			
ARAGONITE	100.089	87.99	34.15	-1207430	-1127793	197.586	243	214	115
$CaCO_3$		0.20	0.05	1423	1464	0.256			
CALCITE	100.089	91.71	36.934	-1207370	-1128842	197.769	243	214	115
$CaCO_3$		0.20	0.015	1339	1381	0.242			
VATERITE	100.089		37.63		-1125540	197.191		256	
$CaCO_3$			0.07		1500	0.263			
MONOHYDROCALCITE	118.104		48.7	-1498290	-1361600	238.548		106	
$CaCO_3 \cdot H_2O$			0.4	1170	1130	0.198			
DOLOMITE	184.403	156.18	64.34	-2324480	-2161672	378.718	244	225	151
$CaMg(CO_3)_2$		0.29	0.03	1460	1670	0.293			

Name and formula	Formula weight g	Entropy S^o_{298} J/mol·K	Molar volume cm³	$\Delta H^o_{f,298}$ J/mol	$\Delta G^o_{f,298}$ J/mol	Log K_f	References S	ΔH^o ΔG^o_f	C^o_p
CARBONATES AND NITRATES									
HUNTITE	353.032	299.53	122.58	-4529600	-4203025	736.426		91	92
$CaMg_3(CO_3)_4$		0.88	0.10	1570	1630	0.286			
OTAVITE	172.409	92.47	34.3	-750610	-669440	117.284	120	262	
$CdCO_3$		2.51	0.02	2510	2636	0.462			
MALACHITE	221.116		54.86	-1053950				216	
$Cu_2(CO_3)(OH)_2$			0.08	2090					
AZURITE	344.671		91.01	-1632180				263	
$Cu_3(OH)_2(CO_3)_2$			0.13	2000					
SIDERITE	115.856	105.0	29.378	-736985	-666698	116.803	220	263	
$FeCO_3$		2.5	0.014	2259	2092	0.367		117	
MAGNESITE	84.314	65.09	28.018	-1113280	-1029480	180.360	95	220	115
$MgCO_3$		0.14	0.013	1339	1381	0.242			
NESQUEHONITE	138.360	195.62	75.47	-1977260	-1723746	301.994	223	224	
$MgCO_3 \cdot 3H_2O$		0.59	0.05	260	500	0.088			
HYDROMAGNESITE	467.637	503.67	211.1	-6514860	-5864166	1027.382	223	224	
$5MgO \cdot 4CO_2 \cdot 5H_2O$		1.55	0.1	1060	1090	0.191			
ARTINITE	196.679	232.92	96.43	-2920610	-2568346	449.966		91	92
$Mg_2(OH)_2CO_3 \cdot 3H_2O$		0.67	0.10	710	750	0.131			
RHODOCHROSITE	114.947	100.0	31.073	-889270	-816047	142.968	220	220	168
$MnCO_3$		2.1	0.014	1213	1381	0.242		68	
DAWSONITE	143.996	132.00	59.3	-1963970	-1785990	312.900	55	55	55
$NaAlCO_3(OH)_2$		0.50	0.3	2930	2950	0.517			
CERUSSITE	267.209	130.96	40.59	-699150	-625337	109.557	120	214	
$PbCO_3$		3.35	0.06	1172	1548	0.271		4	
STRONTIANITE	147.629	97.07	39.01	-1218680	-1137640	199.311	120	4	155
$SrCO_3$		1.67	0.06	1450	1460	0.256			
SMITHSONITE	125.389	82.42	28.275	-812780	-731480	128.153	120	214	
$ZnCO_3$		1.25	0.013	2930	2970	0.521			
NITROBARITE	261.350	213.80	80.58	-992070	-796579	139.558	214	214	238
$Ba(NO_3)_2$		0.84	0.08	2100	2500	0.438			
CALCIUM NITRATE	164.090	193.30	66.09	-938390	-742985	130.168	214	214	238
$Ca(NO_3)_2$		0.40	0.03	1510	1760	0.308			
NITER	101.103	133.09	48.04	-494460	-394544	69.123	120	215	115
KNO_3		0.67	0.06	420	420	0.074	215		
MAGNESIUM NITRATE	148.315	164.01	62.93	-790650	-589181	103.223	214	214	238
$Mg(NO_3)_2$		1.60	0.03	1300	1420	0.249			
AMMONIA-NITER	80.043	151.08	46.49	-365560	-183803	32.202	262	262	115
NH_4NO_3		0.21	0.10	837	879	0.154			
SODA-NITER	84.995	116.52	37.6	-468020	-367153	64.324	120	215	115
$NaNO_3$		0.68	0.02	420	420	0.074	215		
STRONTIUM NITRATE	211.630	194.56	70.93	-978220	-779086	136.493	214	214	250
$Sr(NO_3)_2$		0.50	0.04	1000	1300	0.228			
SULFATES AND BORATES									
ALUMINUM SULFATE	396.182	239.32		-3440840	-3099852	543.084	262	262	239
$Al_2(SO_4)_3$		1.20		1800	1880	0.329			
BARITE	233.398	132.21	52.1	-1473190	-1362186	238.650	120	214	115
$BaSO_4$		0.84	0.06	1000	1300	0.228			
ANHYDRITE	136.138	106.69	45.94	-1434110	-1321696	231.557	120	214	115
$CaSO_4$		1.67	0.06	4226	4184	0.733	214		
GYPSUM	172.168	194.14	74.69	-2022628	-1797197	314.863	214	214	
$CaSO_4 \cdot 2H_2O$		1.25	0.22	4644	4602	0.806			
CHALCOCYANITE	159.604	109.50	40.88	-771360	-662310	116.034	54	3	54
$CuSO_4$		0.60	0.03	1300	1400	0.245	271	263	

Name and formula	Formula weight g	Entropy S^o_{298} J/mol·K	Molar volume cm³	$\Delta H^o_{f,298}$ J/mol	$\Delta G^o_{f,298}$ J/mol	Log K_f	References S	References ΔH^o / ΔG^o_f	References C^o_p
ORTHO AND RING STRUCTURE SILICATES									
FORSTERITE Mg_2SiO_4	140.694	95.19 0.84	43.79 0.03	-2170370 1325	-2051325 1345	359.385 0.236	120	93 128	190
PYROPE $Mg_3Al_2Si_3O_{12}$	403.130	260.76 10.00	113.27 0.05	-6284620 6000	-5932412 7000	1039.341 1.226	285	31	252
CORDIERITE $Mg_2Al_3(AlSi_5O_{18})$	584.957	407.2 3.8	233.22 0.13	-9161524 5850	-8651112 5900	1515.645 1.025	273	180	206
TEPHROITE Mn_2SiO_4	201.960	163.2 4.2	48.61 0.07	-1728070 3180	-1629695 3430	285.517 0.601	120	93 111	160
WILLEMITE Zn_2SiO_4	222.844	131.38 0.84	52.42 0.08	-1636530 2469	-1522936 2510	266.813 0.440	120	126	
ZIRCON $ZrSiO_4$	183.304	84.03 1.25	39.26 0.07	-2033400 1000	-1918890 1040	336.183 0.182	120	264 234	115
CHAIN AND BAND STRUCTURE SILICATES									
WOLLASTONITE $CaSiO_3$	116.164	82.01 0.84	39.93 0.10	-1635220 1435	-1549903 1455	271.538 0.255	120	254 19	240
PSEUDOWOLLASTONITE $CaSiO_3$	116.164	87.45 0.84	40.08 0.14	-1628650 2594	-1544955 2636	270.669 0.462	120	116	115
CA-AL PYROXENE $CaAl_2SiO_6$	218.126	156.00 4.00	63.5 0.09	-3275680 2761	-3103770 2971	543.770 0.521	88	286	285
DIOPSIDE $CaMg(SiO_3)_2$	216.553	143.09 0.84	66.09 0.10	-3210760 9120	-3036554 9160	531.994 1.605	120	148 178	115
ALPHA SPODUMENE $LiAlSi_2O_6$	186.090	129.30 0.80	58.37 0.02	-3053500 2790	-2880203 2800	504.602 0.490	211	93 15	211
BETA SPODUMENE $LiAlSi_2O_6$	186.090	154.40 1.20	78.25 0.04	-3025300 2790	-2859487 2805	500.972 0.490	211	93 15	211
EUCRYPTITE $LiAlSiO_4$	126.006	103.80 0.80	53.63 0.05	-2123300 1980	-2009174 1990	352.000 0.348	211	93 15	211
CLINOENSTATITE $MgSiO_3$	100.389	67.86 0.42	31.47 0.05	-1547750 1215	-1460883 1225	255.942 0.215	120	93 254	115
RHODONITE $MnSiO_3$	131.022	102.5 2.1	35.16 0.02	-1319350 1310	-1243081 1440	217.784 0.252	285	93 127	115 241
JADEITE $NaAl(SiO_3)_2$	202.140	133.47 1.25	60.4 0.1	-3029400 4180	-2850834 4230	499.456 0.741	120	97 149	115
TREMOLITE $Ca_2Mg_5[Si_8O_{22}](OH)_2$	812.374	548.90 1.25	272.92 0.73	-12355080 17320	-11627910 17360	2037.170 3.041	228	270	151
FRAMEWORK STRUCTURE SILICATES									
ANORTHITE $CaAl_2Si_2O_8$	278.211	199.30 0.30	100.79 0.05	-4229100 3125	-4003326 3145	701.371 0.551	227 257	286 93	152 56
HEXAGONAL ANORTHITE $CaAl_2Si_2O_8$	278.211	214.80 1.30	99.85 0.79	-4222575 3125	-4001420 3275	701.035 0.574	136 257	93	
$CaAl_2Si_2O_8$ GLASS $CaAl_2Si_2O_8$	278.211	237.30 2.50	103.0 0.15	-4157300 3300	-3942856 3320	690.777 0.581	227	286 93	152 56
LEONHARDITE $Ca_2Al_4Si_8O_{24}\cdot 7H_2O$	922.867	922.2 10.9	404.4 2.0	-14246460 9635	-13197115 10170	2312.078 1.782	136	93	
MICROCLINE $KAlSi_3O_8$	278.333	214.20 0.41	108.72 0.10	-3967690 3370	-3742330 3400	655.644 0.596	187 123	93 269	90
HIGH SANIDINE $KAlSi_3O_8$	278.333	232.90 0.48	109.05 0.10	-3959560 3370	-3739776 3400	655.196 0.596	187	93	90
$KAlSi_3O_8$ GLASS $KAlSi_3O_8$	278.333	261.60 1.78	116.5 1.0	-3914740 3370	-3703513 3500	648.843 0.613	227	93 269	152
KALIOPHILLITE $KAlSiO_4$	158.164	133.26 1.25	59.89 0.05	-2121920 1435	-2005975 1450	351.440 0.254	120	93 15	201

Name and formula	Formula weight g	Entropy S^o_{298} J/mol·K	Molar volume cm³	$\Delta H^o_{f,298}$ J/mol	$\Delta G^o_{f,298}$ J/mol	Log K_f	References S	References ΔH^o / ΔG^o_f	References C^o_p
FRAMEWORK STRUCTURE SILICATES									
LEUCITE $KAlSi_2O_6$	218.248	200.20 1.70	88.39 0.05	-3038650 2755	-2875890 2850	503.846 0.499	93 120	93 15	201
LOW ALBITE $NaAlSi_3O_8$	262.225	207.40 0.40	100.07 0.13	-3935120 3415	-3711722 3435	650.281 0.602	187 123	93	115 90
ANALBITE $NaAlSi_3O_8$	262.225	226.40 0.40	100.43 0.09	-3924240 3640	-3706507 3660	649.367 0.641	76 187	93 100	90
$NaAlSi_3O_8$ GLASS $NaAlSi_3O_8$	262.225	251.90 1.50	110.086 0.19	-3875460 3700	-3665330 3720	642.153 0.652	227	93 269	152
NEPHELINE $NaAlSiO_4$	142.055	124.35 1.25	54.16 0.06	-2092110 2420	-1977498 2450	346.449 0.363	120	93 229	115
NEPHELINE $Na_{.78}K_{.22}AlSiO_4$	145.277			-2110290 2040				93 229	
ANALCIME $NaAlSi_2O_6\cdot H_2O$	220.155	234.43 2.51	97.49 0.1	-3309839 3598	-3091730 3682	541.661 0.645	120	9	
DEHYDRATED ANALCIME $NaAlSi_2O_6$	202.140	175.40 1.70					136		201
SHEET STRUCTURE SILICATES									
DICKITE $Al_2Si_2O_5(OH)_4$	258.162	197.07 1.25	99.3 0.07	-4118840 3766	-3796305 3807	665.100 0.667	135	93 16	
KAOLINITE $Al_2Si_2O_5(OH)_4$	258.162	203.05 1.25	99.52 0.26	-4120114 3975	-3799364 4017	665.636 0.704	135	93 143	
HALLOYSITE $Al_2Si_2O_5(OH)_4$	258.162	203.00 1.30		-4101480 2930	-3780713 3010	662.368 0.527	135	93 16	
MUSCOVITE $KAl_2[AlSi_3O_{10}](OH)_2$	398.311	334.6 1.0	140.71 0.18	-5976740 3225	-5600671 3290	981.219 0.576	226 277	93 12	152 199
PHLOGOPITE $KMg_3[AlSi_3O_{10}](OH)_2$	417.262	319.66 4.18	149.91 0.36				285		
FLUORPHLOGOPITE $KMg_3(AlSi_3O_{10})F_2$	421.299	336.30 2.10	146.37 0.18	-6392880 3660	-6053067 3800	1060.477 0.666	118 257	93 118	118
ILLITE $(Al_7Mg)(Si_{14}Al_2)O_{40}(OH)_8$	1553.675	1104.20 0.60					226		
TALC $Mg_3Si_4O_{10}(OH)_2$	379.268	260.83 0.63	136.25 0.26	-5915900 4330	-5536048 4350	969.897 0.762	228	93 11	151
PYROPHYLLITE $Al_2Si_4O_{10}(OH)_2$	360.317	239.40 0.40	127.82 0.29	-5639800 3950	-5265884 3960	922.567 0.694	226 139	286	152
CHRYSOTILE $Mg_3Si_2O_5(OH)_4$	277.113	221.30 0.80	108.5 0.6	-4361660 3480	-4034024 3500	706.747 0.613	128	93 128	128