

Database file: minteq.dat

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Reading data base.  
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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

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Reading input data for simulation 1.  
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TITLE BH310a Low  
SOLUTION 1  
pH 10.05 charge  
temp 14.04  
pe -4.6781  
units mg/L  
Al 0.0422  
As 0.00163 as H3AsO4  
Ba 0.109  
B 2.360  
Cd 0.00013  
Ca 717  
C 26.3  
Cl 16500  
Cu 0.00204  
Cr 0.123  
Pb 0.0007  
Mg 690  
Ni 0.00594  
N 0.82 as N03-  
K 342  
Na 10100  
S 2020 as SO4-2  
V 0.0229  
Zn 0.0061  
END

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TITLE  
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BH310a Low

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 Beginning of initial solution calculations.  
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Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.613e-06	1.613e-06
As	1.184e-08	1.184e-08
B	2.252e-04	2.252e-04
Ba	8.185e-07	8.185e-07
C	4.445e-04	4.445e-04
Ca	1.845e-02	1.845e-02
Cd	1.193e-09	1.193e-09
Cl	4.800e-01	4.800e-01
Cr	2.440e-06	2.440e-06
Cu	3.311e-08	3.311e-08
K	9.021e-03	9.021e-03
Mg	2.927e-02	2.927e-02
N	2.013e-05	2.013e-05
Na	4.531e-01	4.531e-01
Ni	1.043e-07	1.043e-07
Pb	3.484e-09	3.484e-09
S	2.169e-02	2.169e-02
V	4.636e-07	4.636e-07
Zn	9.624e-08	9.624e-08

-----Description of solution-----

pH = 12.453    Charge balance  
 pe = -4.678  
 Activity of water = 0.983  
 Ionic strength = 5.752e-01  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 3.422e-02  
 Total CO2 (mol/kg) = 4.445e-04  
 Temperature (deg C) = 14.040  
 Electrical balance (eq) = -4.341e-13  
 Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|)$  = -0.00  
 Iterations = 11  
 Total H = 1.110460e+02  
 Total O = 5.562806e+01

-----Distribution of species-----

## BH310A July

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	1.894e-02	1.186e-02	-1.723	-1.926	-0.203
H+	4.619e-13	3.524e-13	-12.335	-12.453	-0.118
H2O	5.551e+01	9.826e-01	-0.008	-0.008	0.000
Al	1.613e-06				
Al(OH)4-	1.613e-06	1.067e-06	-5.792	-5.972	-0.179
Al(OH)3	5.725e-11	6.535e-11	-10.242	-10.185	0.058
Al(OH)2+	2.706e-17	1.862e-17	-16.568	-16.730	-0.162
AlOH+2	1.783e-24	3.996e-25	-23.749	-24.398	-0.649
Al+3	3.443e-31	3.014e-32	-30.463	-31.521	-1.058
AlSO4+	9.203e-32	6.087e-32	-31.036	-31.216	-0.179
Al(SO4)2-	1.549e-32	1.025e-32	-31.810	-31.989	-0.179
As(3)	7.482e-18				
HAsO3-2	4.598e-18	1.395e-18	-17.337	-17.855	-0.518
AsO3-3	1.513e-18	1.034e-19	-17.820	-18.986	-1.165
H2AsO3-	1.370e-18	1.017e-18	-17.863	-17.993	-0.129
H3AsO3	8.097e-22	9.243e-22	-21.092	-21.034	0.058
H4AsO3+	2.174e-34	1.614e-34	-33.663	-33.792	-0.129
As(5)	1.184e-08				
AsO4-3	1.137e-08	7.770e-10	-7.944	-9.110	-1.165
HAsO4-2	4.711e-10	1.429e-10	-9.327	-9.845	-0.518
H2AsO4-	4.085e-16	3.031e-16	-15.389	-15.518	-0.129
H3AsO4	1.468e-26	1.676e-26	-25.833	-25.776	0.058
B	2.252e-04				
H2BO3-	2.251e-04	1.312e-04	-3.648	-3.882	-0.234
H3BO3	8.661e-08	9.888e-08	-7.062	-7.005	0.058
Ba	8.185e-07				
Ba+2	8.070e-07	1.693e-07	-6.093	-6.771	-0.678
BaOH+	1.157e-08	7.830e-09	-7.937	-8.106	-0.170
C(4)	4.445e-04				
NaCO3-	1.223e-04	8.417e-05	-3.912	-4.075	-0.162
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CO3-2	1.127e-04	2.526e-05	-3.948	-4.598	-0.649
MgCO3	9.258e-05	1.057e-04	-4.033	-3.976	0.058
HCO3-	3.567e-07	2.454e-07	-6.448	-6.610	-0.162
NaHCO3	2.992e-08	3.415e-08	-7.524	-7.467	0.058
MgHCO3+	2.104e-08	1.357e-08	-7.677	-7.868	-0.191
CaHCO3+	1.175e-08	8.268e-09	-7.930	-8.083	-0.153
NiCO3	5.726e-13	6.536e-13	-12.242	-12.185	0.058
H2CO3	1.523e-13	1.739e-13	-12.817	-12.760	0.058
CdCO3	9.763e-14	1.115e-13	-13.010	-12.953	0.058
Ni(CO3)2-2	9.458e-14	2.870e-14	-13.024	-13.542	-0.518
Zn(CO3)2-2	3.438e-16	1.043e-16	-15.464	-15.982	-0.518
ZnCO3	1.692e-16	1.931e-16	-15.772	-15.714	0.058
PbCO3	3.157e-17	3.604e-17	-16.501	-16.443	0.058

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Pb(CO <sub>3</sub> ) <sub>2</sub> -2	7.537e-18	2.287e-18	-17.123	-17.641	-0.518
CuCO <sub>3</sub>	1.511e-18	1.725e-18	-17.821	-17.763	0.058
CdHCO <sub>3</sub> <sup>+</sup>	5.304e-19	3.937e-19	-18.275	-18.405	-0.129
Cu(CO <sub>3</sub> ) <sub>2</sub> -2	1.808e-19	5.486e-20	-18.743	-19.261	-0.518
NiHCO <sub>3</sub> <sup>+</sup>	1.235e-19	9.169e-20	-18.908	-19.038	-0.129
Cd(CO <sub>3</sub> ) <sub>3</sub> -4	5.559e-20	4.711e-22	-19.255	-21.327	-2.072
ZnHCO <sub>3</sub> <sup>+</sup>	1.154e-21	8.567e-22	-20.938	-21.067	-0.129
PbHCO <sub>3</sub> <sup>+</sup>	1.560e-23	1.158e-23	-22.807	-22.936	-0.129
CuHCO <sub>3</sub> <sup>+</sup>	1.525e-24	1.132e-24	-23.817	-23.946	-0.129
Ca	1.845e-02				
Ca <sup>+2</sup>	1.491e-02	4.549e-03	-1.826	-2.342	-0.516
CaOH <sup>+</sup>	1.784e-03	1.255e-03	-2.749	-2.901	-0.153
CaSO <sub>4</sub>	1.636e-03	1.867e-03	-2.786	-2.729	0.058
CaCO <sub>3</sub>	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CaHCO <sub>3</sub> <sup>+</sup>	1.175e-08	8.268e-09	-7.930	-8.083	-0.153
Cd	1.193e-09				
Cd(OH) <sub>2</sub>	5.356e-10	6.115e-10	-9.271	-9.214	0.058
CdOHCl	3.800e-10	4.338e-10	-9.420	-9.363	0.058
Cd(OH) <sub>3</sub> <sup>-</sup>	2.578e-10	1.913e-10	-9.589	-9.718	-0.129
Cd(OH) <sub>4</sub> -2	1.567e-11	4.755e-12	-10.805	-11.323	-0.518
CdOH <sup>+</sup>	2.366e-12	1.756e-12	-11.626	-11.755	-0.129
CdCl <sup>+</sup>	6.467e-13	4.800e-13	-12.189	-12.319	-0.129
CdCl <sub>2</sub>	4.985e-13	5.691e-13	-12.302	-12.245	0.058
CdCl <sub>3</sub> <sup>-</sup>	1.206e-13	8.952e-14	-12.919	-13.048	-0.129
CdCO <sub>3</sub>	9.763e-14	1.115e-13	-13.010	-12.953	0.058
Cd <sup>+2</sup>	5.802e-14	1.760e-14	-13.236	-13.754	-0.518
CdSO <sub>4</sub>	9.190e-15	1.049e-14	-14.037	-13.979	0.058
Cd(SO <sub>4</sub> ) <sub>2</sub> -2	9.005e-16	2.732e-16	-15.046	-15.563	-0.518
CdHCO <sub>3</sub> <sup>+</sup>	5.304e-19	3.937e-19	-18.275	-18.405	-0.129
Cd(CO <sub>3</sub> ) <sub>3</sub> -4	5.559e-20	4.711e-22	-19.255	-21.327	-2.072
Cd <sub>2</sub> OH <sup>+3</sup>	2.554e-24	1.745e-25	-23.593	-24.758	-1.165
CdHS <sup>+</sup>	0.000e+00	0.000e+00	-45.389	-45.518	-0.129
CdNO <sub>3</sub> <sup>+</sup>	0.000e+00	0.000e+00	-57.807	-57.936	-0.129
Cd(HS) <sub>2</sub>	0.000e+00	0.000e+00	-81.150	-81.092	0.058
Cd(HS) <sub>3</sub> <sup>-</sup>	0.000e+00	0.000e+00	-120.717	-120.846	-0.129
Cd(HS) <sub>4</sub> -2	0.000e+00	0.000e+00	-160.072	-160.590	-0.518
Cl	4.800e-01				
Cl <sup>-</sup>	4.800e-01	2.966e-01	-0.319	-0.528	-0.209
CuCl <sub>3</sub> -2	1.752e-08	3.676e-09	-7.756	-8.435	-0.678
CuCl <sub>2</sub> <sup>-</sup>	1.267e-08	8.170e-09	-7.897	-8.088	-0.191
CdOHCl	3.800e-10	4.338e-10	-9.420	-9.363	0.058
ZnOHCl	9.190e-13	1.049e-12	-12.037	-11.979	0.058
CdCl <sup>+</sup>	6.467e-13	4.800e-13	-12.189	-12.319	-0.129
CdCl <sub>2</sub>	4.985e-13	5.691e-13	-12.302	-12.245	0.058
CdCl <sub>3</sub> <sup>-</sup>	1.206e-13	8.952e-14	-12.919	-13.048	-0.129
NiCl <sup>+</sup>	3.495e-15	2.594e-15	-14.457	-14.586	-0.129
NiCl <sub>2</sub>	2.452e-15	2.800e-15	-14.610	-14.553	0.058
ZnCl <sup>+</sup>	2.872e-17	1.852e-17	-16.542	-16.732	-0.191

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ZnCl2	4.812e-18	5.493e-18	-17.318	-17.260	0.058
ZnCl3-	2.648e-18	1.707e-18	-17.577	-17.768	-0.191
ZnCl4-2	1.103e-18	2.313e-19	-17.958	-18.636	-0.678
PbCl+	9.848e-19	7.309e-19	-18.007	-18.136	-0.129
PbCl2	3.722e-19	4.249e-19	-18.429	-18.372	0.058
PbCl3-	1.254e-19	9.310e-20	-18.902	-19.031	-0.129
PbCl4-2	3.999e-20	1.213e-20	-19.398	-19.916	-0.518
CuCl+	9.018e-21	5.814e-21	-20.045	-20.236	-0.191
CuCl2	7.172e-22	8.188e-22	-21.144	-21.087	0.058
CrOHCl2	2.283e-24	2.607e-24	-23.641	-23.584	0.058
CuCl3-	1.092e-24	7.043e-25	-23.962	-24.152	-0.191
CuCl4-2	7.301e-27	1.532e-27	-26.137	-26.815	-0.678
CrCl+2	6.449e-29	1.957e-29	-28.191	-28.708	-0.518
CrCl2+	1.142e-30	8.477e-31	-29.942	-30.072	-0.129
VOCl+	2.185e-32	1.622e-32	-31.660	-31.790	-0.129
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-40.016	-40.534	-0.518
CrO3Cl-	0.000e+00	0.000e+00	-40.622	-40.752	-0.129
Cr(2)	1.069e-30				
Cr+2	1.069e-30	3.243e-31	-29.971	-30.489	-0.518
Cr(3)	2.440e-06				
CrO2-	1.755e-06	1.303e-06	-5.756	-5.885	-0.129
Cr(OH)4-	6.680e-07	4.958e-07	-6.175	-6.305	-0.129
Cr(OH)3	1.631e-08	1.862e-08	-7.788	-7.730	0.058
Cr(OH)2+	1.213e-13	9.006e-14	-12.916	-13.045	-0.129
Cr(OH)+2	4.437e-20	1.346e-20	-19.353	-19.871	-0.518
CrOHSO4	1.182e-20	1.349e-20	-19.928	-19.870	0.058
Cr(NH3)4(OH)2+	1.102e-23	8.175e-24	-22.958	-23.087	-0.129
CrOHCl2	2.283e-24	2.607e-24	-23.641	-23.584	0.058
Cr+3	2.586e-27	1.767e-28	-26.587	-27.753	-1.165
CrCl+2	6.449e-29	1.957e-29	-28.191	-28.708	-0.518
CrSO4+	7.196e-30	5.341e-30	-29.143	-29.272	-0.129
CrCl2+	1.142e-30	8.477e-31	-29.942	-30.072	-0.129
Cr(NH3)5OH+2	3.315e-31	1.006e-31	-30.480	-30.998	-0.518
Cr2(OH)2SO4+2	1.088e-37	3.302e-38	-36.963	-37.481	-0.518
Cr(NH3)6+3	2.406e-40	0.000e+00	-39.619	-40.784	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-40.016	-40.534	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-41.821	-41.763	0.058
CrNO3+2	0.000e+00	0.000e+00	-73.498	-74.016	-0.518
Cr(6)	1.851e-22				
CrO4-2	1.344e-22	2.321e-23	-21.872	-22.634	-0.763
NaCrO4-	4.960e-23	3.681e-23	-22.305	-22.434	-0.129
KCrO4-	1.085e-24	8.052e-25	-23.965	-24.094	-0.129
HCrO4-	3.357e-29	2.492e-29	-28.474	-28.604	-0.129
CrO3Cl-	0.000e+00	0.000e+00	-40.622	-40.752	-0.129
CrO3SO4-2	0.000e+00	0.000e+00	-40.676	-41.193	-0.518
H2CrO4	0.000e+00	0.000e+00	-41.946	-41.889	0.058
Cr2O7-2	0.000e+00	0.000e+00	-55.008	-55.526	-0.518
Cu(1)	3.019e-08				

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CuCl3-2	1.752e-08	3.676e-09	-7.756	-8.435	-0.678
CuCl2-	1.267e-08	8.170e-09	-7.897	-8.088	-0.191
Cu+	4.905e-13	2.859e-13	-12.309	-12.544	-0.234
Cu(2)	2.915e-09				
Cu(OH)2	1.809e-09	2.066e-09	-8.742	-8.685	0.058
Cu(OH)4-2	6.365e-10	1.931e-10	-9.196	-9.714	-0.518
Cu(OH)3-	4.687e-10	3.479e-10	-9.329	-9.459	-0.129
CuOH+	5.500e-16	3.545e-16	-15.260	-15.450	-0.191
CuCO3	1.511e-18	1.725e-18	-17.821	-17.763	0.058
Cu(CO3)2-2	1.808e-19	5.486e-20	-18.743	-19.261	-0.518
Cu+2	1.101e-19	1.271e-20	-18.958	-19.896	-0.938
CuCl+	9.018e-21	5.814e-21	-20.045	-20.236	-0.191
CuSO4	4.657e-21	5.316e-21	-20.332	-20.274	0.058
CuCl2	7.172e-22	8.188e-22	-21.144	-21.087	0.058
CuHCO3+	1.525e-24	1.132e-24	-23.817	-23.946	-0.129
CuCl3-	1.092e-24	7.043e-25	-23.962	-24.152	-0.191
Cu2(OH)2+2	5.858e-26	1.777e-26	-25.232	-25.750	-0.518
CuCl4-2	7.301e-27	1.532e-27	-26.137	-26.815	-0.678
Cu(S4)2-3	0.000e+00	0.000e+00	-67.606	-68.116	-0.510
CuS4S5-3	0.000e+00	0.000e+00	-68.371	-68.846	-0.475
Cu(HS)3-	0.000e+00	0.000e+00	-119.669	-119.799	-0.129
H(0)	3.917e-19				
H2	1.958e-19	2.236e-19	-18.708	-18.651	0.058
K	9.021e-03				
K+	8.918e-03	5.510e-03	-2.050	-2.259	-0.209
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
KCrO4-	1.085e-24	8.052e-25	-23.965	-24.094	-0.129
Mg	2.927e-02				
Mg+2	1.519e-02	5.188e-03	-1.818	-2.285	-0.467
MgOH+	1.235e-02	8.836e-03	-1.908	-2.054	-0.145
MgSO4	1.636e-03	1.868e-03	-2.786	-2.729	0.058
MgCO3	9.258e-05	1.057e-04	-4.033	-3.976	0.058
MgHCO3+	2.104e-08	1.357e-08	-7.677	-7.868	-0.191
N(-3)	2.013e-05				
NH3	2.007e-05	2.291e-05	-4.697	-4.640	0.058
NH4+	5.436e-08	3.169e-08	-7.265	-7.499	-0.234
NH4SO4-	1.336e-09	9.043e-10	-8.874	-9.044	-0.170
Cr(NH3)4(OH)2+	1.102e-23	8.175e-24	-22.958	-23.087	-0.129
Cr(NH3)5OH+2	3.315e-31	1.006e-31	-30.480	-30.998	-0.518
Cr(NH3)6+3	2.406e-40	0.000e+00	-39.619	-40.784	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-40.016	-40.534	-0.518
N(3)	4.520e-31				
NO2-	4.520e-31	3.354e-31	-30.345	-30.474	-0.129
N(5)	0.000e+00				
NO3-	0.000e+00	0.000e+00	-44.509	-44.726	-0.218
CdNO3+	0.000e+00	0.000e+00	-57.807	-57.936	-0.129
PbNO3+	0.000e+00	0.000e+00	-62.513	-62.642	-0.129
CrNO3+2	0.000e+00	0.000e+00	-73.498	-74.016	-0.518

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VO2NO3	0.000e+00	0.000e+00	-74.026	-73.968	0.058
Na	4.531e-01				
Na+	4.482e-01	3.191e-01	-0.349	-0.496	-0.148
NaSO4-	4.791e-03	3.297e-03	-2.320	-2.482	-0.162
NaCO3-	1.223e-04	8.417e-05	-3.912	-4.075	-0.162
NaHCO3	2.992e-08	3.415e-08	-7.524	-7.467	0.058
NaCrO4-	4.960e-23	3.681e-23	-22.305	-22.434	-0.129
Ni	1.043e-07				
Ni(OH)3-	1.020e-07	7.568e-08	-6.992	-7.121	-0.129
Ni(OH)2	2.377e-09	2.714e-09	-8.624	-8.566	0.058
NiOH+	8.134e-13	6.037e-13	-12.090	-12.219	-0.129
NiCO3	5.726e-13	6.536e-13	-12.242	-12.185	0.058
Ni(CO3)2-2	9.458e-14	2.870e-14	-13.024	-13.542	-0.518
Ni+2	1.150e-14	3.490e-15	-13.939	-14.457	-0.518
NiCl+	3.495e-15	2.594e-15	-14.457	-14.586	-0.129
NiCl2	2.452e-15	2.800e-15	-14.610	-14.553	0.058
NiSO4	1.197e-15	1.367e-15	-14.922	-14.864	0.058
Ni(SO4)2-2	5.912e-19	1.794e-19	-18.228	-18.746	-0.518
NiHCO3+	1.235e-19	9.169e-20	-18.908	-19.038	-0.129
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-58.824	-58.766	0.058
Pb	3.484e-09				
Pb(OH)4-2	3.271e-09	9.926e-10	-8.485	-9.003	-0.518
Pb(OH)3-	2.089e-10	1.550e-10	-9.680	-9.810	-0.129
Pb(OH)2	4.241e-12	4.842e-12	-11.373	-11.315	0.058
PbOH+	6.013e-15	4.463e-15	-14.221	-14.350	-0.129
PbCO3	3.157e-17	3.604e-17	-16.501	-16.443	0.058
Pb(CO3)2-2	7.537e-18	2.287e-18	-17.123	-17.641	-0.518
PbCl+	9.848e-19	7.309e-19	-18.007	-18.136	-0.129
PbCl2	3.722e-19	4.249e-19	-18.429	-18.372	0.058
Pb+2	2.705e-19	8.208e-20	-18.568	-19.086	-0.518
PbCl3-	1.254e-19	9.310e-20	-18.902	-19.031	-0.129
PbSO4	8.957e-20	1.023e-19	-19.048	-18.990	0.058
PbCl4-2	3.999e-20	1.213e-20	-19.398	-19.916	-0.518
Pb(SO4)2-2	3.918e-21	1.189e-21	-20.407	-20.925	-0.518
PbHCO3+	1.560e-23	1.158e-23	-22.807	-22.936	-0.129
Pb2OH+3	1.200e-31	8.201e-33	-30.921	-32.086	-1.165
Pb3(OH)4+2	2.636e-32	7.998e-33	-31.579	-32.097	-0.518
PbNO3+	0.000e+00	0.000e+00	-62.513	-62.642	-0.129
Pb(HS)2	0.000e+00	0.000e+00	-87.741	-87.684	0.058
Pb(HS)3-	0.000e+00	0.000e+00	-128.188	-128.318	-0.129
S(-2)	1.965e-38				
S5-2	1.520e-39	4.612e-40	-38.818	-39.336	-0.518
S6-2	1.432e-39	4.346e-40	-38.844	-39.362	-0.518
S4-2	8.643e-40	2.622e-40	-39.063	-39.581	-0.518
HS-	0.000e+00	0.000e+00	-41.731	-41.934	-0.203
S-2	0.000e+00	0.000e+00	-42.059	-42.737	-0.678
S3-2	0.000e+00	0.000e+00	-42.536	-43.054	-0.518

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S2-2	0.000e+00	0.000e+00	-43.810	-44.328	-0.518
CdHS+	0.000e+00	0.000e+00	-45.389	-45.518	-0.129
H2S	0.000e+00	0.000e+00	-47.345	-47.287	0.058
Cu(S4)2-3	0.000e+00	0.000e+00	-67.606	-68.116	-0.510
CuS4S5-3	0.000e+00	0.000e+00	-68.371	-68.846	-0.475
Cd(HS)2	0.000e+00	0.000e+00	-81.150	-81.092	0.058
Zn(HS)2	0.000e+00	0.000e+00	-85.402	-85.345	0.058
Pb(HS)2	0.000e+00	0.000e+00	-87.741	-87.684	0.058
Cu(HS)3-	0.000e+00	0.000e+00	-119.669	-119.799	-0.129
Cd(HS)3-	0.000e+00	0.000e+00	-120.717	-120.846	-0.129
Zn(HS)3-	0.000e+00	0.000e+00	-125.989	-126.119	-0.129
Pb(HS)3-	0.000e+00	0.000e+00	-128.188	-128.318	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-160.072	-160.590	-0.518
S(6)	2.169e-02				
SO4-2	1.352e-02	2.215e-03	-1.869	-2.655	-0.786
NaSO4-	4.791e-03	3.297e-03	-2.320	-2.482	-0.162
MgSO4	1.636e-03	1.868e-03	-2.786	-2.729	0.058
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
NH4SO4-	1.336e-09	9.043e-10	-8.874	-9.044	-0.170
HSO4-	8.495e-14	5.620e-14	-13.071	-13.250	-0.179
CdSO4	9.190e-15	1.049e-14	-14.037	-13.979	0.058
NiSO4	1.197e-15	1.367e-15	-14.922	-14.864	0.058
Cd(SO4)2-2	9.005e-16	2.732e-16	-15.046	-15.563	-0.518
ZnSO4	1.597e-17	1.823e-17	-16.797	-16.739	0.058
Zn(SO4)2-2	1.181e-18	3.583e-19	-17.928	-18.446	-0.518
Ni(SO4)2-2	5.912e-19	1.794e-19	-18.228	-18.746	-0.518
PbSO4	8.957e-20	1.023e-19	-19.048	-18.990	0.058
CrOHSO4	1.182e-20	1.349e-20	-19.928	-19.870	0.058
CuSO4	4.657e-21	5.316e-21	-20.332	-20.274	0.058
Pb(SO4)2-2	3.918e-21	1.189e-21	-20.407	-20.925	-0.518
CrSO4+	7.196e-30	5.341e-30	-29.143	-29.272	-0.129
VO2SO4-	2.360e-30	1.752e-30	-29.627	-29.757	-0.129
AlSO4+	9.203e-32	6.087e-32	-31.036	-31.216	-0.179
VOSO4	2.248e-32	2.566e-32	-31.648	-31.591	0.058
Al(SO4)2-	1.549e-32	1.025e-32	-31.810	-31.989	-0.179
Cr2(OH)2SO4+2	1.088e-37	3.302e-38	-36.963	-37.481	-0.518
CrO3SO4-2	0.000e+00	0.000e+00	-40.676	-41.193	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-41.821	-41.763	0.058
VSO4+	0.000e+00	0.000e+00	-46.490	-46.620	-0.129
V(2)	5.354e-39				
VOH+	5.354e-39	3.974e-39	-38.271	-38.401	-0.129
V+2	0.000e+00	0.000e+00	-44.688	-45.206	-0.518
V(3)	7.134e-20				
V(OH)3	7.134e-20	8.144e-20	-19.147	-19.089	0.058
V(OH)2+	6.095e-27	4.523e-27	-26.215	-26.345	-0.129
VOH+2	9.920e-36	3.010e-36	-35.004	-35.521	-0.518
V+3	0.000e+00	0.000e+00	-44.240	-45.405	-1.165



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VSO4+	0.000e+00	0.000e+00	-46.490	-46.620	-0.129
V2(OH)3+3	0.000e+00	0.000e+00	-59.809	-60.974	-1.165
V2(OH)2+4	0.000e+00	0.000e+00	-67.598	-69.670	-2.072
V(4)	4.122e-25				
V(OH)3+	4.122e-25	3.059e-25	-24.385	-24.514	-0.129
VO+2	1.721e-31	5.223e-32	-30.764	-31.282	-0.518
VOSO4	2.248e-32	2.566e-32	-31.648	-31.591	0.058
VOCI+	2.185e-32	1.622e-32	-31.660	-31.790	-0.129
H2V2O4+2	0.000e+00	0.000e+00	-43.596	-44.113	-0.518
V(5)	4.636e-07				
HVO4-2	3.034e-07	9.207e-08	-6.518	-7.036	-0.518
VO4-3	1.599e-07	1.093e-08	-6.796	-7.962	-1.165
V2O7-4	1.156e-10	9.797e-13	-9.937	-12.009	-2.072
HV2O7-3	2.908e-11	1.987e-12	-10.536	-11.702	-1.165
H2VO4-	6.329e-12	4.697e-12	-11.199	-11.328	-0.129
H3VO4	9.352e-21	1.068e-20	-20.029	-19.972	0.058
H3V2O7-	1.126e-24	8.358e-25	-23.948	-24.078	-0.129
V3O9-3	3.504e-27	2.394e-28	-26.455	-27.621	-1.165
VO2+	2.077e-29	1.542e-29	-28.683	-28.812	-0.129
VO2SO4-	2.360e-30	1.752e-30	-29.627	-29.757	-0.129
V4O12-4	4.240e-35	3.593e-37	-34.373	-36.445	-2.072
VO2NO3	0.000e+00	0.000e+00	-74.026	-73.968	0.058
V10O28-6	0.000e+00	0.000e+00	-101.801	-106.463	-4.662
HV10O28-5	0.000e+00	0.000e+00	-110.101	-113.338	-3.237
H2V10O28-4	0.000e+00	0.000e+00	-119.477	-121.549	-2.072
Zn	9.624e-08				
Zn(OH)4-2	4.828e-08	1.465e-08	-7.316	-7.834	-0.518
Zn(OH)3-	4.466e-08	3.315e-08	-7.350	-7.480	-0.129
Zn(OH)2	3.293e-09	3.759e-09	-8.482	-8.425	0.058
ZnOHCl	9.190e-13	1.049e-12	-12.037	-11.979	0.058
ZnOH+	6.659e-14	4.942e-14	-13.177	-13.306	-0.129
Zn(CO3)2-2	3.438e-16	1.043e-16	-15.464	-15.982	-0.518
ZnCO3	1.692e-16	1.931e-16	-15.772	-15.714	0.058
Zn+2	1.563e-16	3.831e-17	-15.806	-16.417	-0.611
ZnCl+	2.872e-17	1.852e-17	-16.542	-16.732	-0.191
ZnSO4	1.597e-17	1.823e-17	-16.797	-16.739	0.058
ZnCl2	4.812e-18	5.493e-18	-17.318	-17.260	0.058
ZnCl3-	2.648e-18	1.707e-18	-17.577	-17.768	-0.191
Zn(SO4)2-2	1.181e-18	3.583e-19	-17.928	-18.446	-0.518
ZnCl4-2	1.103e-18	2.313e-19	-17.958	-18.636	-0.678
ZnHCO3+	1.154e-21	8.567e-22	-20.938	-21.067	-0.129
Zn(HS)2	0.000e+00	0.000e+00	-85.402	-85.345	0.058
Zn(HS)3-	0.000e+00	0.000e+00	-125.989	-126.119	-0.129

-----Saturation indices-----

Phase            SI log IAP   log KT

(NH<sub>4</sub>)<sub>2</sub>CrO<sub>4</sub> -37.98 32.62 70.60 (NH<sub>4</sub>)<sub>2</sub>CrO<sub>4</sub>  
 Al(OH)<sub>3</sub>(a) -5.32 5.82 11.14 Al(OH)<sub>3</sub>  
 Al<sub>2</sub>O<sub>3</sub> -11.33 11.65 22.98 Al<sub>2</sub>O<sub>3</sub>  
 Al<sub>4</sub>(OH)<sub>10</sub>SO<sub>4</sub> -26.98 -4.28 22.70 Al<sub>4</sub>(OH)<sub>10</sub>SO<sub>4</sub>  
 AlAsO<sub>4</sub>:2H<sub>2</sub>O -24.75 -19.95 4.80 AlAsO<sub>4</sub>:2H<sub>2</sub>O  
 AlOHSO<sub>4</sub> -18.50 -21.73 -3.23 AlOHSO<sub>4</sub>  
 AlumK -33.81 -39.18 -5.37 KAl(SO<sub>4</sub>)<sub>2</sub>:12H<sub>2</sub>O  
 Alunite -26.00 -27.46 -1.46 KAl<sub>3</sub>(SO<sub>4</sub>)<sub>2</sub>(OH)<sub>6</sub>  
 Anglesite -13.89 -21.74 -7.85 PbSO<sub>4</sub>  
 Anhydrite -0.47 -5.00 -4.53 CaSO<sub>4</sub>  
 Anilite -20.17 -92.62 -72.45 Cu<sub>0.25</sub>Cu<sub>1.5</sub>S  
 Antlerite -20.85 -12.56 8.29 Cu<sub>3</sub>(OH)<sub>4</sub>SO<sub>4</sub>  
 Aragonite 1.33 -6.94 -8.27 CaCO<sub>3</sub>  
 Arsenolite -80.89 -165.23 -84.34 As<sub>4</sub>O<sub>6</sub>  
 Artinite 5.30 15.70 10.40 MgCO<sub>3</sub>:Mg(OH)<sub>2</sub>:3H<sub>2</sub>O  
 As<sub>2</sub>O<sub>5</sub> -58.38 -51.53 6.85 As<sub>2</sub>O<sub>5</sub>  
 Atacamite -10.85 -2.98 7.86 Cu<sub>2</sub>(OH)<sub>3</sub>Cl  
 Azurite -27.74 -43.99 -16.26 Cu<sub>3</sub>(OH)<sub>2</sub>(CO<sub>3</sub>)<sub>2</sub>  
 Ba<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub> 11.84 2.85 -8.98 Ba<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>  
 BaCrO<sub>4</sub> -19.56 40.85 60.41 BaCrO<sub>4</sub>  
 Barite 0.73 -9.43 -10.15 BaSO<sub>4</sub>  
 Bianchite -17.36 -19.12 -1.76 ZnSO<sub>4</sub>:6H<sub>2</sub>O  
 Blaubleil -25.73 -85.77 -60.04 Cu<sub>0.9</sub>Cu<sub>0.2</sub>S  
 Blaubleill -24.17 -88.93 -64.76 Cu<sub>0.6</sub>Cu<sub>0.8</sub>S  
 Boehmite -3.54 5.82 9.36 AlOOH  
 Brochantite -22.91 -7.57 15.34 Cu<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub>  
 Brucite 5.09 22.61 17.51 Mg(OH)<sub>2</sub>  
 Bunsenite -2.68 10.44 13.12 NiO  
 Ca<sub>2</sub>V<sub>2</sub>O<sub>7</sub> -3.09 6.19 9.28 CaVO<sub>3.5</sub>  
 Ca<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:6H<sub>2</sub>O -6.21 16.09 22.30 Ca<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:6H<sub>2</sub>O  
 Ca<sub>3</sub>(VO<sub>4</sub>)<sub>2</sub> -2.99 17.47 20.46 Ca<sub>1.5</sub>VO<sub>4</sub>  
 Ca\_Vanadate -8.20 -5.08 3.11 Ca<sub>0.5</sub>VO<sub>3</sub>  
 CaCrO<sub>4</sub> -22.89 45.28 68.17 CaCrO<sub>4</sub>  
 Calcite 1.48 -6.94 -8.42 CaCO<sub>3</sub>  
 Cd(BO<sub>2</sub>)<sub>2</sub> -12.68 -2.84 9.84 Cd(BO<sub>2</sub>)<sub>2</sub>  
 Cd(Gamma) -18.50 -4.40 14.10 Cd  
 Cd(OH)<sub>2</sub>(A) -3.17 11.14 14.31 Cd(OH)<sub>2</sub>  
 Cd(OH)<sub>2</sub>(C) -2.51 11.14 13.65 Cd(OH)<sub>2</sub>  
 Cd<sub>3</sub>(OH)<sub>2</sub>(SO<sub>4</sub>)<sub>2</sub> -28.39 -21.68 6.71 Cd<sub>3</sub>(OH)<sub>2</sub>(SO<sub>4</sub>)<sub>2</sub>  
 Cd<sub>3</sub>(OH)<sub>4</sub>SO<sub>4</sub> -16.70 5.86 22.56 Cd<sub>3</sub>(OH)<sub>4</sub>SO<sub>4</sub>  
 Cd<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub> -11.40 17.00 28.40 Cd<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub>  
 CdCl<sub>2</sub> -14.26 -14.81 -0.55 CdCl<sub>2</sub>  
 CdCl<sub>2</sub>:2.5H<sub>2</sub>O -12.84 -14.83 -1.99 CdCl<sub>2</sub>:2.5H<sub>2</sub>O  
 CdCl<sub>2</sub>:H<sub>2</sub>O -13.16 -14.82 -1.66 CdCl<sub>2</sub>:H<sub>2</sub>O  
 CdMetal -18.39 -4.40 13.99 Cd  
 CdOHCl -5.56 -1.84 3.73 CdOHCl  
 CdSO<sub>4</sub> -16.72 -16.41 0.31 CdSO<sub>4</sub>  
 CdSO<sub>4</sub>:2.67H<sub>2</sub>O -14.68 -16.43 -1.75 CdSO<sub>4</sub>:2.67H<sub>2</sub>O

CdSO4:H2O	-14.97	-16.42	-1.45	CdSO4:H2O
Cerrusite	-10.42	-23.68	-13.27	PbCO3
CH4(g)	-49.87	-91.68	-41.81	CH4
Chalcanthite	-19.91	-22.59	-2.68	CuSO4:5H2O
Chalcocite	-18.57	-95.26	-76.69	Cu2S
Claudetite	-80.65	-165.23	-84.57	As4O6
CO2(g)	-11.32	-29.50	-18.17	CO2
Cotunnite	-15.21	-20.14	-4.93	PbCl2
Covellite	-25.67	-84.72	-59.05	CuS
Cr(OH)2	-16.66	-8.37	8.29	Cr(OH)2
Cr(OH)3(A)	0.15	-0.60	-0.75	Cr(OH)3
Cr(OH)3(C)	-2.50	-0.60	1.90	Cr(OH)3
Cr2O3	1.88	-1.18	-3.05	Cr2O3
CrCl2	-47.96	-34.31	13.65	CrCl2
CrCl3	-53.80	-39.52	14.28	CrCl3
CrMetal	-54.34	-23.90	30.43	Cr
CrO3	-44.36	22.72	67.08	CrO3
Cu(OH)2	-4.07	5.00	9.07	Cu(OH)2
Cu2(OH)3NO3	-56.91	77.13	134.03	Cu2(OH)3NO3
Cu2SO4	-25.92	-33.09	-7.17	Cu2SO4
Cu3(AsO4)2:6H2O	-42.67	-36.57	6.10	Cu3(AsO4)2:6H2O
CuCO3	-14.86	-24.49	-9.63	CuCO3
CuCrO4	-37.05	27.73	64.78	CuCrO4
CuMetal	1.37	-10.54	-11.91	Cu
CuOCuSO4	-30.07	-17.55	12.53	CuO:CuSO4
Cuprite	1.54	-5.54	-7.07	Cu2O
CuSO4	-26.07	-22.55	3.52	CuSO4
Diaspore	-1.74	5.82	7.56	AlOOH
Djurleite	-18.97	-94.56	-75.60	Cu0.066Cu1.868S
Dolomite	2.95	-13.82	-16.77	CaMg(CO3)2
Epsomite	-2.77	-4.99	-2.22	MgSO4:7H2O
Galena	-32.89	-83.91	-51.02	PbS
Gibbsite(C)	-3.59	5.82	9.41	Al(OH)3
Goslarite	-17.07	-19.12	-2.05	ZnSO4:7H2O
Greenockite	-26.85	-78.58	-51.73	CdS
Gypsum	-0.16	-5.01	-4.86	CaSO4:2H2O
Halite	-2.58	-1.02	1.56	NaCl
Huntite	1.66	-27.59	-29.25	CaMg3(CO3)4
Hydcerrusite	-24.10	-41.56	-17.46	Pb(OH)2:2PbCO3
Hydromagnesite	2.35	-4.95	-7.31	Mg5(CO3)4(OH)2:4H2O
K2Cr2O7	-58.51	65.83	124.34	K2Cr2O7
K2CrO4	-27.04	43.11	70.15	K2CrO4
Langite	-25.47	-7.57	17.90	Cu4(OH)6SO4:H2O
Larnakite	-15.83	-15.93	-0.10	PbO:PbSO4
Laurionite	-7.79	-7.17	0.62	PbOHCl
Lime	-11.53	22.56	34.09	CaO
Litharge	-7.37	5.81	13.18	PbO
Magnesite	0.97	-6.88	-7.86	MgCO3

Malachite	-14.75	-19.50	-4.74	Cu <sub>2</sub> (OH) <sub>2</sub> CO <sub>3</sub>
Massicot	-7.57	5.81	13.38	PbO
Melanothallite	-25.03	-20.95	4.07	CuCl <sub>2</sub>
Mg <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-7.78	6.25	14.03	MgVO <sub>3.5</sub>
Mg_Vanadate	-11.15	-5.06	6.10	Mg <sub>0.5</sub> VO <sub>3</sub>
MgCr <sub>2</sub> O <sub>4</sub>	8.24	21.44	13.19	MgCr <sub>2</sub> O <sub>4</sub>
MgCrO <sub>4</sub>	-30.89	45.34	76.23	MgCrO <sub>4</sub>
Millerite	-35.83	-79.28	-43.45	NiS
Minium	-43.58	32.98	76.56	Pb <sub>3</sub> O <sub>4</sub>
Mirabilite	-2.08	-3.72	-1.65	Na <sub>2</sub> SO <sub>4</sub> :10H <sub>2</sub> O
Monteponite	-4.67	11.14	15.81	CdO
Morenosite	-14.72	-17.17	-2.44	NiSO <sub>4</sub> :7H <sub>2</sub> O
Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-61.12	69.36	130.47	Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
Na <sub>2</sub> CrO <sub>4</sub>	-27.02	46.63	73.65	Na <sub>2</sub> CrO <sub>4</sub>
Na <sub>3</sub> VO <sub>4</sub>	-18.69	19.50	38.18	Na <sub>3</sub> VO <sub>4</sub>
Na <sub>4</sub> V <sub>2</sub> O <sub>7</sub>	-11.83	7.54	19.37	Na <sub>2</sub> VO <sub>3.5</sub>
Na_Vanadate	-8.32	-4.41	3.91	NaVO <sub>3</sub>
Nantokite	-6.03	-15.75	-9.71	CuCl
Natron	-3.91	-5.67	-1.75	Na <sub>2</sub> CO <sub>3</sub> :10H <sub>2</sub> O
Nesquehonite	-1.45	-6.91	-5.46	MgCO <sub>3</sub> :3H <sub>2</sub> O
NH <sub>4</sub> VO <sub>3</sub>	-14.21	-11.41	2.80	NH <sub>4</sub> VO <sub>3</sub>
Ni(OH) <sub>2</sub>	0.49	10.43	9.95	Ni(OH) <sub>2</sub>
Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-35.97	-20.27	15.70	Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-17.81	14.19	32.00	Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
NiCO <sub>3</sub>	-12.49	-19.05	-6.56	NiCO <sub>3</sub>
O <sub>2</sub> (g)	-55.78	31.08	86.86	O <sub>2</sub>
Oripment	-141.89	-351.78	-209.88	As <sub>2</sub> S <sub>3</sub>
Otavite	-4.63	-18.35	-13.72	CdCO <sub>3</sub>
Pb(BO <sub>2</sub> ) <sub>2</sub>	-15.95	-8.17	7.77	Pb(BO <sub>2</sub> ) <sub>2</sub>
Pb(OH) <sub>2</sub> (C)	-2.74	5.81	8.54	Pb(OH) <sub>2</sub>
Pb <sub>2</sub> (OH) <sub>3</sub> Cl	-10.16	-1.36	8.79	Pb <sub>2</sub> (OH) <sub>3</sub> Cl
Pb <sub>2</sub> O(OH) <sub>2</sub>	-14.58	11.62	26.20	Pb <sub>2</sub> O(OH) <sub>2</sub>
Pb <sub>2</sub> O <sub>3</sub>	-33.87	27.17	61.04	Pb <sub>2</sub> O <sub>3</sub>
Pb <sub>2</sub> OCO <sub>3</sub>	-17.69	-17.87	-0.18	Pb <sub>2</sub> OCO <sub>3</sub>
Pb <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-9.69	-10.55	-0.86	PbVO <sub>3.5</sub>
Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>	-39.89	-34.09	5.80	Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>
Pb <sub>3</sub> (VO <sub>4</sub> ) <sub>2</sub>	-10.96	-7.64	3.31	Pb <sub>1.5</sub> VO <sub>4</sub>
Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>	-23.82	-12.06	11.76	Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>
Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>	-21.10	-10.12	10.98	Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>
Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-25.43	-4.33	21.10	Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>	-27.38	-4.30	23.08	Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>
PbCrO <sub>4</sub>	-27.75	28.54	56.29	PbCrO <sub>4</sub>
PbMetal	-13.99	-9.73	4.26	Pb
PbO:0.3H <sub>2</sub> O	-7.17	5.81	12.98	PbO:0.33H <sub>2</sub> O
Periclase	0.09	22.61	22.52	MgO
Phosgenite	-24.01	-43.82	-19.81	PbCl <sub>2</sub> :PbCO <sub>3</sub>
Plattnerite	-29.92	21.35	51.28	PbO <sub>2</sub>
Portlandite	-0.98	22.55	23.53	Ca(OH) <sub>2</sub>

Realgar	-62.57	-138.80	-76.23	AsS
Retgersite	-15.09	-17.16	-2.07	NiSO4:6H2O
Smithsonite	-11.14	-21.01	-9.88	ZnCO3
Sphalerite	-34.05	-81.24	-47.19	ZnS
Spinel	-4.56	34.27	38.83	MgAl2O4
SULFUR	-36.84	-74.18	-37.33	S
Tenorite	-3.04	5.00	8.05	CuO
Thenardite	-3.48	-3.65	-0.16	Na2SO4
Thermonatrite	-5.80	-5.60	0.20	Na2CO3:H2O
V(OH)3	-15.72	-31.92	-16.20	V(OH)3
V2O3	-13.51	-31.90	-18.40	VO1.5
V2O4	-11.05	-24.13	-13.09	VO2
V2O5	-15.76	-16.36	-0.60	VO2.5
V3O5	-37.22	-87.94	-50.72	V3O5
V4O7	-49.31	-112.08	-62.77	V4O7
V6O13	-66.59	-129.26	-62.68	V6O13
VCl2	-60.75	-65.63	-4.88	VCl2
VCl3	-69.95	-70.84	-0.89	VCl3
VMetal	-75.48	-55.22	20.26	V
VO	-29.69	-39.68	-9.98	VO
VO(OH)2	-12.24	-24.14	-11.90	VO(OH)2
VO2Cl	-32.42	-29.34	3.08	VO2Cl
VOCl	-31.18	-44.88	-13.71	VOCl
VOCl2	-45.92	-50.09	-4.17	VOCl2
VOSO4(C)	-38.09	-51.69	-13.60	VOSO4
Witherite	-2.77	-11.37	-8.60	BaCO3
Wurtzite	-36.07	-81.24	-45.17	ZnS
Zincite	-3.27	8.48	11.75	ZnO
Zincosite	-22.62	-19.07	3.55	ZnSO4
Zn(BO2)2	-13.80	-5.51	8.29	Zn(BO2)2
Zn(NO3)2:6H2O	-109.20	142.70	251.90	Zn(NO3)2:6H2O
Zn(OH)2(A)	-3.98	8.47	12.45	Zn(OH)2
Zn(OH)2(B)	-3.28	8.47	11.75	Zn(OH)2
Zn(OH)2(C)	-3.73	8.47	12.20	Zn(OH)2
Zn(OH)2(E)	-3.03	8.47	11.50	Zn(OH)2
Zn(OH)2(G)	-3.24	8.47	11.71	Zn(OH)2
Zn2(OH)2SO4	-18.10	-10.60	7.50	Zn2(OH)2SO4
Zn2(OH)3Cl	-11.23	3.97	15.20	Zn2(OH)3Cl
Zn3(AsO4)2:2.5H2O	-39.75	-26.10	13.65	Zn3(AsO4)2:2.5H2O
Zn3O(SO4)2	-50.42	-29.66	20.75	Zn3O(SO4)2
Zn4(OH)6SO4	-22.05	6.35	28.40	Zn4(OH)6SO4
Zn5(OH)8Cl2	-22.08	16.42	38.50	Zn5(OH)8Cl2
ZnCl2	-24.99	-17.47	7.52	ZnCl2
ZnCO3:H2O	-10.76	-21.02	-10.26	ZnCO3:H2O
ZnMetal	-33.85	-7.06	26.79	Zn
ZnO(Active)	-2.83	8.48	11.31	ZnO
ZnS(A)	-36.74	-81.24	-44.50	ZnS
ZnSO4:H2O	-18.81	-19.08	-0.27	ZnSO4:H2O

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End of simulation.  
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Reading input data for simulation 2.  
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End of run.  
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No memory leaks

Database file: minteq.dat

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Reading data base.  
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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH310a Low  
SOLUTION 1  
pH 10.05 charge  
temp 14.04  
pe -3.26  
units mg/L  
Al 0.0422  
As 0.00163 as H3AsO4  
Ba 0.109  
B 2.360  
Cd 0.00013  
Ca 717  
C 26.3  
Cl 16500  
Cu 0.00204  
Cr 0.123  
Pb 0.0007  
Mg 690  
Ni 0.00594  
N 0.82 as N03-  
K 342  
Na 10100  
S 2020 as SO4-2  
V 0.0229  
Zn 0.0061  
END

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TITLE  
-----

BH310a Low

-----  
 Beginning of initial solution calculations.  
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Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.613e-06	1.613e-06
As	1.184e-08	1.184e-08
B	2.252e-04	2.252e-04
Ba	8.185e-07	8.185e-07
C	4.445e-04	4.445e-04
Ca	1.845e-02	1.845e-02
Cd	1.193e-09	1.193e-09
Cl	4.800e-01	4.800e-01
Cr	2.440e-06	2.440e-06
Cu	3.311e-08	3.311e-08
K	9.021e-03	9.021e-03
Mg	2.927e-02	2.927e-02
N	2.013e-05	2.013e-05
Na	4.531e-01	4.531e-01
Ni	1.043e-07	1.043e-07
Pb	3.484e-09	3.484e-09
S	2.169e-02	2.169e-02
V	4.636e-07	4.636e-07
Zn	9.624e-08	9.624e-08

-----Description of solution-----

pH = 12.453    Charge balance  
 pe = -3.260  
 Activity of water = 0.983  
 Ionic strength = 5.752e-01  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 3.422e-02  
 Total CO2 (mol/kg) = 4.445e-04  
 Temperature (deg C) = 14.040  
 Electrical balance (eq) = -7.677e-14  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = -0.00  
 Iterations = 11  
 Total H = 1.110460e+02  
 Total O = 5.562806e+01

-----Distribution of species-----



Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	1.894e-02	1.186e-02	-1.723	-1.926	-0.203
H+	4.619e-13	3.524e-13	-12.335	-12.453	-0.118
H2O	5.551e+01	9.826e-01	-0.008	-0.008	0.000
Al	1.613e-06				
Al(OH)4-	1.613e-06	1.067e-06	-5.792	-5.972	-0.179
Al(OH)3	5.725e-11	6.535e-11	-10.242	-10.185	0.058
Al(OH)2+	2.706e-17	1.862e-17	-16.568	-16.730	-0.162
AlOH+2	1.783e-24	3.996e-25	-23.749	-24.398	-0.649
Al+3	3.443e-31	3.014e-32	-30.463	-31.521	-1.058
AlSO4+	9.203e-32	6.087e-32	-31.036	-31.216	-0.179
Al(SO4)2-	1.549e-32	1.025e-32	-31.810	-31.989	-0.179
As(3)	1.091e-20				
HAsO3-2	6.705e-21	2.034e-21	-20.174	-20.692	-0.518
AsO3-3	2.206e-21	1.507e-22	-20.656	-21.822	-1.165
H2AsO3-	1.998e-21	1.483e-21	-20.699	-20.829	-0.129
H3AsO3	1.181e-24	1.348e-24	-23.928	-23.870	0.058
H4AsO3+	3.170e-37	2.353e-37	-36.499	-36.628	-0.129
As(5)	1.184e-08				
AsO4-3	1.137e-08	7.770e-10	-7.944	-9.110	-1.165
HAsO4-2	4.711e-10	1.429e-10	-9.327	-9.845	-0.518
H2AsO4-	4.085e-16	3.031e-16	-15.389	-15.518	-0.129
H3AsO4	1.468e-26	1.676e-26	-25.833	-25.776	0.058
B	2.252e-04				
H2BO3-	2.251e-04	1.312e-04	-3.648	-3.882	-0.234
H3BO3	8.661e-08	9.888e-08	-7.062	-7.005	0.058
Ba	8.185e-07				
Ba+2	8.070e-07	1.693e-07	-6.093	-6.771	-0.678
BaOH+	1.157e-08	7.830e-09	-7.937	-8.106	-0.170
C(4)	4.445e-04				
NaCO3-	1.223e-04	8.417e-05	-3.912	-4.075	-0.162
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CO3-2	1.127e-04	2.526e-05	-3.948	-4.598	-0.649
MgCO3	9.258e-05	1.057e-04	-4.033	-3.976	0.058
HCO3-	3.567e-07	2.454e-07	-6.448	-6.610	-0.162
NaHCO3	2.992e-08	3.415e-08	-7.524	-7.467	0.058
MgHCO3+	2.104e-08	1.357e-08	-7.677	-7.868	-0.191
CaHCO3+	1.175e-08	8.268e-09	-7.930	-8.083	-0.153
NiCO3	5.726e-13	6.536e-13	-12.242	-12.185	0.058
H2CO3	1.523e-13	1.739e-13	-12.817	-12.760	0.058
CdCO3	9.763e-14	1.115e-13	-13.010	-12.953	0.058
Ni(CO3)2-2	9.458e-14	2.870e-14	-13.024	-13.542	-0.518
Zn(CO3)2-2	3.438e-16	1.043e-16	-15.464	-15.982	-0.518
ZnCO3	1.692e-16	1.931e-16	-15.772	-15.714	0.058
PbCO3	3.157e-17	3.604e-17	-16.501	-16.443	0.058

## BH310A July 2012 Eh=-0.2

CuCO3	1.230e-17	1.404e-17	-16.910	-16.853	0.058
Pb(CO3)2-2	7.537e-18	2.287e-18	-17.123	-17.641	-0.518
Cu(CO3)2-2	1.472e-18	4.466e-19	-17.832	-18.350	-0.518
CdHCO3+	5.304e-19	3.937e-19	-18.275	-18.405	-0.129
NiHCO3+	1.235e-19	9.169e-20	-18.908	-19.038	-0.129
Cd(CO3)3-4	5.559e-20	4.711e-22	-19.255	-21.327	-2.072
ZnHCO3+	1.154e-21	8.567e-22	-20.938	-21.067	-0.129
PbHCO3+	1.560e-23	1.158e-23	-22.807	-22.936	-0.129
CuHCO3+	1.241e-23	9.213e-24	-22.906	-23.036	-0.129
Ca	1.845e-02				
Ca+2	1.491e-02	4.549e-03	-1.826	-2.342	-0.516
CaOH+	1.784e-03	1.255e-03	-2.749	-2.901	-0.153
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CaHCO3+	1.175e-08	8.268e-09	-7.930	-8.083	-0.153
Cd	1.193e-09				
Cd(OH)2	5.356e-10	6.115e-10	-9.271	-9.214	0.058
CdOHCl	3.800e-10	4.338e-10	-9.420	-9.363	0.058
Cd(OH)3-	2.578e-10	1.913e-10	-9.589	-9.718	-0.129
Cd(OH)4-2	1.567e-11	4.755e-12	-10.805	-11.323	-0.518
CdOH+	2.366e-12	1.756e-12	-11.626	-11.755	-0.129
CdCl+	6.467e-13	4.800e-13	-12.189	-12.319	-0.129
CdCl2	4.985e-13	5.691e-13	-12.302	-12.245	0.058
CdCl3-	1.206e-13	8.952e-14	-12.919	-13.048	-0.129
CdCO3	9.763e-14	1.115e-13	-13.010	-12.953	0.058
Cd+2	5.802e-14	1.760e-14	-13.236	-13.754	-0.518
CdSO4	9.190e-15	1.049e-14	-14.037	-13.979	0.058
Cd(SO4)2-2	9.005e-16	2.732e-16	-15.046	-15.563	-0.518
CdHCO3+	5.304e-19	3.937e-19	-18.275	-18.405	-0.129
Cd(CO3)3-4	5.559e-20	4.711e-22	-19.255	-21.327	-2.072
Cd2OH+3	2.554e-24	1.745e-25	-23.593	-24.758	-1.165
CdNO3+	0.000e+00	0.000e+00	-46.462	-46.591	-0.129
CdHS+	0.000e+00	0.000e+00	-56.734	-56.863	-0.129
Cd(HS)2	0.000e+00	0.000e+00	-103.839	-103.782	0.058
Cd(HS)3-	0.000e+00	0.000e+00	-154.751	-154.881	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-205.451	-205.969	-0.518
Cl	4.800e-01				
Cl-	4.800e-01	2.966e-01	-0.319	-0.528	-0.209
CuCl3-2	5.446e-09	1.143e-09	-8.264	-8.942	-0.678
CuCl2-	3.939e-09	2.540e-09	-8.405	-8.595	-0.191
CdOHCl	3.800e-10	4.338e-10	-9.420	-9.363	0.058
ZnOHCl	9.190e-13	1.049e-12	-12.037	-11.979	0.058
CdCl+	6.467e-13	4.800e-13	-12.189	-12.319	-0.129
CdCl2	4.985e-13	5.691e-13	-12.302	-12.245	0.058
CdCl3-	1.206e-13	8.952e-14	-12.919	-13.048	-0.129
NiCl+	3.495e-15	2.594e-15	-14.457	-14.586	-0.129
NiCl2	2.452e-15	2.800e-15	-14.610	-14.553	0.058
ZnCl+	2.872e-17	1.852e-17	-16.542	-16.732	-0.191

## BH310A July 2012 Eh=-0.2

ZnCl2	4.812e-18	5.493e-18	-17.318	-17.260	0.058
ZnCl3-	2.648e-18	1.707e-18	-17.577	-17.768	-0.191
ZnCl4-2	1.103e-18	2.313e-19	-17.958	-18.636	-0.678
PbCl+	9.848e-19	7.309e-19	-18.007	-18.136	-0.129
PbCl2	3.722e-19	4.249e-19	-18.429	-18.372	0.058
PbCl3-	1.254e-19	9.310e-20	-18.902	-19.031	-0.129
CuCl+	7.340e-20	4.732e-20	-19.134	-19.325	-0.191
PbCl4-2	3.999e-20	1.213e-20	-19.398	-19.916	-0.518
CuCl2	5.838e-21	6.665e-21	-20.234	-20.176	0.058
CuCl3-	8.892e-24	5.732e-24	-23.051	-23.242	-0.191
CrOHCl2	2.283e-24	2.607e-24	-23.641	-23.584	0.058
CuCl4-2	5.943e-26	1.247e-26	-25.226	-25.904	-0.678
CrCl+2	6.449e-29	1.957e-29	-28.191	-28.708	-0.518
CrCl2+	1.142e-30	8.477e-31	-29.942	-30.072	-0.129
VOCl+	8.345e-34	6.193e-34	-33.079	-33.208	-0.129
CrO3Cl-	4.284e-37	3.180e-37	-36.368	-36.498	-0.129
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-40.016	-40.534	-0.518
Cr(2)	4.082e-32				
Cr+2	4.082e-32	1.238e-32	-31.389	-31.907	-0.518
Cr(3)	2.440e-06				
CrO2-	1.755e-06	1.303e-06	-5.756	-5.885	-0.129
Cr(OH)4-	6.680e-07	4.958e-07	-6.175	-6.305	-0.129
Cr(OH)3	1.631e-08	1.862e-08	-7.788	-7.730	0.058
Cr(OH)2+	1.213e-13	9.006e-14	-12.916	-13.045	-0.129
Cr(OH)+2	4.437e-20	1.346e-20	-19.353	-19.871	-0.518
CrOHSO4	1.182e-20	1.349e-20	-19.928	-19.870	0.058
Cr(NH3)4(OH)2+	1.102e-23	8.175e-24	-22.958	-23.087	-0.129
CrOHCl2	2.283e-24	2.607e-24	-23.641	-23.584	0.058
Cr+3	2.586e-27	1.767e-28	-26.587	-27.753	-1.165
CrCl+2	6.449e-29	1.957e-29	-28.191	-28.708	-0.518
CrSO4+	7.196e-30	5.341e-30	-29.143	-29.272	-0.129
CrCl2+	1.142e-30	8.477e-31	-29.942	-30.072	-0.129
Cr(NH3)5OH+2	3.315e-31	1.006e-31	-30.480	-30.998	-0.518
Cr2(OH)2SO4+2	1.088e-37	3.302e-38	-36.963	-37.481	-0.518
Cr(NH3)6+3	2.406e-40	0.000e+00	-39.619	-40.784	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-40.016	-40.534	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-41.821	-41.763	0.058
CrNO3+2	0.000e+00	0.000e+00	-62.153	-62.671	-0.518
Cr(6)	3.324e-18				
CrO4-2	2.413e-18	4.169e-19	-17.617	-18.380	-0.763
NaCrO4-	8.908e-19	6.611e-19	-18.050	-18.180	-0.129
KCrO4-	1.949e-20	1.446e-20	-19.710	-19.840	-0.129
HCrO4-	6.029e-25	4.475e-25	-24.220	-24.349	-0.129
CrO3Cl-	4.284e-37	3.180e-37	-36.368	-36.498	-0.129
CrO3SO4-2	3.791e-37	1.150e-37	-36.421	-36.939	-0.518
H2CrO4	2.032e-38	2.319e-38	-37.692	-37.635	0.058
Cr2O7-2	0.000e+00	0.000e+00	-46.499	-47.017	-0.518
Cu(1)	9.385e-09				

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CuCl3-2	5.446e-09	1.143e-09	-8.264	-8.942	-0.678
CuCl2-	3.939e-09	2.540e-09	-8.405	-8.595	-0.191
Cu+	1.525e-13	8.887e-14	-12.817	-13.051	-0.234
Cu(2)	2.372e-08				
Cu(OH)2	1.473e-08	1.681e-08	-7.832	-7.774	0.058
Cu(OH)4-2	5.181e-09	1.572e-09	-8.286	-8.804	-0.518
Cu(OH)3-	3.815e-09	2.832e-09	-8.418	-8.548	-0.129
CuOH+	4.476e-15	2.886e-15	-14.349	-14.540	-0.191
CuCO3	1.230e-17	1.404e-17	-16.910	-16.853	0.058
Cu(CO3)2-2	1.472e-18	4.466e-19	-17.832	-18.350	-0.518
Cu+2	8.964e-19	1.035e-19	-18.048	-18.985	-0.938
CuCl+	7.340e-20	4.732e-20	-19.134	-19.325	-0.191
CuSO4	3.791e-20	4.327e-20	-19.421	-19.364	0.058
CuCl2	5.838e-21	6.665e-21	-20.234	-20.176	0.058
CuHCO3+	1.241e-23	9.213e-24	-22.906	-23.036	-0.129
CuCl3-	8.892e-24	5.732e-24	-23.051	-23.242	-0.191
Cu2(OH)2+2	3.881e-24	1.178e-24	-23.411	-23.929	-0.518
CuCl4-2	5.943e-26	1.247e-26	-25.226	-25.904	-0.678
Cu(S4)2-3	0.000e+00	0.000e+00	-90.803	-91.313	-0.510
CuS4S5-3	0.000e+00	0.000e+00	-91.568	-92.043	-0.475
Cu(HS)3-	0.000e+00	0.000e+00	-152.793	-152.922	-0.129
H(0)	5.711e-22				
H2	2.856e-22	3.260e-22	-21.544	-21.487	0.058
K	9.021e-03				
K+	8.918e-03	5.510e-03	-2.050	-2.259	-0.209
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
KCrO4-	1.949e-20	1.446e-20	-19.710	-19.840	-0.129
Mg	2.927e-02				
Mg+2	1.519e-02	5.188e-03	-1.818	-2.285	-0.467
MgOH+	1.235e-02	8.836e-03	-1.908	-2.054	-0.145
MgSO4	1.636e-03	1.868e-03	-2.786	-2.729	0.058
MgCO3	9.258e-05	1.057e-04	-4.033	-3.976	0.058
MgHCO3+	2.104e-08	1.357e-08	-7.677	-7.868	-0.191
N(-3)	2.013e-05				
NH3	2.007e-05	2.291e-05	-4.697	-4.640	0.058
NH4+	5.436e-08	3.169e-08	-7.265	-7.499	-0.234
NH4SO4-	1.336e-09	9.043e-10	-8.874	-9.044	-0.170
Cr(NH3)4(OH)2+	1.102e-23	8.175e-24	-22.958	-23.087	-0.129
Cr(NH3)5OH+2	3.315e-31	1.006e-31	-30.480	-30.998	-0.518
Cr(NH3)6+3	2.406e-40	0.000e+00	-39.619	-40.784	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-40.016	-40.534	-0.518
N(3)	1.458e-22				
NO2-	1.458e-22	1.082e-22	-21.836	-21.966	-0.129
N(5)	6.858e-34				
NO3-	6.858e-34	4.154e-34	-33.164	-33.382	-0.218
CdNO3+	0.000e+00	0.000e+00	-46.462	-46.591	-0.129
PbNO3+	0.000e+00	0.000e+00	-51.168	-51.297	-0.129
CrNO3+2	0.000e+00	0.000e+00	-62.153	-62.671	-0.518

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VO2NO3	0.000e+00	0.000e+00	-62.681	-62.624	0.058
Na	4.531e-01				
Na+	4.482e-01	3.191e-01	-0.349	-0.496	-0.148
NaSO4-	4.791e-03	3.297e-03	-2.320	-2.482	-0.162
NaCO3-	1.223e-04	8.417e-05	-3.912	-4.075	-0.162
NaHCO3	2.992e-08	3.415e-08	-7.524	-7.467	0.058
NaCrO4-	8.908e-19	6.611e-19	-18.050	-18.180	-0.129
Ni	1.043e-07				
Ni(OH)3-	1.020e-07	7.568e-08	-6.992	-7.121	-0.129
Ni(OH)2	2.377e-09	2.714e-09	-8.624	-8.566	0.058
NiOH+	8.134e-13	6.037e-13	-12.090	-12.219	-0.129
NiCO3	5.726e-13	6.536e-13	-12.242	-12.185	0.058
Ni(CO3)2-2	9.458e-14	2.870e-14	-13.024	-13.542	-0.518
Ni+2	1.150e-14	3.490e-15	-13.939	-14.457	-0.518
NiCl+	3.495e-15	2.594e-15	-14.457	-14.586	-0.129
NiCl2	2.452e-15	2.800e-15	-14.610	-14.553	0.058
NiSO4	1.197e-15	1.367e-15	-14.922	-14.864	0.058
Ni(SO4)2-2	5.912e-19	1.794e-19	-18.228	-18.746	-0.518
NiHCO3+	1.235e-19	9.169e-20	-18.908	-19.038	-0.129
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-53.151	-53.094	0.058
Pb	3.484e-09				
Pb(OH)4-2	3.271e-09	9.926e-10	-8.485	-9.003	-0.518
Pb(OH)3-	2.089e-10	1.550e-10	-9.680	-9.810	-0.129
Pb(OH)2	4.241e-12	4.842e-12	-11.373	-11.315	0.058
PbOH+	6.013e-15	4.463e-15	-14.221	-14.350	-0.129
PbCO3	3.157e-17	3.604e-17	-16.501	-16.443	0.058
Pb(CO3)2-2	7.537e-18	2.287e-18	-17.123	-17.641	-0.518
PbCl+	9.848e-19	7.309e-19	-18.007	-18.136	-0.129
PbCl2	3.722e-19	4.249e-19	-18.429	-18.372	0.058
Pb+2	2.705e-19	8.208e-20	-18.568	-19.086	-0.518
PbCl3-	1.254e-19	9.310e-20	-18.902	-19.031	-0.129
PbSO4	8.957e-20	1.023e-19	-19.048	-18.990	0.058
PbCl4-2	3.999e-20	1.213e-20	-19.398	-19.916	-0.518
Pb(SO4)2-2	3.918e-21	1.189e-21	-20.407	-20.925	-0.518
PbHCO3+	1.560e-23	1.158e-23	-22.807	-22.936	-0.129
Pb2OH+3	1.200e-31	8.201e-33	-30.921	-32.086	-1.165
Pb3(OH)4+2	2.636e-32	7.998e-33	-31.579	-32.097	-0.518
PbNO3+	0.000e+00	0.000e+00	-51.168	-51.297	-0.129
Pb(HS)2	0.000e+00	0.000e+00	-110.431	-110.373	0.058
Pb(HS)3-	0.000e+00	0.000e+00	-162.222	-162.352	-0.129
S(-2)	0.000e+00				
S5-2	0.000e+00	0.000e+00	-50.163	-50.681	-0.518
S6-2	0.000e+00	0.000e+00	-50.189	-50.707	-0.518
S4-2	0.000e+00	0.000e+00	-50.408	-50.926	-0.518
HS-	0.000e+00	0.000e+00	-53.075	-53.279	-0.203
S-2	0.000e+00	0.000e+00	-53.404	-54.082	-0.678
S3-2	0.000e+00	0.000e+00	-53.881	-54.399	-0.518

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S2-2	0.000e+00	0.000e+00	-55.155	-55.673	-0.518
CdHS+	0.000e+00	0.000e+00	-56.734	-56.863	-0.129
H2S	0.000e+00	0.000e+00	-58.689	-58.632	0.058
Cu(S4)2-3	0.000e+00	0.000e+00	-90.803	-91.313	-0.510
CuS4S5-3	0.000e+00	0.000e+00	-91.568	-92.043	-0.475
Cd(HS)2	0.000e+00	0.000e+00	-103.839	-103.782	0.058
Zn(HS)2	0.000e+00	0.000e+00	-108.092	-108.034	0.058
Pb(HS)2	0.000e+00	0.000e+00	-110.431	-110.373	0.058
Cu(HS)3-	0.000e+00	0.000e+00	-152.793	-152.922	-0.129
Cd(HS)3-	0.000e+00	0.000e+00	-154.751	-154.881	-0.129
Zn(HS)3-	0.000e+00	0.000e+00	-160.023	-160.153	-0.129
Pb(HS)3-	0.000e+00	0.000e+00	-162.222	-162.352	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-205.451	-205.969	-0.518
S(6)	2.169e-02				
SO4-2	1.352e-02	2.215e-03	-1.869	-2.655	-0.786
NaSO4-	4.791e-03	3.297e-03	-2.320	-2.482	-0.162
MgSO4	1.636e-03	1.868e-03	-2.786	-2.729	0.058
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
NH4SO4-	1.336e-09	9.043e-10	-8.874	-9.044	-0.170
HSO4-	8.495e-14	5.620e-14	-13.071	-13.250	-0.179
CdSO4	9.190e-15	1.049e-14	-14.037	-13.979	0.058
NiSO4	1.197e-15	1.367e-15	-14.922	-14.864	0.058
Cd(SO4)2-2	9.005e-16	2.732e-16	-15.046	-15.563	-0.518
ZnSO4	1.597e-17	1.823e-17	-16.797	-16.739	0.058
Zn(SO4)2-2	1.181e-18	3.583e-19	-17.928	-18.446	-0.518
Ni(SO4)2-2	5.912e-19	1.794e-19	-18.228	-18.746	-0.518
PbSO4	8.957e-20	1.023e-19	-19.048	-18.990	0.058
CuSO4	3.791e-20	4.327e-20	-19.421	-19.364	0.058
CrOHSO4	1.182e-20	1.349e-20	-19.928	-19.870	0.058
Pb(SO4)2-2	3.918e-21	1.189e-21	-20.407	-20.925	-0.518
CrSO4+	7.196e-30	5.341e-30	-29.143	-29.272	-0.129
VO2SO4-	2.360e-30	1.752e-30	-29.627	-29.757	-0.129
AlSO4+	9.203e-32	6.087e-32	-31.036	-31.216	-0.179
Al(SO4)2-	1.549e-32	1.025e-32	-31.810	-31.989	-0.179
VOSO4	8.583e-34	9.799e-34	-33.066	-33.009	0.058
CrO3SO4-2	3.791e-37	1.150e-37	-36.421	-36.939	-0.518
Cr2(OH)2SO4+2	1.088e-37	3.302e-38	-36.963	-37.481	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-41.821	-41.763	0.058
VSO4+	0.000e+00	0.000e+00	-49.327	-49.456	-0.129
V(2)	0.000e+00				
VOH+	0.000e+00	0.000e+00	-42.526	-42.655	-0.129
V+2	0.000e+00	0.000e+00	-48.942	-49.460	-0.518
V(3)	1.040e-22				
V(OH)3	1.040e-22	1.187e-22	-21.983	-21.925	0.058
V(OH)2+	8.887e-30	6.596e-30	-29.051	-29.181	-0.129
VOH+2	1.446e-38	4.389e-39	-37.840	-38.358	-0.518
V+3	0.000e+00	0.000e+00	-47.076	-48.242	-1.165

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VSO4+	0.000e+00	0.000e+00	-49.327	-49.456	-0.129
V2(OH)3+3	0.000e+00	0.000e+00	-65.481	-66.647	-1.165
V2(OH)2+4	0.000e+00	0.000e+00	-73.270	-75.342	-2.072
V(4)	1.574e-26				
V(OH)3+	1.574e-26	1.168e-26	-25.803	-25.932	-0.129
VO+2	6.573e-33	1.994e-33	-32.182	-32.700	-0.518
VOSO4	8.583e-34	9.799e-34	-33.066	-33.009	0.058
VOCI+	8.345e-34	6.193e-34	-33.079	-33.208	-0.129
H2V2O4+2	0.000e+00	0.000e+00	-46.432	-46.950	-0.518
V(5)	4.636e-07				
HVO4-2	3.034e-07	9.207e-08	-6.518	-7.036	-0.518
VO4-3	1.599e-07	1.093e-08	-6.796	-7.962	-1.165
V2O7-4	1.156e-10	9.797e-13	-9.937	-12.009	-2.072
HV2O7-3	2.908e-11	1.987e-12	-10.536	-11.702	-1.165
H2VO4-	6.329e-12	4.697e-12	-11.199	-11.328	-0.129
H3VO4	9.352e-21	1.068e-20	-20.029	-19.972	0.058
H3V2O7-	1.126e-24	8.358e-25	-23.948	-24.078	-0.129
V3O9-3	3.504e-27	2.394e-28	-26.455	-27.621	-1.165
VO2+	2.077e-29	1.542e-29	-28.683	-28.812	-0.129
VO2SO4-	2.360e-30	1.752e-30	-29.627	-29.757	-0.129
V4O12-4	4.240e-35	3.593e-37	-34.373	-36.445	-2.072
VO2NO3	0.000e+00	0.000e+00	-62.681	-62.624	0.058
V10O28-6	0.000e+00	0.000e+00	-101.801	-106.463	-4.662
HV10O28-5	0.000e+00	0.000e+00	-110.101	-113.338	-3.237
H2V10O28-4	0.000e+00	0.000e+00	-119.477	-121.549	-2.072
Zn	9.624e-08				
Zn(OH)4-2	4.828e-08	1.465e-08	-7.316	-7.834	-0.518
Zn(OH)3-	4.466e-08	3.315e-08	-7.350	-7.480	-0.129
Zn(OH)2	3.293e-09	3.759e-09	-8.482	-8.425	0.058
ZnOHCl	9.190e-13	1.049e-12	-12.037	-11.979	0.058
ZnOH+	6.659e-14	4.942e-14	-13.177	-13.306	-0.129
Zn(CO3)2-2	3.438e-16	1.043e-16	-15.464	-15.982	-0.518
ZnCO3	1.692e-16	1.931e-16	-15.772	-15.714	0.058
Zn+2	1.563e-16	3.831e-17	-15.806	-16.417	-0.611
ZnCl+	2.872e-17	1.852e-17	-16.542	-16.732	-0.191
ZnSO4	1.597e-17	1.823e-17	-16.797	-16.739	0.058
ZnCl2	4.812e-18	5.493e-18	-17.318	-17.260	0.058
ZnCl3-	2.648e-18	1.707e-18	-17.577	-17.768	-0.191
Zn(SO4)2-2	1.181e-18	3.583e-19	-17.928	-18.446	-0.518
ZnCl4-2	1.103e-18	2.313e-19	-17.958	-18.636	-0.678
ZnHCO3+	1.154e-21	8.567e-22	-20.938	-21.067	-0.129
Zn(HS)2	0.000e+00	0.000e+00	-108.092	-108.034	0.058
Zn(HS)3-	0.000e+00	0.000e+00	-160.023	-160.153	-0.129

-----Saturation indices-----

Phase            SI log IAP   log KT

(NH <sub>4</sub> ) <sub>2</sub> CrO <sub>4</sub>	-33.72	36.88	70.60	(NH <sub>4</sub> ) <sub>2</sub> CrO <sub>4</sub>
Al(OH) <sub>3</sub> (a)	-5.32	5.82	11.14	Al(OH) <sub>3</sub>
Al <sub>2</sub> O <sub>3</sub>	-11.33	11.65	22.98	Al <sub>2</sub> O <sub>3</sub>
Al <sub>4</sub> (OH) <sub>10</sub> SO <sub>4</sub>	-26.98	-4.28	22.70	Al <sub>4</sub> (OH) <sub>10</sub> SO <sub>4</sub>
AlAsO <sub>4</sub> :2H <sub>2</sub> O	-24.75	-19.95	4.80	AlAsO <sub>4</sub> :2H <sub>2</sub> O
AlOHSO <sub>4</sub>	-18.50	-21.73	-3.23	AlOHSO <sub>4</sub>
AlumK	-33.81	-39.18	-5.37	KAl(SO <sub>4</sub> ) <sub>2</sub> :12H <sub>2</sub> O
Alunite	-26.00	-27.46	-1.46	KAl <sub>3</sub> (SO <sub>4</sub> ) <sub>2</sub> (OH) <sub>6</sub>
Anglesite	-13.89	-21.74	-7.85	PbSO <sub>4</sub>
Anhydrite	-0.47	-5.00	-4.53	CaSO <sub>4</sub>
Anilite	-32.05	-104.50	-72.45	Cu <sub>0.25</sub> Cu <sub>1.5</sub> S
Antlerite	-18.12	-9.83	8.29	Cu <sub>3</sub> (OH) <sub>4</sub> SO <sub>4</sub>
Aragonite	1.33	-6.94	-8.27	CaCO <sub>3</sub>
Arsenolite	-92.23	-176.57	-84.34	As <sub>4</sub> O <sub>6</sub>
Artinite	5.30	15.70	10.40	MgCO <sub>3</sub> :Mg(OH) <sub>2</sub> :3H <sub>2</sub> O
As <sub>2</sub> O <sub>5</sub>	-58.38	-51.53	6.85	As <sub>2</sub> O <sub>5</sub>
Atacamite	-9.02	-1.16	7.86	Cu <sub>2</sub> (OH) <sub>3</sub> Cl
Azurite	-25.00	-41.26	-16.26	Cu <sub>3</sub> (OH) <sub>2</sub> (CO <sub>3</sub> ) <sub>2</sub>
Ba <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>	11.84	2.85	-8.98	Ba <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>
BaCrO <sub>4</sub>	-15.30	45.11	60.41	BaCrO <sub>4</sub>
Barite	0.73	-9.43	-10.15	BaSO <sub>4</sub>
Bianchite	-17.36	-19.12	-1.76	ZnSO <sub>4</sub> :6H <sub>2</sub> O
Blaubleil	-36.36	-96.40	-60.04	Cu <sub>0.9</sub> Cu <sub>0.2</sub> S
Blaubleill	-35.38	-100.14	-64.76	Cu <sub>0.6</sub> Cu <sub>0.8</sub> S
Boehmite	-3.54	5.82	9.36	AlOOH
Brochantite	-19.26	-3.92	15.34	Cu <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
Brucite	5.09	22.61	17.51	Mg(OH) <sub>2</sub>
Bunsenite	-2.68	10.44	13.12	NiO
Ca <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-3.09	6.19	9.28	CaVO <sub>3.5</sub>
Ca <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :6H <sub>2</sub> O	-6.21	16.09	22.30	Ca <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :6H <sub>2</sub> O
Ca <sub>3</sub> (VO <sub>4</sub> ) <sub>2</sub>	-2.99	17.47	20.46	Ca <sub>1.5</sub> VO <sub>4</sub>
Ca_Vanadate	-8.20	-5.08	3.11	Ca <sub>0.5</sub> VO <sub>3</sub>
CaCrO <sub>4</sub>	-18.64	49.54	68.17	CaCrO <sub>4</sub>
Calcite	1.48	-6.94	-8.42	CaCO <sub>3</sub>
Cd(BO <sub>2</sub> ) <sub>2</sub>	-12.68	-2.84	9.84	Cd(BO <sub>2</sub> ) <sub>2</sub>
Cd(Gamma)	-21.33	-7.23	14.10	Cd
Cd(OH) <sub>2</sub> (A)	-3.17	11.14	14.31	Cd(OH) <sub>2</sub>
Cd(OH) <sub>2</sub> (C)	-2.51	11.14	13.65	Cd(OH) <sub>2</sub>
Cd <sub>3</sub> (OH) <sub>2</sub> (SO <sub>4</sub> ) <sub>2</sub>	-28.39	-21.68	6.71	Cd <sub>3</sub> (OH) <sub>2</sub> (SO <sub>4</sub> ) <sub>2</sub>
Cd <sub>3</sub> (OH) <sub>4</sub> SO <sub>4</sub>	-16.70	5.86	22.56	Cd <sub>3</sub> (OH) <sub>4</sub> SO <sub>4</sub>
Cd <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-11.40	17.00	28.40	Cd <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
CdCl <sub>2</sub>	-14.26	-14.81	-0.55	CdCl <sub>2</sub>
CdCl <sub>2</sub> :2.5H <sub>2</sub> O	-12.84	-14.83	-1.99	CdCl <sub>2</sub> :2.5H <sub>2</sub> O
CdCl <sub>2</sub> :H <sub>2</sub> O	-13.16	-14.82	-1.66	CdCl <sub>2</sub> :H <sub>2</sub> O
CdMetal	-21.23	-7.23	13.99	Cd
CdOHCl	-5.56	-1.84	3.73	CdOHCl
CdSO <sub>4</sub>	-16.72	-16.41	0.31	CdSO <sub>4</sub>
CdSO <sub>4</sub> :2.67H <sub>2</sub> O	-14.68	-16.43	-1.75	CdSO <sub>4</sub> :2.67H <sub>2</sub> O



CdSO4:H2O	-14.97	-16.42	-1.45	CdSO4:H2O
Cerrusite	-10.42	-23.68	-13.27	PbCO3
CH4(g)	-61.22	-103.02	-41.81	CH4
Chalcanthite	-19.00	-21.68	-2.68	CuSO4:5H2O
Chalcocite	-30.93	-107.62	-76.69	Cu2S
Claudetite	-92.00	-176.57	-84.57	As4O6
CO2(g)	-11.32	-29.50	-18.17	CO2
Cotunnite	-15.21	-20.14	-4.93	PbCl2
Covellite	-36.10	-95.15	-59.05	CuS
Cr(OH)2	-18.07	-9.79	8.29	Cr(OH)2
Cr(OH)3(A)	0.15	-0.60	-0.75	Cr(OH)3
Cr(OH)3(C)	-2.50	-0.60	1.90	Cr(OH)3
Cr2O3	1.88	-1.18	-3.05	Cr2O3
CrCl2	-49.38	-35.73	13.65	CrCl2
CrCl3	-53.80	-39.52	14.28	CrCl3
CrMetal	-58.59	-28.16	30.43	Cr
CrO3	-40.10	26.98	67.08	CrO3
Cu(OH)2	-3.16	5.91	9.07	Cu(OH)2
Cu2(OH)3NO3	-43.74	90.29	134.03	Cu2(OH)3NO3
Cu2SO4	-26.93	-34.10	-7.17	Cu2SO4
Cu3(AsO4)2:6H2O	-39.93	-33.83	6.10	Cu3(AsO4)2:6H2O
CuCO3	-13.95	-23.58	-9.63	CuCO3
CuCrO4	-31.89	32.89	64.78	CuCrO4
CuMetal	-0.55	-12.47	-11.91	Cu
CuOCuSO4	-28.25	-15.73	12.53	CuO:CuSO4
Cuprite	0.52	-6.55	-7.07	Cu2O
CuSO4	-25.16	-21.64	3.52	CuSO4
Diaspore	-1.74	5.82	7.56	AlOOH
Djurleite	-31.20	-106.80	-75.60	Cu0.066Cu1.868S
Dolomite	2.95	-13.82	-16.77	CaMg(CO3)2
Epsomite	-2.77	-4.99	-2.22	MgSO4:7H2O
Galena	-44.24	-95.25	-51.02	PbS
Gibbsite(C)	-3.59	5.82	9.41	Al(OH)3
Goslarite	-17.07	-19.12	-2.05	ZnSO4:7H2O
Greenockite	-38.19	-89.92	-51.73	CdS
Gypsum	-0.16	-5.01	-4.86	CaSO4:2H2O
Halite	-2.58	-1.02	1.56	NaCl
Huntite	1.66	-27.59	-29.25	CaMg3(CO3)4
Hydcerrusite	-24.10	-41.56	-17.46	Pb(OH)2:2PbCO3
Hydromagnesite	2.35	-4.95	-7.31	Mg5(CO3)4(OH)2:4H2O
K2Cr2O7	-50.00	74.34	124.34	K2Cr2O7
K2CrO4	-22.79	47.36	70.15	K2CrO4
Langite	-21.83	-3.93	17.90	Cu4(OH)6SO4:H2O
Larnakite	-15.83	-15.93	-0.10	PbO:PbSO4
Laurionite	-7.79	-7.17	0.62	PbOHCl
Lime	-11.53	22.56	34.09	CaO
Litharge	-7.37	5.81	13.18	PbO
Magnesite	0.97	-6.88	-7.86	MgCO3

Malachite	-12.93	-17.68	-4.74	Cu <sub>2</sub> (OH) <sub>2</sub> CO <sub>3</sub>
Massicot	-7.57	5.81	13.38	PbO
Melanothallite	-24.12	-20.04	4.07	CuCl <sub>2</sub>
Mg <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-7.78	6.25	14.03	MgVO <sub>3.5</sub>
Mg_Vanadate	-11.15	-5.06	6.10	Mg <sub>0.5</sub> VO <sub>3</sub>
MgCr <sub>2</sub> O <sub>4</sub>	8.24	21.44	13.19	MgCr <sub>2</sub> O <sub>4</sub>
MgCrO <sub>4</sub>	-26.64	49.59	76.23	MgCrO <sub>4</sub>
Millerite	-47.17	-90.63	-43.45	NiS
Minium	-40.75	35.82	76.56	Pb <sub>3</sub> O <sub>4</sub>
Mirabilite	-2.08	-3.72	-1.65	Na <sub>2</sub> SO <sub>4</sub> :10H <sub>2</sub> O
Monteponite	-4.67	11.14	15.81	CdO
Morenosite	-14.72	-17.17	-2.44	NiSO <sub>4</sub> :7H <sub>2</sub> O
Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-52.61	77.86	130.47	Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
Na <sub>2</sub> CrO <sub>4</sub>	-22.76	50.89	73.65	Na <sub>2</sub> CrO <sub>4</sub>
Na <sub>3</sub> VO <sub>4</sub>	-18.69	19.50	38.18	Na <sub>3</sub> VO <sub>4</sub>
Na <sub>4</sub> V <sub>2</sub> O <sub>7</sub>	-11.83	7.54	19.37	Na <sub>2</sub> VO <sub>3.5</sub>
Na_Vanadate	-8.32	-4.41	3.91	NaVO <sub>3</sub>
Nantokite	-6.54	-16.25	-9.71	CuCl
Natron	-3.91	-5.67	-1.75	Na <sub>2</sub> CO <sub>3</sub> :10H <sub>2</sub> O
Nesquehonite	-1.45	-6.91	-5.46	MgCO <sub>3</sub> :3H <sub>2</sub> O
NH <sub>4</sub> VO <sub>3</sub>	-14.21	-11.41	2.80	NH <sub>4</sub> VO <sub>3</sub>
Ni(OH) <sub>2</sub>	0.49	10.43	9.95	Ni(OH) <sub>2</sub>
Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-35.97	-20.27	15.70	Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-17.81	14.19	32.00	Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
NiCO <sub>3</sub>	-12.49	-19.05	-6.56	NiCO <sub>3</sub>
O <sub>2</sub> (g)	-50.11	36.76	86.86	O <sub>2</sub>
Oripment	-181.60	-391.48	-209.88	As <sub>2</sub> S <sub>3</sub>
Otavite	-4.63	-18.35	-13.72	CdCO <sub>3</sub>
Pb(BO <sub>2</sub> ) <sub>2</sub>	-15.95	-8.17	7.77	Pb(BO <sub>2</sub> ) <sub>2</sub>
Pb(OH) <sub>2</sub> (C)	-2.74	5.81	8.54	Pb(OH) <sub>2</sub>
Pb <sub>2</sub> (OH) <sub>3</sub> Cl	-10.16	-1.36	8.79	Pb <sub>2</sub> (OH) <sub>3</sub> Cl
Pb <sub>2</sub> O(OH) <sub>2</sub>	-14.58	11.62	26.20	Pb <sub>2</sub> O(OH) <sub>2</sub>
Pb <sub>2</sub> O <sub>3</sub>	-31.04	30.00	61.04	Pb <sub>2</sub> O <sub>3</sub>
Pb <sub>2</sub> OCO <sub>3</sub>	-17.69	-17.87	-0.18	Pb <sub>2</sub> OCO <sub>3</sub>
Pb <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-9.69	-10.55	-0.86	PbVO <sub>3.5</sub>
Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>	-39.89	-34.09	5.80	Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>
Pb <sub>3</sub> (VO <sub>4</sub> ) <sub>2</sub>	-10.96	-7.64	3.31	Pb <sub>1.5</sub> VO <sub>4</sub>
Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>	-23.82	-12.06	11.76	Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>
Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>	-21.10	-10.12	10.98	Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>
Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-25.43	-4.33	21.10	Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>	-27.38	-4.30	23.08	Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>
PbCrO <sub>4</sub>	-23.49	32.79	56.29	PbCrO <sub>4</sub>
PbMetal	-16.82	-12.57	4.26	Pb
PbO:0.3H <sub>2</sub> O	-7.17	5.81	12.98	PbO:0.33H <sub>2</sub> O
Periclase	0.09	22.61	22.52	MgO
Phosgenite	-24.01	-43.82	-19.81	PbCl <sub>2</sub> :PbCO <sub>3</sub>
Plattnerite	-27.09	24.19	51.28	PbO <sub>2</sub>
Portlandite	-0.98	22.55	23.53	Ca(OH) <sub>2</sub>

Realgar	-78.17	-154.40	-76.23	AsS
Retgersite	-15.09	-17.16	-2.07	NiSO4:6H2O
Smithsonite	-11.14	-21.01	-9.88	ZnCO3
Sphalerite	-45.39	-92.58	-47.19	ZnS
Spinel	-4.56	34.27	38.83	MgAl2O4
SULFUR	-45.35	-82.69	-37.33	S
Tenorite	-2.13	5.91	8.05	CuO
Thenardite	-3.48	-3.65	-0.16	Na2SO4
Thermonatrite	-5.80	-5.60	0.20	Na2CO3:H2O
V(OH)3	-18.56	-34.75	-16.20	V(OH)3
V2O3	-16.35	-34.74	-18.40	VO1.5
V2O4	-12.47	-25.55	-13.09	VO2
V2O5	-15.76	-16.36	-0.60	VO2.5
V3O5	-44.31	-95.03	-50.72	V3O5
V4O7	-57.82	-120.59	-62.77	V4O7
V6O13	-72.26	-134.93	-62.68	V6O13
VCl2	-65.01	-69.88	-4.88	VCl2
VCl3	-72.78	-73.67	-0.89	VCl3
VMetal	-82.57	-62.31	20.26	V
VO	-33.95	-43.93	-9.98	VO
VO(OH)2	-13.66	-25.56	-11.90	VO(OH)2
VO2Cl	-32.42	-29.34	3.08	VO2Cl
VOCl	-34.01	-47.72	-13.71	VOCl
VOCl2	-47.33	-51.51	-4.17	VOCl2
VOSO4(C)	-39.50	-53.10	-13.60	VOSO4
Witherite	-2.77	-11.37	-8.60	BaCO3
Wurtzite	-47.42	-92.58	-45.17	ZnS
Zincite	-3.27	8.48	11.75	ZnO
Zincosite	-22.62	-19.07	3.55	ZnSO4
Zn(BO2)2	-13.80	-5.51	8.29	Zn(BO2)2
Zn(NO3)2:6H2O	-86.51	165.39	251.90	Zn(NO3)2:6H2O
Zn(OH)2(A)	-3.98	8.47	12.45	Zn(OH)2
Zn(OH)2(B)	-3.28	8.47	11.75	Zn(OH)2
Zn(OH)2(C)	-3.73	8.47	12.20	Zn(OH)2
Zn(OH)2(E)	-3.03	8.47	11.50	Zn(OH)2
Zn(OH)2(G)	-3.24	8.47	11.71	Zn(OH)2
Zn2(OH)2SO4	-18.10	-10.60	7.50	Zn2(OH)2SO4
Zn2(OH)3Cl	-11.23	3.97	15.20	Zn2(OH)3Cl
Zn3(AsO4)2:2.5H2O	-39.75	-26.10	13.65	Zn3(AsO4)2:2.5H2O
Zn3O(SO4)2	-50.42	-29.66	20.75	Zn3O(SO4)2
Zn4(OH)6SO4	-22.05	6.35	28.40	Zn4(OH)6SO4
Zn5(OH)8Cl2	-22.08	16.42	38.50	Zn5(OH)8Cl2
ZnCl2	-24.99	-17.47	7.52	ZnCl2
ZnCO3:H2O	-10.76	-21.02	-10.26	ZnCO3:H2O
ZnMetal	-36.68	-9.90	26.79	Zn
ZnO(Active)	-2.83	8.48	11.31	ZnO
ZnS(A)	-48.09	-92.58	-44.50	ZnS
ZnSO4:H2O	-18.81	-19.08	-0.27	ZnSO4:H2O

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End of simulation.  
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Reading input data for simulation 2.  
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End of run.  
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No memory leaks

Database file: minteq.dat

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Reading data base.  
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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
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TITLE BH310a Low  
SOLUTION 1  
pH 10.05 charge  
temp 14.04  
pe -6.52  
units mg/L  
Al 0.0422  
As 0.00163 as H3AsO4  
Ba 0.109  
B 2.360  
Cd 0.00013  
Ca 717  
C 26.3  
Cl 16500  
Cu 0.00204  
Cr 0.123  
Pb 0.0007  
Mg 690  
Ni 0.00594  
N 0.82 as N03-  
K 342  
Na 10100  
S 2020 as SO4-2  
V 0.0229  
Zn 0.0061  
END

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TITLE  
-----

BH310a Low

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 Beginning of initial solution calculations.  
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Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.613e-06	1.613e-06
As	1.184e-08	1.184e-08
B	2.252e-04	2.252e-04
Ba	8.185e-07	8.185e-07
C	4.445e-04	4.445e-04
Ca	1.845e-02	1.845e-02
Cd	1.193e-09	1.193e-09
Cl	4.800e-01	4.800e-01
Cr	2.440e-06	2.440e-06
Cu	3.311e-08	3.311e-08
K	9.021e-03	9.021e-03
Mg	2.927e-02	2.927e-02
N	2.013e-05	2.013e-05
Na	4.531e-01	4.531e-01
Ni	1.043e-07	1.043e-07
Pb	3.484e-09	3.484e-09
S	2.169e-02	2.169e-02
V	4.636e-07	4.636e-07
Zn	9.624e-08	9.624e-08

-----Description of solution-----

pH = 12.453    Charge balance  
 pe = -6.520  
 Activity of water = 0.983  
 Ionic strength = 5.752e-01  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 3.422e-02  
 Total CO2 (mol/kg) = 4.445e-04  
 Temperature (deg C) = 14.040  
 Electrical balance (eq) = 1.259e-16  
 Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|)$  = 0.00  
 Iterations = 18  
 Total H = 1.110460e+02  
 Total O = 5.562806e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	1.894e-02	1.186e-02	-1.723	-1.926	-0.203
H+	4.619e-13	3.524e-13	-12.335	-12.453	-0.118
H2O	5.551e+01	9.826e-01	-0.008	-0.008	0.000
Al	1.613e-06				
Al(OH)4-	1.613e-06	1.067e-06	-5.792	-5.972	-0.179
Al(OH)3	5.725e-11	6.535e-11	-10.242	-10.185	0.058
Al(OH)2+	2.706e-17	1.862e-17	-16.568	-16.730	-0.162
AlOH+2	1.783e-24	3.996e-25	-23.749	-24.398	-0.649
Al+3	3.443e-31	3.014e-32	-30.463	-31.521	-1.058
AlSO4+	9.203e-32	6.087e-32	-31.036	-31.216	-0.179
Al(SO4)2-	1.549e-32	1.025e-32	-31.810	-31.989	-0.179
As(3)	3.613e-14				
HAsO3-2	2.220e-14	6.736e-15	-13.654	-14.172	-0.518
AsO3-3	7.304e-15	4.991e-16	-14.136	-15.302	-1.165
H2AsO3-	6.616e-15	4.910e-15	-14.179	-14.309	-0.129
H3AsO3	3.909e-18	4.463e-18	-17.408	-17.350	0.058
H4AsO3+	1.050e-30	7.792e-31	-29.979	-30.108	-0.129
As(5)	1.184e-08				
AsO4-3	1.137e-08	7.770e-10	-7.944	-9.110	-1.165
HAsO4-2	4.711e-10	1.429e-10	-9.327	-9.845	-0.518
H2AsO4-	4.085e-16	3.031e-16	-15.389	-15.518	-0.129
H3AsO4	1.468e-26	1.676e-26	-25.833	-25.776	0.058
B	2.252e-04				
H2BO3-	2.251e-04	1.312e-04	-3.648	-3.882	-0.234
H3BO3	8.661e-08	9.888e-08	-7.062	-7.005	0.058
Ba	8.185e-07				
Ba+2	8.070e-07	1.693e-07	-6.093	-6.771	-0.678
BaOH+	1.157e-08	7.830e-09	-7.937	-8.106	-0.170
C(4)	4.445e-04				
NaCO3-	1.223e-04	8.417e-05	-3.912	-4.075	-0.162
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CO3-2	1.127e-04	2.526e-05	-3.948	-4.598	-0.649
MgCO3	9.258e-05	1.057e-04	-4.033	-3.976	0.058
HCO3-	3.567e-07	2.454e-07	-6.448	-6.610	-0.162
NaHCO3	2.992e-08	3.415e-08	-7.524	-7.467	0.058
MgHCO3+	2.104e-08	1.357e-08	-7.677	-7.868	-0.191
CaHCO3+	1.175e-08	8.268e-09	-7.930	-8.083	-0.153
NiCO3	5.726e-13	6.536e-13	-12.242	-12.185	0.058
H2CO3	1.523e-13	1.739e-13	-12.817	-12.760	0.058
CdCO3	9.763e-14	1.115e-13	-13.010	-12.953	0.058
Ni(CO3)2-2	9.458e-14	2.870e-14	-13.024	-13.542	-0.518
Zn(CO3)2-2	3.438e-16	1.043e-16	-15.464	-15.982	-0.518
ZnCO3	1.692e-16	1.931e-16	-15.772	-15.714	0.058
PbCO3	3.157e-17	3.604e-17	-16.501	-16.443	0.058

## BH310A July 2012 Eh=-0.4

Pb(CO <sub>3</sub> ) <sub>2</sub> -2	7.537e-18	2.287e-18	-17.123	-17.641	-0.518
CdHCO <sub>3</sub> <sup>+</sup>	5.304e-19	3.937e-19	-18.275	-18.405	-0.129
NiHCO <sub>3</sub> <sup>+</sup>	1.235e-19	9.169e-20	-18.908	-19.038	-0.129
Cd(CO <sub>3</sub> ) <sub>3</sub> -4	5.559e-20	4.711e-22	-19.255	-21.327	-2.072
CuCO <sub>3</sub>	2.381e-20	2.718e-20	-19.623	-19.566	0.058
Cu(CO <sub>3</sub> ) <sub>2</sub> -2	2.850e-21	8.646e-22	-20.545	-21.063	-0.518
ZnHCO <sub>3</sub> <sup>+</sup>	1.154e-21	8.567e-22	-20.938	-21.067	-0.129
PbHCO <sub>3</sub> <sup>+</sup>	1.560e-23	1.158e-23	-22.807	-22.936	-0.129
CuHCO <sub>3</sub> <sup>+</sup>	2.403e-26	1.784e-26	-25.619	-25.749	-0.129
Ca	1.845e-02				
Ca <sup>+2</sup>	1.491e-02	4.549e-03	-1.826	-2.342	-0.516
CaOH <sup>+</sup>	1.784e-03	1.255e-03	-2.749	-2.901	-0.153
CaSO <sub>4</sub>	1.636e-03	1.867e-03	-2.786	-2.729	0.058
CaCO <sub>3</sub>	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CaHCO <sub>3</sub> <sup>+</sup>	1.175e-08	8.268e-09	-7.930	-8.083	-0.153
Cd	1.193e-09				
Cd(OH) <sub>2</sub>	5.356e-10	6.115e-10	-9.271	-9.214	0.058
CdOHCl	3.800e-10	4.338e-10	-9.420	-9.363	0.058
Cd(OH) <sub>3</sub> <sup>-</sup>	2.578e-10	1.913e-10	-9.589	-9.718	-0.129
Cd(OH) <sub>4</sub> -2	1.567e-11	4.755e-12	-10.805	-11.323	-0.518
CdOH <sup>+</sup>	2.366e-12	1.756e-12	-11.626	-11.755	-0.129
CdCl <sup>+</sup>	6.467e-13	4.800e-13	-12.189	-12.319	-0.129
CdCl <sub>2</sub>	4.985e-13	5.691e-13	-12.302	-12.245	0.058
CdCl <sub>3</sub> <sup>-</sup>	1.206e-13	8.952e-14	-12.919	-13.048	-0.129
CdCO <sub>3</sub>	9.763e-14	1.115e-13	-13.010	-12.953	0.058
Cd <sup>+2</sup>	5.802e-14	1.760e-14	-13.236	-13.754	-0.518
CdSO <sub>4</sub>	9.190e-15	1.049e-14	-14.037	-13.979	0.058
Cd(SO <sub>4</sub> ) <sub>2</sub> -2	9.005e-16	2.732e-16	-15.046	-15.563	-0.518
CdHCO <sub>3</sub> <sup>+</sup>	5.304e-19	3.937e-19	-18.275	-18.405	-0.129
Cd(CO <sub>3</sub> ) <sub>3</sub> -4	5.559e-20	4.711e-22	-19.255	-21.327	-2.072
Cd <sub>2</sub> OH <sup>+3</sup>	2.554e-24	1.745e-25	-23.593	-24.758	-1.165
CdHS <sup>+</sup>	2.220e-31	1.648e-31	-30.654	-30.783	-0.129
Cd(HS) <sub>2</sub>	0.000e+00	0.000e+00	-51.679	-51.622	0.058
CdNO <sub>3</sub> <sup>+</sup>	0.000e+00	0.000e+00	-72.542	-72.671	-0.129
Cd(HS) <sub>3</sub> <sup>-</sup>	0.000e+00	0.000e+00	-76.511	-76.641	-0.129
Cd(HS) <sub>4</sub> -2	0.000e+00	0.000e+00	-101.131	-101.649	-0.518
Cl	4.800e-01				
Cl <sup>-</sup>	4.800e-01	2.966e-01	-0.319	-0.528	-0.209
CuCl <sub>3</sub> -2	1.919e-08	4.025e-09	-7.717	-8.395	-0.678
CuCl <sub>2</sub> <sup>-</sup>	1.388e-08	8.947e-09	-7.858	-8.048	-0.191
CdOHCl	3.800e-10	4.338e-10	-9.420	-9.363	0.058
ZnOHCl	9.190e-13	1.049e-12	-12.037	-11.979	0.058
CdCl <sup>+</sup>	6.467e-13	4.800e-13	-12.189	-12.319	-0.129
CdCl <sub>2</sub>	4.985e-13	5.691e-13	-12.302	-12.245	0.058
CdCl <sub>3</sub> <sup>-</sup>	1.206e-13	8.952e-14	-12.919	-13.048	-0.129
NiCl <sup>+</sup>	3.495e-15	2.594e-15	-14.457	-14.586	-0.129
NiCl <sub>2</sub>	2.452e-15	2.800e-15	-14.610	-14.553	0.058
ZnCl <sup>+</sup>	2.872e-17	1.852e-17	-16.542	-16.732	-0.191



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ZnCl2	4.812e-18	5.493e-18	-17.318	-17.260	0.058
ZnCl3-	2.648e-18	1.707e-18	-17.577	-17.768	-0.191
ZnCl4-2	1.103e-18	2.313e-19	-17.958	-18.636	-0.678
PbCl+	9.848e-19	7.309e-19	-18.007	-18.136	-0.129
PbCl2	3.722e-19	4.249e-19	-18.429	-18.372	0.058
PbCl3-	1.254e-19	9.310e-20	-18.902	-19.031	-0.129
PbCl4-2	3.999e-20	1.213e-20	-19.398	-19.916	-0.518
CuCl+	1.421e-22	9.162e-23	-21.847	-22.038	-0.191
CuCl2	1.130e-23	1.290e-23	-22.947	-22.889	0.058
CrOHCl2	2.283e-24	2.607e-24	-23.641	-23.584	0.058
CuCl3-	1.721e-26	1.110e-26	-25.764	-25.955	-0.191
CuCl4-2	1.151e-28	2.414e-29	-27.939	-28.617	-0.678
CrCl+2	6.449e-29	1.957e-29	-28.191	-28.708	-0.518
VOCl+	1.518e-30	1.127e-30	-29.819	-29.948	-0.129
CrCl2+	1.142e-30	8.477e-31	-29.942	-30.072	-0.129
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-40.016	-40.534	-0.518
CrO3Cl-	0.000e+00	0.000e+00	-46.148	-46.278	-0.129
Cr(2)	7.427e-29				
Cr+2	7.427e-29	2.253e-29	-28.129	-28.647	-0.518
Cr(3)	2.440e-06				
CrO2-	1.755e-06	1.303e-06	-5.756	-5.885	-0.129
Cr(OH)4-	6.680e-07	4.958e-07	-6.175	-6.305	-0.129
Cr(OH)3	1.631e-08	1.862e-08	-7.788	-7.730	0.058
Cr(OH)2+	1.213e-13	9.006e-14	-12.916	-13.045	-0.129
Cr(OH)+2	4.437e-20	1.346e-20	-19.353	-19.871	-0.518
CrOHSO4	1.182e-20	1.349e-20	-19.928	-19.870	0.058
Cr(NH3)4(OH)2+	1.102e-23	8.175e-24	-22.958	-23.087	-0.129
CrOHCl2	2.283e-24	2.607e-24	-23.641	-23.584	0.058
Cr+3	2.586e-27	1.767e-28	-26.587	-27.753	-1.165
CrCl+2	6.449e-29	1.957e-29	-28.191	-28.708	-0.518
CrSO4+	7.196e-30	5.341e-30	-29.143	-29.272	-0.129
CrCl2+	1.142e-30	8.477e-31	-29.942	-30.072	-0.129
Cr(NH3)5OH+2	3.315e-31	1.006e-31	-30.480	-30.998	-0.518
Cr2(OH)2SO4+2	1.088e-37	3.302e-38	-36.963	-37.481	-0.518
Cr(NH3)6+3	2.406e-40	0.000e+00	-39.619	-40.784	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-40.016	-40.534	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-41.821	-41.763	0.058
CrNO3+2	0.000e+00	0.000e+00	-88.233	-88.751	-0.518
Cr(6)	5.516e-28				
CrO4-2	4.005e-28	6.919e-29	-27.397	-28.160	-0.763
NaCrO4-	1.478e-28	1.097e-28	-27.830	-27.960	-0.129
KCrO4-	3.234e-30	2.400e-30	-29.490	-29.620	-0.129
HCrO4-	1.001e-34	7.426e-35	-34.000	-34.129	-0.129
CrO3Cl-	0.000e+00	0.000e+00	-46.148	-46.278	-0.129
CrO3SO4-2	0.000e+00	0.000e+00	-46.201	-46.719	-0.518
H2CrO4	0.000e+00	0.000e+00	-47.472	-47.415	0.058
Cr2O7-2	0.000e+00	0.000e+00	-66.059	-66.577	-0.518
Cu(1)	3.306e-08				

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CuCl3-2	1.919e-08	4.025e-09	-7.717	-8.395	-0.678
CuCl2-	1.388e-08	8.947e-09	-7.858	-8.048	-0.191
Cu+	5.371e-13	3.131e-13	-12.270	-12.504	-0.234
Cu(2)	4.593e-11				
Cu(OH)2	2.851e-11	3.255e-11	-10.545	-10.487	0.058
Cu(OH)4-2	1.003e-11	3.043e-12	-10.999	-11.517	-0.518
Cu(OH)3-	7.387e-12	5.482e-12	-11.132	-11.261	-0.129
CuOH+	8.666e-18	5.587e-18	-17.062	-17.253	-0.191
CuCO3	2.381e-20	2.718e-20	-19.623	-19.566	0.058
Cu(CO3)2-2	2.850e-21	8.646e-22	-20.545	-21.063	-0.518
Cu+2	1.735e-21	2.004e-22	-20.761	-21.698	-0.938
CuCl+	1.421e-22	9.162e-23	-21.847	-22.038	-0.191
CuSO4	7.339e-23	8.378e-23	-22.134	-22.077	0.058
CuCl2	1.130e-23	1.290e-23	-22.947	-22.889	0.058
CuHCO3+	2.403e-26	1.784e-26	-25.619	-25.749	-0.129
CuCl3-	1.721e-26	1.110e-26	-25.764	-25.955	-0.191
CuCl4-2	1.151e-28	2.414e-29	-27.939	-28.617	-0.678
Cu2(OH)2+2	1.455e-29	4.414e-30	-28.837	-29.355	-0.518
Cu(S4)2-3	8.020e-39	2.478e-39	-38.096	-38.606	-0.510
CuS4S5-3	1.377e-39	4.615e-40	-38.861	-39.336	-0.475
Cu(HS)3-	0.000e+00	0.000e+00	-77.266	-77.395	-0.129
H(0)	1.891e-15				
H2	9.456e-16	1.079e-15	-15.024	-14.967	0.058
K	9.021e-03				
K+	8.918e-03	5.510e-03	-2.050	-2.259	-0.209
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
KCrO4-	3.234e-30	2.400e-30	-29.490	-29.620	-0.129
Mg	2.927e-02				
Mg+2	1.519e-02	5.188e-03	-1.818	-2.285	-0.467
MgOH+	1.235e-02	8.836e-03	-1.908	-2.054	-0.145
MgSO4	1.636e-03	1.868e-03	-2.786	-2.729	0.058
MgCO3	9.258e-05	1.057e-04	-4.033	-3.976	0.058
MgHCO3+	2.104e-08	1.357e-08	-7.677	-7.868	-0.191
N(-3)	2.013e-05				
NH3	2.007e-05	2.291e-05	-4.697	-4.640	0.058
NH4+	5.436e-08	3.169e-08	-7.265	-7.499	-0.234
NH4SO4-	1.336e-09	9.043e-10	-8.874	-9.044	-0.170
Cr(NH3)4(OH)2+	1.102e-23	8.175e-24	-22.958	-23.087	-0.129
Cr(NH3)5OH+2	3.315e-31	1.006e-31	-30.480	-30.998	-0.518
Cr(NH3)6+3	2.406e-40	0.000e+00	-39.619	-40.784	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-40.016	-40.534	-0.518
N(3)	0.000e+00				
NO2-	0.000e+00	0.000e+00	-41.396	-41.526	-0.129
N(5)	0.000e+00				
NO3-	0.000e+00	0.000e+00	-59.244	-59.462	-0.218
CdNO3+	0.000e+00	0.000e+00	-72.542	-72.671	-0.129
PbNO3+	0.000e+00	0.000e+00	-77.248	-77.377	-0.129
CrNO3+2	0.000e+00	0.000e+00	-88.233	-88.751	-0.518

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VO2NO3	0.000e+00	0.000e+00	-88.761	-88.704	0.058
Na	4.531e-01				
Na+	4.482e-01	3.191e-01	-0.349	-0.496	-0.148
NaSO4-	4.791e-03	3.297e-03	-2.320	-2.482	-0.162
NaCO3-	1.223e-04	8.417e-05	-3.912	-4.075	-0.162
NaHCO3	2.992e-08	3.415e-08	-7.524	-7.467	0.058
NaCrO4-	1.478e-28	1.097e-28	-27.830	-27.960	-0.129
Ni	1.043e-07				
Ni(OH)3-	1.020e-07	7.568e-08	-6.992	-7.121	-0.129
Ni(OH)2	2.377e-09	2.714e-09	-8.624	-8.566	0.058
NiOH+	8.134e-13	6.037e-13	-12.090	-12.219	-0.129
NiCO3	5.726e-13	6.536e-13	-12.242	-12.185	0.058
Ni(CO3)2-2	9.458e-14	2.870e-14	-13.024	-13.542	-0.518
Ni+2	1.150e-14	3.490e-15	-13.939	-14.457	-0.518
NiCl+	3.495e-15	2.594e-15	-14.457	-14.586	-0.129
NiCl2	2.452e-15	2.800e-15	-14.610	-14.553	0.058
NiSO4	1.197e-15	1.367e-15	-14.922	-14.864	0.058
Ni(SO4)2-2	5.912e-19	1.794e-19	-18.228	-18.746	-0.518
NiHCO3+	1.235e-19	9.169e-20	-18.908	-19.038	-0.129
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-66.191	-66.134	0.058
Pb	3.484e-09				
Pb(OH)4-2	3.271e-09	9.926e-10	-8.485	-9.003	-0.518
Pb(OH)3-	2.089e-10	1.550e-10	-9.680	-9.810	-0.129
Pb(OH)2	4.241e-12	4.842e-12	-11.373	-11.315	0.058
PbOH+	6.013e-15	4.463e-15	-14.221	-14.350	-0.129
PbCO3	3.157e-17	3.604e-17	-16.501	-16.443	0.058
Pb(CO3)2-2	7.537e-18	2.287e-18	-17.123	-17.641	-0.518
PbCl+	9.848e-19	7.309e-19	-18.007	-18.136	-0.129
PbCl2	3.722e-19	4.249e-19	-18.429	-18.372	0.058
Pb+2	2.705e-19	8.208e-20	-18.568	-19.086	-0.518
PbCl3-	1.254e-19	9.310e-20	-18.902	-19.031	-0.129
PbSO4	8.957e-20	1.023e-19	-19.048	-18.990	0.058
PbCl4-2	3.999e-20	1.213e-20	-19.398	-19.916	-0.518
Pb(SO4)2-2	3.918e-21	1.189e-21	-20.407	-20.925	-0.518
PbHCO3+	1.560e-23	1.158e-23	-22.807	-22.936	-0.129
Pb2OH+3	1.200e-31	8.201e-33	-30.921	-32.086	-1.165
Pb3(OH)4+2	2.636e-32	7.998e-33	-31.579	-32.097	-0.518
Pb(HS)2	0.000e+00	0.000e+00	-58.271	-58.213	0.058
PbNO3+	0.000e+00	0.000e+00	-77.248	-77.377	-0.129
Pb(HS)3-	0.000e+00	0.000e+00	-83.982	-84.112	-0.129
S(-2)	1.068e-23				
S5-2	8.262e-25	2.507e-25	-24.083	-24.601	-0.518
S6-2	7.784e-25	2.362e-25	-24.109	-24.627	-0.518
S4-2	4.698e-25	1.425e-25	-24.328	-24.846	-0.518
HS-	1.011e-27	6.328e-28	-26.995	-27.199	-0.203
S-2	4.742e-28	9.949e-29	-27.324	-28.002	-0.678
S3-2	1.582e-28	4.801e-29	-27.801	-28.319	-0.518

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S2-2	8.420e-30	2.555e-30	-29.075	-29.593	-0.518
CdHS+	2.220e-31	1.648e-31	-30.654	-30.783	-0.129
H2S	2.458e-33	2.806e-33	-32.609	-32.552	0.058
Cu(S4)2-3	8.020e-39	2.478e-39	-38.096	-38.606	-0.510
CuS4S5-3	1.377e-39	4.615e-40	-38.861	-39.336	-0.475
Cd(HS)2	0.000e+00	0.000e+00	-51.679	-51.622	0.058
Zn(HS)2	0.000e+00	0.000e+00	-55.932	-55.874	0.058
Pb(HS)2	0.000e+00	0.000e+00	-58.271	-58.213	0.058
Cd(HS)3-	0.000e+00	0.000e+00	-76.511	-76.641	-0.129
Cu(HS)3-	0.000e+00	0.000e+00	-77.266	-77.395	-0.129
Zn(HS)3-	0.000e+00	0.000e+00	-81.783	-81.913	-0.129
Pb(HS)3-	0.000e+00	0.000e+00	-83.982	-84.112	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-101.131	-101.649	-0.518
S(6)	2.169e-02				
SO4-2	1.352e-02	2.215e-03	-1.869	-2.655	-0.786
NaSO4-	4.791e-03	3.297e-03	-2.320	-2.482	-0.162
MgSO4	1.636e-03	1.868e-03	-2.786	-2.729	0.058
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
NH4SO4-	1.336e-09	9.043e-10	-8.874	-9.044	-0.170
HSO4-	8.495e-14	5.620e-14	-13.071	-13.250	-0.179
CdSO4	9.190e-15	1.049e-14	-14.037	-13.979	0.058
NiSO4	1.197e-15	1.367e-15	-14.922	-14.864	0.058
Cd(SO4)2-2	9.005e-16	2.732e-16	-15.046	-15.563	-0.518
ZnSO4	1.597e-17	1.823e-17	-16.797	-16.739	0.058
Zn(SO4)2-2	1.181e-18	3.583e-19	-17.928	-18.446	-0.518
Ni(SO4)2-2	5.912e-19	1.794e-19	-18.228	-18.746	-0.518
PbSO4	8.957e-20	1.023e-19	-19.048	-18.990	0.058
CrOHSO4	1.182e-20	1.349e-20	-19.928	-19.870	0.058
Pb(SO4)2-2	3.918e-21	1.189e-21	-20.407	-20.925	-0.518
CuSO4	7.339e-23	8.378e-23	-22.134	-22.077	0.058
CrSO4+	7.196e-30	5.341e-30	-29.143	-29.272	-0.129
VO2SO4-	2.360e-30	1.752e-30	-29.627	-29.757	-0.129
VOSO4	1.562e-30	1.783e-30	-29.806	-29.749	0.058
AlSO4+	9.203e-32	6.087e-32	-31.036	-31.216	-0.179
Al(SO4)2-	1.549e-32	1.025e-32	-31.810	-31.989	-0.179
Cr2(OH)2SO4+2	1.088e-37	3.302e-38	-36.963	-37.481	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-41.821	-41.763	0.058
VSO4+	0.000e+00	0.000e+00	-42.807	-42.936	-0.129
CrO3SO4-2	0.000e+00	0.000e+00	-46.201	-46.719	-0.518
V(2)	1.796e-33				
VOH+	1.796e-33	1.333e-33	-32.746	-32.875	-0.129
V+2	6.879e-40	2.087e-40	-39.162	-39.680	-0.518
V(3)	3.444e-16				
V(OH)3	3.444e-16	3.932e-16	-15.463	-15.405	0.058
V(OH)2+	2.943e-23	2.184e-23	-22.531	-22.661	-0.129
VOH+2	4.790e-32	1.453e-32	-31.320	-31.838	-0.518
V+3	0.000e+00	0.000e+00	-40.556	-41.722	-1.165

BH310A July 2012 Eh=-0.4

VSO4+	0.000e+00	0.000e+00	-42.807	-42.936	-0.129
V2(OH)3+3	0.000e+00	0.000e+00	-52.441	-53.607	-1.165
V2(OH)2+4	0.000e+00	0.000e+00	-60.230	-62.302	-2.072
V(4)	2.864e-23				
V(OH)3+	2.864e-23	2.126e-23	-22.543	-22.672	-0.129
VO+2	1.196e-29	3.629e-30	-28.922	-29.440	-0.518
VOSO4	1.562e-30	1.783e-30	-29.806	-29.749	0.058
VOCI+	1.518e-30	1.127e-30	-29.819	-29.948	-0.129
H2V2O4+2	1.225e-40	0.000e+00	-39.912	-40.430	-0.518
V(5)	4.636e-07				
HVO4-2	3.034e-07	9.207e-08	-6.518	-7.036	-0.518
VO4-3	1.599e-07	1.093e-08	-6.796	-7.962	-1.165
V2O7-4	1.156e-10	9.797e-13	-9.937	-12.009	-2.072
HV2O7-3	2.908e-11	1.987e-12	-10.536	-11.702	-1.165
H2VO4-	6.329e-12	4.697e-12	-11.199	-11.328	-0.129
H3VO4	9.352e-21	1.068e-20	-20.029	-19.972	0.058
H3V2O7-	1.126e-24	8.358e-25	-23.948	-24.078	-0.129
V3O9-3	3.504e-27	2.394e-28	-26.455	-27.621	-1.165
VO2+	2.077e-29	1.542e-29	-28.683	-28.812	-0.129
VO2SO4-	2.360e-30	1.752e-30	-29.627	-29.757	-0.129
V4O12-4	4.240e-35	3.593e-37	-34.373	-36.445	-2.072
VO2NO3	0.000e+00	0.000e+00	-88.761	-88.704	0.058
V10O28-6	0.000e+00	0.000e+00	-101.801	-106.463	-4.662
HV10O28-5	0.000e+00	0.000e+00	-110.101	-113.338	-3.237
H2V10O28-4	0.000e+00	0.000e+00	-119.477	-121.549	-2.072
Zn	9.624e-08				
Zn(OH)4-2	4.828e-08	1.465e-08	-7.316	-7.834	-0.518
Zn(OH)3-	4.466e-08	3.315e-08	-7.350	-7.480	-0.129
Zn(OH)2	3.293e-09	3.759e-09	-8.482	-8.425	0.058
ZnOHCl	9.190e-13	1.049e-12	-12.037	-11.979	0.058
ZnOH+	6.659e-14	4.942e-14	-13.177	-13.306	-0.129
Zn(CO3)2-2	3.438e-16	1.043e-16	-15.464	-15.982	-0.518
ZnCO3	1.692e-16	1.931e-16	-15.772	-15.714	0.058
Zn+2	1.563e-16	3.831e-17	-15.806	-16.417	-0.611
ZnCl+	2.872e-17	1.852e-17	-16.542	-16.732	-0.191
ZnSO4	1.597e-17	1.823e-17	-16.797	-16.739	0.058
ZnCl2	4.812e-18	5.493e-18	-17.318	-17.260	0.058
ZnCl3-	2.648e-18	1.707e-18	-17.577	-17.768	-0.191
Zn(SO4)2-2	1.181e-18	3.583e-19	-17.928	-18.446	-0.518
ZnCl4-2	1.103e-18	2.313e-19	-17.958	-18.636	-0.678
ZnHCO3+	1.154e-21	8.567e-22	-20.938	-21.067	-0.129
Zn(HS)2	0.000e+00	0.000e+00	-55.932	-55.874	0.058
Zn(HS)3-	0.000e+00	0.000e+00	-81.783	-81.913	-0.129

-----Saturation indices-----

Phase            SI log IAP   log KT

(NH4)2CrO4	-43.50	27.10	70.60	(NH4)2CrO4
Al(OH)3(a)	-5.32	5.82	11.14	Al(OH)3
Al2O3	-11.33	11.65	22.98	Al2O3
Al4(OH)10SO4	-26.98	-4.28	22.70	Al4(OH)10SO4
AlAsO4:2H2O	-24.75	0.33	25.08	AlAsO4:2H2O
AlOHSO4	-18.50	-21.73	-3.23	AlOHSO4
AlumK	-33.81	-39.18	-5.37	KAl(SO4)2:12H2O
Alunite	-26.00	-27.46	-1.46	KAl3(SO4)2(OH)6
Anglesite	-13.89	-21.74	-7.85	PbSO4
Anhydrite	-0.47	-5.00	-4.53	CaSO4
Anilite	-5.83	-78.28	-72.45	Cu0.25Cu1.5S
Antlerite	-26.26	-17.97	8.29	Cu3(OH)4SO4
Aragonite	1.33	-6.94	-8.27	CaCO3
Arsenolite	-66.15	-69.36	-3.20	As4O6
Artinite	5.30	15.70	10.40	MgCO3:Mg(OH)2:3H2O
As2O5	-58.38	-10.96	47.42	As2O5
Atacamite	-14.45	-6.59	7.86	Cu2(OH)3Cl
Azurite	-33.14	-49.40	-16.26	Cu3(OH)2(CO3)2
Ba3(AsO4)2	11.84	43.42	31.58	Ba3(AsO4)2
BaCrO4	-25.08	35.33	60.41	BaCrO4
Barite	0.73	-9.43	-10.15	BaSO4
Bianchite	-17.36	-19.12	-1.76	ZnSO4:6H2O
Blaubleil	-12.61	-72.65	-60.04	Cu0.9Cu0.2S
Blaubleill	-10.49	-75.25	-64.76	Cu0.6Cu0.8S
Boehmite	-3.54	5.82	9.36	AlOOH
Brochantite	-30.12	-14.78	15.34	Cu4(OH)6SO4
Brucite	5.09	22.61	17.51	Mg(OH)2
Bunsenite	-2.68	10.44	13.12	NiO
Ca2V2O7	-3.09	6.19	9.28	CaVO3.5
Ca3(AsO4)2:6H2O	-6.21	56.66	62.87	Ca3(AsO4)2:6H2O
Ca3(VO4)2	-2.99	17.47	20.46	Ca1.5VO4
Ca_Vanadate	-8.20	-5.08	3.11	Ca0.5VO3
CaCrO4	-28.42	39.76	68.17	CaCrO4
Calcite	1.48	-6.94	-8.42	CaCO3
Cd(BO2)2	-12.68	-2.84	9.84	Cd(BO2)2
Cd(Gamma)	-14.81	-0.71	14.10	Cd
Cd(OH)2(A)	-3.17	11.14	14.31	Cd(OH)2
Cd(OH)2(C)	-2.51	11.14	13.65	Cd(OH)2
Cd3(OH)2(SO4)2	-28.39	-21.68	6.71	Cd3(OH)2(SO4)2
Cd3(OH)4SO4	-16.70	5.86	22.56	Cd3(OH)4SO4
Cd4(OH)6SO4	-11.40	17.00	28.40	Cd4(OH)6SO4
CdCl2	-14.26	-14.81	-0.55	CdCl2
CdCl2:2.5H2O	-12.84	-14.83	-1.99	CdCl2:2.5H2O
CdCl2:H2O	-13.16	-14.82	-1.66	CdCl2:H2O
CdMetal	-14.71	-0.71	13.99	Cd
CdOHCl	-5.56	-1.84	3.73	CdOHCl
CdSO4	-16.72	-16.41	0.31	CdSO4
CdSO4:2.67H2O	-14.68	-16.43	-1.75	CdSO4:2.67H2O

CdSO4:H2O	-14.97	-16.42	-1.45	CdSO4:H2O
Cerrusite	-10.42	-23.68	-13.27	PbCO3
CH4(g)	-35.14	-76.94	-41.81	CH4
Chalcanthite	-21.71	-24.39	-2.68	CuSO4:5H2O
Chalcocite	-3.75	-80.44	-76.69	Cu2S
Claudetite	-65.92	-69.36	-3.44	As4O6
CO2(g)	-11.32	-29.50	-18.17	CO2
Cotunnite	-15.21	-20.14	-4.93	PbCl2
Covellite	-12.73	-71.79	-59.05	CuS
Cr(OH)2	-14.81	-6.53	8.29	Cr(OH)2
Cr(OH)3(A)	0.15	-0.60	-0.75	Cr(OH)3
Cr(OH)3(C)	-2.50	-0.60	1.90	Cr(OH)3
Cr2O3	1.88	-1.18	-3.05	Cr2O3
CrCl2	-46.12	-32.47	13.65	CrCl2
CrCl3	-53.80	-39.52	14.28	CrCl3
CrMetal	-48.81	-18.38	30.43	Cr
CrO3	-49.88	17.20	67.08	CrO3
Cu(OH)2	-5.87	3.19	9.07	Cu(OH)2
Cu2(OH)3NO3	-75.25	58.79	134.03	Cu2(OH)3NO3
Cu2SO4	-25.84	-33.01	-7.17	Cu2SO4
Cu3(AsO4)2:6H2O	-48.07	-1.41	46.67	Cu3(AsO4)2:6H2O
CuCO3	-16.67	-26.30	-9.63	CuCO3
CuCrO4	-44.38	20.40	64.78	CuCrO4
CuMetal	3.25	-8.66	-11.91	Cu
CuOCuSO4	-33.68	-21.15	12.53	CuO:CuSO4
Cuprite	1.61	-5.46	-7.07	Cu2O
CuSO4	-27.87	-24.35	3.52	CuSO4
Diaspore	-1.74	5.82	7.56	AlOOH
Djurleite	-4.28	-79.87	-75.60	Cu0.066Cu1.868S
Dolomite	2.95	-13.82	-16.77	CaMg(CO3)2
Epsomite	-2.77	-4.99	-2.22	MgSO4:7H2O
Galena	-18.16	-69.17	-51.02	PbS
Gibbsite(C)	-3.59	5.82	9.41	Al(OH)3
Goslarite	-17.07	-19.12	-2.05	ZnSO4:7H2O
Greenockite	-12.11	-63.84	-51.73	CdS
Gypsum	-0.16	-5.01	-4.86	CaSO4:2H2O
Halite	-2.58	-1.02	1.56	NaCl
Huntite	1.66	-27.59	-29.25	CaMg3(CO3)4
Hydcerrusite	-24.10	-41.56	-17.46	Pb(OH)2:2PbCO3
Hydromagnesite	2.35	-4.95	-7.31	Mg5(CO3)4(OH)2:4H2O
K2Cr2O7	-69.56	54.78	124.34	K2Cr2O7
K2CrO4	-32.57	37.58	70.15	K2CrO4
Langite	-32.68	-14.78	17.90	Cu4(OH)6SO4:H2O
Larnakite	-15.83	-15.93	-0.10	PbO:PbSO4
Laurionite	-7.79	-7.17	0.62	PbOHCl
Lime	-11.53	22.56	34.09	CaO
Litharge	-7.37	5.81	13.18	PbO
Magnesite	0.97	-6.88	-7.86	MgCO3

Malachite	-18.36	-23.10	-4.74	Cu <sub>2</sub> (OH) <sub>2</sub> CO <sub>3</sub>
Massicot	-7.57	5.81	13.38	PbO
Melanothallite	-26.83	-22.75	4.07	CuCl <sub>2</sub>
Mg <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-7.78	6.25	14.03	MgVO <sub>3.5</sub>
Mg_Vanadate	-11.15	-5.06	6.10	Mg <sub>0.5</sub> VO <sub>3</sub>
MgCr <sub>2</sub> O <sub>4</sub>	8.24	21.44	13.19	MgCr <sub>2</sub> O <sub>4</sub>
MgCrO <sub>4</sub>	-36.42	39.81	76.23	MgCrO <sub>4</sub>
Millerite	-21.09	-64.55	-43.45	NiS
Minium	-47.27	29.30	76.56	Pb <sub>3</sub> O <sub>4</sub>
Mirabilite	-2.08	-3.72	-1.65	Na <sub>2</sub> SO <sub>4</sub> :10H <sub>2</sub> O
Monteponite	-4.67	11.14	15.81	CdO
Morenosite	-14.72	-17.17	-2.44	NiSO <sub>4</sub> :7H <sub>2</sub> O
Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-72.17	58.30	130.47	Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
Na <sub>2</sub> CrO <sub>4</sub>	-32.54	41.11	73.65	Na <sub>2</sub> CrO <sub>4</sub>
Na <sub>3</sub> VO <sub>4</sub>	-18.69	19.50	38.18	Na <sub>3</sub> VO <sub>4</sub>
Na <sub>4</sub> V <sub>2</sub> O <sub>7</sub>	-11.83	7.54	19.37	Na <sub>2</sub> VO <sub>3.5</sub>
Na_Vanadate	-8.32	-4.41	3.91	NaVO <sub>3</sub>
Nantokite	-5.99	-15.71	-9.71	CuCl
Natron	-3.91	-5.67	-1.75	Na <sub>2</sub> CO <sub>3</sub> :10H <sub>2</sub> O
Nesquehonite	-1.45	-6.91	-5.46	MgCO <sub>3</sub> :3H <sub>2</sub> O
NH <sub>4</sub> VO <sub>3</sub>	-14.21	-11.41	2.80	NH <sub>4</sub> VO <sub>3</sub>
Ni(OH) <sub>2</sub>	0.49	10.43	9.95	Ni(OH) <sub>2</sub>
Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-35.97	20.30	56.27	Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-17.81	14.19	32.00	Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
NiCO <sub>3</sub>	-12.49	-19.05	-6.56	NiCO <sub>3</sub>
O <sub>2</sub> (g)	-63.15	23.72	86.86	O <sub>2</sub>
Oripment	-90.32	-259.64	-169.32	As <sub>2</sub> S <sub>3</sub>
Otavite	-4.63	-18.35	-13.72	CdCO <sub>3</sub>
Pb(BO <sub>2</sub> ) <sub>2</sub>	-15.95	-8.17	7.77	Pb(BO <sub>2</sub> ) <sub>2</sub>
Pb(OH) <sub>2</sub> (C)	-2.74	5.81	8.54	Pb(OH) <sub>2</sub>
Pb <sub>2</sub> (OH) <sub>3</sub> Cl	-10.16	-1.36	8.79	Pb <sub>2</sub> (OH) <sub>3</sub> Cl
Pb <sub>2</sub> O(OH) <sub>2</sub>	-14.58	11.62	26.20	Pb <sub>2</sub> O(OH) <sub>2</sub>
Pb <sub>2</sub> O <sub>3</sub>	-37.56	23.48	61.04	Pb <sub>2</sub> O <sub>3</sub>
Pb <sub>2</sub> OCO <sub>3</sub>	-17.69	-17.87	-0.18	Pb <sub>2</sub> OCO <sub>3</sub>
Pb <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-9.69	-10.55	-0.86	PbVO <sub>3.5</sub>
Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>	-39.89	6.48	46.37	Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>
Pb <sub>3</sub> (VO <sub>4</sub> ) <sub>2</sub>	-10.96	-7.64	3.31	Pb <sub>1.5</sub> VO <sub>4</sub>
Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>	-23.82	-12.06	11.76	Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>
Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>	-21.10	-10.12	10.98	Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>
Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-25.43	-4.33	21.10	Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>	-27.38	-4.30	23.08	Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>
PbCrO <sub>4</sub>	-33.27	23.01	56.29	PbCrO <sub>4</sub>
PbMetal	-10.30	-6.05	4.26	Pb
PbO:0.3H <sub>2</sub> O	-7.17	5.81	12.98	PbO:0.33H <sub>2</sub> O
Periclase	0.09	22.61	22.52	MgO
Phosgenite	-24.01	-43.82	-19.81	PbCl <sub>2</sub> :PbCO <sub>3</sub>
Plattnerite	-33.61	17.67	51.28	PbO <sub>2</sub>
Portlandite	-0.98	22.55	23.53	Ca(OH) <sub>2</sub>



Realgar	-42.31	-98.25	-55.94	AsS
Retgersite	-15.09	-17.16	-2.07	NiSO4:6H2O
Smithsonite	-11.14	-21.01	-9.88	ZnCO3
Sphalerite	-19.31	-66.50	-47.19	ZnS
Spinel	-4.56	34.27	38.83	MgAl2O4
SULFUR	-25.79	-63.13	-37.33	S
Tenorite	-4.85	3.20	8.05	CuO
Thenardite	-3.48	-3.65	-0.16	Na2SO4
Thermonatrite	-5.80	-5.60	0.20	Na2CO3:H2O
V(OH)3	-12.04	-28.23	-16.20	V(OH)3
V2O3	-9.83	-28.22	-18.40	VO1.5
V2O4	-9.21	-22.29	-13.09	VO2
V2O5	-15.76	-16.36	-0.60	VO2.5
V3O5	-28.01	-78.73	-50.72	V3O5
V4O7	-38.26	-101.03	-62.77	V4O7
V6O13	-59.22	-121.89	-62.68	V6O13
VCl2	-55.23	-60.10	-4.88	VCl2
VCl3	-66.26	-67.15	-0.89	VCl3
VMetal	-66.27	-46.01	20.26	V
VO	-24.17	-34.15	-9.98	VO
VO(OH)2	-10.40	-22.30	-11.90	VO(OH)2
VO2Cl	-32.42	-29.34	3.08	VO2Cl
VOCl	-27.49	-41.20	-13.71	VOCl
VOCl2	-44.07	-48.25	-4.17	VOCl2
VOSO4(C)	-36.24	-49.84	-13.60	VOSO4
Witherite	-2.77	-11.37	-8.60	BaCO3
Wurtzite	-21.34	-66.50	-45.17	ZnS
Zincite	-3.27	8.48	11.75	ZnO
Zincosite	-22.62	-19.07	3.55	ZnSO4
Zn(BO2)2	-13.80	-5.51	8.29	Zn(BO2)2
Zn(NO3)2:6H2O	-138.67	113.23	251.90	Zn(NO3)2:6H2O
Zn(OH)2(A)	-3.98	8.47	12.45	Zn(OH)2
Zn(OH)2(B)	-3.28	8.47	11.75	Zn(OH)2
Zn(OH)2(C)	-3.73	8.47	12.20	Zn(OH)2
Zn(OH)2(E)	-3.03	8.47	11.50	Zn(OH)2
Zn(OH)2(G)	-3.24	8.47	11.71	Zn(OH)2
Zn2(OH)2SO4	-18.10	-10.60	7.50	Zn2(OH)2SO4
Zn2(OH)3Cl	-11.23	3.97	15.20	Zn2(OH)3Cl
Zn3(AsO4)2:2.5H2O	-39.75	14.46	54.22	Zn3(AsO4)2:2.5H2O
Zn3O(SO4)2	-50.42	-29.66	20.75	Zn3O(SO4)2
Zn4(OH)6SO4	-22.05	6.35	28.40	Zn4(OH)6SO4
Zn5(OH)8Cl2	-22.08	16.42	38.50	Zn5(OH)8Cl2
ZnCl2	-24.99	-17.47	7.52	ZnCl2
ZnCO3:H2O	-10.76	-21.02	-10.26	ZnCO3:H2O
ZnMetal	-30.16	-3.38	26.79	Zn
ZnO(Active)	-2.83	8.48	11.31	ZnO
ZnS(A)	-22.01	-66.50	-44.50	ZnS
ZnSO4:H2O	-18.81	-19.08	-0.27	ZnSO4:H2O

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End of simulation.  
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Reading input data for simulation 2.  
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End of run.  
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No memory leaks

Database file: minteq.dat

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Reading data base.  
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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

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Reading input data for simulation 1.  
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TITLE BH310a Low  
SOLUTION 1  
pH 10.05 charge  
temp 14.04  
pe -8.15  
units mg/L  
Al 0.0422  
As 0.00163 as H3AsO4  
Ba 0.109  
B 2.360  
Cd 0.00013  
Ca 717  
C 26.3  
Cl 16500  
Cu 0.00204  
Cr 0.123  
Pb 0.0007  
Mg 690  
Ni 0.00594  
N 0.82 as N03-  
K 342  
Na 10100  
S 2020 as SO4-2  
V 0.0229  
Zn 0.0061  
END

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TITLE  
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BH310a Low

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 Beginning of initial solution calculations.  
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Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.613e-06	1.613e-06
As	1.184e-08	1.184e-08
B	2.252e-04	2.252e-04
Ba	8.185e-07	8.185e-07
C	4.445e-04	4.445e-04
Ca	1.845e-02	1.845e-02
Cd	1.193e-09	1.193e-09
Cl	4.800e-01	4.800e-01
Cr	2.440e-06	2.440e-06
Cu	3.311e-08	3.311e-08
K	9.021e-03	9.021e-03
Mg	2.927e-02	2.927e-02
N	2.013e-05	2.013e-05
Na	4.531e-01	4.531e-01
Ni	1.043e-07	1.043e-07
Pb	3.484e-09	3.484e-09
S	2.169e-02	2.169e-02
V	4.636e-07	4.636e-07
Zn	9.624e-08	9.624e-08

-----Description of solution-----

pH = 12.453    Charge balance  
 pe = -8.150  
 Activity of water = 0.983  
 Ionic strength = 5.752e-01  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 3.422e-02  
 Total CO2 (mol/kg) = 4.445e-04  
 Temperature (deg C) = 14.040  
 Electrical balance (eq) = 2.181e-14  
 Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|)$  = 0.00  
 Iterations = 16  
 Total H = 1.110460e+02  
 Total O = 5.562806e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	1.894e-02	1.186e-02	-1.723	-1.926	-0.203
H+	4.619e-13	3.524e-13	-12.335	-12.453	-0.118
H2O	5.551e+01	9.826e-01	-0.008	-0.008	0.000
Al	1.613e-06				
Al(OH)4-	1.613e-06	1.067e-06	-5.792	-5.972	-0.179
Al(OH)3	5.725e-11	6.535e-11	-10.242	-10.185	0.058
Al(OH)2+	2.706e-17	1.862e-17	-16.568	-16.730	-0.162
AlOH+2	1.783e-24	3.996e-25	-23.749	-24.398	-0.649
Al+3	3.443e-31	3.014e-32	-30.463	-31.521	-1.058
AlSO4+	9.203e-32	6.087e-32	-31.036	-31.216	-0.179
Al(SO4)2-	1.549e-32	1.025e-32	-31.810	-31.989	-0.179
As(3)	6.538e-11				
HAsO3-2	4.018e-11	1.219e-11	-10.396	-10.914	-0.518
AsO3-3	1.322e-11	9.031e-13	-10.879	-12.044	-1.165
H2AsO3-	1.197e-11	8.886e-12	-10.922	-11.051	-0.129
H3AsO3	7.074e-15	8.076e-15	-14.150	-14.093	0.058
H4AsO3+	1.900e-27	1.410e-27	-26.721	-26.851	-0.129
As(5)	1.178e-08				
AsO4-3	1.131e-08	7.727e-10	-7.947	-9.112	-1.165
HAsO4-2	4.685e-10	1.421e-10	-9.329	-9.847	-0.518
H2AsO4-	4.062e-16	3.015e-16	-15.391	-15.521	-0.129
H3AsO4	1.460e-26	1.667e-26	-25.836	-25.778	0.058
B	2.252e-04				
H2BO3-	2.251e-04	1.312e-04	-3.648	-3.882	-0.234
H3BO3	8.661e-08	9.888e-08	-7.062	-7.005	0.058
Ba	8.185e-07				
Ba+2	8.070e-07	1.693e-07	-6.093	-6.771	-0.678
BaOH+	1.157e-08	7.830e-09	-7.937	-8.106	-0.170
C(4)	4.445e-04				
NaCO3-	1.223e-04	8.417e-05	-3.912	-4.075	-0.162
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CO3-2	1.127e-04	2.526e-05	-3.948	-4.598	-0.649
MgCO3	9.258e-05	1.057e-04	-4.033	-3.976	0.058
HCO3-	3.567e-07	2.454e-07	-6.448	-6.610	-0.162
NaHCO3	2.992e-08	3.415e-08	-7.524	-7.467	0.058
MgHCO3+	2.104e-08	1.357e-08	-7.677	-7.868	-0.191
CaHCO3+	1.175e-08	8.268e-09	-7.930	-8.083	-0.153
NiCO3	5.726e-13	6.536e-13	-12.242	-12.185	0.058
H2CO3	1.523e-13	1.739e-13	-12.817	-12.760	0.058
CdCO3	9.763e-14	1.115e-13	-13.010	-12.953	0.058
Ni(CO3)2-2	9.458e-14	2.870e-14	-13.024	-13.542	-0.518
Zn(CO3)2-2	3.438e-16	1.043e-16	-15.464	-15.982	-0.518
ZnCO3	1.692e-16	1.931e-16	-15.772	-15.714	0.058
PbCO3	3.157e-17	3.604e-17	-16.501	-16.443	0.058

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Pb(CO3)2-2	7.537e-18	2.287e-18	-17.123	-17.641	-0.518
CdHCO3+	5.304e-19	3.937e-19	-18.275	-18.405	-0.129
NiHCO3+	1.235e-19	9.169e-20	-18.908	-19.038	-0.129
Cd(CO3)3-4	5.559e-20	4.711e-22	-19.255	-21.327	-2.072
ZnHCO3+	1.154e-21	8.567e-22	-20.938	-21.067	-0.129
CuCO3	5.589e-22	6.381e-22	-21.253	-21.195	0.058
Cu(CO3)2-2	6.689e-23	2.029e-23	-22.175	-22.693	-0.518
PbHCO3+	1.560e-23	1.158e-23	-22.807	-22.936	-0.129
CuHCO3+	5.641e-28	4.187e-28	-27.249	-27.378	-0.129
Ca	1.845e-02				
Ca+2	1.491e-02	4.549e-03	-1.826	-2.342	-0.516
CaOH+	1.784e-03	1.255e-03	-2.749	-2.901	-0.153
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CaHCO3+	1.175e-08	8.268e-09	-7.930	-8.083	-0.153
Cd	1.193e-09				
Cd(OH)2	5.356e-10	6.115e-10	-9.271	-9.214	0.058
CdOHCl	3.800e-10	4.338e-10	-9.420	-9.363	0.058
Cd(OH)3-	2.578e-10	1.913e-10	-9.589	-9.718	-0.129
Cd(OH)4-2	1.567e-11	4.755e-12	-10.805	-11.323	-0.518
CdOH+	2.366e-12	1.756e-12	-11.626	-11.755	-0.129
CdCl+	6.467e-13	4.800e-13	-12.189	-12.319	-0.129
CdCl2	4.985e-13	5.691e-13	-12.302	-12.245	0.058
CdCl3-	1.206e-13	8.952e-14	-12.919	-13.048	-0.129
CdCO3	9.763e-14	1.115e-13	-13.010	-12.953	0.058
Cd+2	5.802e-14	1.760e-14	-13.236	-13.754	-0.518
CdSO4	9.190e-15	1.049e-14	-14.037	-13.979	0.058
Cd(SO4)2-2	9.005e-16	2.732e-16	-15.046	-15.563	-0.518
CdHS+	2.434e-18	1.807e-18	-17.614	-17.743	-0.129
CdHCO3+	5.304e-19	3.937e-19	-18.275	-18.405	-0.129
Cd(CO3)3-4	5.559e-20	4.711e-22	-19.255	-21.327	-2.072
Cd2OH+3	2.554e-24	1.745e-25	-23.593	-24.758	-1.165
Cd(HS)2	2.515e-26	2.872e-26	-25.599	-25.542	0.058
Cd(HS)3-	4.063e-38	3.016e-38	-37.391	-37.521	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-48.971	-49.489	-0.518
CdNO3+	0.000e+00	0.000e+00	-85.582	-85.711	-0.129
Cl	4.800e-01				
Cl-	4.800e-01	2.966e-01	-0.319	-0.528	-0.209
CuCl3-2	1.921e-08	4.030e-09	-7.716	-8.395	-0.678
CuCl2-	1.390e-08	8.959e-09	-7.857	-8.048	-0.191
CdOHCl	3.800e-10	4.338e-10	-9.420	-9.363	0.058
ZnOHCl	9.190e-13	1.049e-12	-12.037	-11.979	0.058
CdCl+	6.467e-13	4.800e-13	-12.189	-12.319	-0.129
CdCl2	4.985e-13	5.691e-13	-12.302	-12.245	0.058
CdCl3-	1.206e-13	8.952e-14	-12.919	-13.048	-0.129
NiCl+	3.495e-15	2.594e-15	-14.457	-14.586	-0.129
NiCl2	2.452e-15	2.800e-15	-14.610	-14.553	0.058
ZnCl+	2.872e-17	1.852e-17	-16.542	-16.732	-0.191

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ZnCl2	4.812e-18	5.493e-18	-17.318	-17.260	0.058
ZnCl3-	2.648e-18	1.707e-18	-17.577	-17.768	-0.191
ZnCl4-2	1.103e-18	2.313e-19	-17.958	-18.636	-0.678
PbCl+	9.848e-19	7.309e-19	-18.007	-18.136	-0.129
PbCl2	3.722e-19	4.249e-19	-18.429	-18.372	0.058
PbCl3-	1.254e-19	9.310e-20	-18.902	-19.031	-0.129
PbCl4-2	3.999e-20	1.213e-20	-19.398	-19.916	-0.518
CuCl+	3.336e-24	2.151e-24	-23.477	-23.667	-0.191
CrOHCl2	2.283e-24	2.607e-24	-23.641	-23.584	0.058
CuCl2	2.653e-25	3.029e-25	-24.576	-24.519	0.058
CuCl3-	4.041e-28	2.605e-28	-27.394	-27.584	-0.191
VOCl+	6.477e-29	4.807e-29	-28.189	-28.318	-0.129
CrCl+2	6.449e-29	1.957e-29	-28.191	-28.708	-0.518
CuCl4-2	2.701e-30	5.666e-31	-29.569	-30.247	-0.678
CrCl2+	1.142e-30	8.477e-31	-29.942	-30.072	-0.129
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-40.016	-40.534	-0.518
CrO3Cl-	0.000e+00	0.000e+00	-51.038	-51.168	-0.129
Cr(2)	3.168e-27				
Cr+2	3.168e-27	9.613e-28	-26.499	-27.017	-0.518
Cr(3)	2.440e-06				
CrO2-	1.755e-06	1.303e-06	-5.756	-5.885	-0.129
Cr(OH)4-	6.680e-07	4.958e-07	-6.175	-6.305	-0.129
Cr(OH)3	1.631e-08	1.862e-08	-7.788	-7.730	0.058
Cr(OH)2+	1.213e-13	9.006e-14	-12.916	-13.045	-0.129
Cr(OH)+2	4.437e-20	1.346e-20	-19.353	-19.871	-0.518
CrOHSO4	1.182e-20	1.349e-20	-19.928	-19.870	0.058
Cr(NH3)4(OH)2+	1.102e-23	8.175e-24	-22.958	-23.087	-0.129
CrOHCl2	2.283e-24	2.607e-24	-23.641	-23.584	0.058
Cr+3	2.586e-27	1.767e-28	-26.587	-27.753	-1.165
CrCl+2	6.449e-29	1.957e-29	-28.191	-28.708	-0.518
CrSO4+	7.196e-30	5.341e-30	-29.143	-29.272	-0.129
CrCl2+	1.142e-30	8.477e-31	-29.942	-30.072	-0.129
Cr(NH3)5OH+2	3.315e-31	1.006e-31	-30.480	-30.998	-0.518
Cr2(OH)2SO4+2	1.088e-37	3.302e-38	-36.963	-37.481	-0.518
Cr(NH3)6+3	2.406e-40	0.000e+00	-39.619	-40.784	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-40.016	-40.534	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-41.821	-41.763	0.058
CrNO3+2	0.000e+00	0.000e+00	-101.273	-101.791	-0.518
Cr(6)	7.106e-33				
CrO4-2	5.160e-33	8.913e-34	-32.287	-33.050	-0.763
NaCrO4-	1.905e-33	1.413e-33	-32.720	-32.850	-0.129
KCrO4-	4.166e-35	3.092e-35	-34.380	-34.510	-0.129
HCrO4-	1.289e-39	9.567e-40	-38.890	-39.019	-0.129
CrO3Cl-	0.000e+00	0.000e+00	-51.038	-51.168	-0.129
CrO3SO4-2	0.000e+00	0.000e+00	-51.091	-51.609	-0.518
H2CrO4	0.000e+00	0.000e+00	-52.362	-52.305	0.058
Cr2O7-2	0.000e+00	0.000e+00	-75.839	-76.357	-0.518
Cu(1)	3.311e-08				

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CuCl3-2	1.921e-08	4.030e-09	-7.716	-8.395	-0.678
CuCl2-	1.390e-08	8.959e-09	-7.857	-8.048	-0.191
Cu+	5.378e-13	3.135e-13	-12.269	-12.504	-0.234
Cu(2)	2.209e-12				
Cu(S4)2-3	9.655e-13	2.984e-13	-12.015	-12.525	-0.510
Cu(OH)2	6.693e-13	7.641e-13	-12.174	-12.117	0.058
Cu(OH)4-2	2.354e-13	7.143e-14	-12.628	-13.146	-0.518
Cu(OH)3-	1.734e-13	1.287e-13	-12.761	-12.890	-0.129
CuS4S5-3	1.658e-13	5.556e-14	-12.780	-13.255	-0.475
CuOH+	2.034e-19	1.311e-19	-18.692	-18.882	-0.191
CuCO3	5.589e-22	6.381e-22	-21.253	-21.195	0.058
Cu(CO3)2-2	6.689e-23	2.029e-23	-22.175	-22.693	-0.518
Cu+2	4.074e-23	4.703e-24	-22.390	-23.328	-0.938
CuCl+	3.336e-24	2.151e-24	-23.477	-23.667	-0.191
CuSO4	1.723e-24	1.967e-24	-23.764	-23.706	0.058
CuCl2	2.653e-25	3.029e-25	-24.576	-24.519	0.058
CuHCO3+	5.641e-28	4.187e-28	-27.249	-27.378	-0.129
CuCl3-	4.041e-28	2.605e-28	-27.394	-27.584	-0.191
CuCl4-2	2.701e-30	5.666e-31	-29.569	-30.247	-0.678
Cu2(OH)2+2	8.016e-33	2.432e-33	-32.096	-32.614	-0.518
Cu(HS)3-	1.677e-40	1.245e-40	-39.775	-39.905	-0.129
H(0)	3.441e-12				
H2	1.721e-12	1.964e-12	-11.764	-11.707	0.058
K	9.021e-03				
K+	8.918e-03	5.510e-03	-2.050	-2.259	-0.209
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
KCrO4-	4.166e-35	3.092e-35	-34.380	-34.510	-0.129
Mg	2.927e-02				
Mg+2	1.519e-02	5.188e-03	-1.818	-2.285	-0.467
MgOH+	1.235e-02	8.836e-03	-1.908	-2.054	-0.145
MgSO4	1.636e-03	1.868e-03	-2.786	-2.729	0.058
MgCO3	9.258e-05	1.057e-04	-4.033	-3.976	0.058
MgHCO3+	2.104e-08	1.357e-08	-7.677	-7.868	-0.191
N(-3)	2.013e-05				
NH3	2.007e-05	2.291e-05	-4.697	-4.640	0.058
NH4+	5.436e-08	3.169e-08	-7.265	-7.499	-0.234
NH4SO4-	1.336e-09	9.043e-10	-8.874	-9.044	-0.170
Cr(NH3)4(OH)2+	1.102e-23	8.175e-24	-22.958	-23.087	-0.129
Cr(NH3)5OH+2	3.315e-31	1.006e-31	-30.480	-30.998	-0.518
Cr(NH3)6+3	2.406e-40	0.000e+00	-39.619	-40.784	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-40.016	-40.534	-0.518
N(3)	0.000e+00				
NO2-	0.000e+00	0.000e+00	-51.176	-51.306	-0.129
N(5)	0.000e+00				
NO3-	0.000e+00	0.000e+00	-72.284	-72.502	-0.218
CdNO3+	0.000e+00	0.000e+00	-85.582	-85.711	-0.129
PbNO3+	0.000e+00	0.000e+00	-90.288	-90.417	-0.129
CrNO3+2	0.000e+00	0.000e+00	-101.273	-101.791	-0.518



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VO2NO3	0.000e+00	0.000e+00	-101.801	-101.744	0.058
Na	4.531e-01				
Na+	4.482e-01	3.191e-01	-0.349	-0.496	-0.148
NaSO4-	4.791e-03	3.297e-03	-2.320	-2.482	-0.162
NaCO3-	1.223e-04	8.417e-05	-3.912	-4.075	-0.162
NaHCO3	2.992e-08	3.415e-08	-7.524	-7.467	0.058
NaCrO4-	1.905e-33	1.413e-33	-32.720	-32.850	-0.129
Ni	1.043e-07				
Ni(OH)3-	1.020e-07	7.568e-08	-6.992	-7.121	-0.129
Ni(OH)2	2.377e-09	2.714e-09	-8.624	-8.566	0.058
NiOH+	8.134e-13	6.037e-13	-12.090	-12.219	-0.129
NiCO3	5.726e-13	6.536e-13	-12.242	-12.185	0.058
Ni(CO3)2-2	9.458e-14	2.870e-14	-13.024	-13.542	-0.518
Ni+2	1.150e-14	3.490e-15	-13.939	-14.457	-0.518
NiCl+	3.495e-15	2.594e-15	-14.457	-14.586	-0.129
NiCl2	2.452e-15	2.800e-15	-14.610	-14.553	0.058
NiSO4	1.197e-15	1.367e-15	-14.922	-14.864	0.058
Ni(SO4)2-2	5.912e-19	1.794e-19	-18.228	-18.746	-0.518
NiHCO3+	1.235e-19	9.169e-20	-18.908	-19.038	-0.129
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-72.711	-72.654	0.058
Pb	3.484e-09				
Pb(OH)4-2	3.271e-09	9.926e-10	-8.485	-9.003	-0.518
Pb(OH)3-	2.089e-10	1.550e-10	-9.680	-9.810	-0.129
Pb(OH)2	4.241e-12	4.842e-12	-11.373	-11.315	0.058
PbOH+	6.013e-15	4.463e-15	-14.221	-14.350	-0.129
PbCO3	3.157e-17	3.604e-17	-16.501	-16.443	0.058
Pb(CO3)2-2	7.537e-18	2.287e-18	-17.123	-17.641	-0.518
PbCl+	9.848e-19	7.309e-19	-18.007	-18.136	-0.129
PbCl2	3.722e-19	4.249e-19	-18.429	-18.372	0.058
Pb+2	2.705e-19	8.208e-20	-18.568	-19.086	-0.518
PbCl3-	1.254e-19	9.310e-20	-18.902	-19.031	-0.129
PbSO4	8.957e-20	1.023e-19	-19.048	-18.990	0.058
PbCl4-2	3.999e-20	1.213e-20	-19.398	-19.916	-0.518
Pb(SO4)2-2	3.918e-21	1.189e-21	-20.407	-20.925	-0.518
PbHCO3+	1.560e-23	1.158e-23	-22.807	-22.936	-0.129
Pb2OH+3	1.200e-31	8.201e-33	-30.921	-32.086	-1.165
Pb3(OH)4+2	2.636e-32	7.998e-33	-31.579	-32.097	-0.518
Pb(HS)2	6.445e-33	7.358e-33	-32.191	-32.133	0.058
Pb(HS)3-	0.000e+00	0.000e+00	-44.862	-44.992	-0.129
PbNO3+	0.000e+00	0.000e+00	-90.288	-90.417	-0.129
S(-2)	1.263e-10				
S5-2	9.059e-12	2.749e-12	-11.043	-11.561	-0.518
S6-2	8.535e-12	2.590e-12	-11.069	-11.587	-0.518
S4-2	5.151e-12	1.563e-12	-11.288	-11.806	-0.518
Cu(S4)2-3	9.655e-13	2.984e-13	-12.015	-12.525	-0.510
CuS4S5-3	1.658e-13	5.556e-14	-12.780	-13.255	-0.475
HS-	1.108e-14	6.938e-15	-13.955	-14.159	-0.203

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S-2	5.200e-15	1.091e-15	-14.284	-14.962	-0.678
S3-2	1.735e-15	5.264e-16	-14.761	-15.279	-0.518
S2-2	9.233e-17	2.801e-17	-16.035	-16.553	-0.518
CdHS+	2.434e-18	1.807e-18	-17.614	-17.743	-0.129
H2S	2.695e-20	3.077e-20	-19.569	-19.512	0.058
Cd(HS)2	2.515e-26	2.872e-26	-25.599	-25.542	0.058
Zn(HS)2	1.407e-30	1.606e-30	-29.852	-29.794	0.058
Pb(HS)2	6.445e-33	7.358e-33	-32.191	-32.133	0.058
Cd(HS)3-	4.063e-38	3.016e-38	-37.391	-37.521	-0.129
Cu(HS)3-	1.677e-40	1.245e-40	-39.775	-39.905	-0.129
Zn(HS)3-	0.000e+00	0.000e+00	-42.663	-42.793	-0.129
Pb(HS)3-	0.000e+00	0.000e+00	-44.862	-44.992	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-48.971	-49.489	-0.518
S(6)	2.169e-02				
SO4-2	1.352e-02	2.215e-03	-1.869	-2.655	-0.786
NaSO4-	4.791e-03	3.297e-03	-2.320	-2.482	-0.162
MgSO4	1.636e-03	1.868e-03	-2.786	-2.729	0.058
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
NH4SO4-	1.336e-09	9.043e-10	-8.874	-9.044	-0.170
HSO4-	8.495e-14	5.620e-14	-13.071	-13.250	-0.179
CdSO4	9.190e-15	1.049e-14	-14.037	-13.979	0.058
NiSO4	1.197e-15	1.367e-15	-14.922	-14.864	0.058
Cd(SO4)2-2	9.005e-16	2.732e-16	-15.046	-15.563	-0.518
ZnSO4	1.597e-17	1.823e-17	-16.797	-16.739	0.058
Zn(SO4)2-2	1.181e-18	3.583e-19	-17.928	-18.446	-0.518
Ni(SO4)2-2	5.912e-19	1.794e-19	-18.228	-18.746	-0.518
PbSO4	8.957e-20	1.023e-19	-19.048	-18.990	0.058
CrOHSO4	1.182e-20	1.349e-20	-19.928	-19.870	0.058
Pb(SO4)2-2	3.918e-21	1.189e-21	-20.407	-20.925	-0.518
CuSO4	1.723e-24	1.967e-24	-23.764	-23.706	0.058
VOSO4	6.663e-29	7.606e-29	-28.176	-28.119	0.058
CrSO4+	7.196e-30	5.341e-30	-29.143	-29.272	-0.129
VO2SO4-	2.360e-30	1.752e-30	-29.627	-29.757	-0.129
AlSO4+	9.203e-32	6.087e-32	-31.036	-31.216	-0.179
Al(SO4)2-	1.549e-32	1.025e-32	-31.810	-31.989	-0.179
Cr2(OH)2SO4+2	1.088e-37	3.302e-38	-36.963	-37.481	-0.518
VSO4+	2.841e-40	2.108e-40	-39.547	-39.676	-0.129
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-41.821	-41.763	0.058
CrO3SO4-2	0.000e+00	0.000e+00	-51.091	-51.609	-0.518
V(2)	1.394e-28				
VOH+	1.394e-28	1.035e-28	-27.856	-27.985	-0.129
V+2	5.340e-35	1.620e-35	-34.272	-34.790	-0.518
V(3)	6.268e-13				
V(OH)3	6.268e-13	7.155e-13	-12.203	-12.145	0.058
V(OH)2+	5.355e-20	3.974e-20	-19.271	-19.401	-0.129
VOH+2	8.715e-29	2.644e-29	-28.060	-28.578	-0.518
V+3	5.057e-38	3.455e-39	-37.296	-38.462	-1.165

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VSO4+	2.841e-40	2.108e-40	-39.547	-39.676	-0.129
V2(OH)3+3	0.000e+00	0.000e+00	-45.921	-47.087	-1.165
V2(OH)2+4	0.000e+00	0.000e+00	-53.710	-55.782	-2.072
V(4)	1.222e-21				
V(OH)3+	1.222e-21	9.069e-22	-20.913	-21.042	-0.129
VO+2	5.102e-28	1.548e-28	-27.292	-27.810	-0.518
VOSO4	6.663e-29	7.606e-29	-28.176	-28.119	0.058
VOCI+	6.477e-29	4.807e-29	-28.189	-28.318	-0.129
H2V2O4+2	2.230e-37	6.766e-38	-36.652	-37.170	-0.518
V(5)	4.636e-07				
HVO4-2	3.034e-07	9.207e-08	-6.518	-7.036	-0.518
VO4-3	1.599e-07	1.093e-08	-6.796	-7.962	-1.165
V2O7-4	1.156e-10	9.797e-13	-9.937	-12.009	-2.072
HV2O7-3	2.908e-11	1.987e-12	-10.536	-11.702	-1.165
H2VO4-	6.329e-12	4.697e-12	-11.199	-11.328	-0.129
H3VO4	9.352e-21	1.068e-20	-20.029	-19.972	0.058
H3V2O7-	1.126e-24	8.358e-25	-23.948	-24.078	-0.129
V3O9-3	3.504e-27	2.394e-28	-26.455	-27.621	-1.165
VO2+	2.077e-29	1.542e-29	-28.683	-28.812	-0.129
VO2SO4-	2.360e-30	1.752e-30	-29.627	-29.757	-0.129
V4O12-4	4.240e-35	3.593e-37	-34.373	-36.445	-2.072
VO2NO3	0.000e+00	0.000e+00	-101.801	-101.744	0.058
V10O28-6	0.000e+00	0.000e+00	-101.801	-106.463	-4.662
HV10O28-5	0.000e+00	0.000e+00	-110.101	-113.338	-3.237
H2V10O28-4	0.000e+00	0.000e+00	-119.477	-121.549	-2.072
Zn	9.624e-08				
Zn(OH)4-2	4.828e-08	1.465e-08	-7.316	-7.834	-0.518
Zn(OH)3-	4.466e-08	3.315e-08	-7.350	-7.480	-0.129
Zn(OH)2	3.293e-09	3.759e-09	-8.482	-8.425	0.058
ZnOHCl	9.190e-13	1.049e-12	-12.037	-11.979	0.058
ZnOH+	6.659e-14	4.942e-14	-13.177	-13.306	-0.129
Zn(CO3)2-2	3.438e-16	1.043e-16	-15.464	-15.982	-0.518
ZnCO3	1.692e-16	1.931e-16	-15.772	-15.714	0.058
Zn+2	1.563e-16	3.831e-17	-15.806	-16.417	-0.611
ZnCl+	2.872e-17	1.852e-17	-16.542	-16.732	-0.191
ZnSO4	1.597e-17	1.823e-17	-16.797	-16.739	0.058
ZnCl2	4.812e-18	5.493e-18	-17.318	-17.260	0.058
ZnCl3-	2.648e-18	1.707e-18	-17.577	-17.768	-0.191
Zn(SO4)2-2	1.181e-18	3.583e-19	-17.928	-18.446	-0.518
ZnCl4-2	1.103e-18	2.313e-19	-17.958	-18.636	-0.678
ZnHCO3+	1.154e-21	8.567e-22	-20.938	-21.067	-0.129
Zn(HS)2	1.407e-30	1.606e-30	-29.852	-29.794	0.058
Zn(HS)3-	0.000e+00	0.000e+00	-42.663	-42.793	-0.129

-----Saturation indices-----

Phase            SI log IAP   log KT

(NH4)2CrO4 -48.39 22.21 70.60 (NH4)2CrO4  
 Al(OH)3(a) -5.32 5.82 11.14 Al(OH)3  
 Al2O3 -11.33 11.65 22.98 Al2O3  
 Al4(OH)10SO4 -26.98 -4.28 22.70 Al4(OH)10SO4  
 AlAsO4:2H2O -24.76 0.33 25.08 AlAsO4:2H2O  
 AlOHSO4 -18.50 -21.73 -3.23 AlOHSO4  
 AlumK -33.81 -39.18 -5.37 KAl(SO4)2:12H2O  
 Alunite -26.00 -27.46 -1.46 KAl3(SO4)2(OH)6  
 Anglesite -13.89 -21.74 -7.85 PbSO4  
 Anhydrite -0.47 -5.00 -4.53 CaSO4  
 Anilite 6.80 -60.97 -67.77 Cu0.25Cu1.5S  
 Antlerite -31.15 -14.83 16.31 Cu3(OH)4SO4  
 Aragonite 1.33 -6.94 -8.27 CaCO3  
 Arsenolite -53.12 -56.33 -3.20 As4O6  
 Artinite 5.30 15.70 10.40 MgCO3:Mg(OH)2:3H2O  
 As2O5 -58.38 -10.97 47.42 As2O5  
 Atacamite -17.71 -4.50 13.21 Cu2(OH)3Cl  
 Azurite -38.03 -46.27 -8.23 Cu3(OH)2(CO3)2  
 Ba3(AsO4)2 11.83 43.42 31.58 Ba3(AsO4)2  
 BaCrO4 -29.97 30.44 60.41 BaCrO4  
 Barite 0.73 -9.43 -10.15 BaSO4  
 Bianchite -17.36 -19.12 -1.76 ZnSO4:6H2O  
 Blaubleil -1.04 -58.14 -57.10 Cu0.9Cu0.2S  
 Blaubleill 1.57 -59.44 -61.02 Cu0.6Cu0.8S  
 Boehmite -3.54 5.82 9.36 AlOOH  
 Brochantite -36.63 -10.60 26.04 Cu4(OH)6SO4  
 Brucite 5.09 22.61 17.51 Mg(OH)2  
 Bunsenite -2.68 10.44 13.12 NiO  
 Ca2V2O7 -3.09 6.19 9.28 CaVO3.5  
 Ca3(AsO4)2:6H2O -6.21 56.66 62.87 Ca3(AsO4)2:6H2O  
 Ca3(VO4)2 -2.99 17.47 20.46 Ca1.5VO4  
 Ca\_Vanadate -8.20 -5.08 3.11 Ca0.5VO3  
 CaCrO4 -33.31 34.87 68.17 CaCrO4  
 Calcite 1.48 -6.94 -8.42 CaCO3  
 Cd(BO2)2 -12.68 -2.84 9.84 Cd(BO2)2  
 Cd(Gamma) -11.55 2.55 14.10 Cd  
 Cd(OH)2(A) -3.17 11.14 14.31 Cd(OH)2  
 Cd(OH)2(C) -2.51 11.14 13.65 Cd(OH)2  
 Cd3(OH)2(SO4)2 -28.39 -21.68 6.71 Cd3(OH)2(SO4)2  
 Cd3(OH)4SO4 -16.70 5.86 22.56 Cd3(OH)4SO4  
 Cd4(OH)6SO4 -11.40 17.00 28.40 Cd4(OH)6SO4  
 CdCl2 -14.26 -14.81 -0.55 CdCl2  
 CdCl2:2.5H2O -12.84 -14.83 -1.99 CdCl2:2.5H2O  
 CdCl2:H2O -13.16 -14.82 -1.66 CdCl2:H2O  
 CdMetal -11.45 2.55 13.99 Cd  
 CdOHCl -5.56 -1.84 3.73 CdOHCl  
 CdSO4 -16.72 -16.41 0.31 CdSO4  
 CdSO4:2.67H2O -14.68 -16.43 -1.75 CdSO4:2.67H2O

CdSO4:H2O	-14.97	-16.42	-1.45	CdSO4:H2O
Cerrusite	-10.42	-23.68	-13.27	PbCO3
CH4(g)	-22.10	-63.90	-41.81	CH4
Chalcanthite	-23.34	-23.35	-0.01	CuSO4:5H2O
Chalcocite	9.29	-62.06	-71.34	Cu2S
Claudetite	-52.89	-56.33	-3.44	As4O6
CO2(g)	-11.32	-29.50	-18.17	CO2
Cotunnite	-15.21	-20.14	-4.93	PbCl2
Covellite	-1.32	-57.70	-56.38	CuS
Cr(OH)2	-13.18	-4.90	8.29	Cr(OH)2
Cr(OH)3(A)	0.15	-0.60	-0.75	Cr(OH)3
Cr(OH)3(C)	-2.50	-0.60	1.90	Cr(OH)3
Cr2O3	1.88	-1.18	-3.05	Cr2O3
CrCl2	-44.49	-30.84	13.65	CrCl2
CrCl3	-53.80	-39.52	14.28	CrCl3
CrMetal	-43.92	-13.49	30.43	Cr
CrO3	-54.77	12.31	67.08	CrO3
Cu(OH)2	-7.50	4.24	11.74	Cu(OH)2
Cu2(OH)3NO3	-91.55	47.84	139.38	Cu2(OH)3NO3
Cu2SO4	-25.84	-27.66	-1.82	Cu2SO4
Cu3(AsO4)2:6H2O	-52.97	1.72	54.69	Cu3(AsO4)2:6H2O
CuCO3	-18.30	-25.25	-6.96	CuCO3
CuCrO4	-50.90	16.55	67.46	CuCrO4
CuMetal	4.89	-4.35	-9.24	Cu
CuOCuSO4	-36.94	-19.06	17.87	CuO:CuSO4
Cuprite	1.62	-0.11	-1.72	Cu2O
CuSO4	-29.50	-23.31	6.19	CuSO4
Diaspore	-1.74	5.82	7.56	AlOOH
Djurleite	8.66	-61.77	-70.43	Cu0.066Cu1.868S
Dolomite	2.95	-13.82	-16.77	CaMg(CO3)2
Epsomite	-2.77	-4.99	-2.22	MgSO4:7H2O
Galena	-5.12	-56.13	-51.02	PbS
Gibbsite(C)	-3.59	5.82	9.41	Al(OH)3
Goslarite	-17.07	-19.12	-2.05	ZnSO4:7H2O
Greenockite	0.93	-50.80	-51.73	CdS
Gypsum	-0.16	-5.01	-4.86	CaSO4:2H2O
Halite	-2.58	-1.02	1.56	NaCl
Huntite	1.66	-27.59	-29.25	CaMg3(CO3)4
Hydcerrusite	-24.10	-41.56	-17.46	Pb(OH)2:2PbCO3
Hydromagnesite	2.35	-4.95	-7.31	Mg5(CO3)4(OH)2:4H2O
K2Cr2O7	-79.34	45.00	124.34	K2Cr2O7
K2CrO4	-37.46	32.69	70.15	K2CrO4
Langite	-39.20	-10.60	28.59	Cu4(OH)6SO4:H2O
Larnakite	-15.83	-15.93	-0.10	PbO:PbSO4
Laurionite	-7.79	-7.17	0.62	PbOHCl
Lime	-11.53	22.56	34.09	CaO
Litharge	-7.37	5.81	13.18	PbO
Magnesite	0.97	-6.88	-7.86	MgCO3

Malachite	-21.62	-21.01	0.60	Cu <sub>2</sub> (OH) <sub>2</sub> CO <sub>3</sub>
Massicot	-7.57	5.81	13.38	PbO
Melanothallite	-28.46	-21.71	6.75	CuCl <sub>2</sub>
Mg <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-7.78	6.25	14.03	MgVO <sub>3.5</sub>
Mg_Vanadate	-11.15	-5.06	6.10	Mg <sub>0.5</sub> VO <sub>3</sub>
MgCr <sub>2</sub> O <sub>4</sub>	8.24	21.44	13.19	MgCr <sub>2</sub> O <sub>4</sub>
MgCrO <sub>4</sub>	-41.31	34.92	76.23	MgCrO <sub>4</sub>
Millerite	-8.05	-51.51	-43.45	NiS
Minium	-50.53	26.04	76.56	Pb <sub>3</sub> O <sub>4</sub>
Mirabilite	-2.08	-3.72	-1.65	Na <sub>2</sub> SO <sub>4</sub> :10H <sub>2</sub> O
Monteponite	-4.67	11.14	15.81	CdO
Morenosite	-14.72	-17.17	-2.44	NiSO <sub>4</sub> :7H <sub>2</sub> O
Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-81.95	48.52	130.47	Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
Na <sub>2</sub> CrO <sub>4</sub>	-37.43	36.22	73.65	Na <sub>2</sub> CrO <sub>4</sub>
Na <sub>3</sub> VO <sub>4</sub>	-18.69	19.50	38.18	Na <sub>3</sub> VO <sub>4</sub>
Na <sub>4</sub> V <sub>2</sub> O <sub>7</sub>	-11.83	7.54	19.37	Na <sub>2</sub> VO <sub>3.5</sub>
Na_Vanadate	-8.32	-4.41	3.91	NaVO <sub>3</sub>
Nantokite	-5.99	-13.03	-7.04	CuCl
Natron	-3.91	-5.67	-1.75	Na <sub>2</sub> CO <sub>3</sub> :10H <sub>2</sub> O
Nesquehonite	-1.45	-6.91	-5.46	MgCO <sub>3</sub> :3H <sub>2</sub> O
NH <sub>4</sub> VO <sub>3</sub>	-14.21	-11.41	2.80	NH <sub>4</sub> VO <sub>3</sub>
Ni(OH) <sub>2</sub>	0.49	10.43	9.95	Ni(OH) <sub>2</sub>
Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-35.97	20.30	56.27	Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-17.81	14.19	32.00	Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
NiCO <sub>3</sub>	-12.49	-19.05	-6.56	NiCO <sub>3</sub>
O <sub>2</sub> (g)	-69.67	17.20	86.86	O <sub>2</sub>
Oripment	-44.69	-214.00	-169.32	As <sub>2</sub> S <sub>3</sub>
Otavite	-4.63	-18.35	-13.72	CdCO <sub>3</sub>
Pb(BO <sub>2</sub> ) <sub>2</sub>	-15.95	-8.17	7.77	Pb(BO <sub>2</sub> ) <sub>2</sub>
Pb(OH) <sub>2</sub> (C)	-2.74	5.81	8.54	Pb(OH) <sub>2</sub>
Pb <sub>2</sub> (OH) <sub>3</sub> Cl	-10.16	-1.36	8.79	Pb <sub>2</sub> (OH) <sub>3</sub> Cl
Pb <sub>2</sub> O(OH) <sub>2</sub>	-14.58	11.62	26.20	Pb <sub>2</sub> O(OH) <sub>2</sub>
Pb <sub>2</sub> O <sub>3</sub>	-40.82	20.22	61.04	Pb <sub>2</sub> O <sub>3</sub>
Pb <sub>2</sub> OCO <sub>3</sub>	-17.69	-17.87	-0.18	Pb <sub>2</sub> OCO <sub>3</sub>
Pb <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-9.69	-10.55	-0.86	PbVO <sub>3.5</sub>
Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>	-39.90	6.47	46.37	Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>
Pb <sub>3</sub> (VO <sub>4</sub> ) <sub>2</sub>	-10.96	-7.64	3.31	Pb <sub>1.5</sub> VO <sub>4</sub>
Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>	-23.82	-12.06	11.76	Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>
Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>	-21.10	-10.12	10.98	Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>
Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-25.43	-4.33	21.10	Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>	-27.38	-4.30	23.08	Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>
PbCrO <sub>4</sub>	-38.16	18.12	56.29	PbCrO <sub>4</sub>
PbMetal	-7.04	-2.79	4.26	Pb
PbO:0.3H <sub>2</sub> O	-7.17	5.81	12.98	PbO:0.33H <sub>2</sub> O
Periclase	0.09	22.61	22.52	MgO
Phosgenite	-24.01	-43.82	-19.81	PbCl <sub>2</sub> :PbCO <sub>3</sub>
Plattnerite	-36.87	14.41	51.28	PbO <sub>2</sub>
Portlandite	-0.98	22.55	23.53	Ca(OH) <sub>2</sub>

Realgar	-24.38	-80.33	-55.94	AsS
Retgersite	-15.09	-17.16	-2.07	NiSO4:6H2O
Smithsonite	-11.14	-21.01	-9.88	ZnCO3
Sphalerite	-6.27	-53.46	-47.19	ZnS
Spinel	-4.56	34.27	38.83	MgAl2O4
SULFUR	-16.01	-53.35	-37.33	S
Tenorite	-6.48	4.24	10.72	CuO
Thenardite	-3.48	-3.65	-0.16	Na2SO4
Thermonatrite	-5.80	-5.60	0.20	Na2CO3:H2O
V(OH)3	-8.78	-24.97	-16.20	V(OH)3
V2O3	-6.57	-24.96	-18.40	VO1.5
V2O4	-7.58	-20.66	-13.09	VO2
V2O5	-15.76	-16.36	-0.60	VO2.5
V3O5	-19.86	-70.58	-50.72	V3O5
V4O7	-28.48	-91.25	-62.77	V4O7
V6O13	-52.70	-115.37	-62.68	V6O13
VCl2	-50.34	-55.21	-4.88	VCl2
VCl3	-63.00	-63.89	-0.89	VCl3
VMetal	-58.12	-37.86	20.26	V
VO	-19.28	-29.26	-9.98	VO
VO(OH)2	-8.77	-20.67	-11.90	VO(OH)2
VO2Cl	-32.42	-29.34	3.08	VO2Cl
VOCl	-24.23	-37.94	-13.71	VOCl
VOCl2	-42.44	-46.62	-4.17	VOCl2
VOSO4(C)	-34.61	-48.21	-13.60	VOSO4
Witherite	-2.77	-11.37	-8.60	BaCO3
Wurtzite	-8.30	-53.46	-45.17	ZnS
Zincite	-3.27	8.48	11.75	ZnO
Zincosite	-22.62	-19.07	3.55	ZnSO4
Zn(BO2)2	-13.80	-5.51	8.29	Zn(BO2)2
Zn(NO3)2:6H2O	-164.75	87.15	251.90	Zn(NO3)2:6H2O
Zn(OH)2(A)	-3.98	8.47	12.45	Zn(OH)2
Zn(OH)2(B)	-3.28	8.47	11.75	Zn(OH)2
Zn(OH)2(C)	-3.73	8.47	12.20	Zn(OH)2
Zn(OH)2(E)	-3.03	8.47	11.50	Zn(OH)2
Zn(OH)2(G)	-3.24	8.47	11.71	Zn(OH)2
Zn2(OH)2SO4	-18.10	-10.60	7.50	Zn2(OH)2SO4
Zn2(OH)3Cl	-11.23	3.97	15.20	Zn2(OH)3Cl
Zn3(AsO4)2:2.5H2O	-39.76	14.46	54.22	Zn3(AsO4)2:2.5H2O
Zn3O(SO4)2	-50.42	-29.66	20.75	Zn3O(SO4)2
Zn4(OH)6SO4	-22.05	6.35	28.40	Zn4(OH)6SO4
Zn5(OH)8Cl2	-22.08	16.42	38.50	Zn5(OH)8Cl2
ZnCl2	-24.99	-17.47	7.52	ZnCl2
ZnCO3:H2O	-10.76	-21.02	-10.26	ZnCO3:H2O
ZnMetal	-26.90	-0.12	26.79	Zn
ZnO(Active)	-2.83	8.48	11.31	ZnO
ZnS(A)	-8.97	-53.46	-44.50	ZnS
ZnSO4:H2O	-18.81	-19.08	-0.27	ZnSO4:H2O

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End of simulation.  
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Reading input data for simulation 2.  
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End of run.  
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No memory leaks



Database file: minteq.dat

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Reading data base.  
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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH310a Low  
SOLUTION 1  
pH 10.05 charge  
temp 14.04  
pe -11.41  
units mg/L  
Al 0.0422  
As 0.00163 as H3AsO4  
Ba 0.109  
B 2.360  
Cd 0.00013  
Ca 717  
C 26.3  
Cl 16500  
Cu 0.00204  
Cr 0.123  
Pb 0.0007  
Mg 690  
Ni 0.00594  
N 0.82 as N03-  
K 342  
Na 10100  
S 2020 as SO4-2  
V 0.0229  
Zn 0.0061  
END

-----  
TITLE  
-----

BH310a Low

-----  
 Beginning of initial solution calculations.  
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Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.613e-06	1.613e-06
As	1.184e-08	1.184e-08
B	2.252e-04	2.252e-04
Ba	8.185e-07	8.185e-07
C	4.445e-04	4.445e-04
Ca	1.845e-02	1.845e-02
Cd	1.193e-09	1.193e-09
Cl	4.800e-01	4.800e-01
Cr	2.440e-06	2.440e-06
Cu	3.311e-08	3.311e-08
K	9.021e-03	9.021e-03
Mg	2.927e-02	2.927e-02
N	2.013e-05	2.013e-05
Na	4.531e-01	4.531e-01
Ni	1.043e-07	1.043e-07
Pb	3.484e-09	3.484e-09
S	2.169e-02	2.169e-02
V	4.636e-07	4.636e-07
Zn	9.624e-08	9.624e-08

-----Description of solution-----

pH = 12.828    Charge balance  
 pe = -11.410  
 Activity of water = 0.982  
 Ionic strength = 5.624e-01  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 7.760e-02  
 Total CO2 (mol/kg) = 4.445e-04  
 Temperature (deg C) = 14.040  
 Electrical balance (eq) = 6.609e-17  
 Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|)$  = 0.00  
 Iterations = 13  
 Total H = 1.110810e+02  
 Total O = 5.557626e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	4.476e-02	2.811e-02	-1.349	-1.551	-0.202
H+	1.947e-13	1.486e-13	-12.711	-12.828	-0.117
H2O	5.551e+01	9.823e-01	-0.008	-0.008	0.000
Al	1.613e-06				
Al(OH)4-	1.613e-06	1.069e-06	-5.792	-5.971	-0.179
Al(OH)3	2.428e-11	2.764e-11	-10.615	-10.558	0.056
Al(OH)2+	4.819e-18	3.322e-18	-17.317	-17.479	-0.162
AlOH+2	1.333e-25	3.009e-26	-24.875	-25.522	-0.646
Al+3	1.085e-32	9.576e-34	-31.965	-33.019	-1.054
AlSO4+	0.000e+00	0.000e+00	-47.351	-47.530	-0.179
Al(SO4)2-	0.000e+00	0.000e+00	-62.941	-63.120	-0.179
As(3)	1.184e-08				
HAsO3-2	6.197e-09	1.871e-09	-8.208	-8.728	-0.520
AsO3-3	4.863e-09	3.286e-10	-8.313	-9.483	-1.170
H2AsO3-	7.761e-10	5.753e-10	-9.110	-9.240	-0.130
H3AsO3	1.938e-13	2.206e-13	-12.713	-12.656	0.056
H4AsO3+	2.191e-26	1.624e-26	-25.659	-25.789	-0.130
As(5)	7.182e-12				
AsO4-3	7.059e-12	4.769e-13	-11.151	-12.322	-1.170
HAsO4-2	1.226e-13	3.701e-14	-12.912	-13.432	-0.520
H2AsO4-	4.467e-20	3.311e-20	-19.350	-19.480	-0.130
H3AsO4	6.786e-31	7.725e-31	-30.168	-30.112	0.056
B	2.252e-04				
H2BO3-	2.251e-04	1.317e-04	-3.648	-3.880	-0.233
H3BO3	3.679e-08	4.188e-08	-7.434	-7.378	0.056
Ba	8.185e-07				
Ba+2	7.915e-07	1.674e-07	-6.102	-6.776	-0.675
BaOH+	2.705e-08	1.834e-08	-7.568	-7.736	-0.169
C(4)	4.445e-04				
NaCO3-	1.343e-04	9.258e-05	-3.872	-4.034	-0.162
CaCO3	1.219e-04	1.388e-04	-3.914	-3.858	0.056
CO3-2	1.217e-04	2.748e-05	-3.915	-4.561	-0.646
MgCO3	6.642e-05	7.560e-05	-4.178	-4.121	0.056
HCO3-	1.634e-07	1.126e-07	-6.787	-6.948	-0.162
NaHCO3	1.392e-08	1.585e-08	-7.856	-7.800	0.056
MgHCO3+	6.334e-09	4.093e-09	-8.198	-8.388	-0.190
CaHCO3+	5.163e-09	3.639e-09	-8.287	-8.439	-0.152
NiCO3	4.750e-14	5.407e-14	-13.323	-13.267	0.056
H2CO3	2.958e-14	3.367e-14	-13.529	-13.473	0.056
CdCO3	1.549e-14	1.763e-14	-13.810	-13.754	0.056
Ni(CO3)2-2	8.554e-15	2.583e-15	-14.068	-14.588	-0.520
Zn(CO3)2-2	1.835e-17	5.541e-18	-16.736	-17.256	-0.520
ZnCO3	8.284e-18	9.429e-18	-17.082	-17.026	0.056
PbCO3	1.127e-18	1.283e-18	-17.948	-17.892	0.056

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Pb(CO <sub>3</sub> ) <sub>2</sub> -2	2.933e-19	8.855e-20	-18.533	-19.053	-0.520
CdHCO <sub>3</sub> <sup>+</sup>	3.544e-20	2.627e-20	-19.451	-19.581	-0.130
Cd(CO <sub>3</sub> ) <sub>3</sub> -4	1.062e-20	8.820e-23	-19.974	-22.055	-2.081
NiHCO <sub>3</sub> <sup>+</sup>	4.317e-21	3.200e-21	-20.365	-20.495	-0.130
ZnHCO <sub>3</sub> <sup>+</sup>	2.380e-23	1.765e-23	-22.623	-22.753	-0.130
PbHCO <sub>3</sub> <sup>+</sup>	2.346e-25	1.739e-25	-24.630	-24.760	-0.130
CuCO <sub>3</sub>	2.895e-37	3.295e-37	-36.538	-36.482	0.056
Cu(CO <sub>3</sub> ) <sub>2</sub> -2	3.777e-38	1.140e-38	-37.423	-37.943	-0.520
CuHCO <sub>3</sub> <sup>+</sup>	0.000e+00	0.000e+00	-42.910	-43.040	-0.130
Ca	1.845e-02				
Ca <sup>+2</sup>	1.428e-02	4.362e-03	-1.845	-2.360	-0.515
CaOH <sup>+</sup>	4.047e-03	2.852e-03	-2.393	-2.545	-0.152
CaCO <sub>3</sub>	1.219e-04	1.388e-04	-3.914	-3.858	0.056
CaHCO <sub>3</sub> <sup>+</sup>	5.163e-09	3.639e-09	-8.287	-8.439	-0.152
CaSO <sub>4</sub>	2.401e-18	2.733e-18	-17.620	-17.563	0.056
Cd	1.193e-09				
Cd(OH) <sub>3</sub> <sup>-</sup>	4.995e-10	3.703e-10	-9.301	-9.431	-0.130
Cd(OH) <sub>2</sub>	4.387e-10	4.993e-10	-9.358	-9.302	0.056
CdOHCl	1.317e-10	1.499e-10	-9.880	-9.824	0.056
Cd(OH) <sub>4</sub> -2	7.223e-11	2.181e-11	-10.141	-10.661	-0.520
CdHS <sup>+</sup>	2.754e-11	2.042e-11	-10.560	-10.690	-0.130
Cd(HS) <sub>2</sub>	2.216e-11	2.522e-11	-10.654	-10.598	0.056
CdOH <sup>+</sup>	8.164e-13	6.051e-13	-12.088	-12.218	-0.130
CdCl <sup>+</sup>	9.442e-14	6.999e-14	-13.025	-13.155	-0.130
CdCl <sub>2</sub>	7.311e-14	8.321e-14	-13.136	-13.080	0.056
CdCl <sub>3</sub> <sup>-</sup>	1.771e-14	1.313e-14	-13.752	-13.882	-0.130
CdCO <sub>3</sub>	1.549e-14	1.763e-14	-13.810	-13.754	0.056
Cd <sup>+2</sup>	8.479e-15	2.560e-15	-14.072	-14.592	-0.520
Cd(HS) <sub>3</sub> <sup>-</sup>	2.777e-15	2.059e-15	-14.556	-14.686	-0.130
Cd(HS) <sub>4</sub> -2	5.695e-19	1.719e-19	-18.245	-18.765	-0.520
CdHCO <sub>3</sub> <sup>+</sup>	3.544e-20	2.627e-20	-19.451	-19.581	-0.130
Cd(CO <sub>3</sub> ) <sub>3</sub> -4	1.062e-20	8.820e-23	-19.974	-22.055	-2.081
Cd <sub>2</sub> OH <sup>+3</sup>	1.294e-25	8.742e-27	-24.888	-26.058	-1.170
CdSO <sub>4</sub>	2.046e-30	2.329e-30	-29.689	-29.633	0.056
Cd(SO <sub>4</sub> ) <sub>2</sub> -2	0.000e+00	0.000e+00	-45.513	-46.034	-0.520
CdNO <sub>3</sub> <sup>+</sup>	0.000e+00	0.000e+00	-109.126	-109.256	-0.130
Cl	4.800e-01				
Cl <sup>-</sup>	4.800e-01	2.974e-01	-0.319	-0.527	-0.208
CdOHCl	1.317e-10	1.499e-10	-9.880	-9.824	0.056
ZnOHCl	9.831e-14	1.119e-13	-13.007	-12.951	0.056
CdCl <sup>+</sup>	9.442e-14	6.999e-14	-13.025	-13.155	-0.130
CdCl <sub>2</sub>	7.311e-14	8.321e-14	-13.136	-13.080	0.056
CdCl <sub>3</sub> <sup>-</sup>	1.771e-14	1.313e-14	-13.752	-13.882	-0.130
NiCl <sup>+</sup>	2.668e-16	1.978e-16	-15.574	-15.704	-0.130
NiCl <sub>2</sub>	1.881e-16	2.141e-16	-15.726	-15.669	0.056
ZnCl <sup>+</sup>	1.289e-18	8.333e-19	-17.890	-18.079	-0.190
ZnCl <sub>2</sub>	2.178e-19	2.479e-19	-18.662	-18.606	0.056
ZnCl <sub>3</sub> <sup>-</sup>	1.196e-19	7.727e-20	-18.922	-19.112	-0.190

## BH310A July 2012 Eh=-0.7

ZnCl4-2	4.965e-20	1.050e-20	-19.304	-19.979	-0.675
PbCl+	3.235e-20	2.398e-20	-19.490	-19.620	-0.130
CuCl3-2	1.660e-20	3.511e-21	-19.780	-20.455	-0.675
PbCl2	1.228e-20	1.398e-20	-19.911	-19.855	0.056
CuCl2-	1.204e-20	7.782e-21	-19.919	-20.109	-0.190
PbCl3-	4.143e-21	3.071e-21	-20.383	-20.513	-0.130
PbCl4-2	1.330e-21	4.014e-22	-20.876	-21.396	-0.520
CrOHCl2	1.734e-25	1.974e-25	-24.761	-24.705	0.056
VOCl+	9.725e-28	7.208e-28	-27.012	-27.142	-0.130
CrCl+2	2.065e-30	6.234e-31	-29.685	-30.205	-0.520
CrCl2+	3.654e-32	2.708e-32	-31.437	-31.567	-0.130
CuCl+	1.584e-39	1.024e-39	-38.800	-38.990	-0.190
CuCl2	1.270e-40	1.446e-40	-39.896	-39.840	0.056
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-41.514	-42.034	-0.520
CuCl3-	0.000e+00	0.000e+00	-42.715	-42.904	-0.190
CuCl4-2	0.000e+00	0.000e+00	-44.891	-45.565	-0.675
CrO3Cl-	0.000e+00	0.000e+00	-60.066	-60.196	-0.130
Cr(2)	1.841e-25				
Cr+2	1.841e-25	5.558e-26	-24.735	-25.255	-0.520
Cr(3)	2.440e-06				
CrO2-	1.763e-06	1.306e-06	-5.754	-5.884	-0.130
Cr(OH)4-	6.703e-07	4.968e-07	-6.174	-6.304	-0.130
Cr(OH)3	6.916e-09	7.873e-09	-8.160	-8.104	0.056
Cr(OH)2+	2.168e-14	1.607e-14	-13.664	-13.794	-0.130
Cr(OH)+2	3.358e-21	1.014e-21	-20.474	-20.994	-0.520
Cr(NH3)4(OH)2+	1.958e-24	1.451e-24	-23.708	-23.838	-0.130
CrOHCl2	1.734e-25	1.974e-25	-24.761	-24.705	0.056
Cr+3	8.308e-29	5.613e-30	-28.081	-29.251	-1.170
CrCl+2	2.065e-30	6.234e-31	-29.685	-30.205	-0.520
CrCl2+	3.654e-32	2.708e-32	-31.437	-31.567	-0.130
Cr(NH3)5OH+2	2.492e-32	7.523e-33	-31.603	-32.124	-0.520
CrOHSO4	1.362e-36	1.550e-36	-35.866	-35.810	0.056
Cr(NH3)6+3	0.000e+00	0.000e+00	-41.115	-42.285	-1.170
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-41.514	-42.034	-0.520
CrSO4+	0.000e+00	0.000e+00	-45.457	-45.587	-0.130
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-54.024	-54.544	-0.520
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-73.698	-73.642	0.056
CrNO3+2	0.000e+00	0.000e+00	-125.476	-125.996	-0.520
Cr(6)	0.000e+00				
CrO4-2	0.000e+00	0.000e+00	-40.571	-41.330	-0.758
NaCrO4-	0.000e+00	0.000e+00	-40.995	-41.125	-0.130
KCrO4-	0.000e+00	0.000e+00	-42.653	-42.783	-0.130
HCrO4-	0.000e+00	0.000e+00	-47.544	-47.674	-0.130
CrO3Cl-	0.000e+00	0.000e+00	-60.066	-60.196	-0.130
H2CrO4	0.000e+00	0.000e+00	-61.390	-61.334	0.056
CrO3SO4-2	0.000e+00	0.000e+00	-74.935	-75.455	-0.520
Cr2O7-2	0.000e+00	0.000e+00	-93.146	-93.666	-0.520
Cu(1)	2.865e-20				

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CuCl3-2	1.660e-20	3.511e-21	-19.780	-20.455	-0.675
CuCl2-	1.204e-20	7.782e-21	-19.919	-20.109	-0.190
Cu+	4.628e-25	2.708e-25	-24.335	-24.567	-0.233
Cu(2)	3.311e-08				
Cu(S4)2-3	2.826e-08	8.748e-09	-7.549	-8.058	-0.509
CuS4S5-3	4.854e-09	1.629e-09	-8.314	-8.788	-0.474
Cu(OH)4-2	3.543e-27	1.070e-27	-26.451	-26.971	-0.520
Cu(OH)2	1.790e-27	2.037e-27	-26.747	-26.691	0.056
Cu(OH)3-	1.097e-27	8.131e-28	-26.960	-27.090	-0.130
Cu(HS)3-	3.743e-32	2.774e-32	-31.427	-31.557	-0.130
CuOH+	2.283e-34	1.475e-34	-33.642	-33.831	-0.190
CuCO3	2.895e-37	3.295e-37	-36.538	-36.482	0.056
Cu(CO3)2-2	3.777e-38	1.140e-38	-37.423	-37.943	-0.520
Cu+2	1.905e-38	2.233e-39	-37.720	-38.651	-0.931
CuCl+	1.584e-39	1.024e-39	-38.800	-38.990	-0.190
CuCl2	1.270e-40	1.446e-40	-39.896	-39.840	0.056
CuCl3-	0.000e+00	0.000e+00	-42.715	-42.904	-0.190
CuHCO3+	0.000e+00	0.000e+00	-42.910	-43.040	-0.130
CuCl4-2	0.000e+00	0.000e+00	-44.891	-45.565	-0.675
CuSO4	0.000e+00	0.000e+00	-53.902	-53.846	0.056
Cu2(OH)2+2	0.000e+00	0.000e+00	-61.992	-62.512	-0.520
H(0)	2.034e-06				
H2	1.017e-06	1.158e-06	-5.993	-5.936	0.056
K	9.021e-03				
K+	9.021e-03	5.589e-03	-2.045	-2.253	-0.208
KSO4-	1.580e-19	1.089e-19	-18.801	-18.963	-0.162
KCrO4-	0.000e+00	0.000e+00	-42.653	-42.783	-0.130
Mg	2.927e-02				
MgOH+	1.922e-02	1.377e-02	-1.716	-1.861	-0.145
Mg+2	9.989e-03	3.411e-03	-2.000	-2.467	-0.467
MgCO3	6.642e-05	7.560e-05	-4.178	-4.121	0.056
MgHCO3+	6.334e-09	4.093e-09	-8.198	-8.388	-0.190
MgSO4	1.647e-18	1.874e-18	-17.783	-17.727	0.056
N(-3)	2.013e-05				
NH3	2.010e-05	2.288e-05	-4.697	-4.640	0.056
NH4+	2.281e-08	1.335e-08	-7.642	-7.875	-0.233
Cr(NH3)4(OH)2+	1.958e-24	1.451e-24	-23.708	-23.838	-0.130
NH4SO4-	8.575e-25	5.815e-25	-24.067	-24.235	-0.169
Cr(NH3)5OH+2	2.492e-32	7.523e-33	-31.603	-32.124	-0.520
Cr(NH3)6+3	0.000e+00	0.000e+00	-41.115	-42.285	-1.170
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-41.514	-42.034	-0.520
N(3)	0.000e+00				
NO2-	0.000e+00	0.000e+00	-68.113	-68.243	-0.130
N(5)	0.000e+00				
NO3-	0.000e+00	0.000e+00	-94.992	-95.209	-0.216
CdNO3+	0.000e+00	0.000e+00	-109.126	-109.256	-0.130
PbNO3+	0.000e+00	0.000e+00	-114.480	-114.610	-0.130
CrNO3+2	0.000e+00	0.000e+00	-125.476	-125.996	-0.520

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VO2NO3	0.000e+00	0.000e+00	-125.843	-125.787	0.056
Na	4.531e-01				
Na+	4.530e-01	3.226e-01	-0.344	-0.491	-0.147
NaCO3-	1.343e-04	9.258e-05	-3.872	-4.034	-0.162
NaHCO3	1.392e-08	1.585e-08	-7.856	-7.800	0.056
NaSO4-	7.380e-18	5.087e-18	-17.132	-17.294	-0.162
NaCrO4-	0.000e+00	0.000e+00	-40.995	-41.125	-0.130
Ni	1.043e-07				
Ni(OH)3-	1.033e-07	7.659e-08	-6.986	-7.116	-0.130
Ni(OH)2	1.018e-09	1.159e-09	-8.992	-8.936	0.056
NiOH+	1.468e-13	1.088e-13	-12.833	-12.963	-0.130
NiCO3	4.750e-14	5.407e-14	-13.323	-13.267	0.056
Ni(CO3)2-2	8.554e-15	2.583e-15	-14.068	-14.588	-0.520
Ni+2	8.791e-16	2.654e-16	-15.056	-15.576	-0.520
NiCl+	2.668e-16	1.978e-16	-15.574	-15.704	-0.130
NiCl2	1.881e-16	2.141e-16	-15.726	-15.669	0.056
NiHCO3+	4.317e-21	3.200e-21	-20.365	-20.495	-0.130
NiSO4	1.394e-31	1.587e-31	-30.856	-30.800	0.056
Ni(SO4)2-2	0.000e+00	0.000e+00	-48.978	-49.498	-0.520
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-84.251	-84.195	0.056
Pb	3.484e-09				
Pb(OH)4-2	3.393e-09	1.024e-09	-8.469	-8.990	-0.520
Pb(OH)3-	9.106e-11	6.750e-11	-10.041	-10.171	-0.130
Pb(OH)2	7.816e-13	8.896e-13	-12.107	-12.051	0.056
PbOH+	4.668e-16	3.460e-16	-15.331	-15.461	-0.130
Pb(HS)2	1.277e-18	1.454e-18	-17.894	-17.837	0.056
PbCO3	1.127e-18	1.283e-18	-17.948	-17.892	0.056
Pb(CO3)2-2	2.933e-19	8.855e-20	-18.533	-19.053	-0.520
PbCl+	3.235e-20	2.398e-20	-19.490	-19.620	-0.130
PbCl2	1.228e-20	1.398e-20	-19.911	-19.855	0.056
Pb+2	8.895e-21	2.685e-21	-20.051	-20.571	-0.520
PbCl3-	4.143e-21	3.071e-21	-20.383	-20.513	-0.130
PbCl4-2	1.330e-21	4.014e-22	-20.876	-21.396	-0.520
Pb(HS)3-	2.111e-23	1.564e-23	-22.676	-22.806	-0.130
PbHCO3+	2.346e-25	1.739e-25	-24.630	-24.760	-0.130
Pb2OH+3	3.079e-34	2.080e-35	-33.512	-34.682	-1.170
Pb3(OH)4+2	2.926e-35	8.833e-36	-34.534	-35.054	-0.520
PbSO4	4.486e-36	5.106e-36	-35.348	-35.292	0.056
Pb(SO4)2-2	0.000e+00	0.000e+00	-51.523	-52.043	-0.520
PbNO3+	0.000e+00	0.000e+00	-114.480	-114.610	-0.130
S(-2)	2.169e-02				
S5-2	1.677e-03	5.064e-04	-2.775	-3.296	-0.520
S6-2	1.580e-03	4.771e-04	-2.801	-3.321	-0.520
S4-2	9.537e-04	2.879e-04	-3.021	-3.541	-0.520
S-2	9.505e-07	2.010e-07	-6.022	-6.697	-0.675
HS-	8.587e-07	5.392e-07	-6.066	-6.268	-0.202
S3-2	3.213e-07	9.699e-08	-6.493	-7.013	-0.520

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Cu(S4)2-3	2.826e-08	8.748e-09	-7.549	-8.058	-0.509
S2-2	1.710e-08	5.161e-09	-7.767	-8.287	-0.520
CuS4S5-3	4.854e-09	1.629e-09	-8.314	-8.788	-0.474
CdHS+	2.754e-11	2.042e-11	-10.560	-10.690	-0.130
Cd(HS)2	2.216e-11	2.522e-11	-10.654	-10.598	0.056
H2S	8.863e-13	1.009e-12	-12.052	-11.996	0.056
Cd(HS)3-	2.777e-15	2.059e-15	-14.556	-14.686	-0.130
Zn(HS)2	3.826e-16	4.355e-16	-15.417	-15.361	0.056
Pb(HS)2	1.277e-18	1.454e-18	-17.894	-17.837	0.056
Cd(HS)4-2	5.695e-19	1.719e-19	-18.245	-18.765	-0.520
Zn(HS)3-	4.579e-21	3.394e-21	-20.339	-20.469	-0.130
Pb(HS)3-	2.111e-23	1.564e-23	-22.676	-22.806	-0.130
Cu(HS)3-	3.743e-32	2.774e-32	-31.427	-31.557	-0.130
S(6)	3.200e-17				
SO4-2	2.041e-17	3.382e-18	-16.690	-17.471	-0.781
NaSO4-	7.380e-18	5.087e-18	-17.132	-17.294	-0.162
CaSO4	2.401e-18	2.733e-18	-17.620	-17.563	0.056
MgSO4	1.647e-18	1.874e-18	-17.783	-17.727	0.056
KSO4-	1.580e-19	1.089e-19	-18.801	-18.963	-0.162
NH4SO4-	8.575e-25	5.815e-25	-24.067	-24.235	-0.169
HSO4-	5.458e-29	3.618e-29	-28.263	-28.441	-0.179
CdSO4	2.046e-30	2.329e-30	-29.689	-29.633	0.056
NiSO4	1.394e-31	1.587e-31	-30.856	-30.800	0.056
ZnSO4	1.097e-33	1.249e-33	-32.960	-32.904	0.056
PbSO4	4.486e-36	5.106e-36	-35.348	-35.292	0.056
CrOHSO4	1.362e-36	1.550e-36	-35.866	-35.810	0.056
VOSO4	0.000e+00	0.000e+00	-41.817	-41.760	0.056
CrSO4+	0.000e+00	0.000e+00	-45.457	-45.587	-0.130
Cd(SO4)2-2	0.000e+00	0.000e+00	-45.513	-46.034	-0.520
VO2SO4-	0.000e+00	0.000e+00	-45.779	-45.909	-0.130
AlSO4+	0.000e+00	0.000e+00	-47.351	-47.530	-0.179
Zn(SO4)2-2	0.000e+00	0.000e+00	-48.906	-49.426	-0.520
Ni(SO4)2-2	0.000e+00	0.000e+00	-48.978	-49.498	-0.520
VSO4+	0.000e+00	0.000e+00	-50.677	-50.807	-0.130
Pb(SO4)2-2	0.000e+00	0.000e+00	-51.523	-52.043	-0.520
CuSO4	0.000e+00	0.000e+00	-53.902	-53.846	0.056
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-54.024	-54.544	-0.520
Al(SO4)2-	0.000e+00	0.000e+00	-62.941	-63.120	-0.179
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-73.698	-73.642	0.056
CrO3SO4-2	0.000e+00	0.000e+00	-74.935	-75.455	-0.520
V(2)	2.916e-21				
VOH+	2.916e-21	2.162e-21	-20.535	-20.665	-0.130
V+2	4.729e-28	1.428e-28	-27.325	-27.845	-0.520
V(3)	4.052e-08				
V(OH)3	4.052e-08	4.613e-08	-7.392	-7.336	0.056
V(OH)2+	1.458e-15	1.081e-15	-14.836	-14.966	-0.130
VOH+2	1.005e-24	3.035e-25	-23.998	-24.518	-0.520
V+3	2.477e-34	1.674e-35	-33.606	-34.776	-1.170



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V2(OH)3+3	3.783e-38	2.556e-39	-37.422	-38.592	-1.170
V2(OH)2+4	0.000e+00	0.000e+00	-45.582	-47.663	-2.081
VSO4+	0.000e+00	0.000e+00	-50.677	-50.807	-0.130
V(4)	4.334e-20				
V(OH)3+	4.334e-20	3.213e-20	-19.363	-19.493	-0.130
VO+2	7.667e-27	2.315e-27	-26.115	-26.635	-0.520
VOCl+	9.725e-28	7.208e-28	-27.012	-27.142	-0.130
H2V2O4+2	2.814e-34	8.496e-35	-33.551	-34.071	-0.520
VOSO4	0.000e+00	0.000e+00	-41.817	-41.760	0.056
V(5)	4.231e-07				
VO4-3	2.356e-07	1.592e-08	-6.628	-7.798	-1.170
HVO4-2	1.874e-07	5.658e-08	-6.727	-7.247	-0.520
V2O7-4	4.456e-11	3.702e-13	-10.351	-12.432	-2.081
HV2O7-3	4.687e-12	3.166e-13	-11.329	-12.499	-1.170
H2VO4-	1.643e-12	1.218e-12	-11.784	-11.914	-0.130
H3VO4	1.026e-21	1.168e-21	-20.989	-20.933	0.056
H3V2O7-	3.198e-26	2.371e-26	-25.495	-25.625	-0.130
V3O9-3	6.180e-29	4.175e-30	-28.209	-29.379	-1.170
VO2+	9.601e-31	7.117e-31	-30.018	-30.148	-0.130
V4O12-4	1.956e-37	1.625e-39	-36.709	-38.789	-2.081
VO2SO4-	0.000e+00	0.000e+00	-45.779	-45.909	-0.130
V10O28-6	0.000e+00	0.000e+00	-109.142	-113.824	-4.681
HV10O28-5	0.000e+00	0.000e+00	-117.823	-121.073	-3.251
VO2NO3	0.000e+00	0.000e+00	-125.843	-125.787	0.056
H2V10O28-4	0.000e+00	0.000e+00	-127.579	-129.659	-2.081
Zn	9.624e-08				
Zn(OH)4-2	6.869e-08	2.074e-08	-7.163	-7.683	-0.520
Zn(OH)3-	2.671e-08	1.980e-08	-7.573	-7.703	-0.130
Zn(OH)2	8.324e-10	9.475e-10	-9.080	-9.023	0.056
ZnOHCl	9.831e-14	1.119e-13	-13.007	-12.951	0.056
ZnOH+	7.091e-15	5.256e-15	-14.149	-14.279	-0.130
Zn(HS)2	3.826e-16	4.355e-16	-15.417	-15.361	0.056
Zn(CO3)2-2	1.835e-17	5.541e-18	-16.736	-17.256	-0.520
ZnCO3	8.284e-18	9.429e-18	-17.082	-17.026	0.056
Zn+2	6.970e-18	1.719e-18	-17.157	-17.765	-0.608
ZnCl+	1.289e-18	8.333e-19	-17.890	-18.079	-0.190
ZnCl2	2.178e-19	2.479e-19	-18.662	-18.606	0.056
ZnCl3-	1.196e-19	7.727e-20	-18.922	-19.112	-0.190
ZnCl4-2	4.965e-20	1.050e-20	-19.304	-19.979	-0.675
Zn(HS)3-	4.579e-21	3.394e-21	-20.339	-20.469	-0.130
ZnHCO3+	2.380e-23	1.765e-23	-22.623	-22.753	-0.130
ZnSO4	1.097e-33	1.249e-33	-32.960	-32.904	0.056
Zn(SO4)2-2	0.000e+00	0.000e+00	-48.906	-49.426	-0.520

-----Saturation indices-----

Phase            SI log IAP   log KT

(NH<sub>4</sub>)<sub>2</sub>CrO<sub>4</sub> -57.42 13.18 70.60 (NH<sub>4</sub>)<sub>2</sub>CrO<sub>4</sub>  
 Al(OH)<sub>3</sub>(a) -5.70 5.44 11.14 Al(OH)<sub>3</sub>  
 Al<sub>2</sub>O<sub>3</sub> -12.07 10.91 22.98 Al<sub>2</sub>O<sub>3</sub>  
 Al<sub>4</sub>(OH)<sub>10</sub>SO<sub>4</sub> -44.05 14.00 58.04 Al<sub>4</sub>(OH)<sub>10</sub>SO<sub>4</sub>  
 AlAsO<sub>4</sub>:2H<sub>2</sub>O -29.46 -4.38 25.08 AlAsO<sub>4</sub>:2H<sub>2</sub>O  
 AlOHSO<sub>4</sub> -34.44 -2.33 32.11 AlOHSO<sub>4</sub>  
 AlumK -64.93 0.38 65.31 KAl(SO<sub>4</sub>)<sub>2</sub>:12H<sub>2</sub>O  
 Alunite -57.87 11.35 69.23 KAl<sub>3</sub>(SO<sub>4</sub>)<sub>2</sub>(OH)<sub>6</sub>  
 Anglesite -30.19 -2.70 27.49 PbSO<sub>4</sub>  
 Anhydrite -15.30 15.51 30.81 CaSO<sub>4</sub>  
 Anilite -6.86 -39.29 -32.43 Cu<sub>0.25</sub>Cu<sub>1.5</sub>S  
 Antlerite -90.43 -38.78 51.65 Cu<sub>3</sub>(OH)<sub>4</sub>SO<sub>4</sub>  
 Aragonite 1.35 -6.92 -8.27 CaCO<sub>3</sub>  
 Arsenolite -47.38 -50.58 -3.20 As<sub>4</sub>O<sub>6</sub>  
 Artinite 5.72 16.12 10.40 MgCO<sub>3</sub>:Mg(OH)<sub>2</sub>:3H<sub>2</sub>O  
 As<sub>2</sub>O<sub>5</sub> -67.05 -19.63 47.42 As<sub>2</sub>O<sub>5</sub>  
 Atacamite -47.23 -34.02 13.21 Cu<sub>2</sub>(OH)<sub>3</sub>Cl  
 Azurite -83.18 -91.41 -8.23 Cu<sub>3</sub>(OH)<sub>2</sub>(CO<sub>3</sub>)<sub>2</sub>  
 Ba<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub> 5.40 36.98 31.58 Ba<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>  
 BaCrO<sub>4</sub> -38.26 22.15 60.41 BaCrO<sub>4</sub>  
 Barite -14.10 11.10 25.19 BaSO<sub>4</sub>  
 Bianchite -33.52 0.06 33.58 ZnSO<sub>4</sub>:6H<sub>2</sub>O  
 Blaubleil -8.98 -30.73 -21.76 Cu<sub>0.9</sub>Cu<sub>0.2</sub>S  
 Blaubleill -9.01 -34.68 -25.67 Cu<sub>0.6</sub>Cu<sub>0.8</sub>S  
 Boehmite -3.92 5.45 9.36 AlOOH  
 Brochantite -110.49 -49.12 61.38 Cu<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub>  
 Brucite 5.66 23.17 17.51 Mg(OH)<sub>2</sub>  
 Bunsenite -3.05 10.07 13.12 NiO  
 Ca<sub>2</sub>V<sub>2</sub>O<sub>7</sub> -3.32 25.33 28.65 CaVO<sub>3.5</sub>  
 Ca<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:6H<sub>2</sub>O -12.68 50.18 62.87 Ca<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:6H<sub>2</sub>O  
 Ca<sub>3</sub>(VO<sub>4</sub>)<sub>2</sub> -2.85 36.98 39.83 Ca<sub>1.5</sub>VO<sub>4</sub>  
 Ca\_Vanadate -8.79 13.69 22.48 Ca<sub>0.5</sub>VO<sub>3</sub>  
 CaCrO<sub>4</sub> -41.60 26.57 68.17 CaCrO<sub>4</sub>  
 Calcite 1.50 -6.92 -8.42 CaCO<sub>3</sub>  
 Cd(BO<sub>2</sub>)<sub>2</sub> -13.52 -3.68 9.84 Cd(BO<sub>2</sub>)<sub>2</sub>  
 Cd(Gamma) -5.87 8.23 14.10 Cd  
 Cd(OH)<sub>2</sub>(A) -3.26 11.05 14.31 Cd(OH)<sub>2</sub>  
 Cd(OH)<sub>2</sub>(C) -2.60 11.05 13.65 Cd(OH)<sub>2</sub>  
 Cd<sub>3</sub>(OH)<sub>2</sub>(SO<sub>4</sub>)<sub>2</sub> -59.79 17.61 77.39 Cd<sub>3</sub>(OH)<sub>2</sub>(SO<sub>4</sub>)<sub>2</sub>  
 Cd<sub>3</sub>(OH)<sub>4</sub>SO<sub>4</sub> -32.53 25.38 57.90 Cd<sub>3</sub>(OH)<sub>4</sub>SO<sub>4</sub>  
 Cd<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub> -27.32 36.42 63.74 Cd<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub>  
 CdCl<sub>2</sub> -15.09 -15.65 -0.55 CdCl<sub>2</sub>  
 CdCl<sub>2</sub>:2.5H<sub>2</sub>O -13.68 -15.66 -1.99 CdCl<sub>2</sub>:2.5H<sub>2</sub>O  
 CdCl<sub>2</sub>:H<sub>2</sub>O -13.99 -15.65 -1.66 CdCl<sub>2</sub>:H<sub>2</sub>O  
 CdMetal -5.77 8.23 13.99 Cd  
 CdOHCl -6.03 -2.30 3.73 CdOHCl  
 CdSO<sub>4</sub> -32.38 3.28 35.65 CdSO<sub>4</sub>  
 CdSO<sub>4</sub>:2.67H<sub>2</sub>O -30.33 3.26 33.59 CdSO<sub>4</sub>:2.67H<sub>2</sub>O

CdSO4:H2O	-30.62	3.27	33.90	CdSO4:H2O
Cerrusite	-11.87	-25.13	-13.27	PbCO3
CH4(g)	0.27	-41.54	-41.81	CH4
Chalcanthite	-53.48	-18.14	35.34	CuSO4:5H2O
Chalcocite	-6.58	-42.58	-36.00	Cu2S
Claudetite	-47.14	-50.58	-3.44	As4O6
CO2(g)	-12.03	-30.21	-18.17	CO2
Cotunnite	-16.70	-21.62	-4.93	PbCl2
Covellite	-8.38	-29.42	-21.04	CuS
Cr(OH)2	-10.67	-2.38	8.29	Cr(OH)2
Cr(OH)3(A)	-0.22	-0.97	-0.75	Cr(OH)3
Cr(OH)3(C)	-2.87	-0.97	1.90	Cr(OH)3
Cr2O3	1.13	-1.92	-3.05	Cr2O3
CrCl2	-42.73	-29.08	13.65	CrCl2
CrCl3	-55.29	-41.01	14.28	CrCl3
CrMetal	-35.64	-5.20	30.43	Cr
CrO3	-63.80	3.28	67.08	CrO3
Cu(OH)2	-22.08	-10.34	11.74	Cu(OH)2
Cu2(OH)3NO3	-143.78	-4.39	139.38	Cu2(OH)3NO3
Cu2SO4	-64.78	-31.26	33.52	Cu2SO4
Cu3(AsO4)2:6H2O	-105.36	-50.67	54.69	Cu3(AsO4)2:6H2O
CuCO3	-33.58	-40.54	-6.96	CuCO3
CuCrO4	-74.51	-7.05	67.46	CuCrO4
CuMetal	-3.92	-13.16	-9.24	Cu
CuOCuSO4	-81.65	-28.44	53.22	CuO:CuSO4
Cuprite	-21.76	-23.49	-1.72	Cu2O
CuSO4	-59.64	-18.11	41.53	CuSO4
Diaspore	-2.11	5.45	7.56	AlOOH
Djurleite	-6.62	-41.71	-35.08	Cu0.066Cu1.868S
Dolomite	2.82	-13.95	-16.77	CaMg(CO3)2
Epsomite	-17.77	15.35	33.12	MgSO4:7H2O
Galena	1.66	-14.01	-15.67	PbS
Gibbsite(C)	-3.97	5.44	9.41	Al(OH)3
Goslarite	-33.24	0.05	33.29	ZnSO4:7H2O
Greenockite	8.36	-8.03	-16.39	CdS
Gypsum	-14.99	15.50	30.49	CaSO4:2H2O
Halite	-2.57	-1.02	1.56	NaCl
Huntite	1.24	-28.01	-29.25	CaMg3(CO3)4
Hydcerrusite	-27.73	-45.19	-17.46	Pb(OH)2:2PbCO3
Hydromagnesite	2.34	-4.97	-7.31	Mg5(CO3)4(OH)2:4H2O
K2Cr2O7	-96.63	27.70	124.34	K2Cr2O7
K2CrO4	-45.72	24.42	70.15	K2CrO4
Langite	-113.06	-49.13	63.94	Cu4(OH)6SO4:H2O
Larnakite	-32.87	2.38	35.24	PbO:PbSO4
Laurionite	-8.90	-8.28	0.62	PbOHCl
Lime	-10.80	23.29	34.09	CaO
Litharge	-8.10	5.08	13.18	PbO
Magnesite	0.83	-7.03	-7.86	MgCO3

Malachite	-51.48	-50.88	0.60	Cu <sub>2</sub> (OH) <sub>2</sub> CO <sub>3</sub>
Massicot	-8.30	5.08	13.38	PbO
Melanothallite	-43.78	-37.03	6.75	CuCl <sub>2</sub>
Mg <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-8.18	25.23	33.40	MgVO <sub>3.5</sub>
Mg_Vanadate	-11.83	13.63	25.47	Mg <sub>0.5</sub> VO <sub>3</sub>
MgCr <sub>2</sub> O <sub>4</sub>	8.06	21.26	13.19	MgCr <sub>2</sub> O <sub>4</sub>
MgCrO <sub>4</sub>	-49.77	26.46	76.23	MgCrO <sub>4</sub>
Millerite	-0.90	-9.02	-8.11	NiS
Minium	-58.51	18.06	76.56	Pb <sub>3</sub> O <sub>4</sub>
Mirabilite	-16.89	16.81	33.70	Na <sub>2</sub> SO <sub>4</sub> :10H <sub>2</sub> O
Monteponite	-4.76	11.06	15.81	CdO
Morenosite	-30.66	2.24	32.90	NiSO <sub>4</sub> :7H <sub>2</sub> O
Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-99.25	31.22	130.47	Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
Na <sub>2</sub> CrO <sub>4</sub>	-45.70	27.94	73.65	Na <sub>2</sub> CrO <sub>4</sub>
Na <sub>3</sub> VO <sub>4</sub>	-18.51	39.04	57.55	Na <sub>3</sub> VO <sub>4</sub>
Na <sub>4</sub> V <sub>2</sub> O <sub>7</sub>	-12.03	26.71	38.74	Na <sub>2</sub> VO <sub>3.5</sub>
Na_Vanadate	-8.90	14.38	23.27	NaVO <sub>3</sub>
Nantokite	-18.05	-25.09	-7.04	CuCl
Natron	-3.87	-5.62	-1.75	Na <sub>2</sub> CO <sub>3</sub> :10H <sub>2</sub> O
Nesquehonite	-1.59	-7.05	-5.46	MgCO <sub>3</sub> :3H <sub>2</sub> O
NH <sub>4</sub> VO <sub>3</sub>	-15.17	6.99	22.16	NH <sub>4</sub> VO <sub>3</sub>
Ni(OH) <sub>2</sub>	0.12	10.06	9.95	Ni(OH) <sub>2</sub>
Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-45.75	10.52	56.27	Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-34.85	32.49	67.34	Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
NiCO <sub>3</sub>	-13.58	-20.14	-6.56	NiCO <sub>3</sub>
O <sub>2</sub> (g)	-81.21	5.66	86.86	O <sub>2</sub>
Oripment	-19.26	-82.55	-63.29	As <sub>2</sub> S <sub>3</sub>
Otavite	-5.43	-19.15	-13.72	CdCO <sub>3</sub>
Pb(BO <sub>2</sub> ) <sub>2</sub>	-17.43	-9.66	7.77	Pb(BO <sub>2</sub> ) <sub>2</sub>
Pb(OH) <sub>2</sub> (C)	-3.47	5.07	8.54	Pb(OH) <sub>2</sub>
Pb <sub>2</sub> (OH) <sub>3</sub> Cl	-12.00	-3.21	8.79	Pb <sub>2</sub> (OH) <sub>3</sub> Cl
Pb <sub>2</sub> O(OH) <sub>2</sub>	-16.05	10.15	26.20	Pb <sub>2</sub> O(OH) <sub>2</sub>
Pb <sub>2</sub> O <sub>3</sub>	-48.06	12.98	61.04	Pb <sub>2</sub> O <sub>3</sub>
Pb <sub>2</sub> OCO <sub>3</sub>	-19.88	-20.05	-0.18	Pb <sub>2</sub> OCO <sub>3</sub>
Pb <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-11.39	7.12	18.51	PbVO <sub>3.5</sub>
Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>	-50.77	-4.40	46.37	Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>
Pb <sub>3</sub> (VO <sub>4</sub> ) <sub>2</sub>	-13.02	9.66	22.68	Pb <sub>1.5</sub> VO <sub>4</sub>
Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>	-26.74	-14.98	11.76	Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>
Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>	-38.87	7.45	46.32	Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>
Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-43.93	12.51	56.44	Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>	-45.89	12.53	58.42	Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>
PbCrO <sub>4</sub>	-47.93	8.36	56.29	PbCrO <sub>4</sub>
PbMetal	-2.01	2.25	4.26	Pb
PbO:0.3H <sub>2</sub> O	-7.91	5.07	12.98	PbO:0.33H <sub>2</sub> O
Periclase	0.66	23.18	22.52	MgO
Phosgenite	-26.95	-46.76	-19.81	PbCl <sub>2</sub> :PbCO <sub>3</sub>
Plattnerite	-43.37	7.90	51.28	PbO <sub>2</sub>
Portlandite	-0.25	23.28	23.53	Ca(OH) <sub>2</sub>

Realgar	-12.55	-33.15	-20.60	AsS
Retgersite	-31.02	2.25	33.27	NiSO4:6H2O
Smithsonite	-12.45	-22.33	-9.88	ZnCO3
Sphalerite	0.64	-11.20	-11.85	ZnS
Spinel	-4.74	34.09	38.83	MgAl2O4
SULFUR	-14.27	-16.26	-1.99	S
Tenorite	-21.05	-10.33	10.72	CuO
Thenardite	-18.29	16.89	35.18	Na2SO4
Thermonatrite	-5.75	-5.55	0.20	Na2CO3:H2O
V(OH)3	-3.97	-0.80	3.17	V(OH)3
V2O3	-1.76	-0.78	0.97	VO1.5
V2O4	-5.65	0.63	6.28	VO2
V2O5	-16.72	2.04	18.76	VO2.5
V3O5	-8.32	-0.94	7.38	V3O5
V4O7	-15.01	-0.31	14.71	V4O7
V6O13	-46.92	6.61	53.53	V6O13
VCl2	-43.39	-28.90	14.49	VCl2
VCl3	-59.32	-40.84	18.48	VCl3
VMetal	-44.66	-5.03	39.63	V
VO	-11.58	-2.20	9.38	VO
VO(OH)2	-6.85	0.62	7.47	VO(OH)2
VO2Cl	-33.75	-11.31	22.45	VO2Cl
VOCl	-19.80	-14.13	5.66	VOCl
VOCl2	-41.27	-26.07	15.20	VOCl2
VOSO4(C)	-48.26	-7.15	41.11	VOSO4
Witherite	-2.74	-11.34	-8.60	BaCO3
Wurtzite	-1.38	-11.20	-9.82	ZnS
Zincite	-3.87	7.88	11.75	ZnO
Zincosite	-38.78	0.11	38.89	ZnSO4
Zn(BO2)2	-15.14	-6.85	8.29	Zn(BO2)2
Zn(NO3)2:6H2O	-211.51	40.39	251.90	Zn(NO3)2:6H2O
Zn(OH)2(A)	-4.57	7.88	12.45	Zn(OH)2
Zn(OH)2(B)	-3.87	7.88	11.75	Zn(OH)2
Zn(OH)2(C)	-4.32	7.88	12.20	Zn(OH)2
Zn(OH)2(E)	-3.62	7.88	11.50	Zn(OH)2
Zn(OH)2(G)	-3.83	7.88	11.71	Zn(OH)2
Zn2(OH)2SO4	-34.86	7.98	42.84	Zn2(OH)2SO4
Zn2(OH)3Cl	-12.80	2.40	15.20	Zn2(OH)3Cl
Zn3(AsO4)2:2.5H2O	-50.22	4.00	54.22	Zn3(AsO4)2:2.5H2O
Zn3O(SO4)2	-83.34	8.10	91.44	Zn3O(SO4)2
Zn4(OH)6SO4	-40.01	23.73	63.74	Zn4(OH)6SO4
Zn5(OH)8Cl2	-25.82	12.68	38.50	Zn5(OH)8Cl2
ZnCl2	-26.34	-18.82	7.52	ZnCl2
ZnCO3:H2O	-12.07	-22.33	-10.26	ZnCO3:H2O
ZnMetal	-21.73	5.06	26.79	Zn
ZnO(Active)	-3.43	7.88	11.31	ZnO
ZnS(A)	-2.05	-11.20	-9.15	ZnS
ZnSO4:H2O	-34.97	0.10	35.07	ZnSO4:H2O

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End of simulation.  
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Reading input data for simulation 2.  
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End of run.  
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No memory leaks

Database file: minteq.dat

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Reading data base.  
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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH310a Low  
SOLUTION 1  
pH 10.05 charge  
temp 14.04  
pe -1.63  
units mg/L  
Al 0.0422  
As 0.00163 as H3AsO4  
Ba 0.109  
B 2.360  
Cd 0.00013  
Ca 717  
C 26.3  
Cl 16500  
Cu 0.00204  
Cr 0.123  
Pb 0.0007  
Mg 690  
Ni 0.00594  
N 0.82 as N03-  
K 342  
Na 10100  
S 2020 as SO4-2  
V 0.0229  
Zn 0.0061  
END

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TITLE  
-----

BH310a Low

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 Beginning of initial solution calculations.  
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Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.613e-06	1.613e-06
As	1.184e-08	1.184e-08
B	2.252e-04	2.252e-04
Ba	8.185e-07	8.185e-07
C	4.445e-04	4.445e-04
Ca	1.845e-02	1.845e-02
Cd	1.193e-09	1.193e-09
Cl	4.800e-01	4.800e-01
Cr	2.440e-06	2.440e-06
Cu	3.311e-08	3.311e-08
K	9.021e-03	9.021e-03
Mg	2.927e-02	2.927e-02
N	2.013e-05	2.013e-05
Na	4.531e-01	4.531e-01
Ni	1.043e-07	1.043e-07
Pb	3.484e-09	3.484e-09
S	2.169e-02	2.169e-02
V	4.636e-07	4.636e-07
Zn	9.624e-08	9.624e-08

-----Description of solution-----

pH = 12.453    Charge balance  
 pe = -1.630  
 Activity of water = 0.983  
 Ionic strength = 5.752e-01  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 3.422e-02  
 Total CO2 (mol/kg) = 4.445e-04  
 Temperature (deg C) = 14.040  
 Electrical balance (eq) = 3.609e-17  
 Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|)$  = 0.00  
 Iterations = 12  
 Total H = 1.110460e+02  
 Total O = 5.562806e+01

-----Distribution of species-----



BH310A July 2012 Eh=-0.1

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	1.894e-02	1.186e-02	-1.723	-1.926	-0.203
H+	4.619e-13	3.524e-13	-12.335	-12.453	-0.118
H2O	5.551e+01	9.826e-01	-0.008	-0.008	0.000
Al	1.613e-06				
Al(OH)4-	1.613e-06	1.067e-06	-5.792	-5.972	-0.179
Al(OH)3	5.725e-11	6.535e-11	-10.242	-10.185	0.058
Al(OH)2+	2.706e-17	1.862e-17	-16.568	-16.730	-0.162
AlOH+2	1.783e-24	3.996e-25	-23.749	-24.398	-0.649
Al+3	3.443e-31	3.014e-32	-30.463	-31.521	-1.058
AlSO4+	9.203e-32	6.088e-32	-31.036	-31.216	-0.179
Al(SO4)2-	1.549e-32	1.025e-32	-31.810	-31.989	-0.179
As(3)	5.995e-24				
HAsO3-2	3.685e-24	1.118e-24	-23.434	-23.952	-0.518
AsO3-3	1.212e-24	8.282e-26	-23.916	-25.082	-1.165
H2AsO3-	1.098e-24	8.149e-25	-23.959	-24.089	-0.129
H3AsO3	6.488e-28	7.407e-28	-27.188	-27.130	0.058
H4AsO3+	1.742e-40	1.293e-40	-39.759	-39.888	-0.129
As(5)	1.184e-08				
AsO4-3	1.137e-08	7.770e-10	-7.944	-9.110	-1.165
HAsO4-2	4.711e-10	1.429e-10	-9.327	-9.845	-0.518
H2AsO4-	4.085e-16	3.031e-16	-15.389	-15.518	-0.129
H3AsO4	1.468e-26	1.676e-26	-25.833	-25.776	0.058
B	2.252e-04				
H2BO3-	2.251e-04	1.312e-04	-3.648	-3.882	-0.234
H3BO3	8.661e-08	9.888e-08	-7.062	-7.005	0.058
Ba	8.185e-07				
Ba+2	8.070e-07	1.693e-07	-6.093	-6.771	-0.678
BaOH+	1.157e-08	7.830e-09	-7.937	-8.106	-0.170
C(4)	4.445e-04				
NaCO3-	1.223e-04	8.417e-05	-3.912	-4.075	-0.162
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CO3-2	1.127e-04	2.526e-05	-3.948	-4.598	-0.649
MgCO3	9.258e-05	1.057e-04	-4.033	-3.976	0.058
HCO3-	3.567e-07	2.454e-07	-6.448	-6.610	-0.162
NaHCO3	2.992e-08	3.415e-08	-7.524	-7.467	0.058
MgHCO3+	2.104e-08	1.357e-08	-7.677	-7.868	-0.191
CaHCO3+	1.175e-08	8.268e-09	-7.930	-8.083	-0.153
NiCO3	5.726e-13	6.536e-13	-12.242	-12.185	0.058
H2CO3	1.524e-13	1.739e-13	-12.817	-12.760	0.058
CdCO3	9.763e-14	1.115e-13	-13.010	-12.953	0.058
Ni(CO3)2-2	9.458e-14	2.870e-14	-13.024	-13.542	-0.518
Zn(CO3)2-2	3.438e-16	1.043e-16	-15.464	-15.982	-0.518
ZnCO3	1.692e-16	1.931e-16	-15.772	-15.714	0.058
PbCO3	3.157e-17	3.604e-17	-16.501	-16.443	0.058

BH310A July 2012 Eh=-0.1

CuCO3	1.701e-17	1.942e-17	-16.769	-16.712	0.058
Pb(CO3)2-2	7.537e-18	2.287e-18	-17.123	-17.641	-0.518
Cu(CO3)2-2	2.035e-18	6.175e-19	-17.691	-18.209	-0.518
CdHCO3+	5.304e-19	3.937e-19	-18.275	-18.405	-0.129
NiHCO3+	1.235e-19	9.170e-20	-18.908	-19.038	-0.129
Cd(CO3)3-4	5.559e-20	4.711e-22	-19.255	-21.327	-2.072
ZnHCO3+	1.154e-21	8.567e-22	-20.938	-21.067	-0.129
CuHCO3+	1.717e-23	1.274e-23	-22.765	-22.895	-0.129
PbHCO3+	1.560e-23	1.158e-23	-22.807	-22.936	-0.129
Ca	1.845e-02				
Ca+2	1.491e-02	4.549e-03	-1.826	-2.342	-0.516
CaOH+	1.784e-03	1.255e-03	-2.749	-2.901	-0.153
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CaHCO3+	1.175e-08	8.268e-09	-7.930	-8.083	-0.153
Cd	1.193e-09				
Cd(OH)2	5.356e-10	6.115e-10	-9.271	-9.214	0.058
CdOHCl	3.800e-10	4.338e-10	-9.420	-9.363	0.058
Cd(OH)3-	2.578e-10	1.913e-10	-9.589	-9.718	-0.129
Cd(OH)4-2	1.567e-11	4.755e-12	-10.805	-11.323	-0.518
CdOH+	2.366e-12	1.756e-12	-11.626	-11.755	-0.129
CdCl+	6.467e-13	4.800e-13	-12.189	-12.319	-0.129
CdCl2	4.985e-13	5.691e-13	-12.302	-12.245	0.058
CdCl3-	1.206e-13	8.952e-14	-12.919	-13.048	-0.129
CdCO3	9.763e-14	1.115e-13	-13.010	-12.953	0.058
Cd+2	5.802e-14	1.760e-14	-13.236	-13.754	-0.518
CdSO4	9.190e-15	1.049e-14	-14.037	-13.979	0.058
Cd(SO4)2-2	9.005e-16	2.732e-16	-15.046	-15.563	-0.518
CdHCO3+	5.304e-19	3.937e-19	-18.275	-18.405	-0.129
Cd(CO3)3-4	5.559e-20	4.711e-22	-19.255	-21.327	-2.072
Cd2OH+3	2.554e-24	1.745e-25	-23.593	-24.758	-1.165
CdNO3+	3.785e-34	2.809e-34	-33.422	-33.551	-0.129
CdHS+	0.000e+00	0.000e+00	-69.774	-69.903	-0.129
Cd(HS)2	0.000e+00	0.000e+00	-129.919	-129.862	0.058
Cd(HS)3-	0.000e+00	0.000e+00	-193.871	-194.001	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-257.611	-258.129	-0.518
Cl	4.800e-01				
Cl-	4.800e-01	2.966e-01	-0.319	-0.528	-0.209
CdOHCl	3.800e-10	4.338e-10	-9.420	-9.363	0.058
CuCl3-2	1.765e-10	3.704e-11	-9.753	-10.431	-0.678
CuCl2-	1.277e-10	8.232e-11	-9.894	-10.084	-0.191
ZnOHCl	9.190e-13	1.049e-12	-12.037	-11.979	0.058
CdCl+	6.467e-13	4.800e-13	-12.189	-12.319	-0.129
CdCl2	4.985e-13	5.691e-13	-12.302	-12.245	0.058
CdCl3-	1.206e-13	8.952e-14	-12.919	-13.048	-0.129
NiCl+	3.495e-15	2.594e-15	-14.457	-14.586	-0.129
NiCl2	2.452e-15	2.800e-15	-14.610	-14.553	0.058
ZnCl+	2.872e-17	1.852e-17	-16.542	-16.732	-0.191

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ZnCl2	4.812e-18	5.493e-18	-17.318	-17.260	0.058
ZnCl3-	2.648e-18	1.707e-18	-17.577	-17.768	-0.191
ZnCl4-2	1.103e-18	2.313e-19	-17.958	-18.636	-0.678
PbCl+	9.848e-19	7.309e-19	-18.007	-18.136	-0.129
PbCl2	3.722e-19	4.249e-19	-18.429	-18.372	0.058
PbCl3-	1.254e-19	9.310e-20	-18.902	-19.031	-0.129
CuCl+	1.015e-19	6.544e-20	-18.994	-19.184	-0.191
PbCl4-2	3.999e-20	1.213e-20	-19.398	-19.916	-0.518
CuCl2	8.072e-21	9.216e-21	-20.093	-20.035	0.058
CuCl3-	1.230e-23	7.927e-24	-22.910	-23.101	-0.191
CrOHCl2	2.283e-24	2.607e-24	-23.641	-23.584	0.058
CuCl4-2	8.218e-26	1.724e-26	-25.085	-25.763	-0.678
CrCl+2	6.449e-29	1.957e-29	-28.191	-28.708	-0.518
CrCl2+	1.142e-30	8.477e-31	-29.942	-30.072	-0.129
CrO3Cl-	3.326e-32	2.468e-32	-31.478	-31.608	-0.129
VOCl+	1.956e-35	1.452e-35	-34.709	-34.838	-0.129
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-40.016	-40.534	-0.518
Cr(2)	9.568e-34				
Cr+2	9.568e-34	2.903e-34	-33.019	-33.537	-0.518
Cr(3)	2.440e-06				
CrO2-	1.755e-06	1.303e-06	-5.756	-5.885	-0.129
Cr(OH)4-	6.680e-07	4.958e-07	-6.175	-6.305	-0.129
Cr(OH)3	1.631e-08	1.862e-08	-7.788	-7.730	0.058
Cr(OH)2+	1.213e-13	9.006e-14	-12.916	-13.045	-0.129
Cr(OH)+2	4.437e-20	1.346e-20	-19.353	-19.871	-0.518
CrOHSO4	1.182e-20	1.349e-20	-19.928	-19.870	0.058
Cr(NH3)4(OH)2+	1.102e-23	8.175e-24	-22.958	-23.087	-0.129
CrOHCl2	2.283e-24	2.607e-24	-23.641	-23.584	0.058
Cr+3	2.586e-27	1.767e-28	-26.587	-27.753	-1.165
CrCl+2	6.449e-29	1.957e-29	-28.191	-28.708	-0.518
CrSO4+	7.196e-30	5.341e-30	-29.143	-29.272	-0.129
CrCl2+	1.142e-30	8.477e-31	-29.942	-30.072	-0.129
Cr(NH3)5OH+2	3.315e-31	1.006e-31	-30.480	-30.998	-0.518
Cr2(OH)2SO4+2	1.088e-37	3.302e-38	-36.963	-37.481	-0.518
Cr(NH3)6+3	2.406e-40	0.000e+00	-39.619	-40.784	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-40.016	-40.534	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-41.821	-41.763	0.058
CrNO3+2	0.000e+00	0.000e+00	-49.113	-49.631	-0.518
Cr(6)	2.580e-13				
CrO4-2	1.873e-13	3.236e-14	-12.727	-13.490	-0.763
NaCrO4-	6.915e-14	5.132e-14	-13.160	-13.290	-0.129
KCrO4-	1.513e-15	1.123e-15	-14.820	-14.950	-0.129
HCrO4-	4.680e-20	3.474e-20	-19.330	-19.459	-0.129
CrO3Cl-	3.326e-32	2.468e-32	-31.478	-31.608	-0.129
CrO3SO4-2	2.943e-32	8.929e-33	-31.531	-32.049	-0.518
H2CrO4	1.577e-33	1.800e-33	-32.802	-32.745	0.058
Cr2O7-2	1.908e-37	5.789e-38	-36.719	-37.237	-0.518
Cu(1)	3.042e-10				

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CuCl3-2	1.765e-10	3.704e-11	-9.753	-10.431	-0.678
CuCl2-	1.277e-10	8.232e-11	-9.894	-10.084	-0.191
Cu+	4.942e-15	2.881e-15	-14.306	-14.540	-0.234
Cu(2)	3.280e-08				
Cu(OH)2	2.037e-08	2.325e-08	-7.691	-7.634	0.058
Cu(OH)4-2	7.164e-09	2.174e-09	-8.145	-8.663	-0.518
Cu(OH)3-	5.276e-09	3.916e-09	-8.278	-8.407	-0.129
CuOH+	6.190e-15	3.991e-15	-14.208	-14.399	-0.191
CuCO3	1.701e-17	1.942e-17	-16.769	-16.712	0.058
Cu(CO3)2-2	2.035e-18	6.175e-19	-17.691	-18.209	-0.518
Cu+2	1.239e-18	1.431e-19	-17.907	-18.844	-0.938
CuCl+	1.015e-19	6.544e-20	-18.994	-19.184	-0.191
CuSO4	5.242e-20	5.984e-20	-19.281	-19.223	0.058
CuCl2	8.072e-21	9.216e-21	-20.093	-20.035	0.058
CuHCO3+	1.717e-23	1.274e-23	-22.765	-22.895	-0.129
CuCl3-	1.230e-23	7.927e-24	-22.910	-23.101	-0.191
Cu2(OH)2+2	7.421e-24	2.252e-24	-23.130	-23.647	-0.518
CuCl4-2	8.218e-26	1.724e-26	-25.085	-25.763	-0.678
Cu(S4)2-3	0.000e+00	0.000e+00	-118.372	-118.882	-0.510
CuS4S5-3	0.000e+00	0.000e+00	-119.137	-119.612	-0.475
Cu(HS)3-	0.000e+00	0.000e+00	-191.772	-191.902	-0.129
H(0)	3.139e-25				
H2	1.569e-25	1.792e-25	-24.804	-24.747	0.058
K	9.021e-03				
K+	8.918e-03	5.510e-03	-2.050	-2.259	-0.209
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
KCrO4-	1.513e-15	1.123e-15	-14.820	-14.950	-0.129
Mg	2.927e-02				
Mg+2	1.519e-02	5.188e-03	-1.818	-2.285	-0.467
MgOH+	1.235e-02	8.836e-03	-1.908	-2.054	-0.145
MgSO4	1.636e-03	1.868e-03	-2.786	-2.729	0.058
MgCO3	9.258e-05	1.057e-04	-4.033	-3.976	0.058
MgHCO3+	2.104e-08	1.357e-08	-7.677	-7.868	-0.191
N(-3)	2.013e-05				
NH3	2.007e-05	2.291e-05	-4.697	-4.640	0.058
NH4+	5.436e-08	3.169e-08	-7.265	-7.499	-0.234
NH4SO4-	1.336e-09	9.043e-10	-8.874	-9.044	-0.170
Cr(NH3)4(OH)2+	1.102e-23	8.175e-24	-22.958	-23.087	-0.129
Cr(NH3)5OH+2	3.315e-31	1.006e-31	-30.480	-30.998	-0.518
Cr(NH3)6+3	2.406e-40	0.000e+00	-39.619	-40.784	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-40.016	-40.534	-0.518
N(3)	8.784e-13				
NO2-	8.784e-13	6.519e-13	-12.056	-12.186	-0.129
N(5)	7.520e-21				
NO3-	7.520e-21	4.555e-21	-20.124	-20.342	-0.218
CdNO3+	3.785e-34	2.809e-34	-33.422	-33.551	-0.129
PbNO3+	7.451e-39	5.530e-39	-38.128	-38.257	-0.129
CrNO3+2	0.000e+00	0.000e+00	-49.113	-49.631	-0.518

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VO2NO3	0.000e+00	0.000e+00	-49.641	-49.584	0.058
Na	4.531e-01				
Na+	4.482e-01	3.191e-01	-0.349	-0.496	-0.148
NaSO4-	4.791e-03	3.297e-03	-2.320	-2.482	-0.162
NaCO3-	1.223e-04	8.417e-05	-3.912	-4.075	-0.162
NaHCO3	2.992e-08	3.415e-08	-7.524	-7.467	0.058
NaCrO4-	6.915e-14	5.132e-14	-13.160	-13.290	-0.129
Ni	1.043e-07				
Ni(OH)3-	1.020e-07	7.568e-08	-6.992	-7.121	-0.129
Ni(OH)2	2.377e-09	2.714e-09	-8.624	-8.566	0.058
NiOH+	8.134e-13	6.037e-13	-12.090	-12.219	-0.129
NiCO3	5.726e-13	6.536e-13	-12.242	-12.185	0.058
Ni(CO3)2-2	9.458e-14	2.870e-14	-13.024	-13.542	-0.518
Ni+2	1.150e-14	3.490e-15	-13.939	-14.457	-0.518
NiCl+	3.495e-15	2.594e-15	-14.457	-14.586	-0.129
NiCl2	2.452e-15	2.800e-15	-14.610	-14.553	0.058
NiSO4	1.197e-15	1.367e-15	-14.922	-14.864	0.058
Ni(SO4)2-2	5.912e-19	1.794e-19	-18.228	-18.746	-0.518
NiHCO3+	1.235e-19	9.170e-20	-18.908	-19.038	-0.129
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-46.631	-46.574	0.058
Pb	3.484e-09				
Pb(OH)4-2	3.271e-09	9.926e-10	-8.485	-9.003	-0.518
Pb(OH)3-	2.089e-10	1.550e-10	-9.680	-9.810	-0.129
Pb(OH)2	4.241e-12	4.842e-12	-11.373	-11.315	0.058
PbOH+	6.013e-15	4.463e-15	-14.221	-14.350	-0.129
PbCO3	3.157e-17	3.604e-17	-16.501	-16.443	0.058
Pb(CO3)2-2	7.537e-18	2.287e-18	-17.123	-17.641	-0.518
PbCl+	9.848e-19	7.309e-19	-18.007	-18.136	-0.129
PbCl2	3.722e-19	4.249e-19	-18.429	-18.372	0.058
Pb+2	2.705e-19	8.208e-20	-18.568	-19.086	-0.518
PbCl3-	1.254e-19	9.310e-20	-18.902	-19.031	-0.129
PbSO4	8.957e-20	1.023e-19	-19.048	-18.990	0.058
PbCl4-2	3.999e-20	1.213e-20	-19.398	-19.916	-0.518
Pb(SO4)2-2	3.918e-21	1.189e-21	-20.407	-20.925	-0.518
PbHCO3+	1.560e-23	1.158e-23	-22.807	-22.936	-0.129
Pb2OH+3	1.200e-31	8.201e-33	-30.921	-32.086	-1.165
Pb3(OH)4+2	2.636e-32	7.998e-33	-31.579	-32.097	-0.518
PbNO3+	7.451e-39	5.530e-39	-38.128	-38.257	-0.129
Pb(HS)2	0.000e+00	0.000e+00	-136.511	-136.453	0.058
Pb(HS)3-	0.000e+00	0.000e+00	-201.342	-201.472	-0.129
S(-2)	0.000e+00				
S5-2	0.000e+00	0.000e+00	-63.203	-63.721	-0.518
S6-2	0.000e+00	0.000e+00	-63.229	-63.747	-0.518
S4-2	0.000e+00	0.000e+00	-63.448	-63.966	-0.518
HS-	0.000e+00	0.000e+00	-66.115	-66.319	-0.203
S-2	0.000e+00	0.000e+00	-66.444	-67.122	-0.678
S3-2	0.000e+00	0.000e+00	-66.921	-67.439	-0.518

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S2-2	0.000e+00	0.000e+00	-68.195	-68.713	-0.518
CdHS+	0.000e+00	0.000e+00	-69.774	-69.903	-0.129
H2S	0.000e+00	0.000e+00	-71.729	-71.672	0.058
Cu(S4)2-3	0.000e+00	0.000e+00	-118.372	-118.882	-0.510
CuS4S5-3	0.000e+00	0.000e+00	-119.137	-119.612	-0.475
Cd(HS)2	0.000e+00	0.000e+00	-129.919	-129.862	0.058
Zn(HS)2	0.000e+00	0.000e+00	-134.172	-134.114	0.058
Pb(HS)2	0.000e+00	0.000e+00	-136.511	-136.453	0.058
Cu(HS)3-	0.000e+00	0.000e+00	-191.772	-191.902	-0.129
Cd(HS)3-	0.000e+00	0.000e+00	-193.871	-194.001	-0.129
Zn(HS)3-	0.000e+00	0.000e+00	-199.143	-199.273	-0.129
Pb(HS)3-	0.000e+00	0.000e+00	-201.342	-201.472	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-257.611	-258.129	-0.518
S(6)	2.169e-02				
SO4-2	1.352e-02	2.215e-03	-1.869	-2.655	-0.786
NaSO4-	4.791e-03	3.297e-03	-2.320	-2.482	-0.162
MgSO4	1.636e-03	1.868e-03	-2.786	-2.729	0.058
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
NH4SO4-	1.336e-09	9.043e-10	-8.874	-9.044	-0.170
HSO4-	8.495e-14	5.620e-14	-13.071	-13.250	-0.179
CdSO4	9.190e-15	1.049e-14	-14.037	-13.979	0.058
NiSO4	1.197e-15	1.367e-15	-14.922	-14.864	0.058
Cd(SO4)2-2	9.005e-16	2.732e-16	-15.046	-15.563	-0.518
ZnSO4	1.597e-17	1.823e-17	-16.797	-16.739	0.058
Zn(SO4)2-2	1.181e-18	3.583e-19	-17.928	-18.446	-0.518
Ni(SO4)2-2	5.912e-19	1.794e-19	-18.228	-18.746	-0.518
PbSO4	8.957e-20	1.023e-19	-19.048	-18.990	0.058
CuSO4	5.242e-20	5.984e-20	-19.281	-19.223	0.058
CrOHSO4	1.182e-20	1.349e-20	-19.928	-19.870	0.058
Pb(SO4)2-2	3.918e-21	1.189e-21	-20.407	-20.925	-0.518
CrSO4+	7.196e-30	5.341e-30	-29.143	-29.272	-0.129
VO2SO4-	2.360e-30	1.752e-30	-29.627	-29.757	-0.129
AlSO4+	9.203e-32	6.088e-32	-31.036	-31.216	-0.179
CrO3SO4-2	2.943e-32	8.929e-33	-31.531	-32.049	-0.518
Al(SO4)2-	1.549e-32	1.025e-32	-31.810	-31.989	-0.179
VOSO4	2.012e-35	2.297e-35	-34.696	-34.639	0.058
Cr2(OH)2SO4+2	1.088e-37	3.302e-38	-36.963	-37.481	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-41.821	-41.763	0.058
VSO4+	0.000e+00	0.000e+00	-52.587	-52.716	-0.129
V(2)	0.000e+00				
VOH+	0.000e+00	0.000e+00	-47.416	-47.545	-0.129
V+2	0.000e+00	0.000e+00	-53.832	-54.350	-0.518
V(3)	5.716e-26				
V(OH)3	5.716e-26	6.526e-26	-25.243	-25.185	0.058
V(OH)2+	4.884e-33	3.625e-33	-32.311	-32.441	-0.129
VOH+2	0.000e+00	0.000e+00	-41.100	-41.618	-0.518
V+3	0.000e+00	0.000e+00	-50.336	-51.502	-1.165

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VSO4+	0.000e+00	0.000e+00	-52.587	-52.716	-0.129
V2(OH)3+3	0.000e+00	0.000e+00	-72.001	-73.167	-1.165
V2(OH)2+4	0.000e+00	0.000e+00	-79.790	-81.862	-2.072
V(4)	3.690e-28				
V(OH)3+	3.690e-28	2.739e-28	-27.433	-27.562	-0.129
VO+2	1.541e-34	4.675e-35	-33.812	-34.330	-0.518
VOSO4	2.012e-35	2.297e-35	-34.696	-34.639	0.058
VOCI+	1.956e-35	1.452e-35	-34.709	-34.838	-0.129
H2V2O4+2	0.000e+00	0.000e+00	-49.692	-50.210	-0.518
V(5)	4.636e-07				
HVO4-2	3.034e-07	9.207e-08	-6.518	-7.036	-0.518
VO4-3	1.599e-07	1.093e-08	-6.796	-7.962	-1.165
V2O7-4	1.156e-10	9.797e-13	-9.937	-12.009	-2.072
HV2O7-3	2.908e-11	1.987e-12	-10.536	-11.702	-1.165
H2VO4-	6.329e-12	4.697e-12	-11.199	-11.328	-0.129
H3VO4	9.352e-21	1.068e-20	-20.029	-19.972	0.058
H3V2O7-	1.126e-24	8.358e-25	-23.948	-24.078	-0.129
V3O9-3	3.504e-27	2.394e-28	-26.455	-27.621	-1.165
VO2+	2.077e-29	1.542e-29	-28.683	-28.812	-0.129
VO2SO4-	2.360e-30	1.752e-30	-29.627	-29.757	-0.129
V4O12-4	4.240e-35	3.593e-37	-34.373	-36.445	-2.072
VO2NO3	0.000e+00	0.000e+00	-49.641	-49.584	0.058
V10O28-6	0.000e+00	0.000e+00	-101.801	-106.463	-4.662
HV10O28-5	0.000e+00	0.000e+00	-110.101	-113.338	-3.237
H2V10O28-4	0.000e+00	0.000e+00	-119.477	-121.549	-2.072
Zn	9.624e-08				
Zn(OH)4-2	4.828e-08	1.465e-08	-7.316	-7.834	-0.518
Zn(OH)3-	4.466e-08	3.315e-08	-7.350	-7.480	-0.129
Zn(OH)2	3.293e-09	3.759e-09	-8.482	-8.425	0.058
ZnOHCl	9.190e-13	1.049e-12	-12.037	-11.979	0.058
ZnOH+	6.659e-14	4.942e-14	-13.177	-13.306	-0.129
Zn(CO3)2-2	3.438e-16	1.043e-16	-15.464	-15.982	-0.518
ZnCO3	1.692e-16	1.931e-16	-15.772	-15.714	0.058
Zn+2	1.563e-16	3.831e-17	-15.806	-16.417	-0.611
ZnCl+	2.872e-17	1.852e-17	-16.542	-16.732	-0.191
ZnSO4	1.597e-17	1.823e-17	-16.797	-16.739	0.058
ZnCl2	4.812e-18	5.493e-18	-17.318	-17.260	0.058
ZnCl3-	2.648e-18	1.707e-18	-17.577	-17.768	-0.191
Zn(SO4)2-2	1.181e-18	3.583e-19	-17.928	-18.446	-0.518
ZnCl4-2	1.103e-18	2.313e-19	-17.958	-18.636	-0.678
ZnHCO3+	1.154e-21	8.567e-22	-20.938	-21.067	-0.129
Zn(HS)2	0.000e+00	0.000e+00	-134.172	-134.114	0.058
Zn(HS)3-	0.000e+00	0.000e+00	-199.143	-199.273	-0.129

-----Saturation indices-----

Phase            SI log IAP   log KT

BH310A July 2012 Eh=-0.1

(NH4)2CrO4 -28.83 41.77 70.60 (NH4)2CrO4  
 Al(OH)3(a) -5.32 5.82 11.14 Al(OH)3  
 Al2O3 -11.33 11.65 22.98 Al2O3  
 Al4(OH)10SO4 -26.98 -4.28 22.70 Al4(OH)10SO4  
 AlAsO4:2H2O -24.75 -19.95 4.80 AlAsO4:2H2O  
 AlOHSO4 -18.50 -21.73 -3.23 AlOHSO4  
 AlumK -33.81 -39.18 -5.37 KAl(SO4)2:12H2O  
 Alunite -26.00 -27.46 -1.46 KAl3(SO4)2(OH)6  
 Anglesite -13.89 -21.74 -7.85 PbSO4  
 Anhydrite -0.47 -5.00 -4.53 CaSO4  
 Anilite -47.29 -119.74 -72.45 Cu0.25Cu1.5S  
 Antlerite -17.70 -9.41 8.29 Cu3(OH)4SO4  
 Aragonite 1.33 -6.94 -8.27 CaCO3  
 Arsenolite -105.27 -189.61 -84.34 As4O6  
 Artinite 5.30 15.70 10.40 MgCO3:Mg(OH)2:3H2O  
 As2O5 -58.38 -51.53 6.85 As2O5  
 Atacamite -8.74 -0.88 7.86 Cu2(OH)3Cl  
 Azurite -24.58 -40.84 -16.26 Cu3(OH)2(CO3)2  
 Ba3(AsO4)2 11.84 2.85 -8.98 Ba3(AsO4)2  
 BaCrO4 -10.41 50.00 60.41 BaCrO4  
 Barite 0.73 -9.43 -10.15 BaSO4  
 Bianchite -17.36 -19.12 -1.76 ZnSO4:6H2O  
 Blaubleil -49.57 -109.61 -60.04 Cu0.9Cu0.2S  
 Blaubleill -49.53 -114.29 -64.76 Cu0.6Cu0.8S  
 Boehmite -3.54 5.82 9.36 AlOOH  
 Brochantite -18.70 -3.36 15.34 Cu4(OH)6SO4  
 Brucite 5.09 22.61 17.51 Mg(OH)2  
 Bunsenite -2.68 10.44 13.12 NiO  
 Ca2V2O7 -3.09 6.19 9.28 CaVO3.5  
 Ca3(AsO4)2:6H2O -6.21 16.09 22.30 Ca3(AsO4)2:6H2O  
 Ca3(VO4)2 -2.99 17.47 20.46 Ca1.5VO4  
 Ca\_Vanadate -8.20 -5.08 3.11 Ca0.5VO3  
 CaCrO4 -13.75 54.43 68.17 CaCrO4  
 Calcite 1.48 -6.94 -8.42 CaCO3  
 Cd(BO2)2 -12.68 -2.84 9.84 Cd(BO2)2  
 Cd(Gamma) -24.59 -10.49 14.10 Cd  
 Cd(OH)2(A) -3.17 11.14 14.31 Cd(OH)2  
 Cd(OH)2(C) -2.51 11.14 13.65 Cd(OH)2  
 Cd3(OH)2(SO4)2 -28.39 -21.68 6.71 Cd3(OH)2(SO4)2  
 Cd3(OH)4SO4 -16.70 5.86 22.56 Cd3(OH)4SO4  
 Cd4(OH)6SO4 -11.40 17.00 28.40 Cd4(OH)6SO4  
 CdCl2 -14.26 -14.81 -0.55 CdCl2  
 CdCl2:2.5H2O -12.84 -14.83 -1.99 CdCl2:2.5H2O  
 CdCl2:H2O -13.16 -14.82 -1.66 CdCl2:H2O  
 CdMetal -24.49 -10.49 13.99 Cd  
 CdOHCl -5.56 -1.84 3.73 CdOHCl  
 CdSO4 -16.72 -16.41 0.31 CdSO4  
 CdSO4:2.67H2O -14.68 -16.43 -1.75 CdSO4:2.67H2O



BH310A July 2012 Eh=-0.1

CdSO4:H2O -14.97 -16.42 -1.45 CdSO4:H2O  
 Cerrusite -10.42 -23.68 -13.27 PbCO3  
 CH4(g) -74.26 -116.06 -41.81 CH4  
 Chalcantite -18.86 -21.54 -2.68 CuSO4:5H2O  
 Chalcocite -46.95 -123.64 -76.69 Cu2S  
 Claudetite -105.04 -189.61 -84.57 As4O6  
 CO2(g) -11.32 -29.50 -18.17 CO2  
 Cotunnite -15.21 -20.14 -4.93 PbCl2  
 Covellite -49.00 -108.05 -59.05 CuS  
 Cr(OH)2 -19.70 -11.42 8.29 Cr(OH)2  
 Cr(OH)3(A) 0.15 -0.60 -0.75 Cr(OH)3  
 Cr(OH)3(C) -2.50 -0.60 1.90 Cr(OH)3  
 Cr2O3 1.88 -1.18 -3.05 Cr2O3  
 CrCl2 -51.01 -37.36 13.65 CrCl2  
 CrCl3 -53.80 -39.52 14.28 CrCl3  
 CrMetal -63.48 -33.05 30.43 Cr  
 CrO3 -35.21 31.87 67.08 CrO3  
 Cu(OH)2 -3.02 6.05 9.07 Cu(OH)2  
 Cu2(OH)3NO3 -30.42 103.62 134.03 Cu2(OH)3NO3  
 Cu2SO4 -29.91 -37.08 -7.17 Cu2SO4  
 Cu3(AsO4)2:6H2O -39.51 -33.41 6.10 Cu3(AsO4)2:6H2O  
 CuCO3 -13.81 -23.44 -9.63 CuCO3  
 CuCrO4 -26.86 37.92 64.78 CuCrO4  
 CuMetal -3.67 -15.58 -11.91 Cu  
 CuOCuSO4 -27.97 -15.44 12.53 CuO:CuSO4  
 Cuprite -2.46 -9.53 -7.07 Cu2O  
 CuSO4 -25.02 -21.50 3.52 CuSO4  
 Diaspore -1.74 5.82 7.56 AlOOH  
 Djurleite -47.01 -122.61 -75.60 Cu0.066Cu1.868S  
 Dolomite 2.95 -13.82 -16.77 CaMg(CO3)2  
 Epsomite -2.77 -4.99 -2.22 MgSO4:7H2O  
 Galena -57.28 -108.29 -51.02 PbS  
 Gibbsite(C) -3.59 5.82 9.41 Al(OH)3  
 Goslarite -17.07 -19.12 -2.05 ZnSO4:7H2O  
 Greenockite -51.23 -102.96 -51.73 CdS  
 Gypsum -0.16 -5.01 -4.86 CaSO4:2H2O  
 Halite -2.58 -1.02 1.56 NaCl  
 Huntite 1.66 -27.59 -29.25 CaMg3(CO3)4  
 Hydrcerrusite -24.10 -41.56 -17.46 Pb(OH)2:2PbCO3  
 Hydromagnesite 2.35 -4.95 -7.31 Mg5(CO3)4(OH)2:4H2O  
 K2Cr2O7 -40.22 84.12 124.34 K2Cr2O7  
 K2CrO4 -17.90 52.25 70.15 K2CrO4  
 Langite -21.27 -3.37 17.90 Cu4(OH)6SO4:H2O  
 Larnakite -15.83 -15.93 -0.10 PbO:PbSO4  
 Laurionite -7.79 -7.17 0.62 PbOHCl  
 Lime -11.53 22.56 34.09 CaO  
 Litharge -7.37 5.81 13.18 PbO  
 Magnesite 0.97 -6.88 -7.86 MgCO3

BH310A July 2012 Eh=-0.1

Malachite	-12.65	-17.40	-4.74	Cu <sub>2</sub> (OH) <sub>2</sub> CO <sub>3</sub>
Massicot	-7.57	5.81	13.38	PbO
Melanothallite	-23.97	-19.90	4.07	CuCl <sub>2</sub>
Mg <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-7.78	6.25	14.03	MgVO <sub>3.5</sub>
Mg_Vanadate	-11.15	-5.06	6.10	Mg <sub>0.5</sub> VO <sub>3</sub>
MgCr <sub>2</sub> O <sub>4</sub>	8.24	21.44	13.19	MgCr <sub>2</sub> O <sub>4</sub>
MgCrO <sub>4</sub>	-21.75	54.48	76.23	MgCrO <sub>4</sub>
Millerite	-60.21	-103.67	-43.45	NiS
Minium	-37.49	39.08	76.56	Pb <sub>3</sub> O <sub>4</sub>
Mirabilite	-2.08	-3.72	-1.65	Na <sub>2</sub> SO <sub>4</sub> :10H <sub>2</sub> O
Monteponite	-4.67	11.14	15.81	CdO
Morenosite	-14.72	-17.17	-2.44	NiSO <sub>4</sub> :7H <sub>2</sub> O
Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-42.83	87.64	130.47	Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
Na <sub>2</sub> CrO <sub>4</sub>	-17.87	55.78	73.65	Na <sub>2</sub> CrO <sub>4</sub>
Na <sub>3</sub> VO <sub>4</sub>	-18.69	19.50	38.18	Na <sub>3</sub> VO <sub>4</sub>
Na <sub>4</sub> V <sub>2</sub> O <sub>7</sub>	-11.83	7.54	19.37	Na <sub>2</sub> VO <sub>3.5</sub>
Na_Vanadate	-8.32	-4.41	3.91	NaVO <sub>3</sub>
Nantokite	-8.03	-17.74	-9.71	CuCl
Natron	-3.91	-5.67	-1.75	Na <sub>2</sub> CO <sub>3</sub> :10H <sub>2</sub> O
Nesquehonite	-1.45	-6.91	-5.46	MgCO <sub>3</sub> :3H <sub>2</sub> O
NH <sub>4</sub> VO <sub>3</sub>	-14.21	-11.41	2.80	NH <sub>4</sub> VO <sub>3</sub>
Ni(OH) <sub>2</sub>	0.49	10.43	9.95	Ni(OH) <sub>2</sub>
Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-35.97	-20.27	15.70	Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-17.81	14.19	32.00	Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
NiCO <sub>3</sub>	-12.49	-19.05	-6.56	NiCO <sub>3</sub>
O <sub>2</sub> (g)	-43.59	43.28	86.86	O <sub>2</sub>
Oripment	-227.24	-437.12	-209.88	As <sub>2</sub> S <sub>3</sub>
Otavite	-4.63	-18.35	-13.72	CdCO <sub>3</sub>
Pb(BO <sub>2</sub> ) <sub>2</sub>	-15.95	-8.17	7.77	Pb(BO <sub>2</sub> ) <sub>2</sub>
Pb(OH) <sub>2</sub> (C)	-2.74	5.81	8.54	Pb(OH) <sub>2</sub>
Pb <sub>2</sub> (OH) <sub>3</sub> Cl	-10.16	-1.36	8.79	Pb <sub>2</sub> (OH) <sub>3</sub> Cl
Pb <sub>2</sub> O(OH) <sub>2</sub>	-14.58	11.62	26.20	Pb <sub>2</sub> O(OH) <sub>2</sub>
Pb <sub>2</sub> O <sub>3</sub>	-27.78	33.26	61.04	Pb <sub>2</sub> O <sub>3</sub>
Pb <sub>2</sub> OCO <sub>3</sub>	-17.69	-17.87	-0.18	Pb <sub>2</sub> OCO <sub>3</sub>
Pb <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-9.69	-10.55	-0.86	PbVO <sub>3.5</sub>
Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>	-39.89	-34.09	5.80	Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>
Pb <sub>3</sub> (VO <sub>4</sub> ) <sub>2</sub>	-10.96	-7.64	3.31	Pb <sub>1.5</sub> VO <sub>4</sub>
Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>	-23.82	-12.06	11.76	Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>
Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>	-21.10	-10.12	10.98	Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>
Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-25.43	-4.33	21.10	Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>	-27.38	-4.30	23.08	Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>
PbCrO <sub>4</sub>	-18.60	37.68	56.29	PbCrO <sub>4</sub>
PbMetal	-20.08	-15.83	4.26	Pb
PbO:0.3H <sub>2</sub> O	-7.17	5.81	12.98	PbO:0.33H <sub>2</sub> O
Periclase	0.09	22.61	22.52	MgO
Phosgenite	-24.01	-43.82	-19.81	PbCl <sub>2</sub> :PbCO <sub>3</sub>
Plattnerite	-23.83	27.45	51.28	PbO <sub>2</sub>
Portlandite	-0.98	22.55	23.53	Ca(OH) <sub>2</sub>

BH310A July 2012 Eh=-0.1

Realgar	-96.10	-172.33	-76.23	AsS
Retgersite	-15.09	-17.16	-2.07	NiSO4:6H2O
Smithsonite	-11.14	-21.01	-9.88	ZnCO3
Sphalerite	-58.43	-105.62	-47.19	ZnS
Spinel	-4.56	34.27	38.83	MgAl2O4
SULFUR	-55.13	-92.47	-37.33	S
Tenorite	-1.99	6.05	8.05	CuO
Thenardite	-3.48	-3.65	-0.16	Na2SO4
Thermonatrite	-5.80	-5.60	0.20	Na2CO3:H2O
V(OH)3	-21.82	-38.01	-16.20	V(OH)3
V2O3	-19.61	-38.00	-18.40	VO1.5
V2O4	-14.10	-27.18	-13.09	VO2
V2O5	-15.76	-16.36	-0.60	VO2.5
V3O5	-52.46	-103.18	-50.72	V3O5
V4O7	-67.60	-130.37	-62.77	V4O7
V6O13	-78.78	-141.45	-62.68	V6O13
VCl2	-69.90	-74.77	-4.88	VCl2
VCl3	-76.04	-76.93	-0.89	VCl3
VMetal	-90.72	-70.46	20.26	V
VO	-38.84	-48.82	-9.98	VO
VO(OH)2	-15.29	-27.19	-11.90	VO(OH)2
VO2Cl	-32.42	-29.34	3.08	VO2Cl
VOCl	-37.27	-50.98	-13.71	VOCl
VOCl2	-48.96	-53.14	-4.17	VOCl2
VOSO4(C)	-41.13	-54.73	-13.60	VOSO4
Witherite	-2.77	-11.37	-8.60	BaCO3
Wurtzite	-60.46	-105.62	-45.17	ZnS
Zincite	-3.27	8.48	11.75	ZnO
Zincosite	-22.62	-19.07	3.55	ZnSO4
Zn(BO2)2	-13.80	-5.51	8.29	Zn(BO2)2
Zn(NO3)2:6H2O	-60.43	191.47	251.90	Zn(NO3)2:6H2O
Zn(OH)2(A)	-3.98	8.47	12.45	Zn(OH)2
Zn(OH)2(B)	-3.28	8.47	11.75	Zn(OH)2
Zn(OH)2(C)	-3.73	8.47	12.20	Zn(OH)2
Zn(OH)2(E)	-3.03	8.47	11.50	Zn(OH)2
Zn(OH)2(G)	-3.24	8.47	11.71	Zn(OH)2
Zn2(OH)2SO4	-18.10	-10.60	7.50	Zn2(OH)2SO4
Zn2(OH)3Cl	-11.23	3.97	15.20	Zn2(OH)3Cl
Zn3(AsO4)2:2.5H2O	-39.75	-26.10	13.65	Zn3(AsO4)2:2.5H2O
Zn3O(SO4)2	-50.42	-29.66	20.75	Zn3O(SO4)2
Zn4(OH)6SO4	-22.05	6.35	28.40	Zn4(OH)6SO4
Zn5(OH)8Cl2	-22.08	16.42	38.50	Zn5(OH)8Cl2
ZnCl2	-24.99	-17.47	7.52	ZnCl2
ZnCO3:H2O	-10.76	-21.02	-10.26	ZnCO3:H2O
ZnMetal	-39.94	-13.16	26.79	Zn
ZnO(Active)	-2.83	8.48	11.31	ZnO
ZnS(A)	-61.13	-105.62	-44.50	ZnS
ZnSO4:H2O	-18.81	-19.08	-0.27	ZnSO4:H2O

-----  
End of simulation.  
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-----  
Reading input data for simulation 2.  
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-----  
End of run.  
-----

No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH310a Low  
SOLUTION 1  
pH 10.05 charge  
temp 14.04  
pe 0  
units mg/L  
Al 0.0422  
As 0.00163 as H3AsO4  
Ba 0.109  
B 2.360  
Cd 0.00013  
Ca 717  
C 26.3  
Cl 16500  
Cu 0.00204  
Cr 0.123  
Pb 0.0007  
Mg 690  
Ni 0.00594  
N 0.82 as N03-  
K 342  
Na 10100  
S 2020 as SO4-2  
V 0.0229  
Zn 0.0061  
END

-----  
TITLE  
-----

BH310a Low

-----  
 Beginning of initial solution calculations.  
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Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.613e-06	1.613e-06
As	1.184e-08	1.184e-08
B	2.252e-04	2.252e-04
Ba	8.185e-07	8.185e-07
C	4.445e-04	4.445e-04
Ca	1.845e-02	1.845e-02
Cd	1.193e-09	1.193e-09
Cl	4.800e-01	4.800e-01
Cr	2.440e-06	2.440e-06
Cu	3.311e-08	3.311e-08
K	9.021e-03	9.021e-03
Mg	2.927e-02	2.927e-02
N	2.013e-05	2.013e-05
Na	4.531e-01	4.531e-01
Ni	1.043e-07	1.043e-07
Pb	3.484e-09	3.484e-09
S	2.169e-02	2.169e-02
V	4.636e-07	4.636e-07
Zn	9.624e-08	9.624e-08

-----Description of solution-----

pH = 12.453    Charge balance  
 pe = 0.000  
 Activity of water = 0.983  
 Ionic strength = 5.752e-01  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 3.418e-02  
 Total CO2 (mol/kg) = 4.445e-04  
 Temperature (deg C) = 14.040  
 Electrical balance (eq) = -1.997e-16  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = -0.00  
 Iterations = 14  
 Total H = 1.110459e+02  
 Total O = 5.562808e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	1.893e-02	1.185e-02	-1.723	-1.926	-0.203
H+	4.622e-13	3.526e-13	-12.335	-12.453	-0.118
H2O	5.551e+01	9.826e-01	-0.008	-0.008	0.000
Al	1.613e-06				
Al(OH)4-	1.613e-06	1.067e-06	-5.792	-5.972	-0.179
Al(OH)3	5.729e-11	6.540e-11	-10.242	-10.184	0.058
Al(OH)2+	2.709e-17	1.864e-17	-16.567	-16.729	-0.162
AlOH+2	1.787e-24	4.005e-25	-23.748	-24.397	-0.649
Al+3	3.453e-31	3.023e-32	-30.462	-31.520	-1.058
AlSO4+	9.229e-32	6.105e-32	-31.035	-31.214	-0.179
Al(SO4)2-	1.553e-32	1.028e-32	-31.809	-31.988	-0.179
As(3)	3.302e-27				
HAsO3-2	2.029e-27	6.157e-28	-26.693	-27.211	-0.518
AsO3-3	6.671e-28	4.558e-29	-27.176	-28.341	-1.165
H2AsO3-	6.052e-28	4.491e-28	-27.218	-27.348	-0.129
H3AsO3	3.578e-31	4.085e-31	-30.446	-30.389	0.058
H4AsO3+	0.000e+00	0.000e+00	-43.017	-43.146	-0.129
As(5)	1.184e-08				
AsO4-3	1.137e-08	7.770e-10	-7.944	-9.110	-1.165
HAsO4-2	4.714e-10	1.430e-10	-9.327	-9.845	-0.518
H2AsO4-	4.090e-16	3.036e-16	-15.388	-15.518	-0.129
H3AsO4	1.472e-26	1.680e-26	-25.832	-25.775	0.058
B	2.252e-04				
H2BO3-	2.251e-04	1.312e-04	-3.648	-3.882	-0.234
H3BO3	8.667e-08	9.895e-08	-7.062	-7.005	0.058
Ba	8.185e-07				
Ba+2	8.070e-07	1.693e-07	-6.093	-6.771	-0.678
BaOH+	1.156e-08	7.825e-09	-7.937	-8.107	-0.170
C(4)	4.445e-04				
NaCO3-	1.223e-04	8.417e-05	-3.912	-4.075	-0.162
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CO3-2	1.127e-04	2.526e-05	-3.948	-4.598	-0.649
MgCO3	9.260e-05	1.057e-04	-4.033	-3.976	0.058
HCO3-	3.569e-07	2.456e-07	-6.447	-6.610	-0.162
NaHCO3	2.994e-08	3.418e-08	-7.524	-7.466	0.058
MgHCO3+	2.106e-08	1.358e-08	-7.676	-7.867	-0.191
CaHCO3+	1.176e-08	8.274e-09	-7.930	-8.082	-0.153
NiCO3	5.738e-13	6.550e-13	-12.241	-12.184	0.058
H2CO3	1.526e-13	1.742e-13	-12.817	-12.759	0.058
CdCO3	9.776e-14	1.116e-13	-13.010	-12.952	0.058
Ni(CO3)2-2	9.477e-14	2.875e-14	-13.023	-13.541	-0.518
Zn(CO3)2-2	3.446e-16	1.046e-16	-15.463	-15.981	-0.518
ZnCO3	1.696e-16	1.936e-16	-15.771	-15.713	0.058
PbCO3	3.165e-17	3.614e-17	-16.500	-16.442	0.058

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CuCO3	1.719e-17	1.963e-17	-16.765	-16.707	0.058
Pb(CO3)2-2	7.558e-18	2.293e-18	-17.122	-17.640	-0.518
Cu(CO3)2-2	2.057e-18	6.242e-19	-17.687	-18.205	-0.518
CdHCO3+	5.315e-19	3.945e-19	-18.274	-18.404	-0.129
NiHCO3+	1.239e-19	9.195e-20	-18.907	-19.036	-0.129
Cd(CO3)3-4	5.565e-20	4.716e-22	-19.255	-21.326	-2.072
ZnHCO3+	1.158e-21	8.594e-22	-20.936	-21.066	-0.129
CuHCO3+	1.737e-23	1.289e-23	-22.760	-22.890	-0.129
PbHCO3+	1.566e-23	1.162e-23	-22.805	-22.935	-0.129
Ca	1.845e-02				
Ca+2	1.492e-02	4.549e-03	-1.826	-2.342	-0.516
CaOH+	1.783e-03	1.254e-03	-2.749	-2.902	-0.153
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CaHCO3+	1.176e-08	8.274e-09	-7.930	-8.082	-0.153
Cd	1.193e-09				
Cd(OH)2	5.356e-10	6.114e-10	-9.271	-9.214	0.058
CdOHCl	3.803e-10	4.341e-10	-9.420	-9.362	0.058
Cd(OH)3-	2.576e-10	1.912e-10	-9.589	-9.719	-0.129
Cd(OH)4-2	1.565e-11	4.747e-12	-10.806	-11.324	-0.518
CdOH+	2.368e-12	1.757e-12	-11.626	-11.755	-0.129
CdCl+	6.477e-13	4.807e-13	-12.189	-12.318	-0.129
CdCl2	4.992e-13	5.699e-13	-12.302	-12.244	0.058
CdCl3-	1.208e-13	8.964e-14	-12.918	-13.047	-0.129
CdCO3	9.776e-14	1.116e-13	-13.010	-12.952	0.058
Cd+2	5.810e-14	1.763e-14	-13.236	-13.754	-0.518
CdSO4	9.203e-15	1.051e-14	-14.036	-13.979	0.058
Cd(SO4)2-2	9.017e-16	2.736e-16	-15.045	-15.563	-0.518
CdHCO3+	5.315e-19	3.945e-19	-18.274	-18.404	-0.129
Cd(CO3)3-4	5.565e-20	4.716e-22	-19.255	-21.326	-2.072
CdNO3+	1.572e-23	1.167e-23	-22.804	-22.933	-0.129
Cd2OH+3	2.559e-24	1.748e-25	-23.592	-24.757	-1.165
CdHS+	0.000e+00	0.000e+00	-82.810	-82.940	-0.129
Cd(HS)2	0.000e+00	0.000e+00	-155.993	-155.936	0.058
Cd(HS)3-	0.000e+00	0.000e+00	-232.982	-233.111	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-309.759	-310.277	-0.518
Cl	4.800e-01				
Cl-	4.800e-01	2.966e-01	-0.319	-0.528	-0.209
CdOHCl	3.803e-10	4.341e-10	-9.420	-9.362	0.058
CuCl3-2	4.184e-12	8.777e-13	-11.378	-12.057	-0.678
CuCl2-	3.026e-12	1.951e-12	-11.519	-11.710	-0.191
ZnOHCl	9.206e-13	1.051e-12	-12.036	-11.978	0.058
CdCl+	6.477e-13	4.807e-13	-12.189	-12.318	-0.129
CdCl2	4.992e-13	5.699e-13	-12.302	-12.244	0.058
CdCl3-	1.208e-13	8.964e-14	-12.918	-13.047	-0.129
NiCl+	3.503e-15	2.600e-15	-14.456	-14.585	-0.129
NiCl2	2.458e-15	2.806e-15	-14.609	-14.552	0.058
ZnCl+	2.879e-17	1.856e-17	-16.541	-16.731	-0.191



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ZnCl2	4.824e-18	5.507e-18	-17.317	-17.259	0.058
ZnCl3-	2.655e-18	1.712e-18	-17.576	-17.767	-0.191
ZnCl4-2	1.105e-18	2.319e-19	-17.956	-18.635	-0.678
PbCl+	9.876e-19	7.330e-19	-18.005	-18.135	-0.129
PbCl2	3.733e-19	4.261e-19	-18.428	-18.370	0.058
PbCl3-	1.258e-19	9.336e-20	-18.900	-19.030	-0.129
CuCl+	1.026e-19	6.616e-20	-18.989	-19.179	-0.191
PbCl4-2	4.011e-20	1.217e-20	-19.397	-19.915	-0.518
CuCl2	8.161e-21	9.317e-21	-20.088	-20.031	0.058
CuCl3-	1.243e-23	8.014e-24	-22.906	-23.096	-0.191
CrOHCl2	2.270e-24	2.591e-24	-23.644	-23.587	0.058
CuCl4-2	8.308e-26	1.743e-26	-25.081	-25.759	-0.678
CrO3Cl-	2.557e-27	1.898e-27	-26.592	-26.722	-0.129
CrCl+2	6.415e-29	1.946e-29	-28.193	-28.711	-0.518
CrCl2+	1.136e-30	8.432e-31	-29.945	-30.074	-0.129
VOCl+	4.604e-37	3.417e-37	-36.337	-36.466	-0.129
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-54.535	-55.053	-0.518
Cr(2)	2.231e-35				
Cr+2	2.231e-35	6.770e-36	-34.651	-35.169	-0.518
Cr(3)	2.420e-06				
CrO2-	1.741e-06	1.292e-06	-5.759	-5.889	-0.129
Cr(OH)4-	6.625e-07	4.917e-07	-6.179	-6.308	-0.129
Cr(OH)3	1.619e-08	1.848e-08	-7.791	-7.733	0.058
Cr(OH)2+	1.205e-13	8.946e-14	-12.919	-13.048	-0.129
Cr(OH)+2	4.411e-20	1.338e-20	-19.355	-19.873	-0.518
CrOHSO4	1.175e-20	1.341e-20	-19.930	-19.873	0.058
CrOHCl2	2.270e-24	2.591e-24	-23.644	-23.587	0.058
Cr+3	2.572e-27	1.757e-28	-26.590	-27.755	-1.165
CrCl+2	6.415e-29	1.946e-29	-28.193	-28.711	-0.518
CrSO4+	7.159e-30	5.313e-30	-29.145	-29.275	-0.129
CrCl2+	1.136e-30	8.432e-31	-29.945	-30.074	-0.129
Cr(NH3)4(OH)2+	2.299e-33	1.707e-33	-32.638	-32.768	-0.129
Cr2(OH)2SO4+2	1.075e-37	3.262e-38	-36.969	-37.486	-0.518
CrNO3+2	3.181e-39	9.652e-40	-38.497	-39.015	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-41.826	-41.768	0.058
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-42.579	-43.097	-0.518
Cr(NH3)6+3	0.000e+00	0.000e+00	-54.137	-55.303	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-54.535	-55.053	-0.518
Cr(6)	1.981e-08				
CrO4-2	1.438e-08	2.484e-09	-7.842	-8.605	-0.763
NaCrO4-	5.308e-09	3.940e-09	-8.275	-8.405	-0.129
KCrO4-	1.161e-10	8.618e-11	-9.935	-10.065	-0.129
HCrO4-	3.596e-15	2.669e-15	-14.444	-14.574	-0.129
CrO3Cl-	2.557e-27	1.898e-27	-26.592	-26.722	-0.129
CrO3SO4-2	2.263e-27	6.865e-28	-26.645	-27.163	-0.518
Cr2O7-2	1.126e-27	3.417e-28	-26.948	-27.466	-0.518
H2CrO4	1.212e-28	1.384e-28	-27.916	-27.859	0.058
Cu(1)	7.210e-12				

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CuCl3-2	4.184e-12	8.777e-13	-11.378	-12.057	-0.678
CuCl2-	3.026e-12	1.951e-12	-11.519	-11.710	-0.191
Cu+	1.171e-16	6.827e-17	-15.931	-16.166	-0.234
Cu(2)	3.310e-08				
Cu(OH)2	2.056e-08	2.347e-08	-7.687	-7.629	0.058
Cu(OH)4-2	7.221e-09	2.191e-09	-8.141	-8.659	-0.518
Cu(OH)3-	5.322e-09	3.950e-09	-8.274	-8.403	-0.129
CuOH+	6.253e-15	4.031e-15	-14.204	-14.395	-0.191
CuCO3	1.719e-17	1.963e-17	-16.765	-16.707	0.058
Cu(CO3)2-2	2.057e-18	6.242e-19	-17.687	-18.205	-0.518
Cu+2	1.253e-18	1.447e-19	-17.902	-18.840	-0.938
CuCl+	1.026e-19	6.616e-20	-18.989	-19.179	-0.191
CuSO4	5.299e-20	6.049e-20	-19.276	-19.218	0.058
CuCl2	8.161e-21	9.317e-21	-20.088	-20.031	0.058
CuHCO3+	1.737e-23	1.289e-23	-22.760	-22.890	-0.129
CuCl3-	1.243e-23	8.014e-24	-22.906	-23.096	-0.191
Cu2(OH)2+2	7.574e-24	2.298e-24	-23.121	-23.639	-0.518
CuCl4-2	8.308e-26	1.743e-26	-25.081	-25.759	-0.678
Cu(S4)2-3	0.000e+00	0.000e+00	-146.072	-146.582	-0.510
CuS4S5-3	0.000e+00	0.000e+00	-146.837	-147.312	-0.475
Cu(HS)3-	0.000e+00	0.000e+00	-230.879	-231.008	-0.129
H(0)	1.727e-28				
H2	8.636e-29	9.859e-29	-28.064	-28.006	0.058
K	9.021e-03				
K+	8.918e-03	5.510e-03	-2.050	-2.259	-0.209
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
KCrO4-	1.161e-10	8.618e-11	-9.935	-10.065	-0.129
Mg	2.927e-02				
Mg+2	1.520e-02	5.190e-03	-1.818	-2.285	-0.467
MgOH+	1.235e-02	8.833e-03	-1.909	-2.054	-0.145
MgSO4	1.636e-03	1.868e-03	-2.786	-2.729	0.058
MgCO3	9.260e-05	1.057e-04	-4.033	-3.976	0.058
MgHCO3+	2.106e-08	1.358e-08	-7.676	-7.867	-0.191
N(-3)	7.663e-08				
NH3	7.642e-08	8.724e-08	-7.117	-7.059	0.058
NH4+	2.071e-10	1.207e-10	-9.684	-9.918	-0.234
NH4SO4-	5.091e-12	3.445e-12	-11.293	-11.463	-0.170
Cr(NH3)4(OH)2+	2.299e-33	1.707e-33	-32.638	-32.768	-0.129
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-42.579	-43.097	-0.518
Cr(NH3)6+3	0.000e+00	0.000e+00	-54.137	-55.303	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-54.535	-55.053	-0.518
N(3)	2.005e-05				
NO2-	2.005e-05	1.488e-05	-4.698	-4.827	-0.129
N(5)	3.119e-10				
NO3-	3.119e-10	1.889e-10	-9.506	-9.724	-0.218
CdNO3+	1.572e-23	1.167e-23	-22.804	-22.933	-0.129
PbNO3+	3.099e-28	2.300e-28	-27.509	-27.638	-0.129
CrNO3+2	3.181e-39	9.652e-40	-38.497	-39.015	-0.518

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VO2NO3	9.502e-40	1.085e-39	-39.022	-38.965	0.058
Na	4.531e-01				
Na+	4.482e-01	3.191e-01	-0.349	-0.496	-0.148
NaSO4-	4.791e-03	3.296e-03	-2.320	-2.482	-0.162
NaCO3-	1.223e-04	8.417e-05	-3.912	-4.075	-0.162
NaHCO3	2.994e-08	3.418e-08	-7.524	-7.466	0.058
NaCrO4-	5.308e-09	3.940e-09	-8.275	-8.405	-0.129
Ni	1.043e-07				
Ni(OH)3-	1.020e-07	7.568e-08	-6.992	-7.121	-0.129
Ni(OH)2	2.379e-09	2.716e-09	-8.624	-8.566	0.058
NiOH+	8.146e-13	6.045e-13	-12.089	-12.219	-0.129
NiCO3	5.738e-13	6.550e-13	-12.241	-12.184	0.058
Ni(CO3)2-2	9.477e-14	2.875e-14	-13.023	-13.541	-0.518
Ni+2	1.153e-14	3.498e-15	-13.938	-14.456	-0.518
NiCl+	3.503e-15	2.600e-15	-14.456	-14.585	-0.129
NiCl2	2.458e-15	2.806e-15	-14.609	-14.552	0.058
NiSO4	1.200e-15	1.370e-15	-14.921	-14.863	0.058
Ni(SO4)2-2	5.924e-19	1.797e-19	-18.227	-18.745	-0.518
NiHCO3+	1.239e-19	9.195e-20	-18.907	-19.036	-0.129
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-40.113	-40.055	0.058
Pb	3.484e-09				
Pb(OH)4-2	3.271e-09	9.925e-10	-8.485	-9.003	-0.518
Pb(OH)3-	2.090e-10	1.551e-10	-9.680	-9.809	-0.129
Pb(OH)2	4.247e-12	4.849e-12	-11.372	-11.314	0.058
PbOH+	6.026e-15	4.473e-15	-14.220	-14.349	-0.129
PbCO3	3.165e-17	3.614e-17	-16.500	-16.442	0.058
Pb(CO3)2-2	7.558e-18	2.293e-18	-17.122	-17.640	-0.518
PbCl+	9.876e-19	7.330e-19	-18.005	-18.135	-0.129
PbCl2	3.733e-19	4.261e-19	-18.428	-18.370	0.058
Pb+2	2.713e-19	8.232e-20	-18.567	-19.084	-0.518
PbCl3-	1.258e-19	9.336e-20	-18.900	-19.030	-0.129
PbSO4	8.983e-20	1.026e-19	-19.047	-18.989	0.058
PbCl4-2	4.011e-20	1.217e-20	-19.397	-19.915	-0.518
Pb(SO4)2-2	3.929e-21	1.192e-21	-20.406	-20.924	-0.518
PbHCO3+	1.566e-23	1.162e-23	-22.805	-22.935	-0.129
PbNO3+	3.099e-28	2.300e-28	-27.509	-27.638	-0.129
Pb2OH+3	1.206e-31	8.243e-33	-30.919	-32.084	-1.165
Pb3(OH)4+2	2.651e-32	8.044e-33	-31.577	-32.095	-0.518
Pb(HS)2	0.000e+00	0.000e+00	-162.584	-162.526	0.058
Pb(HS)3-	0.000e+00	0.000e+00	-240.453	-240.582	-0.129
S(-2)	0.000e+00				
S5-2	0.000e+00	0.000e+00	-76.240	-76.758	-0.518
S6-2	0.000e+00	0.000e+00	-76.266	-76.784	-0.518
S4-2	0.000e+00	0.000e+00	-76.486	-77.004	-0.518
HS-	0.000e+00	0.000e+00	-79.153	-79.356	-0.203
S-2	0.000e+00	0.000e+00	-79.481	-80.160	-0.678
S3-2	0.000e+00	0.000e+00	-79.958	-80.476	-0.518

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S2-2	0.000e+00	0.000e+00	-81.232	-81.750	-0.518
CdHS+	0.000e+00	0.000e+00	-82.810	-82.940	-0.129
H2S	0.000e+00	0.000e+00	-84.766	-84.709	0.058
Cu(S4)2-3	0.000e+00	0.000e+00	-146.072	-146.582	-0.510
CuS4S5-3	0.000e+00	0.000e+00	-146.837	-147.312	-0.475
Cd(HS)2	0.000e+00	0.000e+00	-155.993	-155.936	0.058
Zn(HS)2	0.000e+00	0.000e+00	-160.245	-160.187	0.058
Pb(HS)2	0.000e+00	0.000e+00	-162.584	-162.526	0.058
Cu(HS)3-	0.000e+00	0.000e+00	-230.879	-231.008	-0.129
Cd(HS)3-	0.000e+00	0.000e+00	-232.982	-233.111	-0.129
Zn(HS)3-	0.000e+00	0.000e+00	-238.254	-238.383	-0.129
Pb(HS)3-	0.000e+00	0.000e+00	-240.453	-240.582	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-309.759	-310.277	-0.518
S(6)	2.169e-02				
SO4-2	1.352e-02	2.215e-03	-1.869	-2.655	-0.786
NaSO4-	4.791e-03	3.296e-03	-2.320	-2.482	-0.162
MgSO4	1.636e-03	1.868e-03	-2.786	-2.729	0.058
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
NH4SO4-	5.091e-12	3.445e-12	-11.293	-11.463	-0.170
HSO4-	8.501e-14	5.623e-14	-13.071	-13.250	-0.179
CdSO4	9.203e-15	1.051e-14	-14.036	-13.979	0.058
NiSO4	1.200e-15	1.370e-15	-14.921	-14.863	0.058
Cd(SO4)2-2	9.017e-16	2.736e-16	-15.045	-15.563	-0.518
ZnSO4	1.601e-17	1.827e-17	-16.796	-16.738	0.058
Zn(SO4)2-2	1.184e-18	3.592e-19	-17.927	-18.445	-0.518
Ni(SO4)2-2	5.924e-19	1.797e-19	-18.227	-18.745	-0.518
PbSO4	8.983e-20	1.026e-19	-19.047	-18.989	0.058
CuSO4	5.299e-20	6.049e-20	-19.276	-19.218	0.058
CrOHSO4	1.175e-20	1.341e-20	-19.930	-19.873	0.058
Pb(SO4)2-2	3.929e-21	1.192e-21	-20.406	-20.924	-0.518
CrO3SO4-2	2.263e-27	6.865e-28	-26.645	-27.163	-0.518
CrSO4+	7.159e-30	5.313e-30	-29.145	-29.275	-0.129
VO2SO4-	2.366e-30	1.756e-30	-29.626	-29.756	-0.129
AlSO4+	9.229e-32	6.105e-32	-31.035	-31.214	-0.179
Al(SO4)2-	1.553e-32	1.028e-32	-31.809	-31.988	-0.179
VOSO4	4.735e-37	5.406e-37	-36.325	-36.267	0.058
Cr2(OH)2SO4+2	1.075e-37	3.262e-38	-36.969	-37.486	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-41.826	-41.768	0.058
VSO4+	0.000e+00	0.000e+00	-55.844	-55.974	-0.129
V(2)	0.000e+00				
VOH+	0.000e+00	0.000e+00	-52.304	-52.433	-0.129
V+2	0.000e+00	0.000e+00	-58.720	-59.238	-0.518
V(3)	3.151e-29				
V(OH)3	3.151e-29	3.598e-29	-28.502	-28.444	0.058
V(OH)2+	2.694e-36	2.000e-36	-35.570	-35.699	-0.129
VOH+2	0.000e+00	0.000e+00	-44.358	-44.876	-0.518
V+3	0.000e+00	0.000e+00	-53.594	-54.759	-1.165

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VSO4+	0.000e+00	0.000e+00	-55.844	-55.974	-0.129
V2(OH)3+3	0.000e+00	0.000e+00	-78.518	-79.683	-1.165
V2(OH)2+4	0.000e+00	0.000e+00	-86.306	-88.378	-2.072
V(4)	8.678e-30				
V(OH)3+	8.678e-30	6.441e-30	-29.062	-29.191	-0.129
VO+2	3.626e-36	1.100e-36	-35.441	-35.959	-0.518
VOSO4	4.735e-37	5.406e-37	-36.325	-36.267	0.058
VOCI+	4.604e-37	3.417e-37	-36.337	-36.466	-0.129
H2V2O4+2	0.000e+00	0.000e+00	-52.949	-53.467	-0.518
V(5)	4.636e-07				
HVO4-2	3.035e-07	9.209e-08	-6.518	-7.036	-0.518
VO4-3	1.598e-07	1.092e-08	-6.796	-7.962	-1.165
V2O7-4	1.157e-10	9.802e-13	-9.937	-12.009	-2.072
HV2O7-3	2.911e-11	1.989e-12	-10.536	-11.701	-1.165
H2VO4-	6.335e-12	4.702e-12	-11.198	-11.328	-0.129
H3VO4	9.368e-21	1.069e-20	-20.028	-19.971	0.058
H3V2O7-	1.129e-24	8.381e-25	-23.947	-24.077	-0.129
V3O9-3	3.514e-27	2.401e-28	-26.454	-27.620	-1.165
VO2+	2.082e-29	1.545e-29	-28.681	-28.811	-0.129
VO2SO4-	2.366e-30	1.756e-30	-29.626	-29.756	-0.129
V4O12-4	4.257e-35	3.607e-37	-34.371	-36.443	-2.072
VO2NO3	9.502e-40	1.085e-39	-39.022	-38.965	0.058
V10O28-6	0.000e+00	0.000e+00	-101.796	-106.457	-4.662
HV10O28-5	0.000e+00	0.000e+00	-110.095	-113.332	-3.237
H2V10O28-4	0.000e+00	0.000e+00	-119.471	-121.543	-2.072
Zn	9.624e-08				
Zn(OH)4-2	4.826e-08	1.464e-08	-7.316	-7.834	-0.518
Zn(OH)3-	4.468e-08	3.316e-08	-7.350	-7.479	-0.129
Zn(OH)2	3.296e-09	3.763e-09	-8.482	-8.424	0.058
ZnOHCl	9.206e-13	1.051e-12	-12.036	-11.978	0.058
ZnOH+	6.671e-14	4.951e-14	-13.176	-13.305	-0.129
Zn(CO3)2-2	3.446e-16	1.046e-16	-15.463	-15.981	-0.518
ZnCO3	1.696e-16	1.936e-16	-15.771	-15.713	0.058
Zn+2	1.567e-16	3.841e-17	-15.805	-16.416	-0.611
ZnCl+	2.879e-17	1.856e-17	-16.541	-16.731	-0.191
ZnSO4	1.601e-17	1.827e-17	-16.796	-16.738	0.058
ZnCl2	4.824e-18	5.507e-18	-17.317	-17.259	0.058
ZnCl3-	2.655e-18	1.712e-18	-17.576	-17.767	-0.191
Zn(SO4)2-2	1.184e-18	3.592e-19	-17.927	-18.445	-0.518
ZnCl4-2	1.105e-18	2.319e-19	-17.956	-18.635	-0.678
ZnHCO3+	1.158e-21	8.594e-22	-20.936	-21.066	-0.129
Zn(HS)2	0.000e+00	0.000e+00	-160.245	-160.187	0.058
Zn(HS)3-	0.000e+00	0.000e+00	-238.254	-238.383	-0.129

-----Saturation indices-----

Phase            SI log IAP   log KT

(NH <sub>4</sub> ) <sub>2</sub> CrO <sub>4</sub>	-28.78	-28.44	0.34	(NH <sub>4</sub> ) <sub>2</sub> CrO <sub>4</sub>
Al(OH) <sub>3</sub> (a)	-5.32	5.82	11.14	Al(OH) <sub>3</sub>
Al <sub>2</sub> O <sub>3</sub>	-11.33	11.65	22.98	Al <sub>2</sub> O <sub>3</sub>
Al <sub>4</sub> (OH) <sub>10</sub> SO <sub>4</sub>	-26.98	-4.28	22.70	Al <sub>4</sub> (OH) <sub>10</sub> SO <sub>4</sub>
AlAsO <sub>4</sub> :2H <sub>2</sub> O	-24.75	-19.95	4.80	AlAsO <sub>4</sub> :2H <sub>2</sub> O
AlOHSO <sub>4</sub>	-18.50	-21.73	-3.23	AlOHSO <sub>4</sub>
AlumK	-33.81	-39.18	-5.37	KAl(SO <sub>4</sub> ) <sub>2</sub> :12H <sub>2</sub> O
Alunite	-26.00	-27.46	-1.46	KAl <sub>3</sub> (SO <sub>4</sub> ) <sub>2</sub> (OH) <sub>6</sub>
Anglesite	-13.89	-21.74	-7.85	PbSO <sub>4</sub>
Anhydrite	-0.47	-5.00	-4.53	CaSO <sub>4</sub>
Anilite	-62.77	-135.21	-72.45	Cu <sub>0.25</sub> Cu <sub>1.5</sub> S
Antlerite	-17.68	-9.39	8.29	Cu <sub>3</sub> (OH) <sub>4</sub> SO <sub>4</sub>
Aragonite	1.33	-6.94	-8.27	CaCO <sub>3</sub>
Arsenolite	-118.31	-202.64	-84.34	As <sub>4</sub> O <sub>6</sub>
Artinite	5.30	15.70	10.40	MgCO <sub>3</sub> :Mg(OH) <sub>2</sub> :3H <sub>2</sub> O
As <sub>2</sub> O <sub>5</sub>	-58.38	-51.53	6.85	As <sub>2</sub> O <sub>5</sub>
Atacamite	-8.73	-0.87	7.86	Cu <sub>2</sub> (OH) <sub>3</sub> Cl
Azurite	-24.57	-40.82	-16.26	Cu <sub>3</sub> (OH) <sub>2</sub> (CO <sub>3</sub> ) <sub>2</sub>
Ba <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>	11.84	2.85	-8.98	Ba <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>
BaCrO <sub>4</sub>	-5.53	-15.38	-9.85	BaCrO <sub>4</sub>
Barite	0.73	-9.43	-10.15	BaSO <sub>4</sub>
Bianchite	-17.36	-19.12	-1.76	ZnSO <sub>4</sub> :6H <sub>2</sub> O
Blaubleil	-62.93	-122.97	-60.04	Cu <sub>0.9</sub> Cu <sub>0.2</sub> S
Blaubleill	-63.86	-128.62	-64.76	Cu <sub>0.6</sub> Cu <sub>0.8</sub> S
Boehmite	-3.54	5.82	9.36	AlOOH
Brochantite	-18.68	-3.34	15.34	Cu <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
Brucite	5.09	22.61	17.51	Mg(OH) <sub>2</sub>
Bunsenite	-2.68	10.44	13.12	NiO
Ca <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-3.09	6.19	9.28	CaVO <sub>3.5</sub>
Ca <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :6H <sub>2</sub> O	-6.21	16.09	22.30	Ca <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :6H <sub>2</sub> O
Ca <sub>3</sub> (VO <sub>4</sub> ) <sub>2</sub>	-2.99	17.47	20.46	Ca <sub>1.5</sub> VO <sub>4</sub>
Ca_Vanadate	-8.20	-5.08	3.11	Ca <sub>0.5</sub> VO <sub>3</sub>
CaCrO <sub>4</sub>	-8.86	-10.95	-2.09	CaCrO <sub>4</sub>
Calcite	1.48	-6.94	-8.42	CaCO <sub>3</sub>
Cd(BO <sub>2</sub> ) <sub>2</sub>	-12.68	-2.84	9.84	Cd(BO <sub>2</sub> ) <sub>2</sub>
Cd(Gamma)	-27.85	-13.75	14.10	Cd
Cd(OH) <sub>2</sub> (A)	-3.17	11.14	14.31	Cd(OH) <sub>2</sub>
Cd(OH) <sub>2</sub> (C)	-2.51	11.14	13.65	Cd(OH) <sub>2</sub>
Cd <sub>3</sub> (OH) <sub>2</sub> (SO <sub>4</sub> ) <sub>2</sub>	-28.39	-21.68	6.71	Cd <sub>3</sub> (OH) <sub>2</sub> (SO <sub>4</sub> ) <sub>2</sub>
Cd <sub>3</sub> (OH) <sub>4</sub> SO <sub>4</sub>	-16.70	5.86	22.56	Cd <sub>3</sub> (OH) <sub>4</sub> SO <sub>4</sub>
Cd <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-11.40	17.00	28.40	Cd <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
CdCl <sub>2</sub>	-14.25	-14.81	-0.55	CdCl <sub>2</sub>
CdCl <sub>2</sub> :2.5H <sub>2</sub> O	-12.84	-14.83	-1.99	CdCl <sub>2</sub> :2.5H <sub>2</sub> O
CdCl <sub>2</sub> :H <sub>2</sub> O	-13.16	-14.82	-1.66	CdCl <sub>2</sub> :H <sub>2</sub> O
CdMetal	-27.75	-13.75	13.99	Cd
CdOHCl	-5.56	-1.84	3.73	CdOHCl
CdSO <sub>4</sub>	-16.72	-16.41	0.31	CdSO <sub>4</sub>
CdSO <sub>4</sub> :2.67H <sub>2</sub> O	-14.68	-16.43	-1.75	CdSO <sub>4</sub> :2.67H <sub>2</sub> O

CdSO4:H2O -14.97 -16.42 -1.45 CdSO4:H2O  
 Cerrusite -10.42 -23.68 -13.27 PbCO3  
 CH4(g) -87.30 -129.10 -41.81 CH4  
 Chalcantite -18.85 -21.53 -2.68 CuSO4:5H2O  
 Chalcocite -63.24 -139.92 -76.69 Cu2S  
 Claudetite -118.07 -202.64 -84.57 As4O6  
 CO2(g) -11.32 -29.50 -18.17 CO2  
 Cotunnite -15.21 -20.14 -4.93 PbCl2  
 Covellite -62.03 -121.09 -59.05 CuS  
 Cr(OH)2 -21.34 -83.31 -61.97 Cr(OH)2  
 Cr(OH)3(A) 0.15 -70.86 -71.01 Cr(OH)3  
 Cr(OH)3(C) -2.50 -70.86 -68.36 Cr(OH)3  
 Cr2O3 1.87 -141.70 -143.57 Cr2O3  
 CrCl2 -52.64 -109.25 -56.61 CrCl2  
 CrCl3 -53.80 -109.78 -55.98 CrCl3  
 CrMetal -68.37 -108.20 -39.82 Cr  
 CrO3 -30.33 -33.50 -3.18 CrO3  
 Cu(OH)2 -3.02 6.05 9.07 Cu(OH)2  
 Cu2(OH)3NO3 -19.79 114.24 134.03 Cu2(OH)3NO3  
 Cu2SO4 -33.16 -40.33 -7.17 Cu2SO4  
 Cu3(AsO4)2:6H2O -39.50 -33.40 6.10 Cu3(AsO4)2:6H2O  
 CuCO3 -13.81 -23.44 -9.63 CuCO3  
 CuCrO4 -21.97 -27.44 -5.48 CuCrO4  
 CuMetal -6.93 -18.84 -11.91 Cu  
 CuOCuSO4 -27.96 -15.44 12.53 CuO:CuSO4  
 Cuprite -5.71 -12.78 -7.07 Cu2O  
 CuSO4 -25.01 -21.49 3.52 CuSO4  
 Diaspore -1.74 5.82 7.56 AlOOH  
 Djurleite -63.08 -138.68 -75.60 Cu0.066Cu1.868S  
 Dolomite 2.95 -13.82 -16.77 CaMg(CO3)2  
 Epsomite -2.77 -4.99 -2.22 MgSO4:7H2O  
 Galena -70.31 -121.33 -51.02 PbS  
 Gibbsite(C) -3.59 5.82 9.41 Al(OH)3  
 Goslarite -17.07 -19.12 -2.05 ZnSO4:7H2O  
 Greenockite -64.27 -116.00 -51.73 CdS  
 Gypsum -0.16 -5.01 -4.86 CaSO4:2H2O  
 Halite -2.58 -1.02 1.56 NaCl  
 Huntite 1.66 -27.59 -29.25 CaMg3(CO3)4  
 Hydrcerrusite -24.10 -41.56 -17.46 Pb(OH)2:2PbCO3  
 Hydromagnesite 2.35 -4.95 -7.31 Mg5(CO3)4(OH)2:4H2O  
 K2Cr2O7 -30.45 -46.62 -16.18 K2Cr2O7  
 K2CrO4 -13.01 -13.12 -0.11 K2CrO4  
 Langite -21.25 -3.35 17.90 Cu4(OH)6SO4:H2O  
 Larnakite -15.83 -15.93 -0.10 PbO:PbSO4  
 Laurionite -7.79 -7.17 0.62 PbOHCl  
 Lime -11.54 22.56 34.09 CaO  
 Litharge -7.36 5.81 13.18 PbO  
 Magnesite 0.97 -6.88 -7.86 MgCO3

Malachite	-12.64	-17.39	-4.74	Cu <sub>2</sub> (OH) <sub>2</sub> CO <sub>3</sub>
Massicot	-7.57	5.81	13.38	PbO
Melanothallite	-23.97	-19.90	4.07	CuCl <sub>2</sub>
Mg <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-7.78	6.25	14.03	MgVO <sub>3.5</sub>
Mg_Vanadate	-11.15	-5.06	6.10	Mg <sub>0.5</sub> VO <sub>3</sub>
MgCr <sub>2</sub> O <sub>4</sub>	8.23	-119.09	-127.32	MgCr <sub>2</sub> O <sub>4</sub>
MgCrO <sub>4</sub>	-16.86	-10.89	5.97	MgCrO <sub>4</sub>
Millerite	-73.25	-116.70	-43.45	NiS
Minium	-34.23	42.34	76.56	Pb <sub>3</sub> O <sub>4</sub>
Mirabilite	-2.08	-3.72	-1.65	Na <sub>2</sub> SO <sub>4</sub> :10H <sub>2</sub> O
Monteponite	-4.67	11.14	15.81	CdO
Morenosite	-14.72	-17.16	-2.44	NiSO <sub>4</sub> :7H <sub>2</sub> O
Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-33.06	-43.10	-10.04	Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
Na <sub>2</sub> CrO <sub>4</sub>	-12.99	-9.60	3.39	Na <sub>2</sub> CrO <sub>4</sub>
Na <sub>3</sub> VO <sub>4</sub>	-18.69	19.50	38.18	Na <sub>3</sub> VO <sub>4</sub>
Na <sub>4</sub> V <sub>2</sub> O <sub>7</sub>	-11.83	7.54	19.37	Na <sub>2</sub> VO <sub>3.5</sub>
Na_Vanadate	-8.32	-4.41	3.91	NaVO <sub>3</sub>
Nantokite	-9.65	-19.37	-9.71	CuCl
Natron	-3.91	-5.67	-1.75	Na <sub>2</sub> CO <sub>3</sub> :10H <sub>2</sub> O
Nesquehonite	-1.45	-6.91	-5.46	MgCO <sub>3</sub> :3H <sub>2</sub> O
NH <sub>4</sub> VO <sub>3</sub>	-16.63	-13.83	2.80	NH <sub>4</sub> VO <sub>3</sub>
Ni(OH) <sub>2</sub>	0.49	10.43	9.95	Ni(OH) <sub>2</sub>
Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-35.96	-20.26	15.70	Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-17.81	14.19	32.00	Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
NiCO <sub>3</sub>	-12.49	-19.05	-6.56	NiCO <sub>3</sub>
O <sub>2</sub> (g)	-37.07	49.80	86.86	O <sub>2</sub>
Oripment	-272.87	-482.75	-209.88	As <sub>2</sub> S <sub>3</sub>
Otavite	-4.63	-18.35	-13.72	CdCO <sub>3</sub>
Pb(BO <sub>2</sub> ) <sub>2</sub>	-15.95	-8.17	7.77	Pb(BO <sub>2</sub> ) <sub>2</sub>
Pb(OH) <sub>2</sub> (C)	-2.74	5.81	8.54	Pb(OH) <sub>2</sub>
Pb <sub>2</sub> (OH) <sub>3</sub> Cl	-10.15	-1.36	8.79	Pb <sub>2</sub> (OH) <sub>3</sub> Cl
Pb <sub>2</sub> O(OH) <sub>2</sub>	-14.58	11.62	26.20	Pb <sub>2</sub> O(OH) <sub>2</sub>
Pb <sub>2</sub> O <sub>3</sub>	-24.52	36.52	61.04	Pb <sub>2</sub> O <sub>3</sub>
Pb <sub>2</sub> OCO <sub>3</sub>	-17.69	-17.87	-0.18	Pb <sub>2</sub> OCO <sub>3</sub>
Pb <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-9.69	-10.55	-0.86	PbVO <sub>3.5</sub>
Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>	-39.89	-34.09	5.80	Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>
Pb <sub>3</sub> (VO <sub>4</sub> ) <sub>2</sub>	-10.96	-7.64	3.31	Pb <sub>1.5</sub> VO <sub>4</sub>
Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>	-23.81	-12.06	11.76	Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>
Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>	-21.09	-10.11	10.98	Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>
Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-25.42	-4.32	21.10	Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>	-27.38	-4.30	23.08	Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>
PbCrO <sub>4</sub>	-13.72	-27.69	-13.97	PbCrO <sub>4</sub>
PbMetal	-23.34	-19.08	4.26	Pb
PbO:0.3H <sub>2</sub> O	-7.17	5.81	12.98	PbO:0.33H <sub>2</sub> O
Periclase	0.09	22.61	22.52	MgO
Phosgenite	-24.01	-43.82	-19.81	PbCl <sub>2</sub> :PbCO <sub>3</sub>
Plattnerite	-20.57	30.71	51.28	PbO <sub>2</sub>
Portlandite	-0.99	22.55	23.53	Ca(OH) <sub>2</sub>



Realgar	-114.03	-190.25	-76.23	AsS
Retgersite	-15.09	-17.16	-2.07	NiSO4:6H2O
Smithsonite	-11.14	-21.01	-9.88	ZnCO3
Sphalerite	-71.47	-118.66	-47.19	ZnS
Spinel	-4.56	34.27	38.83	MgAl2O4
SULFUR	-64.91	-102.25	-37.33	S
Tenorite	-1.99	6.06	8.05	CuO
Thenardite	-3.48	-3.65	-0.16	Na2SO4
Thermonatrite	-5.80	-5.60	0.20	Na2CO3:H2O
V(OH)3	-25.07	-41.27	-16.20	V(OH)3
V2O3	-22.86	-41.26	-18.40	VO1.5
V2O4	-15.72	-28.81	-13.09	VO2
V2O5	-15.76	-16.36	-0.60	VO2.5
V3O5	-60.61	-111.33	-50.72	V3O5
V4O7	-77.38	-140.14	-62.77	V4O7
V6O13	-85.29	-147.97	-62.68	V6O13
VCl2	-74.79	-79.66	-4.88	VCl2
VCl3	-79.30	-80.19	-0.89	VCl3
VMetal	-98.87	-78.61	20.26	V
VO	-43.73	-53.71	-9.98	VO
VO(OH)2	-16.92	-28.82	-11.90	VO(OH)2
VO2Cl	-32.42	-29.34	3.08	VO2Cl
VOCl	-40.53	-54.24	-13.71	VOCl
VOCl2	-50.59	-54.76	-4.17	VOCl2
VOSO4(C)	-42.76	-56.36	-13.60	VOSO4
Witherite	-2.77	-11.37	-8.60	BaCO3
Wurtzite	-73.50	-118.66	-45.17	ZnS
Zincite	-3.27	8.48	11.75	ZnO
Zincosite	-22.62	-19.07	3.55	ZnSO4
Zn(BO2)2	-13.79	-5.50	8.29	Zn(BO2)2
Zn(NO3)2:6H2O	-39.19	212.71	251.90	Zn(NO3)2:6H2O
Zn(OH)2(A)	-3.98	8.47	12.45	Zn(OH)2
Zn(OH)2(B)	-3.28	8.47	11.75	Zn(OH)2
Zn(OH)2(C)	-3.73	8.47	12.20	Zn(OH)2
Zn(OH)2(E)	-3.03	8.47	11.50	Zn(OH)2
Zn(OH)2(G)	-3.24	8.47	11.71	Zn(OH)2
Zn2(OH)2SO4	-18.10	-10.60	7.50	Zn2(OH)2SO4
Zn2(OH)3Cl	-11.22	3.98	15.20	Zn2(OH)3Cl
Zn3(AsO4)2:2.5H2O	-39.75	-26.10	13.65	Zn3(AsO4)2:2.5H2O
Zn3O(SO4)2	-50.41	-29.66	20.75	Zn3O(SO4)2
Zn4(OH)6SO4	-22.05	6.35	28.40	Zn4(OH)6SO4
Zn5(OH)8Cl2	-22.07	16.43	38.50	Zn5(OH)8Cl2
ZnCl2	-24.99	-17.47	7.52	ZnCl2
ZnCO3:H2O	-10.76	-21.02	-10.26	ZnCO3:H2O
ZnMetal	-43.20	-16.42	26.79	Zn
ZnO(Active)	-2.83	8.48	11.31	ZnO
ZnS(A)	-74.16	-118.66	-44.50	ZnS
ZnSO4:H2O	-18.81	-19.08	-0.27	ZnSO4:H2O

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End of simulation.  
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Reading input data for simulation 2.  
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End of run.  
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No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH310a Low  
SOLUTION 1  
pH 10.05 charge  
temp 14.04  
pe 1.63  
units mg/L  
Al 0.0422  
As 0.00163 as H3AsO4  
Ba 0.109  
B 2.360  
Cd 0.00013  
Ca 717  
C 26.3  
Cl 16500  
Cu 0.00204  
Cr 0.123  
Pb 0.0007  
Mg 690  
Ni 0.00594  
N 0.82 as N03-  
K 342  
Na 10100  
S 2020 as SO4-2  
V 0.0229  
Zn 0.0061  
END

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TITLE  
-----

BH310a Low

-----  
 Beginning of initial solution calculations.  
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Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.613e-06	1.613e-06
As	1.184e-08	1.184e-08
B	2.252e-04	2.252e-04
Ba	8.185e-07	8.185e-07
C	4.445e-04	4.445e-04
Ca	1.845e-02	1.845e-02
Cd	1.193e-09	1.193e-09
Cl	4.800e-01	4.800e-01
Cr	2.440e-06	2.440e-06
Cu	3.311e-08	3.311e-08
K	9.021e-03	9.021e-03
Mg	2.927e-02	2.927e-02
N	2.013e-05	2.013e-05
Na	4.531e-01	4.531e-01
Ni	1.043e-07	1.043e-07
Pb	3.484e-09	3.484e-09
S	2.169e-02	2.169e-02
V	4.636e-07	4.636e-07
Zn	9.624e-08	9.624e-08

-----Description of solution-----

pH = 12.453    Charge balance  
 pe = 1.630  
 Activity of water = 0.983  
 Ionic strength = 5.752e-01  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 3.418e-02  
 Total CO2 (mol/kg) = 4.445e-04  
 Temperature (deg C) = 14.040  
 Electrical balance (eq) = -9.712e-17  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = -0.00  
 Iterations = 14  
 Total H = 1.110459e+02  
 Total O = 5.562808e+01

-----Distribution of species-----

Species	Molality	Log	Log	Log	Gamma
		Activity	Molality	Activity	
OH-	1.892e-02	1.185e-02	-1.723	-1.926	-0.203
H+	4.623e-13	3.527e-13	-12.335	-12.453	-0.118
H2O	5.551e+01	9.826e-01	-0.008	-0.008	0.000
Al	1.613e-06				
Al(OH)4-	1.613e-06	1.067e-06	-5.792	-5.972	-0.179
Al(OH)3	5.729e-11	6.541e-11	-10.242	-10.184	0.058
Al(OH)2+	2.710e-17	1.865e-17	-16.567	-16.729	-0.162
AlOH+2	1.787e-24	4.006e-25	-23.748	-24.397	-0.649
Al+3	3.454e-31	3.024e-32	-30.462	-31.519	-1.058
AlSO4+	9.233e-32	6.107e-32	-31.035	-31.214	-0.179
Al(SO4)2-	1.554e-32	1.028e-32	-31.809	-31.988	-0.179
As(3)	1.815e-30				
HAsO3-2	1.115e-30	3.384e-31	-29.953	-30.471	-0.518
AsO3-3	3.667e-31	2.505e-32	-30.436	-31.601	-1.165
H2AsO3-	3.327e-31	2.469e-31	-30.478	-30.607	-0.129
H3AsO3	1.967e-34	2.246e-34	-33.706	-33.649	0.058
H4AsO3+	0.000e+00	0.000e+00	-46.277	-46.406	-0.129
As(5)	1.184e-08				
AsO4-3	1.137e-08	7.770e-10	-7.944	-9.110	-1.165
HAsO4-2	4.714e-10	1.430e-10	-9.327	-9.845	-0.518
H2AsO4-	4.091e-16	3.036e-16	-15.388	-15.518	-0.129
H3AsO4	1.472e-26	1.681e-26	-25.832	-25.775	0.058
B	2.252e-04				
H2BO3-	2.251e-04	1.312e-04	-3.648	-3.882	-0.234
H3BO3	8.668e-08	9.896e-08	-7.062	-7.005	0.058
Ba	8.185e-07				
Ba+2	8.070e-07	1.693e-07	-6.093	-6.771	-0.678
BaOH+	1.156e-08	7.824e-09	-7.937	-8.107	-0.170
C(4)	4.445e-04				
NaCO3-	1.223e-04	8.417e-05	-3.913	-4.075	-0.162
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CO3-2	1.127e-04	2.526e-05	-3.948	-4.598	-0.649
MgCO3	9.260e-05	1.057e-04	-4.033	-3.976	0.058
HCO3-	3.569e-07	2.456e-07	-6.447	-6.610	-0.162
NaHCO3	2.994e-08	3.418e-08	-7.524	-7.466	0.058
MgHCO3+	2.107e-08	1.358e-08	-7.676	-7.867	-0.191
CaHCO3+	1.176e-08	8.275e-09	-7.930	-8.082	-0.153
NiCO3	5.739e-13	6.552e-13	-12.241	-12.184	0.058
H2CO3	1.526e-13	1.742e-13	-12.816	-12.759	0.058
CdCO3	9.778e-14	1.116e-13	-13.010	-12.952	0.058
Ni(CO3)2-2	9.479e-14	2.876e-14	-13.023	-13.541	-0.518
Zn(CO3)2-2	3.447e-16	1.046e-16	-15.463	-15.981	-0.518
ZnCO3	1.696e-16	1.937e-16	-15.771	-15.713	0.058
PbCO3	3.167e-17	3.615e-17	-16.499	-16.442	0.058

## BH310A July 2012 Eh=0.1

CuCO3	1.720e-17	1.964e-17	-16.764	-16.707	0.058
Pb(CO3)2-2	7.560e-18	2.294e-18	-17.121	-17.639	-0.518
Cu(CO3)2-2	2.058e-18	6.245e-19	-17.687	-18.204	-0.518
CdHCO3+	5.316e-19	3.946e-19	-18.274	-18.404	-0.129
NiHCO3+	1.239e-19	9.199e-20	-18.907	-19.036	-0.129
Cd(CO3)3-4	5.566e-20	4.717e-22	-19.254	-21.326	-2.072
ZnHCO3+	1.158e-21	8.598e-22	-20.936	-21.066	-0.129
CuHCO3+	1.737e-23	1.289e-23	-22.760	-22.890	-0.129
PbHCO3+	1.567e-23	1.163e-23	-22.805	-22.935	-0.129
Ca	1.845e-02				
Ca+2	1.492e-02	4.549e-03	-1.826	-2.342	-0.516
CaOH+	1.782e-03	1.254e-03	-2.749	-2.902	-0.153
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CaHCO3+	1.176e-08	8.275e-09	-7.930	-8.082	-0.153
Cd	1.193e-09				
Cd(OH)2	5.356e-10	6.114e-10	-9.271	-9.214	0.058
CdOHCl	3.803e-10	4.341e-10	-9.420	-9.362	0.058
Cd(OH)3-	2.575e-10	1.911e-10	-9.589	-9.719	-0.129
Cd(OH)4-2	1.564e-11	4.747e-12	-10.806	-11.324	-0.518
CdOH+	2.368e-12	1.757e-12	-11.626	-11.755	-0.129
CdCl+	6.478e-13	4.808e-13	-12.189	-12.318	-0.129
CdCl2	4.993e-13	5.700e-13	-12.302	-12.244	0.058
CdCl3-	1.208e-13	8.966e-14	-12.918	-13.047	-0.129
CdCO3	9.778e-14	1.116e-13	-13.010	-12.952	0.058
Cd+2	5.811e-14	1.763e-14	-13.236	-13.754	-0.518
CdSO4	9.205e-15	1.051e-14	-14.036	-13.978	0.058
Cd(SO4)2-2	9.018e-16	2.736e-16	-15.045	-15.563	-0.518
CdHCO3+	5.316e-19	3.946e-19	-18.274	-18.404	-0.129
Cd(CO3)3-4	5.566e-20	4.717e-22	-19.254	-21.326	-2.072
CdNO3+	2.792e-20	2.072e-20	-19.554	-19.684	-0.129
Cd2OH+3	2.560e-24	1.749e-25	-23.592	-24.757	-1.165
CdHS+	0.000e+00	0.000e+00	-95.850	-95.979	-0.129
Cd(HS)2	0.000e+00	0.000e+00	-182.072	-182.015	0.058
Cd(HS)3-	0.000e+00	0.000e+00	-272.101	-272.230	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-361.918	-362.436	-0.518
Cl	4.800e-01				
Cl-	4.800e-01	2.966e-01	-0.319	-0.528	-0.209
CdOHCl	3.803e-10	4.341e-10	-9.420	-9.362	0.058
ZnOHCl	9.209e-13	1.051e-12	-12.036	-11.978	0.058
CdCl+	6.478e-13	4.808e-13	-12.189	-12.318	-0.129
CdCl2	4.993e-13	5.700e-13	-12.302	-12.244	0.058
CdCl3-	1.208e-13	8.966e-14	-12.918	-13.047	-0.129
CuCl3-2	9.812e-14	2.058e-14	-13.008	-13.686	-0.678
CuCl2-	7.097e-14	4.576e-14	-13.149	-13.340	-0.191
NiCl+	3.504e-15	2.600e-15	-14.455	-14.585	-0.129
NiCl2	2.458e-15	2.806e-15	-14.609	-14.552	0.058
ZnCl+	2.880e-17	1.857e-17	-16.541	-16.731	-0.191

ZnCl2	4.825e-18	5.509e-18	-17.316	-17.259	0.058
ZnCl3-	2.656e-18	1.712e-18	-17.576	-17.766	-0.191
ZnCl4-2	1.106e-18	2.320e-19	-17.956	-18.635	-0.678
PbCl+	9.880e-19	7.333e-19	-18.005	-18.135	-0.129
PbCl2	3.734e-19	4.263e-19	-18.428	-18.370	0.058
PbCl3-	1.258e-19	9.340e-20	-18.900	-19.030	-0.129
CuCl+	1.027e-19	6.618e-20	-18.989	-19.179	-0.191
PbCl4-2	4.012e-20	1.217e-20	-19.397	-19.915	-0.518
CuCl2	8.165e-21	9.321e-21	-20.088	-20.031	0.058
CuCl3-	1.244e-23	8.017e-24	-22.905	-23.096	-0.191
CrO3Cl-	3.145e-25	2.334e-25	-24.502	-24.632	-0.129
CuCl4-2	8.311e-26	1.744e-26	-25.080	-25.759	-0.678
CrOHCl2	3.598e-27	4.108e-27	-26.444	-26.386	0.058
CrCl+2	1.017e-31	3.086e-32	-30.993	-31.511	-0.518
CrCl2+	1.801e-33	1.337e-33	-32.744	-32.874	-0.129
VOCl+	1.080e-38	8.014e-39	-37.967	-38.096	-0.129
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-116.076	-116.594	-0.518
Cr(2)	8.293e-40				
Cr+2	8.293e-40	2.516e-40	-39.081	-39.599	-0.518
Cr(3)	3.835e-09				
CrO2-	2.760e-09	2.048e-09	-8.559	-8.689	-0.129
Cr(OH)4-	1.050e-09	7.793e-10	-8.979	-9.108	-0.129
Cr(OH)3	2.566e-11	2.929e-11	-10.591	-10.533	0.058
Cr(OH)2+	1.911e-16	1.418e-16	-15.719	-15.848	-0.129
Cr(OH)+2	6.993e-23	2.122e-23	-22.155	-22.673	-0.518
CrOHSO4	1.862e-23	2.126e-23	-22.730	-22.672	0.058
CrOHCl2	3.598e-27	4.108e-27	-26.444	-26.386	0.058
Cr+3	4.078e-30	2.786e-31	-29.390	-30.555	-1.165
CrCl+2	1.017e-31	3.086e-32	-30.993	-31.511	-0.518
CrSO4+	1.135e-32	8.424e-33	-31.945	-32.074	-0.129
CrCl2+	1.801e-33	1.337e-33	-32.744	-32.874	-0.129
CrNO3+2	8.958e-39	2.718e-39	-38.048	-38.566	-0.518
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-42.568	-43.086	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-47.426	-47.368	0.058
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-74.599	-74.729	-0.129
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-94.330	-94.848	-0.518
Cr(NH3)6+3	0.000e+00	0.000e+00	-115.678	-116.843	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-116.076	-116.594	-0.518
Cr(6)	2.436e-06				
CrO4-2	1.769e-06	3.055e-07	-5.752	-6.515	-0.763
NaCrO4-	6.529e-07	4.845e-07	-6.185	-6.315	-0.129
KCrO4-	1.428e-08	1.060e-08	-7.845	-7.975	-0.129
HCrO4-	4.422e-13	3.282e-13	-12.354	-12.484	-0.129
Cr2O7-2	1.704e-23	5.169e-24	-22.769	-23.287	-0.518
CrO3Cl-	3.145e-25	2.334e-25	-24.502	-24.632	-0.129
CrO3SO4-2	2.783e-25	8.444e-26	-24.555	-25.073	-0.518
H2CrO4	1.491e-26	1.703e-26	-25.826	-25.769	0.058
Cu(1)	1.691e-13				

CuCl3-2	9.812e-14	2.058e-14	-13.008	-13.686	-0.678
CuCl2-	7.097e-14	4.576e-14	-13.149	-13.340	-0.191
Cu+	2.747e-18	1.601e-18	-17.561	-17.796	-0.234
Cu(2)	3.311e-08				
Cu(OH)2	2.056e-08	2.348e-08	-7.687	-7.629	0.058
Cu(OH)4-2	7.222e-09	2.191e-09	-8.141	-8.659	-0.518
Cu(OH)3-	5.323e-09	3.951e-09	-8.274	-8.403	-0.129
CuOH+	6.256e-15	4.033e-15	-14.204	-14.394	-0.191
CuCO3	1.720e-17	1.964e-17	-16.764	-16.707	0.058
Cu(CO3)2-2	2.058e-18	6.245e-19	-17.687	-18.204	-0.518
Cu+2	1.254e-18	1.447e-19	-17.902	-18.839	-0.938
CuCl+	1.027e-19	6.618e-20	-18.989	-19.179	-0.191
CuSO4	5.301e-20	6.052e-20	-19.276	-19.218	0.058
CuCl2	8.165e-21	9.321e-21	-20.088	-20.031	0.058
CuHCO3+	1.737e-23	1.289e-23	-22.760	-22.890	-0.129
CuCl3-	1.244e-23	8.017e-24	-22.905	-23.096	-0.191
Cu2(OH)2+2	7.579e-24	2.300e-24	-23.120	-23.638	-0.518
CuCl4-2	8.311e-26	1.744e-26	-25.080	-25.759	-0.678
Cu(S4)2-3	0.000e+00	0.000e+00	-173.781	-174.291	-0.510
CuS4S5-3	0.000e+00	0.000e+00	-174.546	-175.021	-0.475
Cu(HS)3-	0.000e+00	0.000e+00	-269.998	-270.127	-0.129
H(0)	9.494e-32				
H2	4.747e-32	5.419e-32	-31.324	-31.266	0.058
K	9.021e-03				
K+	8.918e-03	5.510e-03	-2.050	-2.259	-0.209
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
KCrO4-	1.428e-08	1.060e-08	-7.845	-7.975	-0.129
Mg	2.927e-02				
Mg+2	1.520e-02	5.190e-03	-1.818	-2.285	-0.467
MgOH+	1.234e-02	8.832e-03	-1.909	-2.054	-0.145
MgSO4	1.637e-03	1.868e-03	-2.786	-2.729	0.058
MgCO3	9.260e-05	1.057e-04	-4.033	-3.976	0.058
MgHCO3+	2.107e-08	1.358e-08	-7.676	-7.867	-0.191
N(-3)	1.242e-17				
NH3	1.239e-17	1.414e-17	-16.907	-16.849	0.058
NH4+	3.358e-20	1.957e-20	-19.474	-19.708	-0.234
NH4SO4-	8.254e-22	5.586e-22	-21.083	-21.253	-0.170
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-74.599	-74.729	-0.129
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-94.330	-94.848	-0.518
Cr(NH3)6+3	0.000e+00	0.000e+00	-115.678	-116.843	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-116.076	-116.594	-0.518
N(3)	1.957e-05				
NO2-	1.957e-05	1.453e-05	-4.708	-4.838	-0.129
N(5)	5.539e-07				
NO3-	5.539e-07	3.355e-07	-6.257	-6.474	-0.218
CdNO3+	2.792e-20	2.072e-20	-19.554	-19.684	-0.129
PbNO3+	5.506e-25	4.087e-25	-24.259	-24.389	-0.129
VO2NO3	1.688e-36	1.927e-36	-35.773	-35.715	0.058



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CrNO3+2	8.958e-39	2.718e-39	-38.048	-38.566	-0.518
Na	4.531e-01				
Na+	4.482e-01	3.191e-01	-0.349	-0.496	-0.148
NaSO4-	4.791e-03	3.296e-03	-2.320	-2.482	-0.162
NaCO3-	1.223e-04	8.417e-05	-3.913	-4.075	-0.162
NaCrO4-	6.529e-07	4.845e-07	-6.185	-6.315	-0.129
NaHCO3	2.994e-08	3.418e-08	-7.524	-7.466	0.058
Ni	1.043e-07				
Ni(OH)3-	1.020e-07	7.568e-08	-6.992	-7.121	-0.129
Ni(OH)2	2.379e-09	2.716e-09	-8.624	-8.566	0.058
NiOH+	8.147e-13	6.047e-13	-12.089	-12.218	-0.129
NiCO3	5.739e-13	6.552e-13	-12.241	-12.184	0.058
Ni(CO3)2-2	9.479e-14	2.876e-14	-13.023	-13.541	-0.518
Ni+2	1.153e-14	3.499e-15	-13.938	-14.456	-0.518
NiCl+	3.504e-15	2.600e-15	-14.455	-14.585	-0.129
NiCl2	2.458e-15	2.806e-15	-14.609	-14.552	0.058
NiSO4	1.200e-15	1.370e-15	-14.921	-14.863	0.058
Ni(SO4)2-2	5.926e-19	1.798e-19	-18.227	-18.745	-0.518
NiHCO3+	1.239e-19	9.199e-20	-18.907	-19.036	-0.129
O(0)	5.109e-34				
O2	2.555e-34	2.916e-34	-33.593	-33.535	0.058
Pb	3.484e-09				
Pb(OH)4-2	3.271e-09	9.925e-10	-8.485	-9.003	-0.518
Pb(OH)3-	2.090e-10	1.551e-10	-9.680	-9.809	-0.129
Pb(OH)2	4.248e-12	4.850e-12	-11.372	-11.314	0.058
PbOH+	6.028e-15	4.474e-15	-14.220	-14.349	-0.129
PbCO3	3.167e-17	3.615e-17	-16.499	-16.442	0.058
Pb(CO3)2-2	7.560e-18	2.294e-18	-17.121	-17.639	-0.518
PbCl+	9.880e-19	7.333e-19	-18.005	-18.135	-0.129
PbCl2	3.734e-19	4.263e-19	-18.428	-18.370	0.058
Pb+2	2.714e-19	8.235e-20	-18.566	-19.084	-0.518
PbCl3-	1.258e-19	9.340e-20	-18.900	-19.030	-0.129
PbSO4	8.986e-20	1.026e-19	-19.046	-18.989	0.058
PbCl4-2	4.012e-20	1.217e-20	-19.397	-19.915	-0.518
Pb(SO4)2-2	3.931e-21	1.193e-21	-20.406	-20.923	-0.518
PbHCO3+	1.567e-23	1.163e-23	-22.805	-22.935	-0.129
PbNO3+	5.506e-25	4.087e-25	-24.259	-24.389	-0.129
Pb2OH+3	1.207e-31	8.248e-33	-30.918	-32.084	-1.165
Pb3(OH)4+2	2.653e-32	8.050e-33	-31.576	-32.094	-0.518
Pb(HS)2	0.000e+00	0.000e+00	-188.663	-188.605	0.058
Pb(HS)3-	0.000e+00	0.000e+00	-279.571	-279.701	-0.129
S(-2)	0.000e+00				
S5-2	0.000e+00	0.000e+00	-89.280	-89.798	-0.518
S6-2	0.000e+00	0.000e+00	-89.306	-89.824	-0.518
S4-2	0.000e+00	0.000e+00	-89.525	-90.043	-0.518
HS-	0.000e+00	0.000e+00	-92.192	-92.396	-0.203
S-2	0.000e+00	0.000e+00	-92.521	-93.199	-0.678
S3-2	0.000e+00	0.000e+00	-92.998	-93.516	-0.518

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S2-2	0.000e+00	0.000e+00	-94.272	-94.790	-0.518
CdHS+	0.000e+00	0.000e+00	-95.850	-95.979	-0.129
H2S	0.000e+00	0.000e+00	-97.806	-97.748	0.058
Cu(S4)2-3	0.000e+00	0.000e+00	-173.781	-174.291	-0.510
CuS4S5-3	0.000e+00	0.000e+00	-174.546	-175.021	-0.475
Cd(HS)2	0.000e+00	0.000e+00	-182.072	-182.015	0.058
Zn(HS)2	0.000e+00	0.000e+00	-186.324	-186.267	0.058
Pb(HS)2	0.000e+00	0.000e+00	-188.663	-188.605	0.058
Cu(HS)3-	0.000e+00	0.000e+00	-269.998	-270.127	-0.129
Cd(HS)3-	0.000e+00	0.000e+00	-272.101	-272.230	-0.129
Zn(HS)3-	0.000e+00	0.000e+00	-277.373	-277.502	-0.129
Pb(HS)3-	0.000e+00	0.000e+00	-279.571	-279.701	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-361.918	-362.436	-0.518
S(6)	2.169e-02				
SO4-2	1.352e-02	2.215e-03	-1.869	-2.655	-0.786
NaSO4-	4.791e-03	3.296e-03	-2.320	-2.482	-0.162
MgSO4	1.637e-03	1.868e-03	-2.786	-2.729	0.058
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
HSO4-	8.502e-14	5.624e-14	-13.070	-13.250	-0.179
CdSO4	9.205e-15	1.051e-14	-14.036	-13.978	0.058
NiSO4	1.200e-15	1.370e-15	-14.921	-14.863	0.058
Cd(SO4)2-2	9.018e-16	2.736e-16	-15.045	-15.563	-0.518
ZnSO4	1.601e-17	1.828e-17	-16.796	-16.738	0.058
Zn(SO4)2-2	1.184e-18	3.593e-19	-17.927	-18.445	-0.518
Ni(SO4)2-2	5.926e-19	1.798e-19	-18.227	-18.745	-0.518
PbSO4	8.986e-20	1.026e-19	-19.046	-18.989	0.058
CuSO4	5.301e-20	6.052e-20	-19.276	-19.218	0.058
Pb(SO4)2-2	3.931e-21	1.193e-21	-20.406	-20.923	-0.518
NH4SO4-	8.254e-22	5.586e-22	-21.083	-21.253	-0.170
CrOHSO4	1.862e-23	2.126e-23	-22.730	-22.672	0.058
CrO3SO4-2	2.783e-25	8.444e-26	-24.555	-25.073	-0.518
VO2SO4-	2.367e-30	1.756e-30	-29.626	-29.755	-0.129
AlSO4+	9.233e-32	6.107e-32	-31.035	-31.214	-0.179
Al(SO4)2-	1.554e-32	1.028e-32	-31.809	-31.988	-0.179
CrSO4+	1.135e-32	8.424e-33	-31.945	-32.074	-0.129
VOSO4	1.111e-38	1.268e-38	-37.954	-37.897	0.058
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-42.568	-43.086	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-47.426	-47.368	0.058
VSO4+	0.000e+00	0.000e+00	-59.104	-59.233	-0.129
V(2)	0.000e+00				
VOH+	0.000e+00	0.000e+00	-57.193	-57.323	-0.129
V+2	0.000e+00	0.000e+00	-63.610	-64.128	-0.518
V(3)	1.732e-32				
V(OH)3	1.732e-32	1.978e-32	-31.761	-31.704	0.058
V(OH)2+	1.481e-39	1.099e-39	-38.829	-38.959	-0.129
VOH+2	0.000e+00	0.000e+00	-47.617	-48.135	-0.518
V+3	0.000e+00	0.000e+00	-56.853	-58.019	-1.165

VSO4+	0.000e+00	0.000e+00	-59.104	-59.233	-0.129
V2(OH)3+3	0.000e+00	0.000e+00	-85.037	-86.203	-1.165
V2(OH)2+4	0.000e+00	0.000e+00	-92.826	-94.898	-2.072
V(4)	2.035e-31				
V(OH)3+	2.035e-31	1.510e-31	-30.691	-30.821	-0.129
VO+2	8.505e-38	2.580e-38	-37.070	-37.588	-0.518
VOSO4	1.111e-38	1.268e-38	-37.954	-37.897	0.058
VOCI+	1.080e-38	8.014e-39	-37.967	-38.096	-0.129
H2V2O4+2	0.000e+00	0.000e+00	-56.209	-56.727	-0.518
V(5)	4.636e-07				
HVO4-2	3.035e-07	9.210e-08	-6.518	-7.036	-0.518
VO4-3	1.598e-07	1.092e-08	-6.796	-7.962	-1.165
V2O7-4	1.157e-10	9.803e-13	-9.937	-12.009	-2.072
HV2O7-3	2.912e-11	1.989e-12	-10.536	-11.701	-1.165
H2VO4-	6.336e-12	4.702e-12	-11.198	-11.328	-0.129
H3VO4	9.370e-21	1.070e-20	-20.028	-19.971	0.058
H3V2O7-	1.130e-24	8.384e-25	-23.947	-24.077	-0.129
V3O9-3	3.515e-27	2.402e-28	-26.454	-27.619	-1.165
VO2+	2.083e-29	1.546e-29	-28.681	-28.811	-0.129
VO2SO4-	2.367e-30	1.756e-30	-29.626	-29.755	-0.129
V4O12-4	4.259e-35	3.609e-37	-34.371	-36.443	-2.072
VO2NO3	1.688e-36	1.927e-36	-35.773	-35.715	0.058
V10O28-6	0.000e+00	0.000e+00	-101.795	-106.457	-4.662
HV10O28-5	0.000e+00	0.000e+00	-110.094	-113.331	-3.237
H2V10O28-4	0.000e+00	0.000e+00	-119.470	-121.542	-2.072
Zn	9.624e-08				
Zn(OH)4-2	4.826e-08	1.464e-08	-7.316	-7.834	-0.518
Zn(OH)3-	4.468e-08	3.316e-08	-7.350	-7.479	-0.129
Zn(OH)2	3.297e-09	3.764e-09	-8.482	-8.424	0.058
ZnOHCl	9.209e-13	1.051e-12	-12.036	-11.978	0.058
ZnOH+	6.672e-14	4.952e-14	-13.176	-13.305	-0.129
Zn(CO3)2-2	3.447e-16	1.046e-16	-15.463	-15.981	-0.518
ZnCO3	1.696e-16	1.937e-16	-15.771	-15.713	0.058
Zn+2	1.567e-16	3.842e-17	-15.805	-16.415	-0.611
ZnCl+	2.880e-17	1.857e-17	-16.541	-16.731	-0.191
ZnSO4	1.601e-17	1.828e-17	-16.796	-16.738	0.058
ZnCl2	4.825e-18	5.509e-18	-17.316	-17.259	0.058
ZnCl3-	2.656e-18	1.712e-18	-17.576	-17.766	-0.191
Zn(SO4)2-2	1.184e-18	3.593e-19	-17.927	-18.445	-0.518
ZnCl4-2	1.106e-18	2.320e-19	-17.956	-18.635	-0.678
ZnHCO3+	1.158e-21	8.598e-22	-20.936	-21.066	-0.129
Zn(HS)2	0.000e+00	0.000e+00	-186.324	-186.267	0.058
Zn(HS)3-	0.000e+00	0.000e+00	-277.373	-277.502	-0.129

-----Saturation indices-----

Phase            SI log IAP   log KT

(NH4)2CrO4 -46.27 -294.55 -248.28 (NH4)2CrO4  
 Al(OH)3(a) -5.32 5.82 11.14 Al(OH)3  
 Al2O3 -11.33 11.65 22.98 Al2O3  
 Al4(OH)10SO4 -26.98 -4.28 22.70 Al4(OH)10SO4  
 AlAsO4:2H2O -24.75 -19.95 4.80 AlAsO4:2H2O  
 AlOHSO4 -18.50 -21.73 -3.23 AlOHSO4  
 AlumK -33.81 -39.18 -5.37 KAl(SO4)2:12H2O  
 Alunite -26.00 -27.46 -1.46 KAl3(SO4)2(OH)6  
 Anglesite -13.89 -21.74 -7.85 PbSO4  
 Anhydrite -0.47 -5.00 -4.53 CaSO4  
 Anilite -78.25 -150.70 -72.45 Cu0.25Cu1.5S  
 Antlerite -17.68 -9.39 8.29 Cu3(OH)4SO4  
 Aragonite 1.33 -6.94 -8.27 CaCO3  
 Arsenolite -131.35 -215.68 -84.34 As4O6  
 Artinite 5.30 15.70 10.40 MgCO3:Mg(OH)2:3H2O  
 As2O5 -58.38 -51.53 6.85 As2O5  
 Atacamite -8.73 -0.87 7.86 Cu2(OH)3Cl  
 Azurite -24.57 -40.82 -16.26 Cu3(OH)2(CO3)2  
 Ba3(AsO4)2 11.84 2.85 -8.98 Ba3(AsO4)2  
 BaCrO4 -3.44 -13.29 -9.85 BaCrO4  
 Barite 0.73 -9.43 -10.15 BaSO4  
 Bianchite -17.36 -19.12 -1.76 ZnSO4:6H2O  
 Blaubleil -76.30 -136.33 -60.04 Cu0.9Cu0.2S  
 Blaubleill -78.20 -142.96 -64.76 Cu0.6Cu0.8S  
 Boehmite -3.54 5.82 9.36 AlOOH  
 Brochantite -18.68 -3.34 15.34 Cu4(OH)6SO4  
 Brucite 5.09 22.61 17.51 Mg(OH)2  
 Bunsenite -2.68 10.44 13.12 NiO  
 Ca2V2O7 -3.09 6.19 9.28 CaVO3.5  
 Ca3(AsO4)2:6H2O -6.21 16.09 22.30 Ca3(AsO4)2:6H2O  
 Ca3(VO4)2 -2.99 17.47 20.46 Ca1.5VO4  
 Ca\_Vanadate -8.20 -5.08 3.11 Ca0.5VO3  
 CaCrO4 -6.77 -8.86 -2.09 CaCrO4  
 Calcite 1.48 -6.94 -8.42 CaCO3  
 Cd(BO2)2 -12.68 -2.84 9.84 Cd(BO2)2  
 Cd(Gamma) -31.11 -17.01 14.10 Cd  
 Cd(OH)2(A) -3.17 11.14 14.31 Cd(OH)2  
 Cd(OH)2(C) -2.51 11.14 13.65 Cd(OH)2  
 Cd3(OH)2(SO4)2 -28.39 -21.68 6.71 Cd3(OH)2(SO4)2  
 Cd3(OH)4SO4 -16.70 5.86 22.56 Cd3(OH)4SO4  
 Cd4(OH)6SO4 -11.40 17.00 28.40 Cd4(OH)6SO4  
 CdCl2 -14.25 -14.81 -0.55 CdCl2  
 CdCl2:2.5H2O -12.84 -14.83 -1.99 CdCl2:2.5H2O  
 CdCl2:H2O -13.16 -14.82 -1.66 CdCl2:H2O  
 CdMetal -31.01 -17.01 13.99 Cd  
 CdOHCl -5.56 -1.84 3.73 CdOHCl  
 CdSO4 -16.72 -16.41 0.31 CdSO4  
 CdSO4:2.67H2O -14.68 -16.43 -1.75 CdSO4:2.67H2O

CdSO4:H2O -14.97 -16.42 -1.45 CdSO4:H2O  
 Cerrusite -10.42 -23.68 -13.27 PbCO3  
 CH4(g) -100.33 -142.14 -41.81 CH4  
 Chalcantite -18.85 -21.53 -2.68 CuSO4:5H2O  
 Chalcocite -79.53 -156.22 -76.69 Cu2S  
 Claudetite -131.11 -215.68 -84.57 As4O6  
 CO2(g) -11.32 -29.50 -18.17 CO2  
 Cotunnite -15.21 -20.14 -4.93 PbCl2  
 Covellite -75.07 -134.12 -59.05 CuS  
 Cr(OH)2 -25.77 -87.74 -61.97 Cr(OH)2  
 Cr(OH)3(A) -2.65 -73.66 -71.01 Cr(OH)3  
 Cr(OH)3(C) -5.30 -73.66 -68.36 Cr(OH)3  
 Cr2O3 -3.73 -147.30 -143.57 Cr2O3  
 CrCl2 -57.07 -113.68 -56.61 CrCl2  
 CrCl3 -56.60 -112.58 -55.98 CrCl3  
 CrMetal -76.06 -115.89 -39.82 Cr  
 CrO3 -28.24 -31.41 -3.18 CrO3  
 Cu(OH)2 -3.02 6.05 9.07 Cu(OH)2  
 Cu2(OH)3NO3 -16.54 -6.82 9.73 Cu2(OH)3NO3  
 Cu2SO4 -36.42 -43.59 -7.17 Cu2SO4  
 Cu3(AsO4)2:6H2O -39.50 -33.40 6.10 Cu3(AsO4)2:6H2O  
 CuCO3 -13.81 -23.44 -9.63 CuCO3  
 CuCrO4 -19.88 -25.35 -5.48 CuCrO4  
 CuMetal -10.19 -22.10 -11.91 Cu  
 CuOCuSO4 -27.96 -15.44 12.53 CuO:CuSO4  
 Cuprite -8.97 -16.04 -7.07 Cu2O  
 CuSO4 -25.01 -21.49 3.52 CuSO4  
 Diaspore -1.74 5.82 7.56 AlOOH  
 Djurleite -79.17 -154.77 -75.60 Cu0.066Cu1.868S  
 Dolomite 2.95 -13.82 -16.77 CaMg(CO3)2  
 Epsomite -2.77 -4.99 -2.22 MgSO4:7H2O  
 Galena -83.35 -134.37 -51.02 PbS  
 Gibbsite(C) -3.59 5.82 9.41 Al(OH)3  
 Goslarite -17.07 -19.12 -2.05 ZnSO4:7H2O  
 Greenockite -77.31 -129.04 -51.73 CdS  
 Gypsum -0.16 -5.01 -4.86 CaSO4:2H2O  
 Halite -2.58 -1.02 1.56 NaCl  
 Huntite 1.66 -27.59 -29.25 CaMg3(CO3)4  
 Hydrcerrusite -24.10 -41.56 -17.46 Pb(OH)2:2PbCO3  
 Hydromagnesite 2.35 -4.95 -7.31 Mg5(CO3)4(OH)2:4H2O  
 K2Cr2O7 -26.27 -42.45 -16.18 K2Cr2O7  
 K2CrO4 -10.92 -11.03 -0.11 K2CrO4  
 Langite -21.25 -3.35 17.90 Cu4(OH)6SO4:H2O  
 Larnakite -15.83 -15.93 -0.10 PbO:PbSO4  
 Laurionite -7.79 -7.17 0.62 PbOHCl  
 Lime -11.54 22.56 34.09 CaO  
 Litharge -7.36 5.81 13.18 PbO  
 Magnesite 0.97 -6.88 -7.86 MgCO3

Malachite	-12.64	-17.39	-4.74	Cu <sub>2</sub> (OH) <sub>2</sub> CO <sub>3</sub>
Massicot	-7.57	5.81	13.38	PbO
Melanothallite	-23.97	-19.90	4.07	CuCl <sub>2</sub>
Mg <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-7.78	6.25	14.03	MgVO <sub>3.5</sub>
Mg_Vanadate	-11.15	-5.06	6.10	Mg <sub>0.5</sub> VO <sub>3</sub>
MgCr <sub>2</sub> O <sub>4</sub>	2.63	-124.69	-127.32	MgCr <sub>2</sub> O <sub>4</sub>
MgCrO <sub>4</sub>	-14.77	-8.80	5.97	MgCrO <sub>4</sub>
Millerite	-86.29	-129.74	-43.45	NiS
Minium	-30.97	45.60	76.56	Pb <sub>3</sub> O <sub>4</sub>
Mirabilite	-2.08	-3.72	-1.65	Na <sub>2</sub> SO <sub>4</sub> :10H <sub>2</sub> O
Monteponite	-4.67	11.14	15.81	CdO
Morenosite	-14.72	-17.16	-2.44	NiSO <sub>4</sub> :7H <sub>2</sub> O
Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-28.88	-38.92	-10.04	Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
Na <sub>2</sub> CrO <sub>4</sub>	-10.90	-7.51	3.39	Na <sub>2</sub> CrO <sub>4</sub>
Na <sub>3</sub> VO <sub>4</sub>	-18.69	19.50	38.18	Na <sub>3</sub> VO <sub>4</sub>
Na <sub>4</sub> V <sub>2</sub> O <sub>7</sub>	-11.83	7.54	19.37	Na <sub>2</sub> VO <sub>3.5</sub>
Na_Vanadate	-8.32	-4.41	3.91	NaVO <sub>3</sub>
Nantokite	-11.28	-21.00	-9.71	CuCl
Natron	-3.91	-5.67	-1.75	Na <sub>2</sub> CO <sub>3</sub> :10H <sub>2</sub> O
Nesquehonite	-1.45	-6.91	-5.46	MgCO <sub>3</sub> :3H <sub>2</sub> O
NH <sub>4</sub> VO <sub>3</sub>	-26.42	-147.93	-121.51	NH <sub>4</sub> VO <sub>3</sub>
Ni(OH) <sub>2</sub>	0.49	10.43	9.95	Ni(OH) <sub>2</sub>
Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-35.96	-20.26	15.70	Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-17.81	14.19	32.00	Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
NiCO <sub>3</sub>	-12.49	-19.05	-6.56	NiCO <sub>3</sub>
O <sub>2</sub> (g)	-30.55	56.32	86.86	O <sub>2</sub>
Oripment	-318.51	-528.39	-209.88	As <sub>2</sub> S <sub>3</sub>
Otavite	-4.63	-18.35	-13.72	CdCO <sub>3</sub>
Pb(BO <sub>2</sub> ) <sub>2</sub>	-15.95	-8.17	7.77	Pb(BO <sub>2</sub> ) <sub>2</sub>
Pb(OH) <sub>2</sub> (C)	-2.74	5.81	8.54	Pb(OH) <sub>2</sub>
Pb <sub>2</sub> (OH) <sub>3</sub> Cl	-10.15	-1.36	8.79	Pb <sub>2</sub> (OH) <sub>3</sub> Cl
Pb <sub>2</sub> O(OH) <sub>2</sub>	-14.58	11.62	26.20	Pb <sub>2</sub> O(OH) <sub>2</sub>
Pb <sub>2</sub> O <sub>3</sub>	-21.26	39.78	61.04	Pb <sub>2</sub> O <sub>3</sub>
Pb <sub>2</sub> OCO <sub>3</sub>	-17.69	-17.87	-0.18	Pb <sub>2</sub> OCO <sub>3</sub>
Pb <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-9.69	-10.55	-0.86	PbVO <sub>3.5</sub>
Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>	-39.89	-34.09	5.80	Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>
Pb <sub>3</sub> (VO <sub>4</sub> ) <sub>2</sub>	-10.95	-7.64	3.31	Pb <sub>1.5</sub> VO <sub>4</sub>
Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>	-23.81	-12.06	11.76	Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>
Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>	-21.09	-10.11	10.98	Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>
Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-25.42	-4.32	21.10	Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>	-27.38	-4.30	23.08	Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>
PbCrO <sub>4</sub>	-11.63	-25.60	-13.97	PbCrO <sub>4</sub>
PbMetal	-26.60	-22.34	4.26	Pb
PbO:0.3H <sub>2</sub> O	-7.17	5.81	12.98	PbO:0.33H <sub>2</sub> O
Periclase	0.09	22.61	22.52	MgO
Phosgenite	-24.01	-43.82	-19.81	PbCl <sub>2</sub> :PbCO <sub>3</sub>
Plattnerite	-17.31	33.97	51.28	PbO <sub>2</sub>
Portlandite	-0.99	22.55	23.53	Ca(OH) <sub>2</sub>

Realgar	-131.96	-208.18	-76.23	AsS
Retgersite	-15.09	-17.16	-2.07	NiSO4:6H2O
Smithsonite	-11.13	-21.01	-9.88	ZnCO3
Sphalerite	-84.51	-131.70	-47.19	ZnS
Spinel	-4.56	34.27	38.83	MgAl2O4
SULFUR	-74.69	-112.03	-37.33	S
Tenorite	-1.99	6.06	8.05	CuO
Thenardite	-3.48	-3.65	-0.16	Na2SO4
Thermonatrite	-5.80	-5.60	0.20	Na2CO3:H2O
V(OH)3	-28.33	-44.53	-16.20	V(OH)3
V2O3	-26.12	-44.52	-18.40	VO1.5
V2O4	-17.35	-30.44	-13.09	VO2
V2O5	-15.76	-16.36	-0.60	VO2.5
V3O5	-68.76	-119.48	-50.72	V3O5
V4O7	-87.16	-149.92	-62.77	V4O7
V6O13	-91.81	-154.49	-62.68	V6O13
VCl2	-79.68	-84.55	-4.88	VCl2
VCl3	-82.56	-83.45	-0.89	VCl3
VMetal	-107.02	-86.76	20.26	V
VO	-48.62	-58.60	-9.98	VO
VO(OH)2	-18.55	-30.45	-11.90	VO(OH)2
VO2Cl	-32.42	-29.34	3.08	VO2Cl
VOCl	-43.79	-57.50	-13.71	VOCl
VOCl2	-52.22	-56.39	-4.17	VOCl2
VOSO4(C)	-44.39	-57.99	-13.60	VOSO4
Witherite	-2.77	-11.37	-8.60	BaCO3
Wurtzite	-86.53	-131.70	-45.17	ZnS
Zincite	-3.27	8.48	11.75	ZnO
Zincosite	-22.62	-19.07	3.55	ZnSO4
Zn(BO2)2	-13.79	-5.50	8.29	Zn(BO2)2
Zn(NO3)2:6H2O	-32.70	-29.41	3.29	Zn(NO3)2:6H2O
Zn(OH)2(A)	-3.98	8.47	12.45	Zn(OH)2
Zn(OH)2(B)	-3.28	8.47	11.75	Zn(OH)2
Zn(OH)2(C)	-3.73	8.47	12.20	Zn(OH)2
Zn(OH)2(E)	-3.03	8.47	11.50	Zn(OH)2
Zn(OH)2(G)	-3.24	8.47	11.71	Zn(OH)2
Zn2(OH)2SO4	-18.10	-10.60	7.50	Zn2(OH)2SO4
Zn2(OH)3Cl	-11.22	3.98	15.20	Zn2(OH)3Cl
Zn3(AsO4)2:2.5H2O	-39.75	-26.10	13.65	Zn3(AsO4)2:2.5H2O
Zn3O(SO4)2	-50.41	-29.66	20.75	Zn3O(SO4)2
Zn4(OH)6SO4	-22.05	6.35	28.40	Zn4(OH)6SO4
Zn5(OH)8Cl2	-22.07	16.43	38.50	Zn5(OH)8Cl2
ZnCl2	-24.99	-17.47	7.52	ZnCl2
ZnCO3:H2O	-10.76	-21.02	-10.26	ZnCO3:H2O
ZnMetal	-46.46	-19.68	26.79	Zn
ZnO(Active)	-2.83	8.48	11.31	ZnO
ZnS(A)	-87.20	-131.70	-44.50	ZnS
ZnSO4:H2O	-18.81	-19.08	-0.27	ZnSO4:H2O

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End of simulation.  
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Reading input data for simulation 2.  
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End of run.  
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No memory leaks



Database file: minteq.dat

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Reading data base.  
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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH310a Low  
SOLUTION 1  
pH 10.05 charge  
temp 14.04  
pe 0.815  
units mg/L  
Al 0.0422  
As 0.00163 as H3AsO4  
Ba 0.109  
B 2.360  
Cd 0.00013  
Ca 717  
C 26.3  
Cl 16500  
Cu 0.00204  
Cr 0.123  
Pb 0.0007  
Mg 690  
Ni 0.00594  
N 0.82 as N03-  
K 342  
Na 10100  
S 2020 as SO4-2  
V 0.0229  
Zn 0.0061  
END

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TITLE  
-----

BH310a Low

-----  
 Beginning of initial solution calculations.  
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Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.613e-06	1.613e-06
As	1.184e-08	1.184e-08
B	2.252e-04	2.252e-04
Ba	8.185e-07	8.185e-07
C	4.445e-04	4.445e-04
Ca	1.845e-02	1.845e-02
Cd	1.193e-09	1.193e-09
Cl	4.800e-01	4.800e-01
Cr	2.440e-06	2.440e-06
Cu	3.311e-08	3.311e-08
K	9.021e-03	9.021e-03
Mg	2.927e-02	2.927e-02
N	2.013e-05	2.013e-05
Na	4.531e-01	4.531e-01
Ni	1.043e-07	1.043e-07
Pb	3.484e-09	3.484e-09
S	2.169e-02	2.169e-02
V	4.636e-07	4.636e-07
Zn	9.624e-08	9.624e-08

-----Description of solution-----

pH = 12.453    Charge balance  
 pe = 0.815  
 Activity of water = 0.983  
 Ionic strength = 5.752e-01  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 3.418e-02  
 Total CO2 (mol/kg) = 4.445e-04  
 Temperature (deg C) = 14.040  
 Electrical balance (eq) = -1.946e-11  
 Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|)$  = -0.00  
 Iterations = 12  
 Total H = 1.110459e+02  
 Total O = 5.562808e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	1.892e-02	1.185e-02	-1.723	-1.926	-0.203
H+	4.623e-13	3.527e-13	-12.335	-12.453	-0.118
H2O	5.551e+01	9.826e-01	-0.008	-0.008	0.000
Al	1.613e-06				
Al(OH)4-	1.613e-06	1.067e-06	-5.792	-5.972	-0.179
Al(OH)3	5.729e-11	6.540e-11	-10.242	-10.184	0.058
Al(OH)2+	2.710e-17	1.865e-17	-16.567	-16.729	-0.162
AlOH+2	1.787e-24	4.006e-25	-23.748	-24.397	-0.649
Al+3	3.454e-31	3.024e-32	-30.462	-31.519	-1.058
AlSO4+	9.232e-32	6.107e-32	-31.035	-31.214	-0.179
Al(SO4)2-	1.554e-32	1.028e-32	-31.809	-31.988	-0.179
As(3)	7.742e-29				
HAsO3-2	4.758e-29	1.444e-29	-28.323	-28.841	-0.518
AsO3-3	1.564e-29	1.069e-30	-28.806	-29.971	-1.165
H2AsO3-	1.419e-29	1.053e-29	-28.848	-28.978	-0.129
H3AsO3	8.391e-33	9.579e-33	-32.076	-32.019	0.058
H4AsO3+	0.000e+00	0.000e+00	-44.647	-44.776	-0.129
As(5)	1.184e-08				
AsO4-3	1.137e-08	7.770e-10	-7.944	-9.110	-1.165
HAsO4-2	4.714e-10	1.430e-10	-9.327	-9.845	-0.518
H2AsO4-	4.091e-16	3.036e-16	-15.388	-15.518	-0.129
H3AsO4	1.472e-26	1.680e-26	-25.832	-25.775	0.058
B	2.252e-04				
H2BO3-	2.251e-04	1.312e-04	-3.648	-3.882	-0.234
H3BO3	8.668e-08	9.896e-08	-7.062	-7.005	0.058
Ba	8.185e-07				
Ba+2	8.070e-07	1.693e-07	-6.093	-6.771	-0.678
BaOH+	1.156e-08	7.824e-09	-7.937	-8.107	-0.170
C(4)	4.445e-04				
NaCO3-	1.223e-04	8.417e-05	-3.912	-4.075	-0.162
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CO3-2	1.127e-04	2.526e-05	-3.948	-4.598	-0.649
MgCO3	9.260e-05	1.057e-04	-4.033	-3.976	0.058
HCO3-	3.569e-07	2.456e-07	-6.447	-6.610	-0.162
NaHCO3	2.994e-08	3.418e-08	-7.524	-7.466	0.058
MgHCO3+	2.107e-08	1.358e-08	-7.676	-7.867	-0.191
CaHCO3+	1.176e-08	8.275e-09	-7.930	-8.082	-0.153
NiCO3	5.739e-13	6.551e-13	-12.241	-12.184	0.058
H2CO3	1.526e-13	1.742e-13	-12.817	-12.759	0.058
CdCO3	9.777e-14	1.116e-13	-13.010	-12.952	0.058
Ni(CO3)2-2	9.479e-14	2.876e-14	-13.023	-13.541	-0.518
Zn(CO3)2-2	3.447e-16	1.046e-16	-15.463	-15.981	-0.518
ZnCO3	1.696e-16	1.936e-16	-15.771	-15.713	0.058
PbCO3	3.166e-17	3.615e-17	-16.499	-16.442	0.058

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CuCO3	1.720e-17	1.963e-17	-16.765	-16.707	0.058
Pb(CO3)2-2	7.559e-18	2.294e-18	-17.122	-17.639	-0.518
Cu(CO3)2-2	2.058e-18	6.244e-19	-17.687	-18.205	-0.518
CdHCO3+	5.316e-19	3.945e-19	-18.274	-18.404	-0.129
NiHCO3+	1.239e-19	9.198e-20	-18.907	-19.036	-0.129
Cd(CO3)3-4	5.566e-20	4.717e-22	-19.254	-21.326	-2.072
ZnHCO3+	1.158e-21	8.597e-22	-20.936	-21.066	-0.129
CuHCO3+	1.737e-23	1.289e-23	-22.760	-22.890	-0.129
PbHCO3+	1.566e-23	1.163e-23	-22.805	-22.935	-0.129
Ca	1.845e-02				
Ca+2	1.492e-02	4.549e-03	-1.826	-2.342	-0.516
CaOH+	1.782e-03	1.254e-03	-2.749	-2.902	-0.153
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CaHCO3+	1.176e-08	8.275e-09	-7.930	-8.082	-0.153
Cd	1.193e-09				
Cd(OH)2	5.356e-10	6.114e-10	-9.271	-9.214	0.058
CdOHCl	3.803e-10	4.341e-10	-9.420	-9.362	0.058
Cd(OH)3-	2.576e-10	1.912e-10	-9.589	-9.719	-0.129
Cd(OH)4-2	1.564e-11	4.747e-12	-10.806	-11.324	-0.518
CdOH+	2.368e-12	1.757e-12	-11.626	-11.755	-0.129
CdCl+	6.477e-13	4.807e-13	-12.189	-12.318	-0.129
CdCl2	4.993e-13	5.700e-13	-12.302	-12.244	0.058
CdCl3-	1.208e-13	8.965e-14	-12.918	-13.047	-0.129
CdCO3	9.777e-14	1.116e-13	-13.010	-12.952	0.058
Cd+2	5.811e-14	1.763e-14	-13.236	-13.754	-0.518
CdSO4	9.204e-15	1.051e-14	-14.036	-13.978	0.058
Cd(SO4)2-2	9.018e-16	2.736e-16	-15.045	-15.563	-0.518
CdHCO3+	5.316e-19	3.945e-19	-18.274	-18.404	-0.129
Cd(CO3)3-4	5.566e-20	4.717e-22	-19.254	-21.326	-2.072
CdNO3+	6.727e-22	4.992e-22	-21.172	-21.302	-0.129
Cd2OH+3	2.559e-24	1.749e-25	-23.592	-24.757	-1.165
CdHS+	0.000e+00	0.000e+00	-89.330	-89.459	-0.129
Cd(HS)2	0.000e+00	0.000e+00	-169.033	-168.975	0.058
Cd(HS)3-	0.000e+00	0.000e+00	-252.541	-252.671	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-335.838	-336.356	-0.518
Cl	4.800e-01				
Cl-	4.800e-01	2.966e-01	-0.319	-0.528	-0.209
CdOHCl	3.803e-10	4.341e-10	-9.420	-9.362	0.058
ZnOHCl	9.208e-13	1.051e-12	-12.036	-11.978	0.058
CdCl+	6.477e-13	4.807e-13	-12.189	-12.318	-0.129
CuCl3-2	6.408e-13	1.344e-13	-12.193	-12.871	-0.678
CdCl2	4.993e-13	5.700e-13	-12.302	-12.244	0.058
CuCl2-	4.635e-13	2.988e-13	-12.334	-12.525	-0.191
CdCl3-	1.208e-13	8.965e-14	-12.918	-13.047	-0.129
NiCl+	3.503e-15	2.600e-15	-14.456	-14.585	-0.129
NiCl2	2.458e-15	2.806e-15	-14.609	-14.552	0.058
ZnCl+	2.880e-17	1.857e-17	-16.541	-16.731	-0.191

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ZnCl2	4.825e-18	5.508e-18	-17.317	-17.259	0.058
ZnCl3-	2.655e-18	1.712e-18	-17.576	-17.767	-0.191
ZnCl4-2	1.106e-18	2.320e-19	-17.956	-18.635	-0.678
PbCl+	9.879e-19	7.332e-19	-18.005	-18.135	-0.129
PbCl2	3.734e-19	4.262e-19	-18.428	-18.370	0.058
PbCl3-	1.258e-19	9.339e-20	-18.900	-19.030	-0.129
CuCl+	1.027e-19	6.618e-20	-18.989	-19.179	-0.191
PbCl4-2	4.012e-20	1.217e-20	-19.397	-19.915	-0.518
CuCl2	8.164e-21	9.320e-21	-20.088	-20.031	0.058
CuCl3-	1.243e-23	8.016e-24	-22.905	-23.096	-0.191
CrOHCl2	6.978e-25	7.967e-25	-24.156	-24.099	0.058
CrO3Cl-	2.190e-25	1.625e-25	-24.660	-24.789	-0.129
CuCl4-2	8.311e-26	1.744e-26	-25.080	-25.759	-0.678
CrCl+2	1.973e-29	5.985e-30	-28.705	-29.223	-0.518
CrCl2+	3.493e-31	2.593e-31	-30.457	-30.586	-0.129
VOCl+	7.051e-38	5.233e-38	-37.152	-37.281	-0.129
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-84.378	-84.896	-0.518
Cr(2)	1.050e-36				
Cr+2	1.050e-36	3.187e-37	-35.979	-36.497	-0.518
Cr(3)	7.439e-07				
CrO2-	5.352e-07	3.972e-07	-6.271	-6.401	-0.129
Cr(OH)4-	2.037e-07	1.512e-07	-6.691	-6.821	-0.129
Cr(OH)3	4.976e-09	5.680e-09	-8.303	-8.246	0.058
Cr(OH)2+	3.705e-14	2.750e-14	-13.431	-13.561	-0.129
Cr(OH)+2	1.356e-20	4.115e-21	-19.868	-20.386	-0.518
CrOHSO4	3.611e-21	4.122e-21	-20.442	-20.385	0.058
CrOHCl2	6.978e-25	7.967e-25	-24.156	-24.099	0.058
Cr+3	7.908e-28	5.403e-29	-27.102	-28.267	-1.165
CrCl+2	1.973e-29	5.985e-30	-28.705	-29.223	-0.518
CrSO4+	2.201e-30	1.634e-30	-29.657	-29.787	-0.129
CrCl2+	3.493e-31	2.593e-31	-30.457	-30.586	-0.129
CrNO3+2	4.185e-38	1.270e-38	-37.378	-37.896	-0.518
Cr2(OH)2SO4+2	1.016e-38	3.084e-39	-37.993	-38.511	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-42.850	-42.793	0.058
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-52.704	-52.834	-0.129
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-67.533	-68.051	-0.518
Cr(NH3)6+3	0.000e+00	0.000e+00	-83.980	-85.145	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-84.378	-84.896	-0.518
Cr(6)	1.696e-06				
CrO4-2	1.231e-06	2.127e-07	-5.910	-6.672	-0.763
NaCrO4-	4.545e-07	3.373e-07	-6.342	-6.472	-0.129
KCrO4-	9.942e-09	7.379e-09	-8.003	-8.132	-0.129
HCrO4-	3.079e-13	2.285e-13	-12.512	-12.641	-0.129
Cr2O7-2	8.256e-24	2.505e-24	-23.083	-23.601	-0.518
CrO3Cl-	2.190e-25	1.625e-25	-24.660	-24.789	-0.129
CrO3SO4-2	1.937e-25	5.878e-26	-24.713	-25.231	-0.518
H2CrO4	1.038e-26	1.185e-26	-25.984	-25.926	0.058
Cu(1)	1.104e-12				

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CuCl3-2	6.408e-13	1.344e-13	-12.193	-12.871	-0.678
CuCl2-	4.635e-13	2.988e-13	-12.334	-12.525	-0.191
Cu+	1.794e-17	1.046e-17	-16.746	-16.981	-0.234
Cu(2)	3.311e-08				
Cu(OH)2	2.056e-08	2.348e-08	-7.687	-7.629	0.058
Cu(OH)4-2	7.222e-09	2.191e-09	-8.141	-8.659	-0.518
Cu(OH)3-	5.323e-09	3.950e-09	-8.274	-8.403	-0.129
CuOH+	6.255e-15	4.033e-15	-14.204	-14.394	-0.191
CuCO3	1.720e-17	1.963e-17	-16.765	-16.707	0.058
Cu(CO3)2-2	2.058e-18	6.244e-19	-17.687	-18.205	-0.518
Cu+2	1.254e-18	1.447e-19	-17.902	-18.839	-0.938
CuCl+	1.027e-19	6.618e-20	-18.989	-19.179	-0.191
CuSO4	5.301e-20	6.051e-20	-19.276	-19.218	0.058
CuCl2	8.164e-21	9.320e-21	-20.088	-20.031	0.058
CuHCO3+	1.737e-23	1.289e-23	-22.760	-22.890	-0.129
CuCl3-	1.243e-23	8.016e-24	-22.905	-23.096	-0.191
Cu2(OH)2+2	7.578e-24	2.299e-24	-23.120	-23.638	-0.518
CuCl4-2	8.311e-26	1.744e-26	-25.080	-25.759	-0.678
Cu(S4)2-3	0.000e+00	0.000e+00	-159.927	-160.437	-0.510
CuS4S5-3	0.000e+00	0.000e+00	-160.692	-161.167	-0.475
Cu(HS)3-	0.000e+00	0.000e+00	-250.438	-250.567	-0.129
H(0)	4.050e-30				
H2	2.025e-30	2.312e-30	-29.694	-29.636	0.058
K	9.021e-03				
K+	8.918e-03	5.510e-03	-2.050	-2.259	-0.209
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
KCrO4-	9.942e-09	7.379e-09	-8.003	-8.132	-0.129
Mg	2.927e-02				
Mg+2	1.520e-02	5.190e-03	-1.818	-2.285	-0.467
MgOH+	1.234e-02	8.832e-03	-1.909	-2.054	-0.145
MgSO4	1.636e-03	1.868e-03	-2.786	-2.729	0.058
MgCO3	9.260e-05	1.057e-04	-4.033	-3.976	0.058
MgHCO3+	2.107e-08	1.358e-08	-7.676	-7.867	-0.191
N(-3)	9.907e-13				
NH3	9.880e-13	1.128e-12	-12.005	-11.948	0.058
NH4+	2.678e-15	1.561e-15	-14.572	-14.807	-0.234
NH4SO4-	6.582e-17	4.455e-17	-16.182	-16.351	-0.170
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-52.704	-52.834	-0.129
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-67.533	-68.051	-0.518
Cr(NH3)6+3	0.000e+00	0.000e+00	-83.980	-85.145	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-84.378	-84.896	-0.518
N(3)	2.011e-05				
NO2-	2.011e-05	1.493e-05	-4.697	-4.826	-0.129
N(5)	1.334e-08				
NO3-	1.334e-08	8.083e-09	-7.875	-8.092	-0.218
CdNO3+	6.727e-22	4.992e-22	-21.172	-21.302	-0.129
PbNO3+	1.326e-26	9.844e-27	-25.877	-26.007	-0.129
CrNO3+2	4.185e-38	1.270e-38	-37.378	-37.896	-0.518

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VO2NO3	4.066e-38	4.642e-38	-37.391	-37.333	0.058
Na	4.531e-01				
Na+	4.482e-01	3.191e-01	-0.349	-0.496	-0.148
NaSO4-	4.791e-03	3.296e-03	-2.320	-2.482	-0.162
NaCO3-	1.223e-04	8.417e-05	-3.912	-4.075	-0.162
NaCrO4-	4.545e-07	3.373e-07	-6.342	-6.472	-0.129
NaHCO3	2.994e-08	3.418e-08	-7.524	-7.466	0.058
Ni	1.043e-07				
Ni(OH)3-	1.020e-07	7.568e-08	-6.992	-7.121	-0.129
Ni(OH)2	2.379e-09	2.716e-09	-8.624	-8.566	0.058
NiOH+	8.147e-13	6.046e-13	-12.089	-12.219	-0.129
NiCO3	5.739e-13	6.551e-13	-12.241	-12.184	0.058
Ni(CO3)2-2	9.479e-14	2.876e-14	-13.023	-13.541	-0.518
Ni+2	1.153e-14	3.498e-15	-13.938	-14.456	-0.518
NiCl+	3.503e-15	2.600e-15	-14.456	-14.585	-0.129
NiCl2	2.458e-15	2.806e-15	-14.609	-14.552	0.058
NiSO4	1.200e-15	1.370e-15	-14.921	-14.863	0.058
Ni(SO4)2-2	5.925e-19	1.798e-19	-18.227	-18.745	-0.518
NiHCO3+	1.239e-19	9.198e-20	-18.907	-19.036	-0.129
O(0)	2.808e-37				
O2	1.404e-37	1.603e-37	-36.853	-36.795	0.058
Pb	3.484e-09				
Pb(OH)4-2	3.271e-09	9.925e-10	-8.485	-9.003	-0.518
Pb(OH)3-	2.090e-10	1.551e-10	-9.680	-9.809	-0.129
Pb(OH)2	4.248e-12	4.849e-12	-11.372	-11.314	0.058
PbOH+	6.028e-15	4.473e-15	-14.220	-14.349	-0.129
PbCO3	3.166e-17	3.615e-17	-16.499	-16.442	0.058
Pb(CO3)2-2	7.559e-18	2.294e-18	-17.122	-17.639	-0.518
PbCl+	9.879e-19	7.332e-19	-18.005	-18.135	-0.129
PbCl2	3.734e-19	4.262e-19	-18.428	-18.370	0.058
Pb+2	2.714e-19	8.234e-20	-18.566	-19.084	-0.518
PbCl3-	1.258e-19	9.339e-20	-18.900	-19.030	-0.129
PbSO4	8.985e-20	1.026e-19	-19.046	-18.989	0.058
PbCl4-2	4.012e-20	1.217e-20	-19.397	-19.915	-0.518
Pb(SO4)2-2	3.930e-21	1.193e-21	-20.406	-20.924	-0.518
PbHCO3+	1.566e-23	1.163e-23	-22.805	-22.935	-0.129
PbNO3+	1.326e-26	9.844e-27	-25.877	-26.007	-0.129
Pb2OH+3	1.207e-31	8.246e-33	-30.918	-32.084	-1.165
Pb3(OH)4+2	2.653e-32	8.048e-33	-31.576	-32.094	-0.518
Pb(HS)2	0.000e+00	0.000e+00	-175.623	-175.566	0.058
Pb(HS)3-	0.000e+00	0.000e+00	-260.012	-260.141	-0.129
S(-2)	0.000e+00				
S5-2	0.000e+00	0.000e+00	-82.760	-83.278	-0.518
S6-2	0.000e+00	0.000e+00	-82.786	-83.304	-0.518
S4-2	0.000e+00	0.000e+00	-83.005	-83.523	-0.518
HS-	0.000e+00	0.000e+00	-85.672	-85.876	-0.203
S-2	0.000e+00	0.000e+00	-86.001	-86.679	-0.678
S3-2	0.000e+00	0.000e+00	-86.478	-86.996	-0.518

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S2-2	0.000e+00	0.000e+00	-87.752	-88.270	-0.518
CdHS+	0.000e+00	0.000e+00	-89.330	-89.459	-0.129
H2S	0.000e+00	0.000e+00	-91.286	-91.228	0.058
Cu(S4)2-3	0.000e+00	0.000e+00	-159.927	-160.437	-0.510
CuS4S5-3	0.000e+00	0.000e+00	-160.692	-161.167	-0.475
Cd(HS)2	0.000e+00	0.000e+00	-169.033	-168.975	0.058
Zn(HS)2	0.000e+00	0.000e+00	-173.284	-173.227	0.058
Pb(HS)2	0.000e+00	0.000e+00	-175.623	-175.566	0.058
Cu(HS)3-	0.000e+00	0.000e+00	-250.438	-250.567	-0.129
Cd(HS)3-	0.000e+00	0.000e+00	-252.541	-252.671	-0.129
Zn(HS)3-	0.000e+00	0.000e+00	-257.813	-257.942	-0.129
Pb(HS)3-	0.000e+00	0.000e+00	-260.012	-260.141	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-335.838	-336.356	-0.518
S(6)	2.169e-02				
SO4-2	1.352e-02	2.215e-03	-1.869	-2.655	-0.786
NaSO4-	4.791e-03	3.296e-03	-2.320	-2.482	-0.162
MgSO4	1.636e-03	1.868e-03	-2.786	-2.729	0.058
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
HSO4-	8.502e-14	5.624e-14	-13.070	-13.250	-0.179
CdSO4	9.204e-15	1.051e-14	-14.036	-13.978	0.058
NiSO4	1.200e-15	1.370e-15	-14.921	-14.863	0.058
Cd(SO4)2-2	9.018e-16	2.736e-16	-15.045	-15.563	-0.518
NH4SO4-	6.582e-17	4.455e-17	-16.182	-16.351	-0.170
ZnSO4	1.601e-17	1.828e-17	-16.796	-16.738	0.058
Zn(SO4)2-2	1.184e-18	3.592e-19	-17.927	-18.445	-0.518
Ni(SO4)2-2	5.925e-19	1.798e-19	-18.227	-18.745	-0.518
PbSO4	8.985e-20	1.026e-19	-19.046	-18.989	0.058
CuSO4	5.301e-20	6.051e-20	-19.276	-19.218	0.058
Pb(SO4)2-2	3.930e-21	1.193e-21	-20.406	-20.924	-0.518
CrOHSO4	3.611e-21	4.122e-21	-20.442	-20.385	0.058
CrO3SO4-2	1.937e-25	5.878e-26	-24.713	-25.231	-0.518
VO2SO4-	2.366e-30	1.756e-30	-29.626	-29.755	-0.129
CrSO4+	2.201e-30	1.634e-30	-29.657	-29.787	-0.129
AlSO4+	9.232e-32	6.107e-32	-31.035	-31.214	-0.179
Al(SO4)2-	1.554e-32	1.028e-32	-31.809	-31.988	-0.179
VOSO4	7.253e-38	8.280e-38	-37.140	-37.082	0.058
Cr2(OH)2SO4+2	1.016e-38	3.084e-39	-37.993	-38.511	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-42.850	-42.793	0.058
VSO4+	0.000e+00	0.000e+00	-57.474	-57.604	-0.129
V(2)	0.000e+00				
VOH+	0.000e+00	0.000e+00	-54.748	-54.878	-0.129
V+2	0.000e+00	0.000e+00	-61.165	-61.683	-0.518
V(3)	7.389e-31				
V(OH)3	7.389e-31	8.436e-31	-30.131	-30.074	0.058
V(OH)2+	6.318e-38	4.689e-38	-37.199	-37.329	-0.129
VOH+2	0.000e+00	0.000e+00	-45.988	-46.505	-0.518
V+3	0.000e+00	0.000e+00	-55.224	-56.389	-1.165



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VSO4+	0.000e+00	0.000e+00	-57.474	-57.604	-0.129
V2(OH)3+3	0.000e+00	0.000e+00	-81.777	-82.943	-1.165
V2(OH)2+4	0.000e+00	0.000e+00	-89.566	-91.638	-2.072
V(4)	1.329e-30				
V(OH)3+	1.329e-30	9.864e-31	-29.876	-30.006	-0.129
VO+2	5.554e-37	1.685e-37	-36.255	-36.773	-0.518
VOSO4	7.253e-38	8.280e-38	-37.140	-37.082	0.058
VOCI+	7.051e-38	5.233e-38	-37.152	-37.281	-0.129
H2V2O4+2	0.000e+00	0.000e+00	-54.579	-55.097	-0.518
V(5)	4.636e-07				
HVO4-2	3.035e-07	9.209e-08	-6.518	-7.036	-0.518
VO4-3	1.598e-07	1.092e-08	-6.796	-7.962	-1.165
V2O7-4	1.157e-10	9.803e-13	-9.937	-12.009	-2.072
HV2O7-3	2.912e-11	1.989e-12	-10.536	-11.701	-1.165
H2VO4-	6.335e-12	4.702e-12	-11.198	-11.328	-0.129
H3VO4	9.369e-21	1.070e-20	-20.028	-19.971	0.058
H3V2O7-	1.130e-24	8.383e-25	-23.947	-24.077	-0.129
V3O9-3	3.515e-27	2.402e-28	-26.454	-27.619	-1.165
VO2+	2.083e-29	1.546e-29	-28.681	-28.811	-0.129
VO2SO4-	2.366e-30	1.756e-30	-29.626	-29.755	-0.129
V4O12-4	4.258e-35	3.609e-37	-34.371	-36.443	-2.072
VO2NO3	4.066e-38	4.642e-38	-37.391	-37.333	0.058
V10O28-6	0.000e+00	0.000e+00	-101.795	-106.457	-4.662
HV10O28-5	0.000e+00	0.000e+00	-110.094	-113.332	-3.237
H2V10O28-4	0.000e+00	0.000e+00	-119.470	-121.542	-2.072
Zn	9.624e-08				
Zn(OH)4-2	4.826e-08	1.464e-08	-7.316	-7.834	-0.518
Zn(OH)3-	4.468e-08	3.316e-08	-7.350	-7.479	-0.129
Zn(OH)2	3.297e-09	3.763e-09	-8.482	-8.424	0.058
ZnOHCl	9.208e-13	1.051e-12	-12.036	-11.978	0.058
ZnOH+	6.672e-14	4.952e-14	-13.176	-13.305	-0.129
Zn(CO3)2-2	3.447e-16	1.046e-16	-15.463	-15.981	-0.518
ZnCO3	1.696e-16	1.936e-16	-15.771	-15.713	0.058
Zn+2	1.567e-16	3.842e-17	-15.805	-16.415	-0.611
ZnCl+	2.880e-17	1.857e-17	-16.541	-16.731	-0.191
ZnSO4	1.601e-17	1.828e-17	-16.796	-16.738	0.058
ZnCl2	4.825e-18	5.508e-18	-17.317	-17.259	0.058
ZnCl3-	2.655e-18	1.712e-18	-17.576	-17.767	-0.191
Zn(SO4)2-2	1.184e-18	3.592e-19	-17.927	-18.445	-0.518
ZnCl4-2	1.106e-18	2.320e-19	-17.956	-18.635	-0.678
ZnHCO3+	1.158e-21	8.597e-22	-20.936	-21.066	-0.129
Zn(HS)2	0.000e+00	0.000e+00	-173.284	-173.227	0.058
Zn(HS)3-	0.000e+00	0.000e+00	-257.813	-257.942	-0.129

-----Saturation indices-----

Phase            SI log IAP   log KT

(NH<sub>4</sub>)<sub>2</sub>CrO<sub>4</sub> -36.63 -225.32 -188.69 (NH<sub>4</sub>)<sub>2</sub>CrO<sub>4</sub>  
 Al(OH)<sub>3</sub>(a) -5.32 5.82 11.14 Al(OH)<sub>3</sub>  
 Al<sub>2</sub>O<sub>3</sub> -11.33 11.65 22.98 Al<sub>2</sub>O<sub>3</sub>  
 Al<sub>4</sub>(OH)<sub>10</sub>SO<sub>4</sub> -26.98 -4.28 22.70 Al<sub>4</sub>(OH)<sub>10</sub>SO<sub>4</sub>  
 AlAsO<sub>4</sub>:2H<sub>2</sub>O -24.75 -19.95 4.80 AlAsO<sub>4</sub>:2H<sub>2</sub>O  
 AlOHSO<sub>4</sub> -18.50 -21.73 -3.23 AlOHSO<sub>4</sub>  
 AlumK -33.81 -39.18 -5.37 KAl(SO<sub>4</sub>)<sub>2</sub>:12H<sub>2</sub>O  
 Alunite -26.00 -27.46 -1.46 KAl<sub>3</sub>(SO<sub>4</sub>)<sub>2</sub>(OH)<sub>6</sub>  
 Anglesite -13.89 -21.74 -7.85 PbSO<sub>4</sub>  
 Anhydrite -0.47 -5.00 -4.53 CaSO<sub>4</sub>  
 Anilite -70.51 -142.96 -72.45 Cu<sub>0.25</sub>Cu<sub>1.5</sub>S  
 Antlerite -17.68 -9.39 8.29 Cu<sub>3</sub>(OH)<sub>4</sub>SO<sub>4</sub>  
 Aragonite 1.33 -6.94 -8.27 CaCO<sub>3</sub>  
 Arsenolite -124.83 -209.16 -84.34 As<sub>4</sub>O<sub>6</sub>  
 Artinite 5.30 15.70 10.40 MgCO<sub>3</sub>:Mg(OH)<sub>2</sub>:3H<sub>2</sub>O  
 As<sub>2</sub>O<sub>5</sub> -58.38 -51.53 6.85 As<sub>2</sub>O<sub>5</sub>  
 Atacamite -8.73 -0.87 7.86 Cu<sub>2</sub>(OH)<sub>3</sub>Cl  
 Azurite -24.57 -40.82 -16.26 Cu<sub>3</sub>(OH)<sub>2</sub>(CO<sub>3</sub>)<sub>2</sub>  
 Ba<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub> 11.84 2.85 -8.98 Ba<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>  
 BaCrO<sub>4</sub> -3.60 -13.44 -9.85 BaCrO<sub>4</sub>  
 Barite 0.73 -9.43 -10.15 BaSO<sub>4</sub>  
 Bianchite -17.36 -19.12 -1.76 ZnSO<sub>4</sub>:6H<sub>2</sub>O  
 Blaubleil -69.61 -129.65 -60.04 Cu<sub>0.9</sub>Cu<sub>0.2</sub>S  
 Blaubleill -71.03 -135.79 -64.76 Cu<sub>0.6</sub>Cu<sub>0.8</sub>S  
 Boehmite -3.54 5.82 9.36 AlOOH  
 Brochantite -18.68 -3.34 15.34 Cu<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub>  
 Brucite 5.09 22.61 17.51 Mg(OH)<sub>2</sub>  
 Bunsenite -2.68 10.44 13.12 NiO  
 Ca<sub>2</sub>V<sub>2</sub>O<sub>7</sub> -3.09 6.19 9.28 CaVO<sub>3.5</sub>  
 Ca<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:6H<sub>2</sub>O -6.21 16.09 22.30 Ca<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:6H<sub>2</sub>O  
 Ca<sub>3</sub>(VO<sub>4</sub>)<sub>2</sub> -2.99 17.47 20.46 Ca<sub>1.5</sub>VO<sub>4</sub>  
 Ca\_Vanadate -8.20 -5.08 3.11 Ca<sub>0.5</sub>VO<sub>3</sub>  
 CaCrO<sub>4</sub> -6.93 -9.01 -2.09 CaCrO<sub>4</sub>  
 Calcite 1.48 -6.94 -8.42 CaCO<sub>3</sub>  
 Cd(BO<sub>2</sub>)<sub>2</sub> -12.68 -2.84 9.84 Cd(BO<sub>2</sub>)<sub>2</sub>  
 Cd(Gamma) -29.48 -15.38 14.10 Cd  
 Cd(OH)<sub>2</sub>(A) -3.17 11.14 14.31 Cd(OH)<sub>2</sub>  
 Cd(OH)<sub>2</sub>(C) -2.51 11.14 13.65 Cd(OH)<sub>2</sub>  
 Cd<sub>3</sub>(OH)<sub>2</sub>(SO<sub>4</sub>)<sub>2</sub> -28.39 -21.68 6.71 Cd<sub>3</sub>(OH)<sub>2</sub>(SO<sub>4</sub>)<sub>2</sub>  
 Cd<sub>3</sub>(OH)<sub>4</sub>SO<sub>4</sub> -16.70 5.86 22.56 Cd<sub>3</sub>(OH)<sub>4</sub>SO<sub>4</sub>  
 Cd<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub> -11.40 17.00 28.40 Cd<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub>  
 CdCl<sub>2</sub> -14.25 -14.81 -0.55 CdCl<sub>2</sub>  
 CdCl<sub>2</sub>:2.5H<sub>2</sub>O -12.84 -14.83 -1.99 CdCl<sub>2</sub>:2.5H<sub>2</sub>O  
 CdCl<sub>2</sub>:H<sub>2</sub>O -13.16 -14.82 -1.66 CdCl<sub>2</sub>:H<sub>2</sub>O  
 CdMetal -29.38 -15.38 13.99 Cd  
 CdOHCl -5.56 -1.84 3.73 CdOHCl  
 CdSO<sub>4</sub> -16.72 -16.41 0.31 CdSO<sub>4</sub>  
 CdSO<sub>4</sub>:2.67H<sub>2</sub>O -14.68 -16.43 -1.75 CdSO<sub>4</sub>:2.67H<sub>2</sub>O

CdSO4:H2O	-14.97	-16.42	-1.45	CdSO4:H2O
Cerrusite	-10.42	-23.68	-13.27	PbCO3
CH4(g)	-93.81	-135.62	-41.81	CH4
Chalcanthite	-18.85	-21.53	-2.68	CuSO4:5H2O
Chalcocite	-71.38	-148.07	-76.69	Cu2S
Claudetite	-124.59	-209.16	-84.57	As4O6
CO2(g)	-11.32	-29.50	-18.17	CO2
Cotunnite	-15.21	-20.14	-4.93	PbCl2
Covellite	-68.55	-127.60	-59.05	CuS
Cr(OH)2	-22.66	-84.63	-61.97	Cr(OH)2
Cr(OH)3(A)	-0.37	-71.37	-71.01	Cr(OH)3
Cr(OH)3(C)	-3.02	-71.37	-68.36	Cr(OH)3
Cr2O3	0.85	-142.72	-143.57	Cr2O3
CrCl2	-53.97	-110.58	-56.61	CrCl2
CrCl3	-54.31	-110.29	-55.98	CrCl3
CrMetal	-71.33	-111.15	-39.82	Cr
CrO3	-28.39	-31.57	-3.18	CrO3
Cu(OH)2	-3.02	6.05	9.07	Cu(OH)2
Cu2(OH)3NO3	-18.16	21.36	39.52	Cu2(OH)3NO3
Cu2SO4	-34.79	-41.96	-7.17	Cu2SO4
Cu3(AsO4)2:6H2O	-39.50	-33.40	6.10	Cu3(AsO4)2:6H2O
CuCO3	-13.81	-23.44	-9.63	CuCO3
CuCrO4	-20.04	-25.51	-5.48	CuCrO4
CuMetal	-8.56	-20.47	-11.91	Cu
CuOCuSO4	-27.96	-15.44	12.53	CuO:CuSO4
Cuprite	-7.34	-14.41	-7.07	Cu2O
CuSO4	-25.01	-21.49	3.52	CuSO4
Diaspore	-1.74	5.82	7.56	AlOOH
Djurleite	-71.13	-146.72	-75.60	Cu0.066Cu1.868S
Dolomite	2.95	-13.82	-16.77	CaMg(CO3)2
Epsomite	-2.77	-4.99	-2.22	MgSO4:7H2O
Galena	-76.83	-127.85	-51.02	PbS
Gibbsite(C)	-3.59	5.82	9.41	Al(OH)3
Goslarite	-17.07	-19.12	-2.05	ZnSO4:7H2O
Greenockite	-70.79	-122.52	-51.73	CdS
Gypsum	-0.16	-5.01	-4.86	CaSO4:2H2O
Halite	-2.58	-1.02	1.56	NaCl
Huntite	1.66	-27.59	-29.25	CaMg3(CO3)4
Hydcerrusite	-24.10	-41.56	-17.46	Pb(OH)2:2PbCO3
Hydromagnesite	2.35	-4.95	-7.31	Mg5(CO3)4(OH)2:4H2O
K2Cr2O7	-26.58	-42.76	-16.18	K2Cr2O7
K2CrO4	-11.08	-11.19	-0.11	K2CrO4
Langite	-21.25	-3.35	17.90	Cu4(OH)6SO4:H2O
Larnakite	-15.83	-15.93	-0.10	PbO:PbSO4
Laurionite	-7.79	-7.17	0.62	PbOHCl
Lime	-11.54	22.56	34.09	CaO
Litharge	-7.36	5.81	13.18	PbO
Magnesite	0.97	-6.88	-7.86	MgCO3

Malachite	-12.64	-17.39	-4.74	Cu <sub>2</sub> (OH) <sub>2</sub> CO <sub>3</sub>
Massicot	-7.57	5.81	13.38	PbO
Melanothallite	-23.97	-19.90	4.07	CuCl <sub>2</sub>
Mg <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-7.78	6.25	14.03	MgVO <sub>3.5</sub>
Mg_Vanadate	-11.15	-5.06	6.10	Mg <sub>0.5</sub> VO <sub>3</sub>
MgCr <sub>2</sub> O <sub>4</sub>	7.21	-120.11	-127.32	MgCr <sub>2</sub> O <sub>4</sub>
MgCrO <sub>4</sub>	-14.93	-8.96	5.97	MgCrO <sub>4</sub>
Millerite	-79.77	-123.22	-43.45	NiS
Minium	-32.60	43.97	76.56	Pb <sub>3</sub> O <sub>4</sub>
Mirabilite	-2.08	-3.72	-1.65	Na <sub>2</sub> SO <sub>4</sub> :10H <sub>2</sub> O
Monteponite	-4.67	11.14	15.81	CdO
Morenosite	-14.72	-17.16	-2.44	NiSO <sub>4</sub> :7H <sub>2</sub> O
Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-29.19	-39.23	-10.04	Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
Na <sub>2</sub> CrO <sub>4</sub>	-11.06	-7.66	3.39	Na <sub>2</sub> CrO <sub>4</sub>
Na <sub>3</sub> VO <sub>4</sub>	-18.69	19.50	38.18	Na <sub>3</sub> VO <sub>4</sub>
Na <sub>4</sub> V <sub>2</sub> O <sub>7</sub>	-11.83	7.54	19.37	Na <sub>2</sub> VO <sub>3.5</sub>
Na_Vanadate	-8.32	-4.41	3.91	NaVO <sub>3</sub>
Nantokite	-10.47	-20.18	-9.71	CuCl
Natron	-3.91	-5.67	-1.75	Na <sub>2</sub> CO <sub>3</sub> :10H <sub>2</sub> O
Nesquehonite	-1.45	-6.91	-5.46	MgCO <sub>3</sub> :3H <sub>2</sub> O
NH <sub>4</sub> VO <sub>3</sub>	-21.52	-113.24	-91.72	NH <sub>4</sub> VO <sub>3</sub>
Ni(OH) <sub>2</sub>	0.49	10.43	9.95	Ni(OH) <sub>2</sub>
Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-35.96	-20.26	15.70	Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-17.81	14.19	32.00	Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
NiCO <sub>3</sub>	-12.49	-19.05	-6.56	NiCO <sub>3</sub>
O <sub>2</sub> (g)	-33.81	53.06	86.86	O <sub>2</sub>
Oripment	-295.69	-505.57	-209.88	As <sub>2</sub> S <sub>3</sub>
Otavite	-4.63	-18.35	-13.72	CdCO <sub>3</sub>
Pb(BO <sub>2</sub> ) <sub>2</sub>	-15.95	-8.17	7.77	Pb(BO <sub>2</sub> ) <sub>2</sub>
Pb(OH) <sub>2</sub> (C)	-2.74	5.81	8.54	Pb(OH) <sub>2</sub>
Pb <sub>2</sub> (OH) <sub>3</sub> Cl	-10.15	-1.36	8.79	Pb <sub>2</sub> (OH) <sub>3</sub> Cl
Pb <sub>2</sub> O(OH) <sub>2</sub>	-14.58	11.62	26.20	Pb <sub>2</sub> O(OH) <sub>2</sub>
Pb <sub>2</sub> O <sub>3</sub>	-22.89	38.15	61.04	Pb <sub>2</sub> O <sub>3</sub>
Pb <sub>2</sub> OCO <sub>3</sub>	-17.69	-17.87	-0.18	Pb <sub>2</sub> OCO <sub>3</sub>
Pb <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-9.69	-10.55	-0.86	PbVO <sub>3.5</sub>
Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>	-39.89	-34.09	5.80	Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>
Pb <sub>3</sub> (VO <sub>4</sub> ) <sub>2</sub>	-10.95	-7.64	3.31	Pb <sub>1.5</sub> VO <sub>4</sub>
Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>	-23.81	-12.06	11.76	Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>
Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>	-21.09	-10.11	10.98	Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>
Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-25.42	-4.32	21.10	Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>	-27.38	-4.30	23.08	Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>
PbCrO <sub>4</sub>	-11.79	-25.76	-13.97	PbCrO <sub>4</sub>
PbMetal	-24.97	-20.71	4.26	Pb
PbO:0.3H <sub>2</sub> O	-7.17	5.81	12.98	PbO:0.33H <sub>2</sub> O
Periclase	0.09	22.61	22.52	MgO
Phosgenite	-24.01	-43.82	-19.81	PbCl <sub>2</sub> :PbCO <sub>3</sub>
Plattnerite	-18.94	32.34	51.28	PbO <sub>2</sub>
Portlandite	-0.99	22.55	23.53	Ca(OH) <sub>2</sub>

Realgar	-122.99	-199.22	-76.23	AsS
Retgersite	-15.09	-17.16	-2.07	NiSO4:6H2O
Smithsonite	-11.13	-21.01	-9.88	ZnCO3
Sphalerite	-77.99	-125.18	-47.19	ZnS
Spinel	-4.56	34.27	38.83	MgAl2O4
SULFUR	-69.80	-107.14	-37.33	S
Tenorite	-1.99	6.06	8.05	CuO
Thenardite	-3.48	-3.65	-0.16	Na2SO4
Thermonatrite	-5.80	-5.60	0.20	Na2CO3:H2O
V(OH)3	-26.70	-42.90	-16.20	V(OH)3
V2O3	-24.49	-42.89	-18.40	VO1.5
V2O4	-16.54	-29.63	-13.09	VO2
V2O5	-15.76	-16.36	-0.60	VO2.5
V3O5	-64.68	-115.41	-50.72	V3O5
V4O7	-82.27	-145.03	-62.77	V4O7
V6O13	-88.55	-151.23	-62.68	V6O13
VCl2	-77.23	-82.11	-4.88	VCl2
VCl3	-80.93	-81.82	-0.89	VCl3
VMetal	-102.94	-82.68	20.26	V
VO	-46.17	-56.15	-9.98	VO
VO(OH)2	-17.73	-29.63	-11.90	VO(OH)2
VO2Cl	-32.42	-29.34	3.08	VO2Cl
VOCl	-42.16	-55.87	-13.71	VOCl
VOCl2	-51.41	-55.58	-4.17	VOCl2
VOSO4(C)	-43.58	-57.18	-13.60	VOSO4
Witherite	-2.77	-11.37	-8.60	BaCO3
Wurtzite	-80.01	-125.18	-45.17	ZnS
Zincite	-3.27	8.48	11.75	ZnO
Zincosite	-22.62	-19.07	3.55	ZnSO4
Zn(BO2)2	-13.79	-5.50	8.29	Zn(BO2)2
Zn(NO3)2:6H2O	-35.93	26.94	62.87	Zn(NO3)2:6H2O
Zn(OH)2(A)	-3.98	8.47	12.45	Zn(OH)2
Zn(OH)2(B)	-3.28	8.47	11.75	Zn(OH)2
Zn(OH)2(C)	-3.73	8.47	12.20	Zn(OH)2
Zn(OH)2(E)	-3.03	8.47	11.50	Zn(OH)2
Zn(OH)2(G)	-3.24	8.47	11.71	Zn(OH)2
Zn2(OH)2SO4	-18.10	-10.60	7.50	Zn2(OH)2SO4
Zn2(OH)3Cl	-11.22	3.98	15.20	Zn2(OH)3Cl
Zn3(AsO4)2:2.5H2O	-39.75	-26.10	13.65	Zn3(AsO4)2:2.5H2O
Zn3O(SO4)2	-50.41	-29.66	20.75	Zn3O(SO4)2
Zn4(OH)6SO4	-22.05	6.35	28.40	Zn4(OH)6SO4
Zn5(OH)8Cl2	-22.07	16.43	38.50	Zn5(OH)8Cl2
ZnCl2	-24.99	-17.47	7.52	ZnCl2
ZnCO3:H2O	-10.76	-21.02	-10.26	ZnCO3:H2O
ZnMetal	-44.83	-18.05	26.79	Zn
ZnO(Active)	-2.83	8.48	11.31	ZnO
ZnS(A)	-80.68	-125.18	-44.50	ZnS
ZnSO4:H2O	-18.81	-19.08	-0.27	ZnSO4:H2O

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End of simulation.  
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Reading input data for simulation 2.  
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End of run.  
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No memory leaks

Database file: minteq.dat

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Reading data base.  
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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH310a Low  
SOLUTION 1  
pH 10.05 charge  
temp 14.04  
pe 0.163  
units mg/L  
Al 0.0422  
As 0.00163 as H3AsO4  
Ba 0.109  
B 2.360  
Cd 0.00013  
Ca 717  
C 26.3  
Cl 16500  
Cu 0.00204  
Cr 0.123  
Pb 0.0007  
Mg 690  
Ni 0.00594  
N 0.82 as N03-  
K 342  
Na 10100  
S 2020 as SO4-2  
V 0.0229  
Zn 0.0061  
END

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TITLE  
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BH310a Low

-----  
 Beginning of initial solution calculations.  
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Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.613e-06	1.613e-06
As	1.184e-08	1.184e-08
B	2.252e-04	2.252e-04
Ba	8.185e-07	8.185e-07
C	4.445e-04	4.445e-04
Ca	1.845e-02	1.845e-02
Cd	1.193e-09	1.193e-09
Cl	4.800e-01	4.800e-01
Cr	2.440e-06	2.440e-06
Cu	3.311e-08	3.311e-08
K	9.021e-03	9.021e-03
Mg	2.927e-02	2.927e-02
N	2.013e-05	2.013e-05
Na	4.531e-01	4.531e-01
Ni	1.043e-07	1.043e-07
Pb	3.484e-09	3.484e-09
S	2.169e-02	2.169e-02
V	4.636e-07	4.636e-07
Zn	9.624e-08	9.624e-08

-----Description of solution-----

pH = 12.453    Charge balance  
 pe = 0.163  
 Activity of water = 0.983  
 Ionic strength = 5.752e-01  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 3.418e-02  
 Total CO2 (mol/kg) = 4.445e-04  
 Temperature (deg C) = 14.040  
 Electrical balance (eq) = -9.574e-16  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = -0.00  
 Iterations = 15  
 Total H = 1.110459e+02  
 Total O = 5.562808e+01

-----Distribution of species-----



Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	1.893e-02	1.185e-02	-1.723	-1.926	-0.203
H+	4.622e-13	3.526e-13	-12.335	-12.453	-0.118
H2O	5.551e+01	9.826e-01	-0.008	-0.008	0.000
Al	1.613e-06				
Al(OH)4-	1.613e-06	1.067e-06	-5.792	-5.972	-0.179
Al(OH)3	5.729e-11	6.540e-11	-10.242	-10.184	0.058
Al(OH)2+	2.709e-17	1.864e-17	-16.567	-16.729	-0.162
AlOH+2	1.787e-24	4.005e-25	-23.748	-24.397	-0.649
Al+3	3.453e-31	3.023e-32	-30.462	-31.520	-1.058
AlSO4+	9.230e-32	6.105e-32	-31.035	-31.214	-0.179
Al(SO4)2-	1.553e-32	1.028e-32	-31.809	-31.988	-0.179
As(3)	1.559e-27				
HAsO3-2	9.579e-28	2.906e-28	-27.019	-27.537	-0.518
AsO3-3	3.149e-28	2.152e-29	-27.502	-28.667	-1.165
H2AsO3-	2.857e-28	2.120e-28	-27.544	-27.674	-0.129
H3AsO3	1.689e-31	1.928e-31	-30.772	-30.715	0.058
H4AsO3+	0.000e+00	0.000e+00	-43.343	-43.472	-0.129
As(5)	1.184e-08				
AsO4-3	1.137e-08	7.770e-10	-7.944	-9.110	-1.165
HAsO4-2	4.714e-10	1.430e-10	-9.327	-9.845	-0.518
H2AsO4-	4.090e-16	3.036e-16	-15.388	-15.518	-0.129
H3AsO4	1.472e-26	1.680e-26	-25.832	-25.775	0.058
B	2.252e-04				
H2BO3-	2.251e-04	1.312e-04	-3.648	-3.882	-0.234
H3BO3	8.667e-08	9.895e-08	-7.062	-7.005	0.058
Ba	8.185e-07				
Ba+2	8.070e-07	1.693e-07	-6.093	-6.771	-0.678
BaOH+	1.156e-08	7.825e-09	-7.937	-8.107	-0.170
C(4)	4.445e-04				
NaCO3-	1.223e-04	8.417e-05	-3.912	-4.075	-0.162
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CO3-2	1.127e-04	2.526e-05	-3.948	-4.598	-0.649
MgCO3	9.260e-05	1.057e-04	-4.033	-3.976	0.058
HCO3-	3.569e-07	2.456e-07	-6.447	-6.610	-0.162
NaHCO3	2.994e-08	3.418e-08	-7.524	-7.466	0.058
MgHCO3+	2.106e-08	1.358e-08	-7.676	-7.867	-0.191
CaHCO3+	1.176e-08	8.274e-09	-7.930	-8.082	-0.153
NiCO3	5.738e-13	6.550e-13	-12.241	-12.184	0.058
H2CO3	1.526e-13	1.742e-13	-12.817	-12.759	0.058
CdCO3	9.776e-14	1.116e-13	-13.010	-12.952	0.058
Ni(CO3)2-2	9.477e-14	2.875e-14	-13.023	-13.541	-0.518
Zn(CO3)2-2	3.446e-16	1.046e-16	-15.463	-15.981	-0.518
ZnCO3	1.696e-16	1.936e-16	-15.771	-15.713	0.058
PbCO3	3.166e-17	3.614e-17	-16.500	-16.442	0.058

## BH310A July 2012 Eh=0.01

CuCO3	1.719e-17	1.963e-17	-16.765	-16.707	0.058
Pb(CO3)2-2	7.558e-18	2.293e-18	-17.122	-17.640	-0.518
Cu(CO3)2-2	2.057e-18	6.242e-19	-17.687	-18.205	-0.518
CdHCO3+	5.315e-19	3.945e-19	-18.274	-18.404	-0.129
NiHCO3+	1.239e-19	9.196e-20	-18.907	-19.036	-0.129
Cd(CO3)3-4	5.565e-20	4.716e-22	-19.255	-21.326	-2.072
ZnHCO3+	1.158e-21	8.594e-22	-20.936	-21.066	-0.129
CuHCO3+	1.737e-23	1.289e-23	-22.760	-22.890	-0.129
PbHCO3+	1.566e-23	1.162e-23	-22.805	-22.935	-0.129
Ca	1.845e-02				
Ca+2	1.492e-02	4.549e-03	-1.826	-2.342	-0.516
CaOH+	1.783e-03	1.254e-03	-2.749	-2.902	-0.153
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CaHCO3+	1.176e-08	8.274e-09	-7.930	-8.082	-0.153
Cd	1.193e-09				
Cd(OH)2	5.356e-10	6.114e-10	-9.271	-9.214	0.058
CdOHCl	3.803e-10	4.341e-10	-9.420	-9.362	0.058
Cd(OH)3-	2.576e-10	1.912e-10	-9.589	-9.719	-0.129
Cd(OH)4-2	1.565e-11	4.747e-12	-10.806	-11.324	-0.518
CdOH+	2.368e-12	1.757e-12	-11.626	-11.755	-0.129
CdCl+	6.477e-13	4.807e-13	-12.189	-12.318	-0.129
CdCl2	4.992e-13	5.699e-13	-12.302	-12.244	0.058
CdCl3-	1.208e-13	8.964e-14	-12.918	-13.047	-0.129
CdCO3	9.776e-14	1.116e-13	-13.010	-12.952	0.058
Cd+2	5.810e-14	1.763e-14	-13.236	-13.754	-0.518
CdSO4	9.203e-15	1.051e-14	-14.036	-13.979	0.058
Cd(SO4)2-2	9.017e-16	2.736e-16	-15.045	-15.563	-0.518
CdHCO3+	5.315e-19	3.945e-19	-18.274	-18.404	-0.129
Cd(CO3)3-4	5.565e-20	4.716e-22	-19.255	-21.326	-2.072
CdNO3+	3.341e-23	2.480e-23	-22.476	-22.606	-0.129
Cd2OH+3	2.559e-24	1.748e-25	-23.592	-24.757	-1.165
CdHS+	0.000e+00	0.000e+00	-84.114	-84.244	-0.129
Cd(HS)2	0.000e+00	0.000e+00	-158.601	-158.544	0.058
Cd(HS)3-	0.000e+00	0.000e+00	-236.894	-237.023	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-314.975	-315.493	-0.518
Cl	4.800e-01				
Cl-	4.800e-01	2.966e-01	-0.319	-0.528	-0.209
CdOHCl	3.803e-10	4.341e-10	-9.420	-9.362	0.058
CuCl3-2	2.875e-12	6.031e-13	-11.541	-12.220	-0.678
CuCl2-	2.079e-12	1.341e-12	-11.682	-11.873	-0.191
ZnOHCl	9.207e-13	1.051e-12	-12.036	-11.978	0.058
CdCl+	6.477e-13	4.807e-13	-12.189	-12.318	-0.129
CdCl2	4.992e-13	5.699e-13	-12.302	-12.244	0.058
CdCl3-	1.208e-13	8.964e-14	-12.918	-13.047	-0.129
NiCl+	3.503e-15	2.600e-15	-14.456	-14.585	-0.129
NiCl2	2.458e-15	2.806e-15	-14.609	-14.552	0.058
ZnCl+	2.879e-17	1.856e-17	-16.541	-16.731	-0.191

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ZnCl2	4.824e-18	5.507e-18	-17.317	-17.259	0.058
ZnCl3-	2.655e-18	1.712e-18	-17.576	-17.767	-0.191
ZnCl4-2	1.105e-18	2.319e-19	-17.956	-18.635	-0.678
PbCl+	9.877e-19	7.330e-19	-18.005	-18.135	-0.129
PbCl2	3.733e-19	4.261e-19	-18.428	-18.370	0.058
PbCl3-	1.258e-19	9.337e-20	-18.900	-19.030	-0.129
CuCl+	1.026e-19	6.616e-20	-18.989	-19.179	-0.191
PbCl4-2	4.011e-20	1.217e-20	-19.397	-19.915	-0.518
CuCl2	8.162e-21	9.317e-21	-20.088	-20.031	0.058
CuCl3-	1.243e-23	8.014e-24	-22.905	-23.096	-0.191
CrOHCl2	2.232e-24	2.548e-24	-23.651	-23.594	0.058
CuCl4-2	8.308e-26	1.743e-26	-25.080	-25.759	-0.678
CrO3Cl-	7.752e-27	5.753e-27	-26.111	-26.240	-0.129
CrCl+2	6.309e-29	1.914e-29	-28.200	-28.718	-0.518
CrCl2+	1.117e-30	8.292e-31	-29.952	-30.081	-0.129
VOCl+	3.163e-37	2.348e-37	-36.500	-36.629	-0.129
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-60.401	-60.919	-0.518
Cr(2)	1.508e-35				
Cr+2	1.508e-35	4.574e-36	-34.822	-35.340	-0.518
Cr(3)	2.380e-06				
CrO2-	1.712e-06	1.271e-06	-5.766	-5.896	-0.129
Cr(OH)4-	6.515e-07	4.835e-07	-6.186	-6.316	-0.129
Cr(OH)3	1.592e-08	1.817e-08	-7.798	-7.741	0.058
Cr(OH)2+	1.185e-13	8.797e-14	-12.926	-13.056	-0.129
Cr(OH)+2	4.337e-20	1.316e-20	-19.363	-19.881	-0.518
CrOHSO4	1.155e-20	1.319e-20	-19.937	-19.880	0.058
CrOHCl2	2.232e-24	2.548e-24	-23.651	-23.594	0.058
Cr+3	2.529e-27	1.728e-28	-26.597	-27.762	-1.165
CrCl+2	6.309e-29	1.914e-29	-28.200	-28.718	-0.518
CrSO4+	7.040e-30	5.225e-30	-29.152	-29.282	-0.129
CrCl2+	1.117e-30	8.292e-31	-29.952	-30.081	-0.129
Cr(NH3)4(OH)2+	2.807e-37	2.083e-37	-36.552	-36.681	-0.129
Cr2(OH)2SO4+2	1.040e-37	3.155e-38	-36.983	-37.501	-0.518
CrNO3+2	6.650e-39	2.018e-39	-38.177	-38.695	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-41.840	-41.783	0.058
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-47.469	-47.987	-0.518
Cr(NH3)6+3	0.000e+00	0.000e+00	-60.003	-61.169	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-60.401	-60.919	-0.518
Cr(6)	6.005e-08				
CrO4-2	4.360e-08	7.532e-09	-7.360	-8.123	-0.763
NaCrO4-	1.609e-08	1.195e-08	-7.793	-7.923	-0.129
KCrO4-	3.520e-10	2.613e-10	-9.453	-9.583	-0.129
HCrO4-	1.090e-14	8.091e-15	-13.963	-14.092	-0.129
Cr2O7-2	1.035e-26	3.141e-27	-25.985	-26.503	-0.518
CrO3Cl-	7.752e-27	5.753e-27	-26.111	-26.240	-0.129
CrO3SO4-2	6.860e-27	2.081e-27	-26.164	-26.682	-0.518
H2CrO4	3.676e-28	4.197e-28	-27.435	-27.377	0.058
Cu(1)	4.954e-12				

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CuCl3-2	2.875e-12	6.031e-13	-11.541	-12.220	-0.678
CuCl2-	2.079e-12	1.341e-12	-11.682	-11.873	-0.191
Cu+	8.048e-17	4.691e-17	-16.094	-16.329	-0.234
Cu(2)	3.310e-08				
Cu(OH)2	2.056e-08	2.347e-08	-7.687	-7.629	0.058
Cu(OH)4-2	7.222e-09	2.191e-09	-8.141	-8.659	-0.518
Cu(OH)3-	5.322e-09	3.950e-09	-8.274	-8.403	-0.129
CuOH+	6.254e-15	4.032e-15	-14.204	-14.395	-0.191
CuCO3	1.719e-17	1.963e-17	-16.765	-16.707	0.058
Cu(CO3)2-2	2.057e-18	6.242e-19	-17.687	-18.205	-0.518
Cu+2	1.253e-18	1.447e-19	-17.902	-18.840	-0.938
CuCl+	1.026e-19	6.616e-20	-18.989	-19.179	-0.191
CuSO4	5.299e-20	6.050e-20	-19.276	-19.218	0.058
CuCl2	8.162e-21	9.317e-21	-20.088	-20.031	0.058
CuHCO3+	1.737e-23	1.289e-23	-22.760	-22.890	-0.129
CuCl3-	1.243e-23	8.014e-24	-22.905	-23.096	-0.191
Cu2(OH)2+2	7.575e-24	2.298e-24	-23.121	-23.639	-0.518
CuCl4-2	8.308e-26	1.743e-26	-25.080	-25.759	-0.678
Cu(S4)2-3	0.000e+00	0.000e+00	-148.843	-149.353	-0.510
CuS4S5-3	0.000e+00	0.000e+00	-149.608	-150.083	-0.475
Cu(HS)3-	0.000e+00	0.000e+00	-234.791	-234.920	-0.129
H(0)	8.154e-29				
H2	4.077e-29	4.654e-29	-28.390	-28.332	0.058
K	9.021e-03				
K+	8.918e-03	5.510e-03	-2.050	-2.259	-0.209
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
KCrO4-	3.520e-10	2.613e-10	-9.453	-9.583	-0.129
Mg	2.927e-02				
Mg+2	1.520e-02	5.190e-03	-1.818	-2.285	-0.467
MgOH+	1.235e-02	8.833e-03	-1.909	-2.054	-0.145
MgSO4	1.636e-03	1.868e-03	-2.786	-2.729	0.058
MgCO3	9.260e-05	1.057e-04	-4.033	-3.976	0.058
MgHCO3+	2.106e-08	1.358e-08	-7.676	-7.867	-0.191
N(-3)	8.089e-09				
NH3	8.066e-09	9.209e-09	-8.093	-8.036	0.058
NH4+	2.186e-11	1.274e-11	-10.660	-10.895	-0.234
NH4SO4-	5.374e-13	3.637e-13	-12.270	-12.439	-0.170
Cr(NH3)4(OH)2+	2.807e-37	2.083e-37	-36.552	-36.681	-0.129
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-47.469	-47.987	-0.518
Cr(NH3)6+3	0.000e+00	0.000e+00	-60.003	-61.169	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-60.401	-60.919	-0.518
N(3)	2.012e-05				
NO2-	2.012e-05	1.493e-05	-4.696	-4.826	-0.129
N(5)	6.629e-10				
NO3-	6.629e-10	4.015e-10	-9.179	-9.396	-0.218
CdNO3+	3.341e-23	2.480e-23	-22.476	-22.606	-0.129
PbNO3+	6.588e-28	4.889e-28	-27.181	-27.311	-0.129
CrNO3+2	6.650e-39	2.018e-39	-38.177	-38.695	-0.518

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VO2NO3	2.020e-39	2.306e-39	-38.695	-38.637	0.058
Na	4.531e-01				
Na+	4.482e-01	3.191e-01	-0.349	-0.496	-0.148
NaSO4-	4.791e-03	3.296e-03	-2.320	-2.482	-0.162
NaCO3-	1.223e-04	8.417e-05	-3.912	-4.075	-0.162
NaHCO3	2.994e-08	3.418e-08	-7.524	-7.466	0.058
NaCrO4-	1.609e-08	1.195e-08	-7.793	-7.923	-0.129
Ni	1.043e-07				
Ni(OH)3-	1.020e-07	7.568e-08	-6.992	-7.121	-0.129
Ni(OH)2	2.379e-09	2.716e-09	-8.624	-8.566	0.058
NiOH+	8.146e-13	6.045e-13	-12.089	-12.219	-0.129
NiCO3	5.738e-13	6.550e-13	-12.241	-12.184	0.058
Ni(CO3)2-2	9.477e-14	2.875e-14	-13.023	-13.541	-0.518
Ni+2	1.153e-14	3.498e-15	-13.938	-14.456	-0.518
NiCl+	3.503e-15	2.600e-15	-14.456	-14.585	-0.129
NiCl2	2.458e-15	2.806e-15	-14.609	-14.552	0.058
NiSO4	1.200e-15	1.370e-15	-14.921	-14.863	0.058
Ni(SO4)2-2	5.924e-19	1.797e-19	-18.227	-18.745	-0.518
NiHCO3+	1.239e-19	9.196e-20	-18.907	-19.036	-0.129
O(0)	6.927e-40				
O2	3.463e-40	3.954e-40	-39.461	-39.403	0.058
Pb	3.484e-09				
Pb(OH)4-2	3.271e-09	9.925e-10	-8.485	-9.003	-0.518
Pb(OH)3-	2.090e-10	1.551e-10	-9.680	-9.809	-0.129
Pb(OH)2	4.247e-12	4.849e-12	-11.372	-11.314	0.058
PbOH+	6.026e-15	4.473e-15	-14.220	-14.349	-0.129
PbCO3	3.166e-17	3.614e-17	-16.500	-16.442	0.058
Pb(CO3)2-2	7.558e-18	2.293e-18	-17.122	-17.640	-0.518
PbCl+	9.877e-19	7.330e-19	-18.005	-18.135	-0.129
PbCl2	3.733e-19	4.261e-19	-18.428	-18.370	0.058
Pb+2	2.713e-19	8.232e-20	-18.567	-19.084	-0.518
PbCl3-	1.258e-19	9.337e-20	-18.900	-19.030	-0.129
PbSO4	8.983e-20	1.026e-19	-19.047	-18.989	0.058
PbCl4-2	4.011e-20	1.217e-20	-19.397	-19.915	-0.518
Pb(SO4)2-2	3.930e-21	1.192e-21	-20.406	-20.924	-0.518
PbHCO3+	1.566e-23	1.162e-23	-22.805	-22.935	-0.129
PbNO3+	6.588e-28	4.889e-28	-27.181	-27.311	-0.129
Pb2OH+3	1.206e-31	8.243e-33	-30.918	-32.084	-1.165
Pb3(OH)4+2	2.651e-32	8.044e-33	-31.577	-32.095	-0.518
Pb(HS)2	0.000e+00	0.000e+00	-165.192	-165.134	0.058
Pb(HS)3-	0.000e+00	0.000e+00	-244.365	-244.494	-0.129
S(-2)	0.000e+00				
S5-2	0.000e+00	0.000e+00	-77.544	-78.062	-0.518
S6-2	0.000e+00	0.000e+00	-77.570	-78.088	-0.518
S4-2	0.000e+00	0.000e+00	-77.790	-78.308	-0.518
HS-	0.000e+00	0.000e+00	-80.457	-80.660	-0.203
S-2	0.000e+00	0.000e+00	-80.785	-81.464	-0.678
S3-2	0.000e+00	0.000e+00	-81.262	-81.780	-0.518

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S2-2	0.000e+00	0.000e+00	-82.536	-83.054	-0.518
CdHS+	0.000e+00	0.000e+00	-84.114	-84.244	-0.129
H2S	0.000e+00	0.000e+00	-86.070	-86.013	0.058
Cu(S4)2-3	0.000e+00	0.000e+00	-148.843	-149.353	-0.510
CuS4S5-3	0.000e+00	0.000e+00	-149.608	-150.083	-0.475
Cd(HS)2	0.000e+00	0.000e+00	-158.601	-158.544	0.058
Zn(HS)2	0.000e+00	0.000e+00	-162.853	-162.795	0.058
Pb(HS)2	0.000e+00	0.000e+00	-165.192	-165.134	0.058
Cu(HS)3-	0.000e+00	0.000e+00	-234.791	-234.920	-0.129
Cd(HS)3-	0.000e+00	0.000e+00	-236.894	-237.023	-0.129
Zn(HS)3-	0.000e+00	0.000e+00	-242.166	-242.295	-0.129
Pb(HS)3-	0.000e+00	0.000e+00	-244.365	-244.494	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-314.975	-315.493	-0.518
S(6)	2.169e-02				
SO4-2	1.352e-02	2.215e-03	-1.869	-2.655	-0.786
NaSO4-	4.791e-03	3.296e-03	-2.320	-2.482	-0.162
MgSO4	1.636e-03	1.868e-03	-2.786	-2.729	0.058
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
NH4SO4-	5.374e-13	3.637e-13	-12.270	-12.439	-0.170
HSO4-	8.501e-14	5.623e-14	-13.071	-13.250	-0.179
CdSO4	9.203e-15	1.051e-14	-14.036	-13.979	0.058
NiSO4	1.200e-15	1.370e-15	-14.921	-14.863	0.058
Cd(SO4)2-2	9.017e-16	2.736e-16	-15.045	-15.563	-0.518
ZnSO4	1.601e-17	1.827e-17	-16.796	-16.738	0.058
Zn(SO4)2-2	1.184e-18	3.592e-19	-17.927	-18.445	-0.518
Ni(SO4)2-2	5.924e-19	1.797e-19	-18.227	-18.745	-0.518
PbSO4	8.983e-20	1.026e-19	-19.047	-18.989	0.058
CuSO4	5.299e-20	6.050e-20	-19.276	-19.218	0.058
CrOHSO4	1.155e-20	1.319e-20	-19.937	-19.880	0.058
Pb(SO4)2-2	3.930e-21	1.192e-21	-20.406	-20.924	-0.518
CrO3SO4-2	6.860e-27	2.081e-27	-26.164	-26.682	-0.518
CrSO4+	7.040e-30	5.225e-30	-29.152	-29.282	-0.129
VO2SO4-	2.366e-30	1.756e-30	-29.626	-29.756	-0.129
AlSO4+	9.230e-32	6.105e-32	-31.035	-31.214	-0.179
Al(SO4)2-	1.553e-32	1.028e-32	-31.809	-31.988	-0.179
VOSO4	3.254e-37	3.714e-37	-36.488	-36.430	0.058
Cr2(OH)2SO4+2	1.040e-37	3.155e-38	-36.983	-37.501	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-41.840	-41.783	0.058
VSO4+	0.000e+00	0.000e+00	-56.170	-56.300	-0.129
V(2)	0.000e+00				
VOH+	0.000e+00	0.000e+00	-52.793	-52.922	-0.129
V+2	0.000e+00	0.000e+00	-59.209	-59.727	-0.518
V(3)	1.488e-29				
V(OH)3	1.488e-29	1.698e-29	-28.828	-28.770	0.058
V(OH)2+	1.272e-36	9.440e-37	-35.896	-36.025	-0.129
VOH+2	0.000e+00	0.000e+00	-44.684	-45.202	-0.518
V+3	0.000e+00	0.000e+00	-53.920	-55.085	-1.165

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VSO4+	0.000e+00	0.000e+00	-56.170	-56.300	-0.129
V2(OH)3+3	0.000e+00	0.000e+00	-79.170	-80.335	-1.165
V2(OH)2+4	0.000e+00	0.000e+00	-86.958	-89.030	-2.072
V(4)	5.963e-30				
V(OH)3+	5.963e-30	4.425e-30	-29.225	-29.354	-0.129
VO+2	2.492e-36	7.560e-37	-35.604	-36.121	-0.518
VOSO4	3.254e-37	3.714e-37	-36.488	-36.430	0.058
VOCI+	3.163e-37	2.348e-37	-36.500	-36.629	-0.129
H2V2O4+2	0.000e+00	0.000e+00	-53.275	-53.793	-0.518
V(5)	4.636e-07				
HVO4-2	3.035e-07	9.209e-08	-6.518	-7.036	-0.518
VO4-3	1.598e-07	1.092e-08	-6.796	-7.962	-1.165
V2O7-4	1.157e-10	9.802e-13	-9.937	-12.009	-2.072
HV2O7-3	2.911e-11	1.989e-12	-10.536	-11.701	-1.165
H2VO4-	6.335e-12	4.702e-12	-11.198	-11.328	-0.129
H3VO4	9.368e-21	1.069e-20	-20.028	-19.971	0.058
H3V2O7-	1.129e-24	8.381e-25	-23.947	-24.077	-0.129
V3O9-3	3.514e-27	2.401e-28	-26.454	-27.620	-1.165
VO2+	2.082e-29	1.545e-29	-28.681	-28.811	-0.129
VO2SO4-	2.366e-30	1.756e-30	-29.626	-29.756	-0.129
V4O12-4	4.257e-35	3.607e-37	-34.371	-36.443	-2.072
VO2NO3	2.020e-39	2.306e-39	-38.695	-38.637	0.058
V10O28-6	0.000e+00	0.000e+00	-101.796	-106.457	-4.662
HV10O28-5	0.000e+00	0.000e+00	-110.095	-113.332	-3.237
H2V10O28-4	0.000e+00	0.000e+00	-119.471	-121.543	-2.072
Zn	9.624e-08				
Zn(OH)4-2	4.826e-08	1.464e-08	-7.316	-7.834	-0.518
Zn(OH)3-	4.468e-08	3.316e-08	-7.350	-7.479	-0.129
Zn(OH)2	3.296e-09	3.763e-09	-8.482	-8.424	0.058
ZnOHCl	9.207e-13	1.051e-12	-12.036	-11.978	0.058
ZnOH+	6.671e-14	4.951e-14	-13.176	-13.305	-0.129
Zn(CO3)2-2	3.446e-16	1.046e-16	-15.463	-15.981	-0.518
ZnCO3	1.696e-16	1.936e-16	-15.771	-15.713	0.058
Zn+2	1.567e-16	3.841e-17	-15.805	-16.416	-0.611
ZnCl+	2.879e-17	1.856e-17	-16.541	-16.731	-0.191
ZnSO4	1.601e-17	1.827e-17	-16.796	-16.738	0.058
ZnCl2	4.824e-18	5.507e-18	-17.317	-17.259	0.058
ZnCl3-	2.655e-18	1.712e-18	-17.576	-17.767	-0.191
Zn(SO4)2-2	1.184e-18	3.592e-19	-17.927	-18.445	-0.518
ZnCl4-2	1.105e-18	2.319e-19	-17.956	-18.635	-0.678
ZnHCO3+	1.158e-21	8.594e-22	-20.936	-21.066	-0.129
Zn(HS)2	0.000e+00	0.000e+00	-162.853	-162.795	0.058
Zn(HS)3-	0.000e+00	0.000e+00	-242.166	-242.295	-0.129

-----Saturation indices-----

Phase            SI log IAP   log KT

(NH4)2CrO4	-30.26	-29.91	0.34	(NH4)2CrO4
Al(OH)3(a)	-5.32	5.82	11.14	Al(OH)3
Al2O3	-11.33	11.65	22.98	Al2O3
Al4(OH)10SO4	-26.98	-4.28	22.70	Al4(OH)10SO4
AlAsO4:2H2O	-24.75	-19.95	4.80	AlAsO4:2H2O
AlOHSO4	-18.50	-21.73	-3.23	AlOHSO4
AlumK	-33.81	-39.18	-5.37	KAl(SO4)2:12H2O
Alunite	-26.00	-27.46	-1.46	KAl3(SO4)2(OH)6
Anglesite	-13.89	-21.74	-7.85	PbSO4
Anhydrite	-0.47	-5.00	-4.53	CaSO4
Anilite	-64.31	-136.76	-72.45	Cu0.25Cu1.5S
Antlerite	-17.68	-9.39	8.29	Cu3(OH)4SO4
Aragonite	1.33	-6.94	-8.27	CaCO3
Arsenolite	-119.61	-203.95	-84.34	As4O6
Artinite	5.30	15.70	10.40	MgCO3:Mg(OH)2:3H2O
As2O5	-58.38	-51.53	6.85	As2O5
Atacamite	-8.73	-0.87	7.86	Cu2(OH)3Cl
Azurite	-24.57	-40.82	-16.26	Cu3(OH)2(CO3)2
Ba3(AsO4)2	11.84	2.85	-8.98	Ba3(AsO4)2
BaCrO4	-5.05	-14.89	-9.85	BaCrO4
Barite	0.73	-9.43	-10.15	BaSO4
Bianchite	-17.36	-19.12	-1.76	ZnSO4:6H2O
Blaubleil	-64.27	-124.31	-60.04	Cu0.9Cu0.2S
Blaubleill	-65.29	-130.06	-64.76	Cu0.6Cu0.8S
Boehmite	-3.54	5.82	9.36	AlOOH
Brochantite	-18.68	-3.34	15.34	Cu4(OH)6SO4
Brucite	5.09	22.61	17.51	Mg(OH)2
Bunsenite	-2.68	10.44	13.12	NiO
Ca2V2O7	-3.09	6.19	9.28	CaVO3.5
Ca3(AsO4)2:6H2O	-6.21	16.09	22.30	Ca3(AsO4)2:6H2O
Ca3(VO4)2	-2.99	17.47	20.46	Ca1.5VO4
Ca_Vanadate	-8.20	-5.08	3.11	Ca0.5VO3
CaCrO4	-8.38	-10.47	-2.09	CaCrO4
Calcite	1.48	-6.94	-8.42	CaCO3
Cd(BO2)2	-12.68	-2.84	9.84	Cd(BO2)2
Cd(Gamma)	-28.18	-14.08	14.10	Cd
Cd(OH)2(A)	-3.17	11.14	14.31	Cd(OH)2
Cd(OH)2(C)	-2.51	11.14	13.65	Cd(OH)2
Cd3(OH)2(SO4)2	-28.39	-21.68	6.71	Cd3(OH)2(SO4)2
Cd3(OH)4SO4	-16.70	5.86	22.56	Cd3(OH)4SO4
Cd4(OH)6SO4	-11.40	17.00	28.40	Cd4(OH)6SO4
CdCl2	-14.25	-14.81	-0.55	CdCl2
CdCl2:2.5H2O	-12.84	-14.83	-1.99	CdCl2:2.5H2O
CdCl2:H2O	-13.16	-14.82	-1.66	CdCl2:H2O
CdMetal	-28.07	-14.08	13.99	Cd
CdOHCl	-5.56	-1.84	3.73	CdOHCl
CdSO4	-16.72	-16.41	0.31	CdSO4
CdSO4:2.67H2O	-14.68	-16.43	-1.75	CdSO4:2.67H2O



CdSO4:H2O -14.97 -16.42 -1.45 CdSO4:H2O  
 Cerrusite -10.42 -23.68 -13.27 PbCO3  
 CH4(g) -88.60 -130.41 -41.81 CH4  
 Chalcantite -18.85 -21.53 -2.68 CuSO4:5H2O  
 Chalcocite -64.87 -141.55 -76.69 Cu2S  
 Claudetite -119.38 -203.95 -84.57 As4O6  
 CO2(g) -11.32 -29.50 -18.17 CO2  
 Cotunnite -15.21 -20.14 -4.93 PbCl2  
 Covellite -63.34 -122.39 -59.05 CuS  
 Cr(OH)2 -21.51 -83.48 -61.97 Cr(OH)2  
 Cr(OH)3(A) 0.14 -70.87 -71.01 Cr(OH)3  
 Cr(OH)3(C) -2.51 -70.87 -68.36 Cr(OH)3  
 Cr2O3 1.86 -141.71 -143.57 Cr2O3  
 CrCl2 -52.81 -109.42 -56.61 CrCl2  
 CrCl3 -53.81 -109.79 -55.98 CrCl3  
 CrMetal -68.87 -108.69 -39.82 Cr  
 CrO3 -29.85 -33.02 -3.18 CrO3  
 Cu(OH)2 -3.02 6.05 9.07 Cu(OH)2  
 Cu2(OH)3NO3 -19.47 114.57 134.03 Cu2(OH)3NO3  
 Cu2SO4 -33.49 -40.66 -7.17 Cu2SO4  
 Cu3(AsO4)2:6H2O -39.50 -33.40 6.10 Cu3(AsO4)2:6H2O  
 CuCO3 -13.81 -23.44 -9.63 CuCO3  
 CuCrO4 -21.49 -26.96 -5.48 CuCrO4  
 CuMetal -7.25 -19.17 -11.91 Cu  
 CuOCuSO4 -27.96 -15.44 12.53 CuO:CuSO4  
 Cuprite -6.04 -13.11 -7.07 Cu2O  
 CuSO4 -25.01 -21.49 3.52 CuSO4  
 Diaspore -1.74 5.82 7.56 AlOOH  
 Djurleite -64.69 -140.29 -75.60 Cu0.066Cu1.868S  
 Dolomite 2.95 -13.82 -16.77 CaMg(CO3)2  
 Epsomite -2.77 -4.99 -2.22 MgSO4:7H2O  
 Galena -71.62 -122.63 -51.02 PbS  
 Gibbsite(C) -3.59 5.82 9.41 Al(OH)3  
 Goslarite -17.07 -19.12 -2.05 ZnSO4:7H2O  
 Greenockite -65.57 -117.30 -51.73 CdS  
 Gypsum -0.16 -5.01 -4.86 CaSO4:2H2O  
 Halite -2.58 -1.02 1.56 NaCl  
 Huntite 1.66 -27.59 -29.25 CaMg3(CO3)4  
 Hydrcerrusite -24.10 -41.56 -17.46 Pb(OH)2:2PbCO3  
 Hydromagnesite 2.35 -4.95 -7.31 Mg5(CO3)4(OH)2:4H2O  
 K2Cr2O7 -29.48 -45.66 -16.18 K2Cr2O7  
 K2CrO4 -12.53 -12.64 -0.11 K2CrO4  
 Langite -21.25 -3.35 17.90 Cu4(OH)6SO4:H2O  
 Larnakite -15.83 -15.93 -0.10 PbO:PbSO4  
 Laurionite -7.79 -7.17 0.62 PbOHCl  
 Lime -11.54 22.56 34.09 CaO  
 Litharge -7.36 5.81 13.18 PbO  
 Magnesite 0.97 -6.88 -7.86 MgCO3

Malachite	-12.64	-17.39	-4.74	Cu <sub>2</sub> (OH) <sub>2</sub> CO <sub>3</sub>
Massicot	-7.57	5.81	13.38	PbO
Melanothallite	-23.97	-19.90	4.07	CuCl <sub>2</sub>
Mg <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-7.78	6.25	14.03	MgVO <sub>3.5</sub>
Mg_Vanadate	-11.15	-5.06	6.10	Mg <sub>0.5</sub> VO <sub>3</sub>
MgCr <sub>2</sub> O <sub>4</sub>	8.22	-119.10	-127.32	MgCr <sub>2</sub> O <sub>4</sub>
MgCrO <sub>4</sub>	-16.38	-10.41	5.97	MgCrO <sub>4</sub>
Millerite	-74.55	-118.01	-43.45	NiS
Minium	-33.90	42.66	76.56	Pb <sub>3</sub> O <sub>4</sub>
Mirabilite	-2.08	-3.72	-1.65	Na <sub>2</sub> SO <sub>4</sub> :10H <sub>2</sub> O
Monteponite	-4.67	11.14	15.81	CdO
Morenosite	-14.72	-17.16	-2.44	NiSO <sub>4</sub> :7H <sub>2</sub> O
Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-32.09	-42.14	-10.04	Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
Na <sub>2</sub> CrO <sub>4</sub>	-12.51	-9.12	3.39	Na <sub>2</sub> CrO <sub>4</sub>
Na <sub>3</sub> VO <sub>4</sub>	-18.69	19.50	38.18	Na <sub>3</sub> VO <sub>4</sub>
Na <sub>4</sub> V <sub>2</sub> O <sub>7</sub>	-11.83	7.54	19.37	Na <sub>2</sub> VO <sub>3.5</sub>
Na_Vanadate	-8.32	-4.41	3.91	NaVO <sub>3</sub>
Nantokite	-9.82	-19.53	-9.71	CuCl
Natron	-3.91	-5.67	-1.75	Na <sub>2</sub> CO <sub>3</sub> :10H <sub>2</sub> O
Nesquehonite	-1.45	-6.91	-5.46	MgCO <sub>3</sub> :3H <sub>2</sub> O
NH <sub>4</sub> VO <sub>3</sub>	-17.60	-14.81	2.80	NH <sub>4</sub> VO <sub>3</sub>
Ni(OH) <sub>2</sub>	0.49	10.43	9.95	Ni(OH) <sub>2</sub>
Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-35.96	-20.26	15.70	Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-17.81	14.19	32.00	Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
NiCO <sub>3</sub>	-12.49	-19.05	-6.56	NiCO <sub>3</sub>
O <sub>2</sub> (g)	-36.42	50.45	86.86	O <sub>2</sub>
Oripment	-277.43	-487.32	-209.88	As <sub>2</sub> S <sub>3</sub>
Otavite	-4.63	-18.35	-13.72	CdCO <sub>3</sub>
Pb(BO <sub>2</sub> ) <sub>2</sub>	-15.95	-8.17	7.77	Pb(BO <sub>2</sub> ) <sub>2</sub>
Pb(OH) <sub>2</sub> (C)	-2.74	5.81	8.54	Pb(OH) <sub>2</sub>
Pb <sub>2</sub> (OH) <sub>3</sub> Cl	-10.15	-1.36	8.79	Pb <sub>2</sub> (OH) <sub>3</sub> Cl
Pb <sub>2</sub> O(OH) <sub>2</sub>	-14.58	11.62	26.20	Pb <sub>2</sub> O(OH) <sub>2</sub>
Pb <sub>2</sub> O <sub>3</sub>	-24.19	36.85	61.04	Pb <sub>2</sub> O <sub>3</sub>
Pb <sub>2</sub> OCO <sub>3</sub>	-17.69	-17.87	-0.18	Pb <sub>2</sub> OCO <sub>3</sub>
Pb <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-9.69	-10.55	-0.86	PbVO <sub>3.5</sub>
Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>	-39.89	-34.09	5.80	Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>
Pb <sub>3</sub> (VO <sub>4</sub> ) <sub>2</sub>	-10.96	-7.64	3.31	Pb <sub>1.5</sub> VO <sub>4</sub>
Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>	-23.81	-12.06	11.76	Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>
Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>	-21.09	-10.11	10.98	Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>
Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-25.42	-4.32	21.10	Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>	-27.38	-4.30	23.08	Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>
PbCrO <sub>4</sub>	-13.24	-27.21	-13.97	PbCrO <sub>4</sub>
PbMetal	-23.67	-19.41	4.26	Pb
PbO:0.3H <sub>2</sub> O	-7.17	5.81	12.98	PbO:0.33H <sub>2</sub> O
Periclase	0.09	22.61	22.52	MgO
Phosgenite	-24.01	-43.82	-19.81	PbCl <sub>2</sub> :PbCO <sub>3</sub>
Plattnerite	-20.24	31.04	51.28	PbO <sub>2</sub>
Portlandite	-0.99	22.55	23.53	Ca(OH) <sub>2</sub>

Realgar	-115.82	-192.05	-76.23	AsS
Retgersite	-15.09	-17.16	-2.07	NiSO4:6H2O
Smithsonite	-11.14	-21.01	-9.88	ZnCO3
Sphalerite	-72.77	-119.97	-47.19	ZnS
Spinel	-4.56	34.27	38.83	MgAl2O4
SULFUR	-65.89	-103.22	-37.33	S
Tenorite	-1.99	6.06	8.05	CuO
Thenardite	-3.48	-3.65	-0.16	Na2SO4
Thermonatrite	-5.80	-5.60	0.20	Na2CO3:H2O
V(OH)3	-25.40	-41.60	-16.20	V(OH)3
V2O3	-23.19	-41.59	-18.40	VO1.5
V2O4	-15.89	-28.97	-13.09	VO2
V2O5	-15.76	-16.36	-0.60	VO2.5
V3O5	-61.42	-112.15	-50.72	V3O5
V4O7	-78.35	-141.12	-62.77	V4O7
V6O13	-85.94	-148.62	-62.68	V6O13
VCl2	-75.28	-80.15	-4.88	VCl2
VCl3	-79.63	-80.52	-0.89	VCl3
VMetal	-99.68	-79.42	20.26	V
VO	-44.21	-54.20	-9.98	VO
VO(OH)2	-17.08	-28.98	-11.90	VO(OH)2
VO2Cl	-32.42	-29.34	3.08	VO2Cl
VOCl	-40.86	-54.56	-13.71	VOCl
VOCl2	-50.76	-54.93	-4.17	VOCl2
VOSO4(C)	-42.93	-56.53	-13.60	VOSO4
Witherite	-2.77	-11.37	-8.60	BaCO3
Wurtzite	-74.80	-119.97	-45.17	ZnS
Zincite	-3.27	8.48	11.75	ZnO
Zincosite	-22.62	-19.07	3.55	ZnSO4
Zn(BO2)2	-13.79	-5.50	8.29	Zn(BO2)2
Zn(NO3)2:6H2O	-38.54	213.37	251.90	Zn(NO3)2:6H2O
Zn(OH)2(A)	-3.98	8.47	12.45	Zn(OH)2
Zn(OH)2(B)	-3.28	8.47	11.75	Zn(OH)2
Zn(OH)2(C)	-3.73	8.47	12.20	Zn(OH)2
Zn(OH)2(E)	-3.03	8.47	11.50	Zn(OH)2
Zn(OH)2(G)	-3.24	8.47	11.71	Zn(OH)2
Zn2(OH)2SO4	-18.10	-10.60	7.50	Zn2(OH)2SO4
Zn2(OH)3Cl	-11.22	3.98	15.20	Zn2(OH)3Cl
Zn3(AsO4)2:2.5H2O	-39.75	-26.10	13.65	Zn3(AsO4)2:2.5H2O
Zn3O(SO4)2	-50.41	-29.66	20.75	Zn3O(SO4)2
Zn4(OH)6SO4	-22.05	6.35	28.40	Zn4(OH)6SO4
Zn5(OH)8Cl2	-22.07	16.43	38.50	Zn5(OH)8Cl2
ZnCl2	-24.99	-17.47	7.52	ZnCl2
ZnCO3:H2O	-10.76	-21.02	-10.26	ZnCO3:H2O
ZnMetal	-43.53	-16.74	26.79	Zn
ZnO(Active)	-2.83	8.48	11.31	ZnO
ZnS(A)	-75.47	-119.97	-44.50	ZnS
ZnSO4:H2O	-18.81	-19.08	-0.27	ZnSO4:H2O

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End of simulation.  
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Reading input data for simulation 2.  
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End of run.  
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No memory leaks

Database file: minteq.dat

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Reading data base.

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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

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Reading input data for simulation 1.

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TITLE BH310a Low  
SOLUTION 1  
pH 10.05 charge  
temp 14.04  
pe 3.26  
units mg/L  
Al 0.0422  
As 0.00163 as H3AsO4  
Ba 0.109  
B 2.360  
Cd 0.00013  
Ca 717  
C 26.3  
Cl 16500  
Cu 0.00204  
Cr 0.123  
Pb 0.0007  
Mg 690  
Ni 0.00594  
N 0.82 as N03-  
K 342  
Na 10100  
S 2020 as SO4-2  
V 0.0229  
Zn 0.0061  
END

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TITLE

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BH310a Low

-----  
 Beginning of initial solution calculations.  
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Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.613e-06	1.613e-06
As	1.184e-08	1.184e-08
B	2.252e-04	2.252e-04
Ba	8.185e-07	8.185e-07
C	4.445e-04	4.445e-04
Ca	1.845e-02	1.845e-02
Cd	1.193e-09	1.193e-09
Cl	4.800e-01	4.800e-01
Cr	2.440e-06	2.440e-06
Cu	3.311e-08	3.311e-08
K	9.021e-03	9.021e-03
Mg	2.927e-02	2.927e-02
N	2.013e-05	2.013e-05
Na	4.531e-01	4.531e-01
Ni	1.043e-07	1.043e-07
Pb	3.484e-09	3.484e-09
S	2.169e-02	2.169e-02
V	4.636e-07	4.636e-07
Zn	9.624e-08	9.624e-08

-----Description of solution-----

pH = 12.453    Charge balance  
 pe = 3.260  
 Activity of water = 0.983  
 Ionic strength = 5.752e-01  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 3.418e-02  
 Total CO2 (mol/kg) = 4.445e-04  
 Temperature (deg C) = 14.040  
 Electrical balance (eq) = -2.505e-17  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = -0.00  
 Iterations = 12  
 Total H = 1.110459e+02  
 Total O = 5.562810e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	1.892e-02	1.185e-02	-1.723	-1.926	-0.203
H+	4.623e-13	3.527e-13	-12.335	-12.453	-0.118
H2O	5.551e+01	9.826e-01	-0.008	-0.008	0.000
Al	1.613e-06				
Al(OH)4-	1.613e-06	1.067e-06	-5.792	-5.972	-0.179
Al(OH)3	5.729e-11	6.541e-11	-10.242	-10.184	0.058
Al(OH)2+	2.710e-17	1.865e-17	-16.567	-16.729	-0.162
AlOH+2	1.787e-24	4.006e-25	-23.748	-24.397	-0.649
Al+3	3.454e-31	3.024e-32	-30.462	-31.519	-1.058
AlSO4+	9.233e-32	6.107e-32	-31.035	-31.214	-0.179
Al(SO4)2-	1.554e-32	1.028e-32	-31.809	-31.988	-0.179
As(3)	9.974e-34				
HAsO3-2	6.130e-34	1.860e-34	-33.213	-33.731	-0.518
AsO3-3	2.015e-34	1.377e-35	-33.696	-34.861	-1.165
H2AsO3-	1.828e-34	1.357e-34	-33.738	-33.867	-0.129
H3AsO3	1.081e-37	1.234e-37	-36.966	-36.909	0.058
H4AsO3+	0.000e+00	0.000e+00	-49.537	-49.666	-0.129
As(5)	1.184e-08				
AsO4-3	1.137e-08	7.770e-10	-7.944	-9.110	-1.165
HAsO4-2	4.714e-10	1.430e-10	-9.327	-9.845	-0.518
H2AsO4-	4.091e-16	3.036e-16	-15.388	-15.518	-0.129
H3AsO4	1.472e-26	1.681e-26	-25.832	-25.775	0.058
B	2.252e-04				
H2BO3-	2.251e-04	1.312e-04	-3.648	-3.882	-0.234
H3BO3	8.668e-08	9.896e-08	-7.062	-7.005	0.058
Ba	8.185e-07				
Ba+2	8.070e-07	1.693e-07	-6.093	-6.771	-0.678
BaOH+	1.156e-08	7.824e-09	-7.937	-8.107	-0.170
C(4)	4.445e-04				
NaCO3-	1.223e-04	8.417e-05	-3.913	-4.075	-0.162
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CO3-2	1.127e-04	2.526e-05	-3.948	-4.598	-0.649
MgCO3	9.260e-05	1.057e-04	-4.033	-3.976	0.058
HCO3-	3.569e-07	2.456e-07	-6.447	-6.610	-0.162
NaHCO3	2.994e-08	3.418e-08	-7.524	-7.466	0.058
MgHCO3+	2.107e-08	1.358e-08	-7.676	-7.867	-0.191
CaHCO3+	1.176e-08	8.275e-09	-7.930	-8.082	-0.153
NiCO3	5.739e-13	6.552e-13	-12.241	-12.184	0.058
H2CO3	1.526e-13	1.742e-13	-12.816	-12.759	0.058
CdCO3	9.778e-14	1.116e-13	-13.010	-12.952	0.058
Ni(CO3)2-2	9.479e-14	2.876e-14	-13.023	-13.541	-0.518
Zn(CO3)2-2	3.447e-16	1.046e-16	-15.463	-15.981	-0.518
ZnCO3	1.696e-16	1.937e-16	-15.771	-15.713	0.058
PbCO3	3.167e-17	3.615e-17	-16.499	-16.442	0.058

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CuCO <sub>3</sub>	1.720e-17	1.964e-17	-16.764	-16.707	0.058
Pb(CO <sub>3</sub> ) <sub>2-2</sub>	7.560e-18	2.294e-18	-17.121	-17.639	-0.518
Cu(CO <sub>3</sub> ) <sub>2-2</sub>	2.058e-18	6.245e-19	-17.687	-18.204	-0.518
CdHCO <sub>3+</sub>	5.316e-19	3.946e-19	-18.274	-18.404	-0.129
NiHCO <sub>3+</sub>	1.239e-19	9.199e-20	-18.907	-19.036	-0.129
Cd(CO <sub>3</sub> ) <sub>3-4</sub>	5.566e-20	4.717e-22	-19.254	-21.326	-2.072
ZnHCO <sub>3+</sub>	1.158e-21	8.598e-22	-20.936	-21.066	-0.129
CuHCO <sub>3+</sub>	1.737e-23	1.289e-23	-22.760	-22.890	-0.129
PbHCO <sub>3+</sub>	1.567e-23	1.163e-23	-22.805	-22.935	-0.129
Ca	1.845e-02				
Ca+2	1.492e-02	4.549e-03	-1.826	-2.342	-0.516
CaOH+	1.782e-03	1.254e-03	-2.749	-2.902	-0.153
CaSO <sub>4</sub>	1.636e-03	1.867e-03	-2.786	-2.729	0.058
CaCO <sub>3</sub>	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CaHCO <sub>3+</sub>	1.176e-08	8.275e-09	-7.930	-8.082	-0.153
Cd	1.193e-09				
Cd(OH) <sub>2</sub>	5.356e-10	6.114e-10	-9.271	-9.214	0.058
CdOHCl	3.803e-10	4.341e-10	-9.420	-9.362	0.058
Cd(OH) <sub>3-</sub>	2.575e-10	1.911e-10	-9.589	-9.719	-0.129
Cd(OH) <sub>4-2</sub>	1.564e-11	4.747e-12	-10.806	-11.324	-0.518
CdOH+	2.368e-12	1.757e-12	-11.626	-11.755	-0.129
CdCl+	6.478e-13	4.808e-13	-12.189	-12.318	-0.129
CdCl <sub>2</sub>	4.993e-13	5.700e-13	-12.302	-12.244	0.058
CdCl <sub>3-</sub>	1.208e-13	8.966e-14	-12.918	-13.047	-0.129
CdCO <sub>3</sub>	9.778e-14	1.116e-13	-13.010	-12.952	0.058
Cd+2	5.811e-14	1.763e-14	-13.236	-13.754	-0.518
CdSO <sub>4</sub>	9.205e-15	1.051e-14	-14.036	-13.978	0.058
Cd(SO <sub>4</sub> ) <sub>2-2</sub>	9.018e-16	2.736e-16	-15.045	-15.563	-0.518
CdNO <sub>3+</sub>	9.952e-19	7.386e-19	-18.002	-18.132	-0.129
CdHCO <sub>3+</sub>	5.316e-19	3.946e-19	-18.274	-18.404	-0.129
Cd(CO <sub>3</sub> ) <sub>3-4</sub>	5.566e-20	4.717e-22	-19.254	-21.326	-2.072
Cd <sub>2</sub> OH+ <sub>3</sub>	2.560e-24	1.749e-25	-23.592	-24.757	-1.165
CdHS+	0.000e+00	0.000e+00	-108.890	-109.019	-0.129
Cd(HS) <sub>2</sub>	0.000e+00	0.000e+00	-208.152	-208.095	0.058
Cd(HS) <sub>3-</sub>	0.000e+00	0.000e+00	-311.221	-311.350	-0.129
Cd(HS) <sub>4-2</sub>	0.000e+00	0.000e+00	-414.078	-414.596	-0.518
Cl	4.800e-01				
Cl-	4.800e-01	2.966e-01	-0.319	-0.528	-0.209
CdOHCl	3.803e-10	4.341e-10	-9.420	-9.362	0.058
ZnOHCl	9.209e-13	1.051e-12	-12.036	-11.978	0.058
CdCl+	6.478e-13	4.808e-13	-12.189	-12.318	-0.129
CdCl <sub>2</sub>	4.993e-13	5.700e-13	-12.302	-12.244	0.058
CdCl <sub>3-</sub>	1.208e-13	8.966e-14	-12.918	-13.047	-0.129
NiCl+	3.504e-15	2.600e-15	-14.455	-14.585	-0.129
NiCl <sub>2</sub>	2.458e-15	2.806e-15	-14.609	-14.552	0.058
CuCl <sub>3-2</sub>	2.300e-15	4.826e-16	-14.638	-15.316	-0.678
CuCl <sub>2-</sub>	1.664e-15	1.073e-15	-14.779	-14.970	-0.191
ZnCl+	2.880e-17	1.857e-17	-16.541	-16.731	-0.191



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ZnCl2	4.825e-18	5.509e-18	-17.316	-17.259	0.058
ZnCl3-	2.656e-18	1.712e-18	-17.576	-17.766	-0.191
ZnCl4-2	1.106e-18	2.320e-19	-17.956	-18.635	-0.678
PbCl+	9.880e-19	7.333e-19	-18.005	-18.135	-0.129
PbCl2	3.734e-19	4.263e-19	-18.428	-18.370	0.058
PbCl3-	1.258e-19	9.340e-20	-18.900	-19.030	-0.129
CuCl+	1.027e-19	6.619e-20	-18.989	-19.179	-0.191
PbCl4-2	4.012e-20	1.217e-20	-19.397	-19.915	-0.518
CuCl2	8.165e-21	9.321e-21	-20.088	-20.031	0.058
CuCl3-	1.244e-23	8.017e-24	-22.905	-23.096	-0.191
CrO3Cl-	3.150e-25	2.338e-25	-24.502	-24.631	-0.129
CuCl4-2	8.311e-26	1.744e-26	-25.080	-25.759	-0.678
CrOHCl2	4.643e-32	5.300e-32	-31.333	-31.276	0.058
CrCl+2	1.312e-36	3.982e-37	-35.882	-36.400	-0.518
CrCl2+	2.324e-38	1.725e-38	-37.634	-37.763	-0.129
VOCl+	2.531e-40	1.879e-40	-39.597	-39.726	-0.129
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-189.893	-190.411	-0.518
Cr(2)	0.000e+00				
Cr+2	0.000e+00	0.000e+00	-45.601	-46.119	-0.518
Cr(3)	4.949e-14				
CrO2-	3.561e-14	2.643e-14	-13.448	-13.578	-0.129
Cr(OH)4-	1.355e-14	1.006e-14	-13.868	-13.998	-0.129
Cr(OH)3	3.310e-16	3.779e-16	-15.480	-15.423	0.058
Cr(OH)2+	2.465e-21	1.830e-21	-20.608	-20.738	-0.129
Cr(OH)+2	9.022e-28	2.738e-28	-27.045	-27.563	-0.518
CrOHSO4	2.403e-28	2.743e-28	-27.619	-27.562	0.058
CrOHCl2	4.643e-32	5.300e-32	-31.333	-31.276	0.058
Cr+3	5.262e-35	3.595e-36	-34.279	-35.444	-1.165
CrCl+2	1.312e-36	3.982e-37	-35.882	-36.400	-0.518
CrSO4+	1.464e-37	1.087e-37	-36.834	-36.964	-0.129
CrCl2+	2.324e-38	1.725e-38	-37.634	-37.763	-0.129
CrNO3+2	0.000e+00	0.000e+00	-41.385	-41.903	-0.518
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-52.347	-52.865	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-57.204	-57.147	0.058
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-125.441	-125.570	-0.129
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-156.659	-157.177	-0.518
Cr(NH3)6+3	0.000e+00	0.000e+00	-189.496	-190.661	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-189.893	-190.411	-0.518
Cr(6)	2.440e-06				
CrO4-2	1.772e-06	3.060e-07	-5.752	-6.514	-0.763
NaCrO4-	6.539e-07	4.853e-07	-6.184	-6.314	-0.129
KCrO4-	1.430e-08	1.062e-08	-7.845	-7.974	-0.129
HCrO4-	4.429e-13	3.287e-13	-12.354	-12.483	-0.129
Cr2O7-2	1.709e-23	5.185e-24	-22.767	-23.285	-0.518
CrO3Cl-	3.150e-25	2.338e-25	-24.502	-24.631	-0.129
CrO3SO4-2	2.787e-25	8.457e-26	-24.555	-25.073	-0.518
H2CrO4	1.494e-26	1.705e-26	-25.826	-25.768	0.058
Cu(1)	3.964e-15				

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CuCl3-2	2.300e-15	4.826e-16	-14.638	-15.316	-0.678
CuCl2-	1.664e-15	1.073e-15	-14.779	-14.970	-0.191
Cu+	6.439e-20	3.754e-20	-19.191	-19.426	-0.234
Cu(2)	3.311e-08				
Cu(OH)2	2.056e-08	2.348e-08	-7.687	-7.629	0.058
Cu(OH)4-2	7.222e-09	2.191e-09	-8.141	-8.659	-0.518
Cu(OH)3-	5.323e-09	3.951e-09	-8.274	-8.403	-0.129
CuOH+	6.256e-15	4.033e-15	-14.204	-14.394	-0.191
CuCO3	1.720e-17	1.964e-17	-16.764	-16.707	0.058
Cu(CO3)2-2	2.058e-18	6.245e-19	-17.687	-18.204	-0.518
Cu+2	1.254e-18	1.447e-19	-17.902	-18.839	-0.938
CuCl+	1.027e-19	6.619e-20	-18.989	-19.179	-0.191
CuSO4	5.301e-20	6.052e-20	-19.276	-19.218	0.058
CuCl2	8.165e-21	9.321e-21	-20.088	-20.031	0.058
CuHCO3+	1.737e-23	1.289e-23	-22.760	-22.890	-0.129
CuCl3-	1.244e-23	8.017e-24	-22.905	-23.096	-0.191
Cu2(OH)2+2	7.580e-24	2.300e-24	-23.120	-23.638	-0.518
CuCl4-2	8.311e-26	1.744e-26	-25.080	-25.759	-0.678
Cu(S4)2-3	0.000e+00	0.000e+00	-201.491	-202.001	-0.510
CuS4S5-3	0.000e+00	0.000e+00	-202.256	-202.731	-0.475
Cu(HS)3-	0.000e+00	0.000e+00	-309.118	-309.247	-0.129
H(0)	5.217e-35				
H2	2.609e-35	2.978e-35	-34.584	-34.526	0.058
K	9.021e-03				
K+	8.918e-03	5.510e-03	-2.050	-2.259	-0.209
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
KCrO4-	1.430e-08	1.062e-08	-7.845	-7.974	-0.129
Mg	2.927e-02				
Mg+2	1.520e-02	5.190e-03	-1.818	-2.285	-0.467
MgOH+	1.234e-02	8.832e-03	-1.909	-2.054	-0.145
MgSO4	1.637e-03	1.868e-03	-2.786	-2.729	0.058
MgCO3	9.260e-05	1.057e-04	-4.033	-3.976	0.058
MgHCO3+	2.107e-08	1.358e-08	-7.676	-7.867	-0.191
N(-3)	4.038e-29				
NH3	4.027e-29	4.597e-29	-28.395	-28.338	0.058
NH4+	1.091e-31	6.362e-32	-30.962	-31.196	-0.234
NH4SO4-	2.683e-33	1.816e-33	-32.571	-32.741	-0.170
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-125.441	-125.570	-0.129
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-156.659	-157.177	-0.518
Cr(NH3)6+3	0.000e+00	0.000e+00	-189.496	-190.661	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-189.893	-190.411	-0.518
N(3)	3.834e-07				
NO2-	3.834e-07	2.845e-07	-6.416	-6.546	-0.129
N(5)	1.974e-05				
NO3-	1.974e-05	1.196e-05	-4.705	-4.922	-0.218
CdNO3+	9.952e-19	7.386e-19	-18.002	-18.132	-0.129
PbNO3+	1.963e-23	1.457e-23	-22.707	-22.837	-0.129
VO2NO3	6.017e-35	6.869e-35	-34.221	-34.163	0.058

CrNO3+2	0.000e+00	0.000e+00	-41.385	-41.903	-0.518
Na	4.531e-01				
Na+	4.482e-01	3.191e-01	-0.349	-0.496	-0.148
NaSO4-	4.791e-03	3.296e-03	-2.320	-2.482	-0.162
NaCO3-	1.223e-04	8.417e-05	-3.913	-4.075	-0.162
NaCrO4-	6.539e-07	4.853e-07	-6.184	-6.314	-0.129
NaHCO3	2.994e-08	3.418e-08	-7.524	-7.466	0.058
Ni	1.043e-07				
Ni(OH)3-	1.020e-07	7.568e-08	-6.992	-7.121	-0.129
Ni(OH)2	2.379e-09	2.716e-09	-8.624	-8.566	0.058
NiOH+	8.147e-13	6.047e-13	-12.089	-12.218	-0.129
NiCO3	5.739e-13	6.552e-13	-12.241	-12.184	0.058
Ni(CO3)2-2	9.479e-14	2.876e-14	-13.023	-13.541	-0.518
Ni+2	1.153e-14	3.499e-15	-13.938	-14.456	-0.518
NiCl+	3.504e-15	2.600e-15	-14.455	-14.585	-0.129
NiCl2	2.458e-15	2.806e-15	-14.609	-14.552	0.058
NiSO4	1.200e-15	1.370e-15	-14.921	-14.863	0.058
Ni(SO4)2-2	5.926e-19	1.798e-19	-18.227	-18.745	-0.518
NiHCO3+	1.239e-19	9.199e-20	-18.907	-19.036	-0.129
O(0)	1.692e-27				
O2	8.459e-28	9.657e-28	-27.073	-27.015	0.058
Pb	3.484e-09				
Pb(OH)4-2	3.271e-09	9.925e-10	-8.485	-9.003	-0.518
Pb(OH)3-	2.090e-10	1.551e-10	-9.680	-9.809	-0.129
Pb(OH)2	4.248e-12	4.850e-12	-11.372	-11.314	0.058
PbOH+	6.028e-15	4.474e-15	-14.220	-14.349	-0.129
PbCO3	3.167e-17	3.615e-17	-16.499	-16.442	0.058
Pb(CO3)2-2	7.560e-18	2.294e-18	-17.121	-17.639	-0.518
PbCl+	9.880e-19	7.333e-19	-18.005	-18.135	-0.129
PbCl2	3.734e-19	4.263e-19	-18.428	-18.370	0.058
Pb+2	2.714e-19	8.235e-20	-18.566	-19.084	-0.518
PbCl3-	1.258e-19	9.340e-20	-18.900	-19.030	-0.129
PbSO4	8.986e-20	1.026e-19	-19.046	-18.989	0.058
PbCl4-2	4.012e-20	1.217e-20	-19.397	-19.915	-0.518
Pb(SO4)2-2	3.931e-21	1.193e-21	-20.406	-20.923	-0.518
PbNO3+	1.963e-23	1.457e-23	-22.707	-22.837	-0.129
PbHCO3+	1.567e-23	1.163e-23	-22.805	-22.935	-0.129
Pb2OH+3	1.207e-31	8.248e-33	-30.918	-32.084	-1.165
Pb3(OH)4+2	2.653e-32	8.050e-33	-31.576	-32.094	-0.518
Pb(HS)2	0.000e+00	0.000e+00	-214.743	-214.685	0.058
Pb(HS)3-	0.000e+00	0.000e+00	-318.691	-318.821	-0.129
S(-2)	0.000e+00				
S5-2	0.000e+00	0.000e+00	-102.320	-102.838	-0.518
S6-2	0.000e+00	0.000e+00	-102.346	-102.864	-0.518
S4-2	0.000e+00	0.000e+00	-102.565	-103.083	-0.518
HS-	0.000e+00	0.000e+00	-105.232	-105.436	-0.203
S-2	0.000e+00	0.000e+00	-105.561	-106.239	-0.678
S3-2	0.000e+00	0.000e+00	-106.038	-106.556	-0.518

## BH310A July 2012 Eh=0.2

S2-2	0.000e+00	0.000e+00	-107.312	-107.830	-0.518
CdHS+	0.000e+00	0.000e+00	-108.890	-109.019	-0.129
H2S	0.000e+00	0.000e+00	-110.846	-110.788	0.058
Cu(S4)2-3	0.000e+00	0.000e+00	-201.491	-202.001	-0.510
CuS4S5-3	0.000e+00	0.000e+00	-202.256	-202.731	-0.475
Cd(HS)2	0.000e+00	0.000e+00	-208.152	-208.095	0.058
Zn(HS)2	0.000e+00	0.000e+00	-212.404	-212.347	0.058
Pb(HS)2	0.000e+00	0.000e+00	-214.743	-214.685	0.058
Cu(HS)3-	0.000e+00	0.000e+00	-309.118	-309.247	-0.129
Cd(HS)3-	0.000e+00	0.000e+00	-311.221	-311.350	-0.129
Zn(HS)3-	0.000e+00	0.000e+00	-316.493	-316.622	-0.129
Pb(HS)3-	0.000e+00	0.000e+00	-318.691	-318.821	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-414.078	-414.596	-0.518
S(6)	2.169e-02				
SO4-2	1.352e-02	2.215e-03	-1.869	-2.655	-0.786
NaSO4-	4.791e-03	3.296e-03	-2.320	-2.482	-0.162
MgSO4	1.637e-03	1.868e-03	-2.786	-2.729	0.058
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
HSO4-	8.502e-14	5.624e-14	-13.070	-13.250	-0.179
CdSO4	9.205e-15	1.051e-14	-14.036	-13.978	0.058
NiSO4	1.200e-15	1.370e-15	-14.921	-14.863	0.058
Cd(SO4)2-2	9.018e-16	2.736e-16	-15.045	-15.563	-0.518
ZnSO4	1.601e-17	1.828e-17	-16.796	-16.738	0.058
Zn(SO4)2-2	1.184e-18	3.593e-19	-17.927	-18.445	-0.518
Ni(SO4)2-2	5.926e-19	1.798e-19	-18.227	-18.745	-0.518
PbSO4	8.986e-20	1.026e-19	-19.046	-18.989	0.058
CuSO4	5.301e-20	6.052e-20	-19.276	-19.218	0.058
Pb(SO4)2-2	3.931e-21	1.193e-21	-20.406	-20.923	-0.518
CrO3SO4-2	2.787e-25	8.457e-26	-24.555	-25.073	-0.518
CrOHSO4	2.403e-28	2.743e-28	-27.619	-27.562	0.058
VO2SO4-	2.367e-30	1.756e-30	-29.626	-29.755	-0.129
AlSO4+	9.233e-32	6.107e-32	-31.035	-31.214	-0.179
Al(SO4)2-	1.554e-32	1.028e-32	-31.809	-31.988	-0.179
NH4SO4-	2.683e-33	1.816e-33	-32.571	-32.741	-0.170
CrSO4+	1.464e-37	1.087e-37	-36.834	-36.964	-0.129
VOSO4	2.603e-40	2.972e-40	-39.584	-39.527	0.058
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-52.347	-52.865	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-57.204	-57.147	0.058
VSO4+	0.000e+00	0.000e+00	-62.364	-62.493	-0.129
V(2)	0.000e+00				
VOH+	0.000e+00	0.000e+00	-62.083	-62.213	-0.129
V+2	0.000e+00	0.000e+00	-68.500	-69.018	-0.518
V(3)	9.521e-36				
V(OH)3	9.521e-36	1.087e-35	-35.021	-34.964	0.058
V(OH)2+	0.000e+00	0.000e+00	-42.089	-42.219	-0.129
VOH+2	0.000e+00	0.000e+00	-50.877	-51.395	-0.518
V+3	0.000e+00	0.000e+00	-60.113	-61.279	-1.165

BH310A July 2012 Eh=0.2

VSO4+	0.000e+00	0.000e+00	-62.364	-62.493	-0.129
V2(OH)3+3	0.000e+00	0.000e+00	-91.557	-92.723	-1.165
V2(OH)2+4	0.000e+00	0.000e+00	-99.346	-101.418	-2.072
V(4)	4.771e-33				
V(OH)3+	4.771e-33	3.541e-33	-32.321	-32.451	-0.129
VO+2	1.994e-39	6.049e-40	-38.700	-39.218	-0.518
VOSO4	2.603e-40	2.972e-40	-39.584	-39.527	0.058
VOCI+	2.531e-40	1.879e-40	-39.597	-39.726	-0.129
H2V2O4+2	0.000e+00	0.000e+00	-59.469	-59.987	-0.518
V(5)	4.636e-07				
HVO4-2	3.035e-07	9.210e-08	-6.518	-7.036	-0.518
VO4-3	1.598e-07	1.092e-08	-6.796	-7.962	-1.165
V2O7-4	1.157e-10	9.803e-13	-9.937	-12.009	-2.072
HV2O7-3	2.912e-11	1.989e-12	-10.536	-11.701	-1.165
H2VO4-	6.336e-12	4.702e-12	-11.198	-11.328	-0.129
H3VO4	9.370e-21	1.070e-20	-20.028	-19.971	0.058
H3V2O7-	1.130e-24	8.384e-25	-23.947	-24.077	-0.129
V3O9-3	3.515e-27	2.402e-28	-26.454	-27.619	-1.165
VO2+	2.083e-29	1.546e-29	-28.681	-28.811	-0.129
VO2SO4-	2.367e-30	1.756e-30	-29.626	-29.755	-0.129
VO2NO3	6.017e-35	6.869e-35	-34.221	-34.163	0.058
V4O12-4	4.259e-35	3.609e-37	-34.371	-36.443	-2.072
V10O28-6	0.000e+00	0.000e+00	-101.795	-106.457	-4.662
HV10O28-5	0.000e+00	0.000e+00	-110.094	-113.331	-3.237
H2V10O28-4	0.000e+00	0.000e+00	-119.470	-121.542	-2.072
Zn	9.624e-08				
Zn(OH)4-2	4.826e-08	1.464e-08	-7.316	-7.834	-0.518
Zn(OH)3-	4.468e-08	3.316e-08	-7.350	-7.479	-0.129
Zn(OH)2	3.297e-09	3.764e-09	-8.482	-8.424	0.058
ZnOHCl	9.209e-13	1.051e-12	-12.036	-11.978	0.058
ZnOH+	6.672e-14	4.952e-14	-13.176	-13.305	-0.129
Zn(CO3)2-2	3.447e-16	1.046e-16	-15.463	-15.981	-0.518
ZnCO3	1.696e-16	1.937e-16	-15.771	-15.713	0.058
Zn+2	1.567e-16	3.842e-17	-15.805	-16.415	-0.611
ZnCl+	2.880e-17	1.857e-17	-16.541	-16.731	-0.191
ZnSO4	1.601e-17	1.828e-17	-16.796	-16.738	0.058
ZnCl2	4.825e-18	5.509e-18	-17.316	-17.259	0.058
ZnCl3-	2.656e-18	1.712e-18	-17.576	-17.766	-0.191
Zn(SO4)2-2	1.184e-18	3.593e-19	-17.927	-18.445	-0.518
ZnCl4-2	1.106e-18	2.320e-19	-17.956	-18.635	-0.678
ZnHCO3+	1.158e-21	8.598e-22	-20.936	-21.066	-0.129
Zn(HS)2	0.000e+00	0.000e+00	-212.404	-212.347	0.058
Zn(HS)3-	0.000e+00	0.000e+00	-316.493	-316.622	-0.129

-----Saturation indices-----

Phase            SI log IAP   log KT

(NH4)2CrO4 -69.25 -317.53 -248.28 (NH4)2CrO4  
 Al(OH)3(a) -5.32 5.82 11.14 Al(OH)3  
 Al2O3 -11.33 11.65 22.98 Al2O3  
 Al4(OH)10SO4 -26.98 -4.28 22.70 Al4(OH)10SO4  
 AlAsO4:2H2O -24.75 -19.95 4.80 AlAsO4:2H2O  
 AlOHSO4 -18.50 -21.73 -3.23 AlOHSO4  
 AlumK -33.81 -39.18 -5.37 KAl(SO4)2:12H2O  
 Alunite -26.00 -27.46 -1.46 KAl3(SO4)2(OH)6  
 Anglesite -13.89 -21.74 -7.85 PbSO4  
 Anhydrite -0.47 -5.00 -4.53 CaSO4  
 Anilite -93.74 -166.18 -72.45 Cu0.25Cu1.5S  
 Antlerite -17.68 -9.39 8.29 Cu3(OH)4SO4  
 Aragonite 1.33 -6.94 -8.27 CaCO3  
 Arsenolite -144.39 -228.72 -84.34 As4O6  
 Artinite 5.30 15.70 10.40 MgCO3:Mg(OH)2:3H2O  
 As2O5 -58.38 -51.53 6.85 As2O5  
 Atacamite -8.73 -0.87 7.86 Cu2(OH)3Cl  
 Azurite -24.57 -40.82 -16.26 Cu3(OH)2(CO3)2  
 Ba3(AsO4)2 11.84 2.85 -8.98 Ba3(AsO4)2  
 BaCrO4 -3.44 -13.29 -9.85 BaCrO4  
 Barite 0.73 -9.43 -10.15 BaSO4  
 Bianchite -17.36 -19.12 -1.76 ZnSO4:6H2O  
 Blaubleil -89.66 -149.70 -60.04 Cu0.9Cu0.2S  
 Blaubleill -92.55 -157.31 -64.76 Cu0.6Cu0.8S  
 Boehmite -3.54 5.82 9.36 AlOOH  
 Brochantite -18.68 -3.34 15.34 Cu4(OH)6SO4  
 Brucite 5.09 22.61 17.51 Mg(OH)2  
 Bunsenite -2.68 10.44 13.12 NiO  
 Ca2V2O7 -3.09 6.19 9.28 CaVO3.5  
 Ca3(AsO4)2:6H2O -6.21 16.09 22.30 Ca3(AsO4)2:6H2O  
 Ca3(VO4)2 -2.99 17.47 20.46 Ca1.5VO4  
 Ca\_Vanadate -8.20 -5.08 3.11 Ca0.5VO3  
 CaCrO4 -6.77 -8.86 -2.09 CaCrO4  
 Calcite 1.48 -6.94 -8.42 CaCO3  
 Cd(BO2)2 -12.68 -2.84 9.84 Cd(BO2)2  
 Cd(Gamma) -34.37 -20.27 14.10 Cd  
 Cd(OH)2(A) -3.17 11.14 14.31 Cd(OH)2  
 Cd(OH)2(C) -2.51 11.14 13.65 Cd(OH)2  
 Cd3(OH)2(SO4)2 -28.39 -21.68 6.71 Cd3(OH)2(SO4)2  
 Cd3(OH)4SO4 -16.70 5.86 22.56 Cd3(OH)4SO4  
 Cd4(OH)6SO4 -11.40 17.00 28.40 Cd4(OH)6SO4  
 CdCl2 -14.25 -14.81 -0.55 CdCl2  
 CdCl2:2.5H2O -12.84 -14.83 -1.99 CdCl2:2.5H2O  
 CdCl2:H2O -13.16 -14.82 -1.66 CdCl2:H2O  
 CdMetal -34.27 -20.27 13.99 Cd  
 CdOHCl -5.56 -1.84 3.73 CdOHCl  
 CdSO4 -16.72 -16.41 0.31 CdSO4  
 CdSO4:2.67H2O -14.68 -16.43 -1.75 CdSO4:2.67H2O

CdSO4:H2O -14.97 -16.42 -1.45 CdSO4:H2O  
 Cerrusite -10.42 -23.68 -13.27 PbCO3  
 CH4(g) -113.37 -155.18 -41.81 CH4  
 Chalcantite -18.85 -21.53 -2.68 CuSO4:5H2O  
 Chalcocite -95.83 -172.52 -76.69 Cu2S  
 Claudetite -144.15 -228.72 -84.57 As4O6  
 CO2(g) -11.32 -29.50 -18.17 CO2  
 Cotunnite -15.21 -20.14 -4.93 PbCl2  
 Covellite -88.11 -147.16 -59.05 CuS  
 Cr(OH)2 -32.29 -94.25 -61.97 Cr(OH)2  
 Cr(OH)3(A) -7.54 -78.55 -71.01 Cr(OH)3  
 Cr(OH)3(C) -10.19 -78.55 -68.36 Cr(OH)3  
 Cr2O3 -13.51 -157.08 -143.57 Cr2O3  
 CrCl2 -63.59 -120.20 -56.61 CrCl2  
 CrCl3 -61.49 -117.47 -55.98 CrCl3  
 CrMetal -85.84 -125.66 -39.82 Cr  
 CrO3 -28.24 -31.41 -3.18 CrO3  
 Cu(OH)2 -3.02 6.05 9.07 Cu(OH)2  
 Cu2(OH)3NO3 -14.99 -5.27 9.73 Cu2(OH)3NO3  
 Cu2SO4 -39.68 -46.85 -7.17 Cu2SO4  
 Cu3(AsO4)2:6H2O -39.50 -33.40 6.10 Cu3(AsO4)2:6H2O  
 CuCO3 -13.81 -23.44 -9.63 CuCO3  
 CuCrO4 -19.88 -25.35 -5.48 CuCrO4  
 CuMetal -13.45 -25.36 -11.91 Cu  
 CuOCuSO4 -27.96 -15.44 12.53 CuO:CuSO4  
 Cuprite -12.23 -19.30 -7.07 Cu2O  
 CuSO4 -25.01 -21.49 3.52 CuSO4  
 Diaspore -1.74 5.82 7.56 AlOOH  
 Djurleite -95.25 -170.85 -75.60 Cu0.066Cu1.868S  
 Dolomite 2.95 -13.82 -16.77 CaMg(CO3)2  
 Epsomite -2.77 -4.99 -2.22 MgSO4:7H2O  
 Galena -96.39 -147.41 -51.02 PbS  
 Gibbsite(C) -3.59 5.82 9.41 Al(OH)3  
 Goslarite -17.07 -19.12 -2.05 ZnSO4:7H2O  
 Greenockite -90.35 -142.08 -51.73 CdS  
 Gypsum -0.16 -5.01 -4.86 CaSO4:2H2O  
 Halite -2.58 -1.02 1.56 NaCl  
 Huntite 1.66 -27.59 -29.25 CaMg3(CO3)4  
 Hydrcerrusite -24.10 -41.56 -17.46 Pb(OH)2:2PbCO3  
 Hydromagnesite 2.35 -4.95 -7.31 Mg5(CO3)4(OH)2:4H2O  
 K2Cr2O7 -26.27 -42.44 -16.18 K2Cr2O7  
 K2CrO4 -10.92 -11.03 -0.11 K2CrO4  
 Langite -21.25 -3.35 17.90 Cu4(OH)6SO4:H2O  
 Larnakite -15.83 -15.93 -0.10 PbO:PbSO4  
 Laurionite -7.79 -7.17 0.62 PbOHCl  
 Lime -11.54 22.56 34.09 CaO  
 Litharge -7.36 5.81 13.18 PbO  
 Magnesite 0.97 -6.88 -7.86 MgCO3

Malachite	-12.64	-17.39	-4.74	Cu <sub>2</sub> (OH) <sub>2</sub> CO <sub>3</sub>
Massicot	-7.57	5.81	13.38	PbO
Melanothallite	-23.97	-19.90	4.07	CuCl <sub>2</sub>
Mg <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-7.78	6.25	14.03	MgVO <sub>3.5</sub>
Mg_Vanadate	-11.15	-5.06	6.10	Mg <sub>0.5</sub> VO <sub>3</sub>
MgCr <sub>2</sub> O <sub>4</sub>	-7.14	-134.46	-127.32	MgCr <sub>2</sub> O <sub>4</sub>
MgCrO <sub>4</sub>	-14.77	-8.80	5.97	MgCrO <sub>4</sub>
Millerite	-99.33	-142.78	-43.45	NiS
Minium	-27.71	48.86	76.56	Pb <sub>3</sub> O <sub>4</sub>
Mirabilite	-2.08	-3.72	-1.65	Na <sub>2</sub> SO <sub>4</sub> :10H <sub>2</sub> O
Monteponite	-4.67	11.14	15.81	CdO
Morenosite	-14.72	-17.16	-2.44	NiSO <sub>4</sub> :7H <sub>2</sub> O
Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-28.87	-38.92	-10.04	Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
Na <sub>2</sub> CrO <sub>4</sub>	-10.90	-7.51	3.39	Na <sub>2</sub> CrO <sub>4</sub>
Na <sub>3</sub> VO <sub>4</sub>	-18.69	19.50	38.18	Na <sub>3</sub> VO <sub>4</sub>
Na <sub>4</sub> V <sub>2</sub> O <sub>7</sub>	-11.83	7.54	19.37	Na <sub>2</sub> VO <sub>3.5</sub>
Na_Vanadate	-8.32	-4.41	3.91	NaVO <sub>3</sub>
Nantokite	-12.91	-22.63	-9.71	CuCl
Natron	-3.91	-5.67	-1.75	Na <sub>2</sub> CO <sub>3</sub> :10H <sub>2</sub> O
Nesquehonite	-1.45	-6.91	-5.46	MgCO <sub>3</sub> :3H <sub>2</sub> O
NH <sub>4</sub> VO <sub>3</sub>	-37.90	-159.42	-121.51	NH <sub>4</sub> VO <sub>3</sub>
Ni(OH) <sub>2</sub>	0.49	10.43	9.95	Ni(OH) <sub>2</sub>
Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-35.96	-20.26	15.70	Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-17.81	14.19	32.00	Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
NiCO <sub>3</sub>	-12.49	-19.05	-6.56	NiCO <sub>3</sub>
O <sub>2</sub> (g)	-24.03	62.84	86.86	O <sub>2</sub>
Oripment	-364.15	-574.03	-209.88	As <sub>2</sub> S <sub>3</sub>
Otavite	-4.63	-18.35	-13.72	CdCO <sub>3</sub>
Pb(BO <sub>2</sub> ) <sub>2</sub>	-15.95	-8.17	7.77	Pb(BO <sub>2</sub> ) <sub>2</sub>
Pb(OH) <sub>2</sub> (C)	-2.74	5.81	8.54	Pb(OH) <sub>2</sub>
Pb <sub>2</sub> (OH) <sub>3</sub> Cl	-10.15	-1.36	8.79	Pb <sub>2</sub> (OH) <sub>3</sub> Cl
Pb <sub>2</sub> O(OH) <sub>2</sub>	-14.58	11.62	26.20	Pb <sub>2</sub> O(OH) <sub>2</sub>
Pb <sub>2</sub> O <sub>3</sub>	-18.00	43.04	61.04	Pb <sub>2</sub> O <sub>3</sub>
Pb <sub>2</sub> OCO <sub>3</sub>	-17.69	-17.87	-0.18	Pb <sub>2</sub> OCO <sub>3</sub>
Pb <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-9.69	-10.55	-0.86	PbVO <sub>3.5</sub>
Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>	-39.89	-34.09	5.80	Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>
Pb <sub>3</sub> (VO <sub>4</sub> ) <sub>2</sub>	-10.95	-7.64	3.31	Pb <sub>1.5</sub> VO <sub>4</sub>
Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>	-23.81	-12.06	11.76	Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>
Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>	-21.09	-10.11	10.98	Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>
Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-25.42	-4.32	21.10	Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>	-27.38	-4.30	23.08	Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>
PbCrO <sub>4</sub>	-11.63	-25.60	-13.97	PbCrO <sub>4</sub>
PbMetal	-29.86	-25.60	4.26	Pb
PbO:0.3H <sub>2</sub> O	-7.17	5.81	12.98	PbO:0.33H <sub>2</sub> O
Periclase	0.09	22.61	22.52	MgO
Phosgenite	-24.01	-43.82	-19.81	PbCl <sub>2</sub> :PbCO <sub>3</sub>
Plattnerite	-14.05	37.23	51.28	PbO <sub>2</sub>
Portlandite	-0.99	22.55	23.53	Ca(OH) <sub>2</sub>



Realgar	-149.89	-226.11	-76.23	AsS
Retgersite	-15.09	-17.16	-2.07	NiSO4:6H2O
Smithsonite	-11.13	-21.01	-9.88	ZnCO3
Sphalerite	-97.55	-144.74	-47.19	ZnS
Spinel	-4.56	34.27	38.83	MgAl2O4
SULFUR	-84.47	-121.81	-37.33	S
Tenorite	-1.99	6.06	8.05	CuO
Thenardite	-3.48	-3.65	-0.16	Na2SO4
Thermonatrite	-5.80	-5.60	0.20	Na2CO3:H2O
V(OH)3	-31.59	-47.79	-16.20	V(OH)3
V2O3	-29.38	-47.78	-18.40	VO1.5
V2O4	-18.98	-32.07	-13.09	VO2
V2O5	-15.76	-16.36	-0.60	VO2.5
V3O5	-76.91	-127.63	-50.72	V3O5
V4O7	-96.94	-159.70	-62.77	V4O7
V6O13	-98.33	-161.01	-62.68	V6O13
VCl2	-84.57	-89.44	-4.88	VCl2
VCl3	-85.82	-86.71	-0.89	VCl3
VMetal	-115.17	-94.91	20.26	V
VO	-53.51	-63.49	-9.98	VO
VO(OH)2	-20.18	-32.08	-11.90	VO(OH)2
VO2Cl	-32.42	-29.34	3.08	VO2Cl
VOCl	-47.05	-60.76	-13.71	VOCl
VOCl2	-53.85	-58.02	-4.17	VOCl2
VOSO4(C)	-46.02	-59.62	-13.60	VOSO4
Witherite	-2.77	-11.37	-8.60	BaCO3
Wurtzite	-99.57	-144.74	-45.17	ZnS
Zincite	-3.27	8.48	11.75	ZnO
Zincosite	-22.62	-19.07	3.55	ZnSO4
Zn(BO2)2	-13.79	-5.50	8.29	Zn(BO2)2
Zn(NO3)2:6H2O	-29.59	-26.31	3.29	Zn(NO3)2:6H2O
Zn(OH)2(A)	-3.98	8.47	12.45	Zn(OH)2
Zn(OH)2(B)	-3.28	8.47	11.75	Zn(OH)2
Zn(OH)2(C)	-3.73	8.47	12.20	Zn(OH)2
Zn(OH)2(E)	-3.03	8.47	11.50	Zn(OH)2
Zn(OH)2(G)	-3.24	8.47	11.71	Zn(OH)2
Zn2(OH)2SO4	-18.10	-10.60	7.50	Zn2(OH)2SO4
Zn2(OH)3Cl	-11.22	3.98	15.20	Zn2(OH)3Cl
Zn3(AsO4)2:2.5H2O	-39.75	-26.10	13.65	Zn3(AsO4)2:2.5H2O
Zn3O(SO4)2	-50.41	-29.66	20.75	Zn3O(SO4)2
Zn4(OH)6SO4	-22.05	6.35	28.40	Zn4(OH)6SO4
Zn5(OH)8Cl2	-22.07	16.43	38.50	Zn5(OH)8Cl2
ZnCl2	-24.99	-17.47	7.52	ZnCl2
ZnCO3:H2O	-10.76	-21.02	-10.26	ZnCO3:H2O
ZnMetal	-49.72	-22.94	26.79	Zn
ZnO(Active)	-2.83	8.48	11.31	ZnO
ZnS(A)	-100.24	-144.74	-44.50	ZnS
ZnSO4:H2O	-18.81	-19.08	-0.27	ZnSO4:H2O

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End of simulation.  
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Reading input data for simulation 2.  
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-----  
End of run.  
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No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH310a Low  
SOLUTION 1  
pH 10.05 charge  
temp 14.04  
pe 8.15  
units mg/L  
Al 0.0422  
As 0.00163 as H3AsO4  
Ba 0.109  
B 2.360  
Cd 0.00013  
Ca 717  
C 26.3  
Cl 16500  
Cu 0.00204  
Cr 0.123  
Pb 0.0007  
Mg 690  
Ni 0.00594  
N 0.82 as N03-  
K 342  
Na 10100  
S 2020 as SO4-2  
V 0.0229  
Zn 0.0061  
END

-----  
TITLE  
-----

BH310a Low

-----  
 Beginning of initial solution calculations.  
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Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.613e-06	1.613e-06
As	1.184e-08	1.184e-08
B	2.252e-04	2.252e-04
Ba	8.185e-07	8.185e-07
C	4.445e-04	4.445e-04
Ca	1.845e-02	1.845e-02
Cd	1.193e-09	1.193e-09
Cl	4.800e-01	4.800e-01
Cr	2.440e-06	2.440e-06
Cu	3.311e-08	3.311e-08
K	9.021e-03	9.021e-03
Mg	2.927e-02	2.927e-02
N	2.013e-05	2.013e-05
Na	4.531e-01	4.531e-01
Ni	1.043e-07	1.043e-07
Pb	3.484e-09	3.484e-09
S	2.169e-02	2.169e-02
V	4.636e-07	4.636e-07
Zn	9.624e-08	9.624e-08

-----Description of solution-----

pH = 12.453    Charge balance  
 pe = 8.150  
 Activity of water = 0.983  
 Ionic strength = 5.752e-01  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 3.418e-02  
 Total CO2 (mol/kg) = 4.445e-04  
 Temperature (deg C) = 14.040  
 Electrical balance (eq) = -7.075e-14  
 Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|)$  = -0.00  
 Iterations = 8  
 Total H = 1.110459e+02  
 Total O = 5.562810e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	1.892e-02	1.185e-02	-1.723	-1.926	-0.203
H+	4.623e-13	3.527e-13	-12.335	-12.453	-0.118
H2O	5.551e+01	9.826e-01	-0.008	-0.008	0.000
Al	1.613e-06				
Al(OH)4-	1.613e-06	1.067e-06	-5.792	-5.972	-0.179
Al(OH)3	5.729e-11	6.541e-11	-10.242	-10.184	0.058
Al(OH)2+	2.710e-17	1.865e-17	-16.567	-16.729	-0.162
AlOH+2	1.787e-24	4.006e-25	-23.748	-24.397	-0.649
Al+3	3.454e-31	3.024e-32	-30.462	-31.519	-1.058
AlSO4+	9.233e-32	6.107e-32	-31.035	-31.214	-0.179
Al(SO4)2-	1.554e-32	1.028e-32	-31.809	-31.988	-0.179
As(3)	0.000e+00				
HAsO3-2	0.000e+00	0.000e+00	-42.993	-43.511	-0.518
AsO3-3	0.000e+00	0.000e+00	-43.476	-44.641	-1.165
H2AsO3-	0.000e+00	0.000e+00	-43.518	-43.647	-0.129
H3AsO3	0.000e+00	0.000e+00	-46.746	-46.689	0.058
H4AsO3+	0.000e+00	0.000e+00	-59.317	-59.446	-0.129
As(5)	1.184e-08				
AsO4-3	1.137e-08	7.770e-10	-7.944	-9.110	-1.165
HAsO4-2	4.714e-10	1.430e-10	-9.327	-9.845	-0.518
H2AsO4-	4.091e-16	3.036e-16	-15.388	-15.518	-0.129
H3AsO4	1.472e-26	1.681e-26	-25.832	-25.775	0.058
B	2.252e-04				
H2BO3-	2.251e-04	1.312e-04	-3.648	-3.882	-0.234
H3BO3	8.668e-08	9.896e-08	-7.062	-7.005	0.058
Ba	8.185e-07				
Ba+2	8.070e-07	1.693e-07	-6.093	-6.771	-0.678
BaOH+	1.156e-08	7.824e-09	-7.937	-8.107	-0.170
C(4)	4.445e-04				
NaCO3-	1.223e-04	8.417e-05	-3.913	-4.075	-0.162
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CO3-2	1.127e-04	2.526e-05	-3.948	-4.598	-0.649
MgCO3	9.260e-05	1.057e-04	-4.033	-3.976	0.058
HCO3-	3.569e-07	2.456e-07	-6.447	-6.610	-0.162
NaHCO3	2.994e-08	3.418e-08	-7.524	-7.466	0.058
MgHCO3+	2.107e-08	1.358e-08	-7.676	-7.867	-0.191
CaHCO3+	1.176e-08	8.275e-09	-7.930	-8.082	-0.153
NiCO3	5.739e-13	6.552e-13	-12.241	-12.184	0.058
H2CO3	1.526e-13	1.742e-13	-12.816	-12.759	0.058
CdCO3	9.778e-14	1.116e-13	-13.010	-12.952	0.058
Ni(CO3)2-2	9.479e-14	2.876e-14	-13.023	-13.541	-0.518
Zn(CO3)2-2	3.447e-16	1.046e-16	-15.463	-15.981	-0.518
ZnCO3	1.696e-16	1.937e-16	-15.771	-15.713	0.058
PbCO3	3.167e-17	3.615e-17	-16.499	-16.442	0.058

## BH310A July 2012 Eh=0.5

CuCO3	1.720e-17	1.964e-17	-16.764	-16.707	0.058
Pb(CO3)2-2	7.560e-18	2.294e-18	-17.121	-17.639	-0.518
Cu(CO3)2-2	2.058e-18	6.245e-19	-17.687	-18.204	-0.518
CdHCO3+	5.316e-19	3.946e-19	-18.274	-18.404	-0.129
NiHCO3+	1.239e-19	9.199e-20	-18.907	-19.036	-0.129
Cd(CO3)3-4	5.566e-20	4.717e-22	-19.254	-21.326	-2.072
ZnHCO3+	1.158e-21	8.598e-22	-20.936	-21.066	-0.129
CuHCO3+	1.737e-23	1.289e-23	-22.760	-22.890	-0.129
PbHCO3+	1.567e-23	1.163e-23	-22.805	-22.935	-0.129
Ca	1.845e-02				
Ca+2	1.492e-02	4.549e-03	-1.826	-2.342	-0.516
CaOH+	1.782e-03	1.254e-03	-2.749	-2.902	-0.153
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CaHCO3+	1.176e-08	8.275e-09	-7.930	-8.082	-0.153
Cd	1.193e-09				
Cd(OH)2	5.356e-10	6.114e-10	-9.271	-9.214	0.058
CdOHCl	3.803e-10	4.341e-10	-9.420	-9.362	0.058
Cd(OH)3-	2.575e-10	1.911e-10	-9.589	-9.719	-0.129
Cd(OH)4-2	1.564e-11	4.747e-12	-10.806	-11.324	-0.518
CdOH+	2.368e-12	1.757e-12	-11.626	-11.755	-0.129
CdCl+	6.478e-13	4.808e-13	-12.189	-12.318	-0.129
CdCl2	4.993e-13	5.700e-13	-12.302	-12.244	0.058
CdCl3-	1.208e-13	8.966e-14	-12.918	-13.047	-0.129
CdCO3	9.778e-14	1.116e-13	-13.010	-12.952	0.058
Cd+2	5.811e-14	1.763e-14	-13.236	-13.754	-0.518
CdSO4	9.205e-15	1.051e-14	-14.036	-13.978	0.058
Cd(SO4)2-2	9.018e-16	2.736e-16	-15.045	-15.563	-0.518
CdNO3+	1.015e-18	7.530e-19	-17.994	-18.123	-0.129
CdHCO3+	5.316e-19	3.946e-19	-18.274	-18.404	-0.129
Cd(CO3)3-4	5.566e-20	4.717e-22	-19.254	-21.326	-2.072
Cd2OH+3	2.560e-24	1.749e-25	-23.592	-24.757	-1.165
CdHS+	0.000e+00	0.000e+00	-148.010	-148.139	-0.129
Cd(HS)2	0.000e+00	0.000e+00	-286.392	-286.335	0.058
Cd(HS)3-	0.000e+00	0.000e+00	-428.581	-428.710	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-570.558	-571.076	-0.518
Cl	4.800e-01				
Cl-	4.800e-01	2.966e-01	-0.319	-0.528	-0.209
CdOHCl	3.803e-10	4.341e-10	-9.420	-9.362	0.058
ZnOHCl	9.209e-13	1.051e-12	-12.036	-11.978	0.058
CdCl+	6.478e-13	4.808e-13	-12.189	-12.318	-0.129
CdCl2	4.993e-13	5.700e-13	-12.302	-12.244	0.058
CdCl3-	1.208e-13	8.966e-14	-12.918	-13.047	-0.129
NiCl+	3.504e-15	2.600e-15	-14.455	-14.585	-0.129
NiCl2	2.458e-15	2.806e-15	-14.609	-14.552	0.058
ZnCl+	2.880e-17	1.857e-17	-16.541	-16.731	-0.191
ZnCl2	4.825e-18	5.509e-18	-17.316	-17.259	0.058
ZnCl3-	2.656e-18	1.712e-18	-17.576	-17.766	-0.191

## BH310A July 2012 Eh=0.5

ZnCl4-2	1.106e-18	2.320e-19	-17.956	-18.635	-0.678
PbCl+	9.880e-19	7.333e-19	-18.005	-18.135	-0.129
PbCl2	3.734e-19	4.263e-19	-18.428	-18.370	0.058
PbCl3-	1.258e-19	9.340e-20	-18.900	-19.030	-0.129
CuCl+	1.027e-19	6.619e-20	-18.989	-19.179	-0.191
PbCl4-2	4.012e-20	1.217e-20	-19.397	-19.915	-0.518
CuCl3-2	2.963e-20	6.217e-21	-19.528	-20.206	-0.678
CuCl2-	2.143e-20	1.382e-20	-19.669	-19.860	-0.191
CuCl2	8.165e-21	9.321e-21	-20.088	-20.031	0.058
CuCl3-	1.244e-23	8.017e-24	-22.905	-23.096	-0.191
CrO3Cl-	3.150e-25	2.338e-25	-24.502	-24.631	-0.129
CuCl4-2	8.311e-26	1.744e-26	-25.080	-25.759	-0.678
VOCl+	0.000e+00	0.000e+00	-44.487	-44.616	-0.129
CrOHCl2	0.000e+00	0.000e+00	-46.003	-45.946	0.058
CrCl+2	0.000e+00	0.000e+00	-50.552	-51.070	-0.518
CrCl2+	0.000e+00	0.000e+00	-52.304	-52.433	-0.129
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-439.233	-439.751	-0.518
Cr(2)	0.000e+00				
Cr+2	0.000e+00	0.000e+00	-65.161	-65.679	-0.518
Cr(3)	1.058e-28				
CrO2-	7.613e-29	5.650e-29	-28.118	-28.248	-0.129
Cr(OH)4-	2.897e-29	2.150e-29	-28.538	-28.668	-0.129
Cr(OH)3	7.077e-31	8.080e-31	-30.150	-30.093	0.058
Cr(OH)2+	5.271e-36	3.912e-36	-35.278	-35.408	-0.129
Cr(OH)+2	0.000e+00	0.000e+00	-41.715	-42.233	-0.518
CrOHSO4	0.000e+00	0.000e+00	-42.289	-42.232	0.058
CrOHCl2	0.000e+00	0.000e+00	-46.003	-45.946	0.058
Cr+3	0.000e+00	0.000e+00	-48.949	-50.114	-1.165
CrCl+2	0.000e+00	0.000e+00	-50.552	-51.070	-0.518
CrSO4+	0.000e+00	0.000e+00	-51.504	-51.634	-0.129
CrCl2+	0.000e+00	0.000e+00	-52.304	-52.433	-0.129
CrNO3+2	0.000e+00	0.000e+00	-56.047	-56.565	-0.518
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-81.687	-82.205	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-86.544	-86.487	0.058
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-296.557	-296.687	-0.129
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-366.888	-367.406	-0.518
Cr(NH3)6+3	0.000e+00	0.000e+00	-438.836	-440.001	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-439.233	-439.751	-0.518
Cr(6)	2.440e-06				
CrO4-2	1.772e-06	3.060e-07	-5.752	-6.514	-0.763
NaCrO4-	6.539e-07	4.853e-07	-6.184	-6.314	-0.129
KCrO4-	1.430e-08	1.062e-08	-7.845	-7.974	-0.129
HCrO4-	4.429e-13	3.287e-13	-12.354	-12.483	-0.129
Cr2O7-2	1.709e-23	5.185e-24	-22.767	-23.285	-0.518
CrO3Cl-	3.150e-25	2.338e-25	-24.502	-24.631	-0.129
CrO3SO4-2	2.787e-25	8.457e-26	-24.555	-25.073	-0.518
H2CrO4	1.494e-26	1.705e-26	-25.826	-25.768	0.058
Cu(1)	5.107e-20				

CuCl3-2	2.963e-20	6.217e-21	-19.528	-20.206	-0.678
CuCl2-	2.143e-20	1.382e-20	-19.669	-19.860	-0.191
Cu+	8.295e-25	4.836e-25	-24.081	-24.316	-0.234
Cu(2)	3.311e-08				
Cu(OH)2	2.056e-08	2.348e-08	-7.687	-7.629	0.058
Cu(OH)4-2	7.222e-09	2.191e-09	-8.141	-8.659	-0.518
Cu(OH)3-	5.323e-09	3.951e-09	-8.274	-8.403	-0.129
CuOH+	6.256e-15	4.033e-15	-14.204	-14.394	-0.191
CuCO3	1.720e-17	1.964e-17	-16.764	-16.707	0.058
Cu(CO3)2-2	2.058e-18	6.245e-19	-17.687	-18.204	-0.518
Cu+2	1.254e-18	1.447e-19	-17.902	-18.839	-0.938
CuCl+	1.027e-19	6.619e-20	-18.989	-19.179	-0.191
CuSO4	5.301e-20	6.052e-20	-19.276	-19.218	0.058
CuCl2	8.165e-21	9.321e-21	-20.088	-20.031	0.058
CuHCO3+	1.737e-23	1.289e-23	-22.760	-22.890	-0.129
CuCl3-	1.244e-23	8.017e-24	-22.905	-23.096	-0.191
Cu2(OH)2+2	7.580e-24	2.300e-24	-23.120	-23.638	-0.518
CuCl4-2	8.311e-26	1.744e-26	-25.080	-25.759	-0.678
Cu(S4)2-3	0.000e+00	0.000e+00	-284.621	-285.131	-0.510
CuS4S5-3	0.000e+00	0.000e+00	-285.386	-285.861	-0.475
Cu(HS)3-	0.000e+00	0.000e+00	-426.478	-426.607	-0.129
H(0)	0.000e+00				
H2	0.000e+00	0.000e+00	-44.364	-44.306	0.058
K	9.021e-03				
K+	8.918e-03	5.510e-03	-2.050	-2.259	-0.209
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
KCrO4-	1.430e-08	1.062e-08	-7.845	-7.974	-0.129
Mg	2.927e-02				
Mg+2	1.520e-02	5.190e-03	-1.818	-2.285	-0.467
MgOH+	1.234e-02	8.832e-03	-1.909	-2.054	-0.145
MgSO4	1.637e-03	1.868e-03	-2.786	-2.729	0.058
MgCO3	9.260e-05	1.057e-04	-4.033	-3.976	0.058
MgHCO3+	2.107e-08	1.358e-08	-7.676	-7.867	-0.191
N(-3)	0.000e+00				
NH3	0.000e+00	0.000e+00	-67.507	-67.449	0.058
NH4+	0.000e+00	0.000e+00	-70.074	-70.308	-0.234
NH4SO4-	0.000e+00	0.000e+00	-71.683	-71.853	-0.170
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-296.557	-296.687	-0.129
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-366.888	-367.406	-0.518
Cr(NH3)6+3	0.000e+00	0.000e+00	-438.836	-440.001	-1.165
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-439.233	-439.751	-0.518
N(3)	6.486e-17				
NO2-	6.486e-17	4.813e-17	-16.188	-16.318	-0.129
N(5)	2.013e-05				
NO3-	2.013e-05	1.219e-05	-4.696	-4.914	-0.218
CdNO3+	1.015e-18	7.530e-19	-17.994	-18.123	-0.129
PbNO3+	2.001e-23	1.485e-23	-22.699	-22.828	-0.129
VO2NO3	6.133e-35	7.002e-35	-34.212	-34.155	0.058



CrNO3+2	0.000e+00	0.000e+00	-56.047	-56.565	-0.518
Na	4.531e-01				
Na+	4.482e-01	3.191e-01	-0.349	-0.496	-0.148
NaSO4-	4.791e-03	3.296e-03	-2.320	-2.482	-0.162
NaCO3-	1.223e-04	8.417e-05	-3.913	-4.075	-0.162
NaCrO4-	6.539e-07	4.853e-07	-6.184	-6.314	-0.129
NaHCO3	2.994e-08	3.418e-08	-7.524	-7.466	0.058
Ni	1.043e-07				
Ni(OH)3-	1.020e-07	7.568e-08	-6.992	-7.121	-0.129
Ni(OH)2	2.379e-09	2.716e-09	-8.624	-8.566	0.058
NiOH+	8.147e-13	6.047e-13	-12.089	-12.218	-0.129
NiCO3	5.739e-13	6.552e-13	-12.241	-12.184	0.058
Ni(CO3)2-2	9.479e-14	2.876e-14	-13.023	-13.541	-0.518
Ni+2	1.153e-14	3.499e-15	-13.938	-14.456	-0.518
NiCl+	3.504e-15	2.600e-15	-14.455	-14.585	-0.129
NiCl2	2.458e-15	2.806e-15	-14.609	-14.552	0.058
NiSO4	1.200e-15	1.370e-15	-14.921	-14.863	0.058
Ni(SO4)2-2	5.926e-19	1.798e-19	-18.227	-18.745	-0.518
NiHCO3+	1.239e-19	9.199e-20	-18.907	-19.036	-0.129
O(0)	6.143e-08				
O2	3.071e-08	3.506e-08	-7.513	-7.455	0.058
Pb	3.484e-09				
Pb(OH)4-2	3.271e-09	9.925e-10	-8.485	-9.003	-0.518
Pb(OH)3-	2.090e-10	1.551e-10	-9.680	-9.809	-0.129
Pb(OH)2	4.248e-12	4.850e-12	-11.372	-11.314	0.058
PbOH+	6.028e-15	4.474e-15	-14.220	-14.349	-0.129
PbCO3	3.167e-17	3.615e-17	-16.499	-16.442	0.058
Pb(CO3)2-2	7.560e-18	2.294e-18	-17.121	-17.639	-0.518
PbCl+	9.880e-19	7.333e-19	-18.005	-18.135	-0.129
PbCl2	3.734e-19	4.263e-19	-18.428	-18.370	0.058
Pb+2	2.714e-19	8.235e-20	-18.566	-19.084	-0.518
PbCl3-	1.258e-19	9.340e-20	-18.900	-19.030	-0.129
PbSO4	8.986e-20	1.026e-19	-19.046	-18.989	0.058
PbCl4-2	4.012e-20	1.217e-20	-19.397	-19.915	-0.518
Pb(SO4)2-2	3.931e-21	1.193e-21	-20.406	-20.923	-0.518
PbNO3+	2.001e-23	1.485e-23	-22.699	-22.828	-0.129
PbHCO3+	1.567e-23	1.163e-23	-22.805	-22.935	-0.129
Pb2OH+3	1.207e-31	8.248e-33	-30.918	-32.084	-1.165
Pb3(OH)4+2	2.653e-32	8.050e-33	-31.576	-32.094	-0.518
Pb(HS)2	0.000e+00	0.000e+00	-292.983	-292.925	0.058
Pb(HS)3-	0.000e+00	0.000e+00	-436.051	-436.181	-0.129
S(-2)	0.000e+00				
S5-2	0.000e+00	0.000e+00	-141.440	-141.958	-0.518
S6-2	0.000e+00	0.000e+00	-141.466	-141.984	-0.518
S4-2	0.000e+00	0.000e+00	-141.685	-142.203	-0.518
HS-	0.000e+00	0.000e+00	-144.352	-144.556	-0.203
S-2	0.000e+00	0.000e+00	-144.681	-145.359	-0.678
S3-2	0.000e+00	0.000e+00	-145.158	-145.676	-0.518

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S2-2	0.000e+00	0.000e+00	-146.432	-146.950	-0.518
CdHS+	0.000e+00	0.000e+00	-148.010	-148.139	-0.129
H2S	0.000e+00	0.000e+00	-149.966	-149.908	0.058
Cu(S4)2-3	0.000e+00	0.000e+00	-284.621	-285.131	-0.510
CuS4S5-3	0.000e+00	0.000e+00	-285.386	-285.861	-0.475
Cd(HS)2	0.000e+00	0.000e+00	-286.392	-286.335	0.058
Zn(HS)2	0.000e+00	0.000e+00	-290.644	-290.587	0.058
Pb(HS)2	0.000e+00	0.000e+00	-292.983	-292.925	0.058
Cu(HS)3-	0.000e+00	0.000e+00	-426.478	-426.607	-0.129
Cd(HS)3-	0.000e+00	0.000e+00	-428.581	-428.710	-0.129
Zn(HS)3-	0.000e+00	0.000e+00	-433.853	-433.982	-0.129
Pb(HS)3-	0.000e+00	0.000e+00	-436.051	-436.181	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-570.558	-571.076	-0.518
S(6)	2.169e-02				
SO4-2	1.352e-02	2.215e-03	-1.869	-2.655	-0.786
NaSO4-	4.791e-03	3.296e-03	-2.320	-2.482	-0.162
MgSO4	1.637e-03	1.868e-03	-2.786	-2.729	0.058
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
HSO4-	8.502e-14	5.624e-14	-13.070	-13.250	-0.179
CdSO4	9.205e-15	1.051e-14	-14.036	-13.978	0.058
NiSO4	1.200e-15	1.370e-15	-14.921	-14.863	0.058
Cd(SO4)2-2	9.018e-16	2.736e-16	-15.045	-15.563	-0.518
ZnSO4	1.601e-17	1.828e-17	-16.796	-16.738	0.058
Zn(SO4)2-2	1.184e-18	3.593e-19	-17.927	-18.445	-0.518
Ni(SO4)2-2	5.926e-19	1.798e-19	-18.227	-18.745	-0.518
PbSO4	8.986e-20	1.026e-19	-19.046	-18.989	0.058
CuSO4	5.301e-20	6.052e-20	-19.276	-19.218	0.058
Pb(SO4)2-2	3.931e-21	1.193e-21	-20.406	-20.923	-0.518
CrO3SO4-2	2.787e-25	8.457e-26	-24.555	-25.073	-0.518
VO2SO4-	2.367e-30	1.756e-30	-29.626	-29.755	-0.129
AlSO4+	9.233e-32	6.107e-32	-31.035	-31.214	-0.179
Al(SO4)2-	1.554e-32	1.028e-32	-31.809	-31.988	-0.179
CrOHSO4	0.000e+00	0.000e+00	-42.289	-42.232	0.058
VOSO4	0.000e+00	0.000e+00	-44.474	-44.417	0.058
CrSO4+	0.000e+00	0.000e+00	-51.504	-51.634	-0.129
NH4SO4-	0.000e+00	0.000e+00	-71.683	-71.853	-0.170
VSO4+	0.000e+00	0.000e+00	-72.144	-72.273	-0.129
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-81.687	-82.205	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-86.544	-86.487	0.058
V(2)	0.000e+00				
VOH+	0.000e+00	0.000e+00	-76.753	-76.883	-0.129
V+2	0.000e+00	0.000e+00	-83.170	-83.688	-0.518
V(3)	0.000e+00				
V(OH)3	0.000e+00	0.000e+00	-44.801	-44.744	0.058
V(OH)2+	0.000e+00	0.000e+00	-51.869	-51.999	-0.129
VOH+2	0.000e+00	0.000e+00	-60.657	-61.175	-0.518
V+3	0.000e+00	0.000e+00	-69.893	-71.059	-1.165

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VSO4+	0.000e+00	0.000e+00	-72.144	-72.273	-0.129
V2(OH)3+3	0.000e+00	0.000e+00	-111.117	-112.283	-1.165
V2(OH)2+4	0.000e+00	0.000e+00	-118.906	-120.978	-2.072
V(4)	6.146e-38				
V(OH)3+	6.146e-38	4.561e-38	-37.211	-37.341	-0.129
VO+2	0.000e+00	0.000e+00	-43.590	-44.108	-0.518
VOSO4	0.000e+00	0.000e+00	-44.474	-44.417	0.058
VOCI+	0.000e+00	0.000e+00	-44.487	-44.616	-0.129
H2V2O4+2	0.000e+00	0.000e+00	-69.249	-69.767	-0.518
V(5)	4.636e-07				
HVO4-2	3.035e-07	9.210e-08	-6.518	-7.036	-0.518
VO4-3	1.598e-07	1.092e-08	-6.796	-7.962	-1.165
V2O7-4	1.157e-10	9.803e-13	-9.937	-12.009	-2.072
HV2O7-3	2.912e-11	1.989e-12	-10.536	-11.701	-1.165
H2VO4-	6.336e-12	4.702e-12	-11.198	-11.328	-0.129
H3VO4	9.370e-21	1.070e-20	-20.028	-19.971	0.058
H3V2O7-	1.130e-24	8.384e-25	-23.947	-24.077	-0.129
V3O9-3	3.515e-27	2.402e-28	-26.454	-27.619	-1.165
VO2+	2.083e-29	1.546e-29	-28.681	-28.811	-0.129
VO2SO4-	2.367e-30	1.756e-30	-29.626	-29.755	-0.129
VO2NO3	6.133e-35	7.002e-35	-34.212	-34.155	0.058
V4O12-4	4.259e-35	3.609e-37	-34.371	-36.443	-2.072
V10O28-6	0.000e+00	0.000e+00	-101.795	-106.457	-4.662
HV10O28-5	0.000e+00	0.000e+00	-110.094	-113.331	-3.237
H2V10O28-4	0.000e+00	0.000e+00	-119.470	-121.542	-2.072
Zn	9.624e-08				
Zn(OH)4-2	4.826e-08	1.464e-08	-7.316	-7.834	-0.518
Zn(OH)3-	4.468e-08	3.316e-08	-7.350	-7.479	-0.129
Zn(OH)2	3.297e-09	3.764e-09	-8.482	-8.424	0.058
ZnOHCl	9.209e-13	1.051e-12	-12.036	-11.978	0.058
ZnOH+	6.672e-14	4.952e-14	-13.176	-13.305	-0.129
Zn(CO3)2-2	3.447e-16	1.046e-16	-15.463	-15.981	-0.518
ZnCO3	1.696e-16	1.937e-16	-15.771	-15.713	0.058
Zn+2	1.567e-16	3.842e-17	-15.805	-16.415	-0.611
ZnCl+	2.880e-17	1.857e-17	-16.541	-16.731	-0.191
ZnSO4	1.601e-17	1.828e-17	-16.796	-16.738	0.058
ZnCl2	4.825e-18	5.509e-18	-17.316	-17.259	0.058
ZnCl3-	2.656e-18	1.712e-18	-17.576	-17.766	-0.191
Zn(SO4)2-2	1.184e-18	3.593e-19	-17.927	-18.445	-0.518
ZnCl4-2	1.106e-18	2.320e-19	-17.956	-18.635	-0.678
ZnHCO3+	1.158e-21	8.598e-22	-20.936	-21.066	-0.129
Zn(HS)2	0.000e+00	0.000e+00	-290.644	-290.587	0.058
Zn(HS)3-	0.000e+00	0.000e+00	-433.853	-433.982	-0.129

-----Saturation indices-----

Phase            SI log IAP   log KT

(NH4)2CrO4 -147.47 -395.75 -248.28 (NH4)2CrO4  
 Al(OH)3(a) -5.32 5.82 11.14 Al(OH)3  
 Al2O3 -11.33 11.65 22.98 Al2O3  
 Al4(OH)10SO4 -26.98 -4.28 22.70 Al4(OH)10SO4  
 AlAsO4:2H2O -24.75 -19.95 4.80 AlAsO4:2H2O  
 AlOHSO4 -18.50 -21.73 -3.23 AlOHSO4  
 AlumK -33.81 -39.18 -5.37 KAl(SO4)2:12H2O  
 Alunite -26.00 -27.46 -1.46 KAl3(SO4)2(OH)6  
 Anglesite -13.89 -21.74 -7.85 PbSO4  
 Anhydrite -0.47 -5.00 -4.53 CaSO4  
 Anilite -140.19 -212.64 -72.45 Cu0.25Cu1.5S  
 Antlerite -17.68 -9.39 8.29 Cu3(OH)4SO4  
 Aragonite 1.33 -6.94 -8.27 CaCO3  
 Arsenolite -183.51 -267.84 -84.34 As4O6  
 Artinite 5.30 15.70 10.40 MgCO3:Mg(OH)2:3H2O  
 As2O5 -58.38 -51.53 6.85 As2O5  
 Atacamite -8.73 -0.87 7.86 Cu2(OH)3Cl  
 Azurite -24.57 -40.82 -16.26 Cu3(OH)2(CO3)2  
 Ba3(AsO4)2 11.84 2.85 -8.98 Ba3(AsO4)2  
 BaCrO4 -3.44 -13.29 -9.85 BaCrO4  
 Barite 0.73 -9.43 -10.15 BaSO4  
 Bianchite -17.36 -19.12 -1.76 ZnSO4:6H2O  
 Blaubleil -129.76 -189.80 -60.04 Cu0.9Cu0.2S  
 Blaubleill -135.58 -200.34 -64.76 Cu0.6Cu0.8S  
 Boehmite -3.54 5.82 9.36 AlOOH  
 Brochantite -18.68 -3.34 15.34 Cu4(OH)6SO4  
 Brucite 5.09 22.61 17.51 Mg(OH)2  
 Bunsenite -2.68 10.44 13.12 NiO  
 Ca2V2O7 -3.09 6.19 9.28 CaVO3.5  
 Ca3(AsO4)2:6H2O -6.21 16.09 22.30 Ca3(AsO4)2:6H2O  
 Ca3(VO4)2 -2.99 17.47 20.46 Ca1.5VO4  
 Ca\_Vanadate -8.20 -5.08 3.11 Ca0.5VO3  
 CaCrO4 -6.77 -8.86 -2.09 CaCrO4  
 Calcite 1.48 -6.94 -8.42 CaCO3  
 Cd(BO2)2 -12.68 -2.84 9.84 Cd(BO2)2  
 Cd(Gamma) -44.15 -30.05 14.10 Cd  
 Cd(OH)2(A) -3.17 11.14 14.31 Cd(OH)2  
 Cd(OH)2(C) -2.51 11.14 13.65 Cd(OH)2  
 Cd3(OH)2(SO4)2 -28.39 -21.68 6.71 Cd3(OH)2(SO4)2  
 Cd3(OH)4SO4 -16.70 5.86 22.56 Cd3(OH)4SO4  
 Cd4(OH)6SO4 -11.40 17.00 28.40 Cd4(OH)6SO4  
 CdCl2 -14.25 -14.81 -0.55 CdCl2  
 CdCl2:2.5H2O -12.84 -14.83 -1.99 CdCl2:2.5H2O  
 CdCl2:H2O -13.16 -14.82 -1.66 CdCl2:H2O  
 CdMetal -44.05 -30.05 13.99 Cd  
 CdOHCl -5.56 -1.84 3.73 CdOHCl  
 CdSO4 -16.72 -16.41 0.31 CdSO4  
 CdSO4:2.67H2O -14.68 -16.43 -1.75 CdSO4:2.67H2O

CdSO4:H2O -14.97 -16.42 -1.45 CdSO4:H2O  
 Cerrusite -10.42 -23.68 -13.27 PbCO3  
 CH4(g) -152.49 -194.30 -41.81 CH4  
 Chalcantite -18.85 -21.53 -2.68 CuSO4:5H2O  
 Chalcocite -144.73 -221.42 -76.69 Cu2S  
 Claudetite -183.27 -267.84 -84.57 As4O6  
 CO2(g) -11.32 -29.50 -18.17 CO2  
 Cotunnite -15.21 -20.14 -4.93 PbCl2  
 Covellite -127.23 -186.28 -59.05 CuS  
 Cr(OH)2 -51.85 -113.81 -61.97 Cr(OH)2  
 Cr(OH)3(A) -22.21 -93.22 -71.01 Cr(OH)3  
 Cr(OH)3(C) -24.86 -93.22 -68.36 Cr(OH)3  
 Cr2O3 -42.85 -186.42 -143.57 Cr2O3  
 CrCl2 -83.15 -139.76 -56.61 CrCl2  
 CrCl3 -76.16 -132.14 -55.98 CrCl3  
 CrMetal -115.18 -155.00 -39.82 Cr  
 CrO3 -28.24 -31.41 -3.18 CrO3  
 Cu(OH)2 -3.02 6.05 9.07 Cu(OH)2  
 Cu2(OH)3NO3 -14.98 -5.26 9.73 Cu2(OH)3NO3  
 Cu2SO4 -49.46 -56.63 -7.17 Cu2SO4  
 Cu3(AsO4)2:6H2O -39.50 -33.40 6.10 Cu3(AsO4)2:6H2O  
 CuCO3 -13.81 -23.44 -9.63 CuCO3  
 CuCrO4 -19.88 -25.35 -5.48 CuCrO4  
 CuMetal -23.23 -35.14 -11.91 Cu  
 CuOCuSO4 -27.96 -15.44 12.53 CuO:CuSO4  
 Cuprite -22.01 -29.08 -7.07 Cu2O  
 CuSO4 -25.01 -21.49 3.52 CuSO4  
 Diaspore -1.74 5.82 7.56 AlOOH  
 Djurleite -143.51 -219.10 -75.60 Cu0.066Cu1.868S  
 Dolomite 2.95 -13.82 -16.77 CaMg(CO3)2  
 Epsomite -2.77 -4.99 -2.22 MgSO4:7H2O  
 Galena -135.51 -186.53 -51.02 PbS  
 Gibbsite(C) -3.59 5.82 9.41 Al(OH)3  
 Goslarite -17.07 -19.12 -2.05 ZnSO4:7H2O  
 Greenockite -129.47 -181.20 -51.73 CdS  
 Gypsum -0.16 -5.01 -4.86 CaSO4:2H2O  
 Halite -2.58 -1.02 1.56 NaCl  
 Huntite 1.66 -27.59 -29.25 CaMg3(CO3)4  
 Hydrcerrusite -24.10 -41.56 -17.46 Pb(OH)2:2PbCO3  
 Hydromagnesite 2.35 -4.95 -7.31 Mg5(CO3)4(OH)2:4H2O  
 K2Cr2O7 -26.27 -42.44 -16.18 K2Cr2O7  
 K2CrO4 -10.92 -11.03 -0.11 K2CrO4  
 Langite -21.25 -3.35 17.90 Cu4(OH)6SO4:H2O  
 Larnakite -15.83 -15.93 -0.10 PbO:PbSO4  
 Laurionite -7.79 -7.17 0.62 PbOHCl  
 Lime -11.54 22.56 34.09 CaO  
 Litharge -7.36 5.81 13.18 PbO  
 Magnesite 0.97 -6.88 -7.86 MgCO3

Malachite	-12.64	-17.39	-4.74	Cu <sub>2</sub> (OH) <sub>2</sub> CO <sub>3</sub>
Massicot	-7.57	5.81	13.38	PbO
Melanothallite	-23.97	-19.90	4.07	CuCl <sub>2</sub>
Mg <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-7.78	6.25	14.03	MgVO <sub>3.5</sub>
Mg_Vanadate	-11.15	-5.06	6.10	Mg <sub>0.5</sub> VO <sub>3</sub>
MgCr <sub>2</sub> O <sub>4</sub>	-36.48	-163.80	-127.32	MgCr <sub>2</sub> O <sub>4</sub>
MgCrO <sub>4</sub>	-14.77	-8.80	5.97	MgCrO <sub>4</sub>
Millerite	-138.45	-181.90	-43.45	NiS
Minium	-17.93	58.64	76.56	Pb <sub>3</sub> O <sub>4</sub>
Mirabilite	-2.08	-3.72	-1.65	Na <sub>2</sub> SO <sub>4</sub> :10H <sub>2</sub> O
Monteponite	-4.67	11.14	15.81	CdO
Morenosite	-14.72	-17.16	-2.44	NiSO <sub>4</sub> :7H <sub>2</sub> O
Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-28.87	-38.92	-10.04	Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
Na <sub>2</sub> CrO <sub>4</sub>	-10.90	-7.51	3.39	Na <sub>2</sub> CrO <sub>4</sub>
Na <sub>3</sub> VO <sub>4</sub>	-18.69	19.50	38.18	Na <sub>3</sub> VO <sub>4</sub>
Na <sub>4</sub> V <sub>2</sub> O <sub>7</sub>	-11.83	7.54	19.37	Na <sub>2</sub> VO <sub>3.5</sub>
Na_Vanadate	-8.32	-4.41	3.91	NaVO <sub>3</sub>
Nantokite	-17.80	-27.52	-9.71	CuCl
Natron	-3.91	-5.67	-1.75	Na <sub>2</sub> CO <sub>3</sub> :10H <sub>2</sub> O
Nesquehonite	-1.45	-6.91	-5.46	MgCO <sub>3</sub> :3H <sub>2</sub> O
NH <sub>4</sub> VO <sub>3</sub>	-77.02	-198.53	-121.51	NH <sub>4</sub> VO <sub>3</sub>
Ni(OH) <sub>2</sub>	0.49	10.43	9.95	Ni(OH) <sub>2</sub>
Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-35.96	-20.26	15.70	Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-17.81	14.19	32.00	Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
NiCO <sub>3</sub>	-12.49	-19.05	-6.56	NiCO <sub>3</sub>
O <sub>2</sub> (g)	-4.47	82.40	86.86	O <sub>2</sub>
Oripment	-501.07	-710.95	-209.88	As <sub>2</sub> S <sub>3</sub>
Otavite	-4.63	-18.35	-13.72	CdCO <sub>3</sub>
Pb(BO <sub>2</sub> ) <sub>2</sub>	-15.95	-8.17	7.77	Pb(BO <sub>2</sub> ) <sub>2</sub>
Pb(OH) <sub>2</sub> (C)	-2.74	5.81	8.54	Pb(OH) <sub>2</sub>
Pb <sub>2</sub> (OH) <sub>3</sub> Cl	-10.15	-1.36	8.79	Pb <sub>2</sub> (OH) <sub>3</sub> Cl
Pb <sub>2</sub> O(OH) <sub>2</sub>	-14.58	11.62	26.20	Pb <sub>2</sub> O(OH) <sub>2</sub>
Pb <sub>2</sub> O <sub>3</sub>	-8.22	52.82	61.04	Pb <sub>2</sub> O <sub>3</sub>
Pb <sub>2</sub> OCO <sub>3</sub>	-17.69	-17.87	-0.18	Pb <sub>2</sub> OCO <sub>3</sub>
Pb <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-9.69	-10.55	-0.86	PbVO <sub>3.5</sub>
Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>	-39.89	-34.09	5.80	Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>
Pb <sub>3</sub> (VO <sub>4</sub> ) <sub>2</sub>	-10.95	-7.64	3.31	Pb <sub>1.5</sub> VO <sub>4</sub>
Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>	-23.81	-12.06	11.76	Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>
Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>	-21.09	-10.11	10.98	Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>
Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-25.42	-4.32	21.10	Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>	-27.38	-4.30	23.08	Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>
PbCrO <sub>4</sub>	-11.63	-25.60	-13.97	PbCrO <sub>4</sub>
PbMetal	-39.64	-35.38	4.26	Pb
PbO:0.3H <sub>2</sub> O	-7.17	5.81	12.98	PbO:0.33H <sub>2</sub> O
Periclase	0.09	22.61	22.52	MgO
Phosgenite	-24.01	-43.82	-19.81	PbCl <sub>2</sub> :PbCO <sub>3</sub>
Plattnerite	-4.27	47.01	51.28	PbO <sub>2</sub>
Portlandite	-0.99	22.55	23.53	Ca(OH) <sub>2</sub>

Realgar	-203.68	-279.90	-76.23	AsS
Retgersite	-15.09	-17.16	-2.07	NiSO4:6H2O
Smithsonite	-11.13	-21.01	-9.88	ZnCO3
Sphalerite	-136.67	-183.86	-47.19	ZnS
Spinel	-4.56	34.27	38.83	MgAl2O4
SULFUR	-113.81	-151.15	-37.33	S
Tenorite	-1.99	6.06	8.05	CuO
Thenardite	-3.48	-3.65	-0.16	Na2SO4
Thermonatrite	-5.80	-5.60	0.20	Na2CO3:H2O
V(OH)3	-41.37	-57.57	-16.20	V(OH)3
V2O3	-39.16	-57.56	-18.40	VO1.5
V2O4	-23.87	-36.96	-13.09	VO2
V2O5	-15.76	-16.36	-0.60	VO2.5
V3O5	-101.36	-152.08	-50.72	V3O5
V4O7	-126.28	-189.04	-62.77	V4O7
V6O13	-117.89	-180.57	-62.68	V6O13
VCl2	-99.24	-104.11	-4.88	VCl2
VCl3	-95.60	-96.49	-0.89	VCl3
VMetal	-139.62	-119.36	20.26	V
VO	-68.18	-78.16	-9.98	VO
VO(OH)2	-25.07	-36.97	-11.90	VO(OH)2
VO2Cl	-32.42	-29.34	3.08	VO2Cl
VOCl	-56.83	-70.54	-13.71	VOCl
VOCl2	-58.74	-62.91	-4.17	VOCl2
VOSO4(C)	-50.91	-64.51	-13.60	VOSO4
Witherite	-2.77	-11.37	-8.60	BaCO3
Wurtzite	-138.69	-183.86	-45.17	ZnS
Zincite	-3.27	8.48	11.75	ZnO
Zincosite	-22.62	-19.07	3.55	ZnSO4
Zn(BO2)2	-13.79	-5.50	8.29	Zn(BO2)2
Zn(NO3)2:6H2O	-29.57	-26.29	3.29	Zn(NO3)2:6H2O
Zn(OH)2(A)	-3.98	8.47	12.45	Zn(OH)2
Zn(OH)2(B)	-3.28	8.47	11.75	Zn(OH)2
Zn(OH)2(C)	-3.73	8.47	12.20	Zn(OH)2
Zn(OH)2(E)	-3.03	8.47	11.50	Zn(OH)2
Zn(OH)2(G)	-3.24	8.47	11.71	Zn(OH)2
Zn2(OH)2SO4	-18.10	-10.60	7.50	Zn2(OH)2SO4
Zn2(OH)3Cl	-11.22	3.98	15.20	Zn2(OH)3Cl
Zn3(AsO4)2:2.5H2O	-39.75	-26.10	13.65	Zn3(AsO4)2:2.5H2O
Zn3O(SO4)2	-50.41	-29.66	20.75	Zn3O(SO4)2
Zn4(OH)6SO4	-22.05	6.35	28.40	Zn4(OH)6SO4
Zn5(OH)8Cl2	-22.07	16.43	38.50	Zn5(OH)8Cl2
ZnCl2	-24.99	-17.47	7.52	ZnCl2
ZnCO3:H2O	-10.76	-21.02	-10.26	ZnCO3:H2O
ZnMetal	-59.50	-32.72	26.79	Zn
ZnO(Active)	-2.83	8.48	11.31	ZnO
ZnS(A)	-139.36	-183.86	-44.50	ZnS
ZnSO4:H2O	-18.81	-19.08	-0.27	ZnSO4:H2O

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End of simulation.  
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Reading input data for simulation 2.  
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End of run.  
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No memory leaks



Database file: minteq.dat

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Reading data base.  
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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
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TITLE BH310a Nov 2012  
SOLUTION 1  
    pH 11.2 charge  
    temp 12.7  
    pe 0  
    units mg/L  
    Cd 0.00013  
    Cr 0.033 as CrO4-2  
    Pb 0.0007  
    Zn 0.0061  
END

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TITLE  
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BH310a Nov 2012

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Beginning of initial solution calculations.  
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Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Cd	1.157e-09	1.157e-09
Cr	2.845e-07	2.845e-07
Pb	3.379e-09	3.379e-09
Zn	9.331e-08	9.331e-08

## -----Description of solution-----

pH = 7.811    Charge balance  
 pe = 0.000  
 Activity of water = 1.000  
 Ionic strength = 3.368e-07  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 7.647e-07  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.700  
 Electrical balance (eq) = -3.231e-20  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = -0.00  
 Iterations = 12  
 Total H = 1.110124e+02  
 Total O = 5.550622e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	2.468e-07	2.467e-07	-6.608	-6.608	-0.000
H+	1.546e-08	1.545e-08	-7.811	-7.811	-0.000
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
Cd	1.157e-09				
Cd+2	1.154e-09	1.151e-09	-8.938	-8.939	-0.001
CdOH+	2.395e-12	2.393e-12	-11.621	-11.621	-0.000
Cd(OH)2	2.154e-14	2.154e-14	-13.667	-13.667	0.000
Cd(OH)3-	1.565e-19	1.564e-19	-18.805	-18.806	-0.000
Cd2OH+3	1.593e-20	1.583e-20	-19.798	-19.800	-0.003
Cd(OH)4-2	9.046e-26	9.022e-26	-25.044	-25.045	-0.001
Cr(2)	6.531e-21				
Cr+2	6.531e-21	6.513e-21	-20.185	-20.186	-0.001
Cr(3)	2.845e-07				
Cr(OH)3	2.347e-07	2.347e-07	-6.629	-6.629	0.000
Cr(OH)2+	4.895e-08	4.892e-08	-7.310	-7.311	-0.000
CrO2-	3.684e-10	3.681e-10	-9.434	-9.434	-0.000
Cr(OH)+2	3.159e-10	3.151e-10	-9.500	-9.502	-0.001
Cr(OH)4-	1.452e-10	1.451e-10	-9.838	-9.838	-0.000
Cr+3	2.115e-13	2.102e-13	-12.675	-12.677	-0.003
Cr(6)	8.955e-32				
CrO4-2	8.556e-32	8.534e-32	-31.068	-31.069	-0.001
HCrO4-	3.989e-33	3.987e-33	-32.399	-32.399	-0.000
H2CrO4	0.000e+00	0.000e+00	-41.040	-41.040	0.000
Cr2O7-2	0.000e+00	0.000e+00	-63.107	-63.108	-0.001
H(0)	3.841e-19				

H2	1.920e-19	1.920e-19	-18.717	-18.717	0.000
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-59.087	-59.087	0.000
Pb	3.379e-09				
PbOH+	1.857e-09	1.856e-09	-8.731	-8.731	-0.000
Pb+2	1.475e-09	1.471e-09	-8.831	-8.832	-0.001
Pb(OH)2	4.673e-11	4.673e-11	-10.330	-10.330	0.000
Pb(OH)3-	3.475e-14	3.473e-14	-13.459	-13.459	-0.000
Pb2OH+3	6.147e-17	6.111e-17	-16.211	-16.214	-0.003
Pb(OH)4-2	5.174e-18	5.161e-18	-17.286	-17.287	-0.001
Pb3(OH)4+2	1.077e-20	1.074e-20	-19.968	-19.969	-0.001
Zn	9.331e-08				
Zn+2	8.644e-08	8.621e-08	-7.063	-7.064	-0.001
Zn(OH)2	4.557e-09	4.557e-09	-8.341	-8.341	0.000
ZnOH+	2.314e-09	2.312e-09	-8.636	-8.636	-0.000
Zn(OH)3-	9.332e-13	9.326e-13	-12.030	-12.030	-0.000
Zn(OH)4-2	9.592e-18	9.566e-18	-17.018	-17.019	-0.001

## -----Saturation indices-----

Phase	SI	log IAP	log KT	
Cd(Gamma)	-23.10	-8.94	14.16	Cd
Cd(OH)2(A)	-7.70	6.68	14.39	Cd(OH)2
Cd(OH)2(C)	-6.97	6.68	13.65	Cd(OH)2
CdMetal	-23.00	-8.94	14.06	Cd
Cr(OH)2	-15.65	-7.31	8.34	Cr(OH)2
Cr(OH)3(A)	1.25	0.50	-0.75	Cr(OH)3
Cr(OH)3(C)	-1.42	0.50	1.92	Cr(OH)3
Cr2O3	4.01	1.00	-3.01	Cr2O3
CrMetal	-53.51	-22.93	30.58	Cr
CrO3	-43.52	23.93	67.45	CrO3
Litharge	-6.45	6.79	13.24	PbO
Massicot	-6.65	6.79	13.44	PbO
Minium	-40.94	35.99	76.93	Pb3O4
Monteponite	-9.22	6.68	15.90	CdO
O2(g)	-56.10	31.24	87.34	O2
Pb(OH)2(C)	-1.80	6.79	8.59	Pb(OH)2
Pb2O(OH)2	-12.62	13.58	26.20	Pb2O(OH)2
Pb2O3	-31.84	29.20	61.04	Pb2O3
PbCrO4	-25.89	30.72	56.62	PbCrO4
PbMetal	-13.09	-8.83	4.26	Pb
PbO:0.3H2O	-6.19	6.79	12.98	PbO:0.33H2O
Plattnerite	-29.12	22.41	51.53	PbO2
Zincite	-3.27	8.56	11.83	ZnO
Zn(OH)2(A)	-3.89	8.56	12.45	Zn(OH)2
Zn(OH)2(B)	-3.19	8.56	11.75	Zn(OH)2
Zn(OH)2(C)	-3.64	8.56	12.20	Zn(OH)2

Zn(OH)2(E)	-2.94	8.56	11.50	Zn(OH)2
Zn(OH)2(G)	-3.15	8.56	11.71	Zn(OH)2
ZnMetal	-33.98	-7.06	26.92	Zn
ZnO(Active)	-2.75	8.56	11.31	ZnO

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End of simulation.

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Reading input data for simulation 2.

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End of run.

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No memory leaks

Database file: minteq.dat

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Reading data base.  
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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

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Reading input data for simulation 1.  
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TITLE BH310a Nov 2012  
SOLUTION 1  
pH 11.2 charge  
temp 12.7  
pe -1.25673  
units mg/L  
Cd 0.00013  
Cr 0.033 as CrO4-2  
Pb 0.0007  
Zn 0.0061  
END

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TITLE  
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BH310a Nov 2012

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Beginning of initial solution calculations.  
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Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Cd	1.157e-09	1.157e-09
Cr	2.845e-07	2.845e-07
Pb	3.379e-09	3.379e-09
Zn	9.331e-08	9.331e-08

## -----Description of solution-----

pH = 7.811    Charge balance  
 pe = -1.257  
 Activity of water = 1.000  
 Ionic strength = 3.368e-07  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 7.647e-07  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.700  
 Electrical balance (eq) = -2.808e-20  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = -0.00  
 Iterations = 12  
 Total H = 1.110124e+02  
 Total O = 5.550622e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	2.468e-07	2.467e-07	-6.608	-6.608	-0.000
H+	1.546e-08	1.545e-08	-7.811	-7.811	-0.000
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
Cd	1.157e-09				
Cd+2	1.154e-09	1.151e-09	-8.938	-8.939	-0.001
CdOH+	2.395e-12	2.393e-12	-11.621	-11.621	-0.000
Cd(OH)2	2.154e-14	2.154e-14	-13.667	-13.667	0.000
Cd(OH)3-	1.565e-19	1.564e-19	-18.805	-18.806	-0.000
Cd2OH+3	1.593e-20	1.583e-20	-19.798	-19.800	-0.003
Cd(OH)4-2	9.046e-26	9.022e-26	-25.044	-25.045	-0.001
Cr(2)	1.179e-19				
Cr+2	1.179e-19	1.176e-19	-18.928	-18.929	-0.001
Cr(3)	2.845e-07				
Cr(OH)3	2.347e-07	2.347e-07	-6.629	-6.629	0.000
Cr(OH)2+	4.895e-08	4.892e-08	-7.310	-7.311	-0.000
CrO2-	3.684e-10	3.681e-10	-9.434	-9.434	-0.000
Cr(OH)+2	3.159e-10	3.151e-10	-9.500	-9.502	-0.001
Cr(OH)4-	1.452e-10	1.451e-10	-9.838	-9.838	-0.000
Cr+3	2.115e-13	2.102e-13	-12.675	-12.677	-0.003
Cr(6)	1.520e-35				
CrO4-2	1.452e-35	1.449e-35	-34.838	-34.839	-0.001
HCrO4-	6.772e-37	6.767e-37	-36.169	-36.170	-0.000
H2CrO4	0.000e+00	0.000e+00	-44.810	-44.810	0.000
Cr2O7-2	0.000e+00	0.000e+00	-70.647	-70.649	-0.001
H(0)	1.253e-16				

H2	6.264e-17	6.264e-17	-16.203	-16.203	0.000
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-64.114	-64.114	0.000
Pb	3.379e-09				
PbOH+	1.857e-09	1.856e-09	-8.731	-8.731	-0.000
Pb+2	1.475e-09	1.471e-09	-8.831	-8.832	-0.001
Pb(OH)2	4.673e-11	4.673e-11	-10.330	-10.330	0.000
Pb(OH)3-	3.475e-14	3.473e-14	-13.459	-13.459	-0.000
Pb2OH+3	6.147e-17	6.111e-17	-16.211	-16.214	-0.003
Pb(OH)4-2	5.174e-18	5.161e-18	-17.286	-17.287	-0.001
Pb3(OH)4+2	1.077e-20	1.074e-20	-19.968	-19.969	-0.001
Zn	9.331e-08				
Zn+2	8.644e-08	8.621e-08	-7.063	-7.064	-0.001
Zn(OH)2	4.557e-09	4.557e-09	-8.341	-8.341	0.000
ZnOH+	2.314e-09	2.312e-09	-8.636	-8.636	-0.000
Zn(OH)3-	9.332e-13	9.326e-13	-12.030	-12.030	-0.000
Zn(OH)4-2	9.592e-18	9.566e-18	-17.018	-17.019	-0.001

## -----Saturation indices-----

Phase	SI	log IAP	log KT	
Cd(Gamma)	-20.59	-6.43	14.16	Cd
Cd(OH)2(A)	-7.70	6.68	14.39	Cd(OH)2
Cd(OH)2(C)	-6.97	6.68	13.65	Cd(OH)2
CdMetal	-20.48	-6.43	14.06	Cd
Cr(OH)2	-14.39	-6.05	8.34	Cr(OH)2
Cr(OH)3(A)	1.25	0.50	-0.75	Cr(OH)3
Cr(OH)3(C)	-1.42	0.50	1.92	Cr(OH)3
Cr2O3	4.01	1.00	-3.01	Cr2O3
CrMetal	-49.74	-19.16	30.58	Cr
CrO3	-47.29	20.16	67.45	CrO3
Litharge	-6.45	6.79	13.24	PbO
Massicot	-6.65	6.79	13.44	PbO
Minium	-43.45	33.48	76.93	Pb3O4
Monteponite	-9.22	6.68	15.90	CdO
O2(g)	-61.12	26.22	87.34	O2
Pb(OH)2(C)	-1.80	6.79	8.59	Pb(OH)2
Pb2O(OH)2	-12.62	13.58	26.20	Pb2O(OH)2
Pb2O3	-34.35	26.69	61.04	Pb2O3
PbCrO4	-29.66	26.95	56.62	PbCrO4
PbMetal	-10.58	-6.32	4.26	Pb
PbO:0.3H2O	-6.19	6.79	12.98	PbO:0.33H2O
Plattnerite	-31.63	19.90	51.53	PbO2
Zincite	-3.27	8.56	11.83	ZnO
Zn(OH)2(A)	-3.89	8.56	12.45	Zn(OH)2
Zn(OH)2(B)	-3.19	8.56	11.75	Zn(OH)2
Zn(OH)2(C)	-3.64	8.56	12.20	Zn(OH)2

Zn(OH)2(E)	-2.94	8.56	11.50	Zn(OH)2
Zn(OH)2(G)	-3.15	8.56	11.71	Zn(OH)2
ZnMetal	-31.47	-4.55	26.92	Zn
ZnO(Active)	-2.75	8.56	11.31	ZnO

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End of simulation.  
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Reading input data for simulation 2.  
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-----  
End of run.  
-----

No memory leaks



Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH310a Nov 2012  
SOLUTION 1  
pH 11.2 charge  
temp 12.7  
pe -0.163  
units mg/L  
Cd 0.00013  
Cr 0.033 as CrO4-2  
Pb 0.0007  
Zn 0.0061  
END

-----  
TITLE  
-----

BH301a Nov 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Cd	1.157e-09	1.157e-09
Cr	2.845e-07	2.845e-07
Pb	3.379e-09	3.379e-09
Zn	9.331e-08	9.331e-08

## -----Description of solution-----

pH = 7.811    Charge balance  
 pe = -0.163  
 Activity of water = 1.000  
 Ionic strength = 3.368e-07  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 7.647e-07  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.700  
 Electrical balance (eq) = -3.225e-20  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = -0.00  
 Iterations = 12  
 Total H = 1.110124e+02  
 Total O = 5.550622e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	2.468e-07	2.467e-07	-6.608	-6.608	-0.000
H+	1.546e-08	1.545e-08	-7.811	-7.811	-0.000
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
Cd	1.157e-09				
Cd+2	1.154e-09	1.151e-09	-8.938	-8.939	-0.001
CdOH+	2.395e-12	2.393e-12	-11.621	-11.621	-0.000
Cd(OH)2	2.154e-14	2.154e-14	-13.667	-13.667	0.000
Cd(OH)3-	1.565e-19	1.564e-19	-18.805	-18.806	-0.000
Cd2OH+3	1.593e-20	1.583e-20	-19.798	-19.800	-0.003
Cd(OH)4-2	9.046e-26	9.022e-26	-25.044	-25.045	-0.001
Cr(2)	9.505e-21				
Cr+2	9.505e-21	9.480e-21	-20.022	-20.023	-0.001
Cr(3)	2.845e-07				
Cr(OH)3	2.347e-07	2.347e-07	-6.629	-6.629	0.000
Cr(OH)2+	4.895e-08	4.892e-08	-7.310	-7.311	-0.000
CrO2-	3.684e-10	3.681e-10	-9.434	-9.434	-0.000
Cr(OH)+2	3.159e-10	3.151e-10	-9.500	-9.502	-0.001
Cr(OH)4-	1.452e-10	1.451e-10	-9.838	-9.838	-0.000
Cr+3	2.115e-13	2.102e-13	-12.675	-12.677	-0.003
Cr(6)	2.905e-32				
CrO4-2	2.775e-32	2.768e-32	-31.557	-31.558	-0.001
HCrO4-	1.294e-33	1.293e-33	-32.888	-32.888	-0.000
H2CrO4	0.000e+00	0.000e+00	-41.529	-41.529	0.000
Cr2O7-2	0.000e+00	0.000e+00	-64.085	-64.086	-0.001
H(0)	8.136e-19				

H2	4.068e-19	4.068e-19	-18.391	-18.391	0.000
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-59.739	-59.739	0.000
Pb	3.379e-09				
PbOH+	1.857e-09	1.856e-09	-8.731	-8.731	-0.000
Pb+2	1.475e-09	1.471e-09	-8.831	-8.832	-0.001
Pb(OH)2	4.673e-11	4.673e-11	-10.330	-10.330	0.000
Pb(OH)3-	3.475e-14	3.473e-14	-13.459	-13.459	-0.000
Pb2OH+3	6.147e-17	6.111e-17	-16.211	-16.214	-0.003
Pb(OH)4-2	5.174e-18	5.161e-18	-17.286	-17.287	-0.001
Pb3(OH)4+2	1.077e-20	1.074e-20	-19.968	-19.969	-0.001
Zn	9.331e-08				
Zn+2	8.644e-08	8.621e-08	-7.063	-7.064	-0.001
Zn(OH)2	4.557e-09	4.557e-09	-8.341	-8.341	0.000
ZnOH+	2.314e-09	2.312e-09	-8.636	-8.636	-0.000
Zn(OH)3-	9.332e-13	9.326e-13	-12.030	-12.030	-0.000
Zn(OH)4-2	9.592e-18	9.566e-18	-17.018	-17.019	-0.001

## -----Saturation indices-----

Phase	SI	log IAP	log KT	
Cd(Gamma)	-22.78	-8.61	14.16	Cd
Cd(OH)2(A)	-7.70	6.68	14.39	Cd(OH)2
Cd(OH)2(C)	-6.97	6.68	13.65	Cd(OH)2
CdMetal	-22.67	-8.61	14.06	Cd
Cr(OH)2	-15.49	-7.15	8.34	Cr(OH)2
Cr(OH)3(A)	1.25	0.50	-0.75	Cr(OH)3
Cr(OH)3(C)	-1.42	0.50	1.92	Cr(OH)3
Cr2O3	4.01	1.00	-3.01	Cr2O3
CrMetal	-53.02	-22.44	30.58	Cr
CrO3	-44.01	23.44	67.45	CrO3
Litharge	-6.45	6.79	13.24	PbO
Massicot	-6.65	6.79	13.44	PbO
Minium	-41.27	35.66	76.93	Pb3O4
Monteponite	-9.22	6.68	15.90	CdO
O2(g)	-56.75	30.59	87.34	O2
Pb(OH)2(C)	-1.80	6.79	8.59	Pb(OH)2
Pb2O(OH)2	-12.62	13.58	26.20	Pb2O(OH)2
Pb2O3	-32.16	28.88	61.04	Pb2O3
PbCrO4	-26.38	30.23	56.62	PbCrO4
PbMetal	-12.76	-8.51	4.26	Pb
PbO:0.3H2O	-6.19	6.79	12.98	PbO:0.33H2O
Plattnerite	-29.45	22.09	51.53	PbO2
Zincite	-3.27	8.56	11.83	ZnO
Zn(OH)2(A)	-3.89	8.56	12.45	Zn(OH)2
Zn(OH)2(B)	-3.19	8.56	11.75	Zn(OH)2
Zn(OH)2(C)	-3.64	8.56	12.20	Zn(OH)2

Zn(OH)2(E)	-2.94	8.56	11.50	Zn(OH)2
Zn(OH)2(G)	-3.15	8.56	11.71	Zn(OH)2
ZnMetal	-33.66	-6.74	26.92	Zn
ZnO(Active)	-2.75	8.56	11.31	ZnO

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH310a Nov 2012  
SOLUTION 1  
pH 11.2 charge  
temp 12.7  
pe -0.815  
units mg/L  
Cd 0.00013  
Cr 0.033 as CrO4-2  
Pb 0.0007  
Zn 0.0061  
END

-----  
TITLE  
-----

BH310a Nov 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Cd	1.157e-09	1.157e-09
Cr	2.845e-07	2.845e-07
Pb	3.379e-09	3.379e-09
Zn	9.331e-08	9.331e-08

## -----Description of solution-----

pH = 7.811    Charge balance  
 pe = -0.815  
 Activity of water = 1.000  
 Ionic strength = 3.368e-07  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 7.647e-07  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.700  
 Electrical balance (eq) = -2.788e-20  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = -0.00  
 Iterations = 12  
 Total H = 1.110124e+02  
 Total O = 5.550622e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	2.468e-07	2.467e-07	-6.608	-6.608	-0.000
H+	1.546e-08	1.545e-08	-7.811	-7.811	-0.000
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
Cd	1.157e-09				
Cd+2	1.154e-09	1.151e-09	-8.938	-8.939	-0.001
CdOH+	2.395e-12	2.393e-12	-11.621	-11.621	-0.000
Cd(OH)2	2.154e-14	2.154e-14	-13.667	-13.667	0.000
Cd(OH)3-	1.565e-19	1.564e-19	-18.805	-18.806	-0.000
Cd2OH+3	1.593e-20	1.583e-20	-19.798	-19.800	-0.003
Cd(OH)4-2	9.046e-26	9.022e-26	-25.044	-25.045	-0.001
Cr(2)	4.265e-20				
Cr+2	4.265e-20	4.254e-20	-19.370	-19.371	-0.001
Cr(3)	2.845e-07				
Cr(OH)3	2.347e-07	2.347e-07	-6.629	-6.629	0.000
Cr(OH)2+	4.895e-08	4.892e-08	-7.310	-7.311	-0.000
CrO2-	3.684e-10	3.681e-10	-9.434	-9.434	-0.000
Cr(OH)+2	3.159e-10	3.151e-10	-9.500	-9.502	-0.001
Cr(OH)4-	1.452e-10	1.451e-10	-9.838	-9.838	-0.000
Cr+3	2.115e-13	2.102e-13	-12.675	-12.677	-0.003
Cr(6)	3.214e-34				
CrO4-2	3.071e-34	3.063e-34	-33.513	-33.514	-0.001
HCrO4-	1.432e-35	1.431e-35	-34.844	-34.844	-0.000
H2CrO4	0.000e+00	0.000e+00	-43.485	-43.485	0.000
Cr2O7-2	0.000e+00	0.000e+00	-67.997	-67.998	-0.001
H(0)	1.638e-17				

H2	8.192e-18	8.192e-18	-17.087	-17.087	0.000
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-62.347	-62.347	0.000
Pb	3.379e-09				
PbOH+	1.857e-09	1.856e-09	-8.731	-8.731	-0.000
Pb+2	1.475e-09	1.471e-09	-8.831	-8.832	-0.001
Pb(OH)2	4.673e-11	4.673e-11	-10.330	-10.330	0.000
Pb(OH)3-	3.475e-14	3.473e-14	-13.459	-13.459	-0.000
Pb2OH+3	6.147e-17	6.111e-17	-16.211	-16.214	-0.003
Pb(OH)4-2	5.174e-18	5.161e-18	-17.286	-17.287	-0.001
Pb3(OH)4+2	1.077e-20	1.074e-20	-19.968	-19.969	-0.001
Zn	9.331e-08				
Zn+2	8.644e-08	8.621e-08	-7.063	-7.064	-0.001
Zn(OH)2	4.557e-09	4.557e-09	-8.341	-8.341	0.000
ZnOH+	2.314e-09	2.312e-09	-8.636	-8.636	-0.000
Zn(OH)3-	9.332e-13	9.326e-13	-12.030	-12.030	-0.000
Zn(OH)4-2	9.592e-18	9.566e-18	-17.018	-17.019	-0.001

## -----Saturation indices-----

Phase	SI	log IAP	log KT	
Cd(Gamma)	-21.47	-7.31	14.16	Cd
Cd(OH)2(A)	-7.70	6.68	14.39	Cd(OH)2
Cd(OH)2(C)	-6.97	6.68	13.65	Cd(OH)2
CdMetal	-21.37	-7.31	14.06	Cd
Cr(OH)2	-14.84	-6.50	8.34	Cr(OH)2
Cr(OH)3(A)	1.25	0.50	-0.75	Cr(OH)3
Cr(OH)3(C)	-1.42	0.50	1.92	Cr(OH)3
Cr2O3	4.01	1.00	-3.01	Cr2O3
CrMetal	-51.07	-20.49	30.58	Cr
CrO3	-45.96	21.49	67.45	CrO3
Litharge	-6.45	6.79	13.24	PbO
Massicot	-6.65	6.79	13.44	PbO
Minium	-42.57	34.36	76.93	Pb3O4
Monteponite	-9.22	6.68	15.90	CdO
O2(g)	-59.36	27.98	87.34	O2
Pb(OH)2(C)	-1.80	6.79	8.59	Pb(OH)2
Pb2O(OH)2	-12.62	13.58	26.20	Pb2O(OH)2
Pb2O3	-33.47	27.57	61.04	Pb2O3
PbCrO4	-28.34	28.28	56.62	PbCrO4
PbMetal	-11.46	-7.20	4.26	Pb
PbO:0.3H2O	-6.19	6.79	12.98	PbO:0.33H2O
Plattnerite	-30.75	20.78	51.53	PbO2
Zincite	-3.27	8.56	11.83	ZnO
Zn(OH)2(A)	-3.89	8.56	12.45	Zn(OH)2
Zn(OH)2(B)	-3.19	8.56	11.75	Zn(OH)2
Zn(OH)2(C)	-3.64	8.56	12.20	Zn(OH)2

Zn(OH)2(E)	-2.94	8.56	11.50	Zn(OH)2
Zn(OH)2(G)	-3.15	8.56	11.71	Zn(OH)2
ZnMetal	-32.35	-5.43	26.92	Zn
ZnO(Active)	-2.75	8.56	11.31	ZnO

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks



Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH310a Nov 2012  
SOLUTION 1  
pH 11.2 charge  
temp 12.7  
pe -1.63  
units mg/L  
Cd 0.00013  
Cr 0.033 as CrO4-2  
Pb 0.0007  
Zn 0.0061  
END

-----  
TITLE  
-----

BH301a Nov 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Cd	1.157e-09	1.157e-09
Cr	2.845e-07	2.845e-07
Pb	3.379e-09	3.379e-09
Zn	9.331e-08	9.331e-08

## -----Description of solution-----

pH = 7.811    Charge balance  
 pe = -1.630  
 Activity of water = 1.000  
 Ionic strength = 3.368e-07  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 7.647e-07  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.700  
 Electrical balance (eq) = -4.326e-18  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = -0.00  
 Iterations = 12  
 Total H = 1.110124e+02  
 Total O = 5.550622e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	2.468e-07	2.467e-07	-6.608	-6.608	-0.000
H+	1.546e-08	1.545e-08	-7.811	-7.811	-0.000
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
Cd	1.157e-09				
Cd+2	1.154e-09	1.151e-09	-8.938	-8.939	-0.001
CdOH+	2.395e-12	2.393e-12	-11.621	-11.621	-0.000
Cd(OH)2	2.154e-14	2.154e-14	-13.667	-13.667	0.000
Cd(OH)3-	1.565e-19	1.564e-19	-18.805	-18.806	-0.000
Cd2OH+3	1.593e-20	1.583e-20	-19.798	-19.800	-0.003
Cd(OH)4-2	9.046e-26	9.022e-26	-25.044	-25.045	-0.001
Cr(2)	2.786e-19				
Cr+2	2.786e-19	2.778e-19	-18.555	-18.556	-0.001
Cr(3)	2.845e-07				
Cr(OH)3	2.347e-07	2.347e-07	-6.629	-6.629	0.000
Cr(OH)2+	4.895e-08	4.892e-08	-7.310	-7.311	-0.000
CrO2-	3.684e-10	3.681e-10	-9.434	-9.434	-0.000
Cr(OH)+2	3.159e-10	3.151e-10	-9.500	-9.502	-0.001
Cr(OH)4-	1.452e-10	1.451e-10	-9.838	-9.838	-0.000
Cr+3	2.115e-13	2.102e-13	-12.675	-12.677	-0.003
Cr(6)	1.154e-36				
CrO4-2	1.102e-36	1.099e-36	-35.958	-35.959	-0.001
HCrO4-	5.139e-38	5.136e-38	-37.289	-37.289	-0.000
H2CrO4	0.000e+00	0.000e+00	-45.930	-45.930	0.000
Cr2O7-2	0.000e+00	0.000e+00	-72.887	-72.888	-0.001
H(0)	6.989e-16				

H2	3.495e-16	3.495e-16	-15.457	-15.457	0.000
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-65.607	-65.607	0.000
Pb	3.379e-09				
PbOH+	1.857e-09	1.856e-09	-8.731	-8.731	-0.000
Pb+2	1.475e-09	1.471e-09	-8.831	-8.832	-0.001
Pb(OH)2	4.673e-11	4.673e-11	-10.330	-10.330	0.000
Pb(OH)3-	3.475e-14	3.473e-14	-13.459	-13.459	-0.000
Pb2OH+3	6.147e-17	6.111e-17	-16.211	-16.214	-0.003
Pb(OH)4-2	5.174e-18	5.161e-18	-17.286	-17.287	-0.001
Pb3(OH)4+2	1.077e-20	1.074e-20	-19.968	-19.969	-0.001
Zn	9.331e-08				
Zn+2	8.644e-08	8.621e-08	-7.063	-7.064	-0.001
Zn(OH)2	4.557e-09	4.557e-09	-8.341	-8.341	0.000
ZnOH+	2.314e-09	2.312e-09	-8.636	-8.636	-0.000
Zn(OH)3-	9.332e-13	9.326e-13	-12.030	-12.030	-0.000
Zn(OH)4-2	9.592e-18	9.566e-18	-17.018	-17.019	-0.001

## -----Saturation indices-----

Phase	SI	log IAP	log KT	
Cd(Gamma)	-19.84	-5.68	14.16	Cd
Cd(OH)2(A)	-7.70	6.68	14.39	Cd(OH)2
Cd(OH)2(C)	-6.97	6.68	13.65	Cd(OH)2
CdMetal	-19.74	-5.68	14.06	Cd
Cr(OH)2	-14.02	-5.68	8.34	Cr(OH)2
Cr(OH)3(A)	1.25	0.50	-0.75	Cr(OH)3
Cr(OH)3(C)	-1.42	0.50	1.92	Cr(OH)3
Cr2O3	4.01	1.00	-3.01	Cr2O3
CrMetal	-48.62	-18.04	30.58	Cr
CrO3	-48.41	19.04	67.45	CrO3
Litharge	-6.45	6.79	13.24	PbO
Massicot	-6.65	6.79	13.44	PbO
Minium	-44.20	32.73	76.93	Pb3O4
Monteponite	-9.22	6.68	15.90	CdO
O2(g)	-62.62	24.72	87.34	O2
Pb(OH)2(C)	-1.80	6.79	8.59	Pb(OH)2
Pb2O(OH)2	-12.62	13.58	26.20	Pb2O(OH)2
Pb2O3	-35.10	25.94	61.04	Pb2O3
PbCrO4	-30.78	25.83	56.62	PbCrO4
PbMetal	-9.83	-5.57	4.26	Pb
PbO:0.3H2O	-6.19	6.79	12.98	PbO:0.33H2O
Plattnerite	-32.38	19.15	51.53	PbO2
Zincite	-3.27	8.56	11.83	ZnO
Zn(OH)2(A)	-3.89	8.56	12.45	Zn(OH)2
Zn(OH)2(B)	-3.19	8.56	11.75	Zn(OH)2
Zn(OH)2(C)	-3.64	8.56	12.20	Zn(OH)2

Zn(OH)2(E)	-2.94	8.56	11.50	Zn(OH)2
Zn(OH)2(G)	-3.15	8.56	11.71	Zn(OH)2
ZnMetal	-30.72	-3.80	26.92	Zn
ZnO(Active)	-2.75	8.56	11.31	ZnO

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH310a Nov 2012  
SOLUTION 1  
    pH 11.2 charge  
    temp 12.7  
    pe -3.26  
    units mg/L  
    Cd 0.00013  
    Cr 0.033 as CrO4-2  
    Pb 0.0007  
    Zn 0.0061  
END

-----  
TITLE  
-----

BH301a Nov 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Cd	1.157e-09	1.157e-09
Cr	2.845e-07	2.845e-07
Pb	3.379e-09	3.379e-09
Zn	9.331e-08	9.331e-08

## -----Description of solution-----

pH = 7.811    Charge balance  
 pe = -3.260  
 Activity of water = 1.000  
 Ionic strength = 3.368e-07  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 7.647e-07  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.700  
 Electrical balance (eq) = -4.325e-18  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = -0.00  
 Iterations = 12  
 Total H = 1.110124e+02  
 Total O = 5.550622e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	2.468e-07	2.467e-07	-6.608	-6.608	-0.000
H+	1.546e-08	1.545e-08	-7.811	-7.811	-0.000
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
Cd	1.157e-09				
Cd+2	1.154e-09	1.151e-09	-8.938	-8.939	-0.001
CdOH+	2.395e-12	2.393e-12	-11.621	-11.621	-0.000
Cd(OH)2	2.154e-14	2.154e-14	-13.667	-13.667	0.000
Cd(OH)3-	1.565e-19	1.564e-19	-18.805	-18.806	-0.000
Cd2OH+3	1.593e-20	1.583e-20	-19.798	-19.800	-0.003
Cd(OH)4-2	9.046e-26	9.022e-26	-25.044	-25.045	-0.001
Cr(2)	1.188e-17				
Cr+2	1.188e-17	1.185e-17	-16.925	-16.926	-0.001
Cr(3)	2.845e-07				
Cr(OH)3	2.347e-07	2.347e-07	-6.629	-6.629	0.000
Cr(OH)2+	4.895e-08	4.892e-08	-7.310	-7.311	-0.000
CrO2-	3.684e-10	3.681e-10	-9.434	-9.434	-0.000
Cr(OH)+2	3.159e-10	3.151e-10	-9.500	-9.502	-0.001
Cr(OH)4-	1.452e-10	1.451e-10	-9.838	-9.838	-0.000
Cr+3	2.115e-13	2.102e-13	-12.675	-12.677	-0.003
Cr(6)	0.000e+00				
CrO4-2	0.000e+00	0.000e+00	-40.848	-40.849	-0.001
HCrO4-	0.000e+00	0.000e+00	-42.179	-42.179	-0.000
H2CrO4	0.000e+00	0.000e+00	-50.820	-50.820	0.000
Cr2O7-2	0.000e+00	0.000e+00	-82.667	-82.668	-0.001
H(0)	1.272e-12				

H2	6.359e-13	6.359e-13	-12.197	-12.197	0.000
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-72.127	-72.127	0.000
Pb	3.379e-09				
PbOH+	1.857e-09	1.856e-09	-8.731	-8.731	-0.000
Pb+2	1.475e-09	1.471e-09	-8.831	-8.832	-0.001
Pb(OH)2	4.673e-11	4.673e-11	-10.330	-10.330	0.000
Pb(OH)3-	3.475e-14	3.473e-14	-13.459	-13.459	-0.000
Pb2OH+3	6.147e-17	6.111e-17	-16.211	-16.214	-0.003
Pb(OH)4-2	5.174e-18	5.161e-18	-17.286	-17.287	-0.001
Pb3(OH)4+2	1.077e-20	1.074e-20	-19.968	-19.969	-0.001
Zn	9.331e-08				
Zn+2	8.644e-08	8.621e-08	-7.063	-7.064	-0.001
Zn(OH)2	4.557e-09	4.557e-09	-8.341	-8.341	0.000
ZnOH+	2.314e-09	2.312e-09	-8.636	-8.636	-0.000
Zn(OH)3-	9.332e-13	9.326e-13	-12.030	-12.030	-0.000
Zn(OH)4-2	9.592e-18	9.566e-18	-17.018	-17.019	-0.001

## -----Saturation indices-----

Phase	SI	log IAP	log KT	
Cd(Gamma)	-16.58	-2.42	14.16	Cd
Cd(OH)2(A)	-7.70	6.68	14.39	Cd(OH)2
Cd(OH)2(C)	-6.97	6.68	13.65	Cd(OH)2
CdMetal	-16.48	-2.42	14.06	Cd
Cr(OH)2	-12.39	-4.05	8.34	Cr(OH)2
Cr(OH)3(A)	1.25	0.50	-0.75	Cr(OH)3
Cr(OH)3(C)	-1.42	0.50	1.92	Cr(OH)3
Cr2O3	4.01	1.00	-3.01	Cr2O3
CrMetal	-43.73	-13.15	30.58	Cr
CrO3	-53.30	14.15	67.45	CrO3
Litharge	-6.45	6.79	13.24	PbO
Massicot	-6.65	6.79	13.44	PbO
Minium	-47.46	29.47	76.93	Pb3O4
Monteponite	-9.22	6.68	15.90	CdO
O2(g)	-69.14	18.20	87.34	O2
Pb(OH)2(C)	-1.80	6.79	8.59	Pb(OH)2
Pb2O(OH)2	-12.62	13.58	26.20	Pb2O(OH)2
Pb2O3	-38.36	22.68	61.04	Pb2O3
PbCrO4	-35.67	20.94	56.62	PbCrO4
PbMetal	-6.57	-2.31	4.26	Pb
PbO:0.3H2O	-6.19	6.79	12.98	PbO:0.33H2O
Plattnerite	-35.64	15.89	51.53	PbO2
Zincite	-3.27	8.56	11.83	ZnO
Zn(OH)2(A)	-3.89	8.56	12.45	Zn(OH)2
Zn(OH)2(B)	-3.19	8.56	11.75	Zn(OH)2
Zn(OH)2(C)	-3.64	8.56	12.20	Zn(OH)2

Zn(OH)2(E)	-2.94	8.56	11.50	Zn(OH)2
Zn(OH)2(G)	-3.15	8.56	11.71	Zn(OH)2
ZnMetal	-27.46	-0.54	26.92	Zn
ZnO(Active)	-2.75	8.56	11.31	ZnO

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks



Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH310a Nov 2012  
SOLUTION 1  
pH 11.2 charge  
temp 12.7  
pe -8.15  
units mg/L  
Cd 0.00013  
Cr 0.033 as CrO4-2  
Pb 0.0007  
Zn 0.0061  
END

-----  
TITLE  
-----

BH301a Nov 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Cd	1.157e-09	1.157e-09
Cr	2.845e-07	2.845e-07
Pb	3.379e-09	3.379e-09
Zn	9.331e-08	9.331e-08

## -----Description of solution-----

pH = 7.811    Charge balance  
 pe = -8.150  
 Activity of water = 1.000  
 Ionic strength = 3.368e-07  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 7.647e-07  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.700  
 Electrical balance (eq) = 7.561e-16  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = 0.00  
 Iterations = 12  
 Total H = 1.110201e+02  
 Total O = 5.550622e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	2.469e-07	2.467e-07	-6.608	-6.608	-0.000
H+	1.546e-08	1.545e-08	-7.811	-7.811	-0.000
H2O	5.551e+01	9.999e-01	-0.000	-0.000	0.000
Cd	1.157e-09				
Cd+2	1.154e-09	1.151e-09	-8.938	-8.939	-0.001
CdOH+	2.395e-12	2.393e-12	-11.621	-11.621	-0.000
Cd(OH)2	2.154e-14	2.154e-14	-13.667	-13.667	0.000
Cd(OH)3-	1.565e-19	1.564e-19	-18.805	-18.806	-0.000
Cd2OH+3	1.593e-20	1.583e-20	-19.798	-19.800	-0.003
Cd(OH)4-2	9.046e-26	9.022e-26	-25.044	-25.045	-0.001
Cr(2)	9.225e-13				
Cr+2	9.225e-13	9.200e-13	-12.035	-12.036	-0.001
Cr(3)	2.845e-07				
Cr(OH)3	2.347e-07	2.347e-07	-6.629	-6.629	0.000
Cr(OH)2+	4.895e-08	4.892e-08	-7.310	-7.311	-0.000
CrO2-	3.684e-10	3.682e-10	-9.434	-9.434	-0.000
Cr(OH)+2	3.159e-10	3.151e-10	-9.500	-9.502	-0.001
Cr(OH)4-	1.452e-10	1.451e-10	-9.838	-9.838	-0.000
Cr+3	2.115e-13	2.102e-13	-12.675	-12.677	-0.003
Cr(6)	0.000e+00				
CrO4-2	0.000e+00	0.000e+00	-55.518	-55.519	-0.001
HCrO4-	0.000e+00	0.000e+00	-56.849	-56.849	-0.000
H2CrO4	0.000e+00	0.000e+00	-65.490	-65.490	0.000
Cr2O7-2	0.000e+00	0.000e+00	-112.007	-112.008	-0.001
H(0)	7.662e-03				

H2	3.831e-03	3.831e-03	-2.417	-2.417	0.000
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-91.687	-91.687	0.000
Pb	3.379e-09				
PbOH+	1.857e-09	1.856e-09	-8.731	-8.731	-0.000
Pb+2	1.475e-09	1.471e-09	-8.831	-8.832	-0.001
Pb(OH)2	4.673e-11	4.673e-11	-10.330	-10.330	0.000
Pb(OH)3-	3.475e-14	3.473e-14	-13.459	-13.459	-0.000
Pb2OH+3	6.147e-17	6.111e-17	-16.211	-16.214	-0.003
Pb(OH)4-2	5.174e-18	5.161e-18	-17.286	-17.287	-0.001
Pb3(OH)4+2	1.077e-20	1.074e-20	-19.968	-19.969	-0.001
Zn	9.331e-08				
Zn+2	8.644e-08	8.621e-08	-7.063	-7.064	-0.001
Zn(OH)2	4.557e-09	4.557e-09	-8.341	-8.341	0.000
ZnOH+	2.314e-09	2.312e-09	-8.636	-8.636	-0.000
Zn(OH)3-	9.333e-13	9.326e-13	-12.030	-12.030	-0.000
Zn(OH)4-2	9.592e-18	9.567e-18	-17.018	-17.019	-0.001

## -----Saturation indices-----

Phase	SI	log IAP	log KT	
Cd(Gamma)	-6.80	7.36	14.16	Cd
Cd(OH)2(A)	-7.70	6.68	14.39	Cd(OH)2
Cd(OH)2(C)	-6.97	6.68	13.65	Cd(OH)2
CdMetal	-6.70	7.36	14.06	Cd
Cr(OH)2	-7.50	0.84	8.34	Cr(OH)2
Cr(OH)3(A)	1.25	0.50	-0.75	Cr(OH)3
Cr(OH)3(C)	-1.42	0.50	1.92	Cr(OH)3
Cr2O3	4.01	1.00	-3.01	Cr2O3
CrMetal	-29.06	1.52	30.58	Cr
CrO3	-67.97	-0.52	67.45	CrO3
Litharge	-6.45	6.79	13.24	PbO
Massicot	-6.65	6.79	13.44	PbO
Minium	-57.24	19.69	76.93	Pb3O4
Monteponite	-9.22	6.68	15.90	CdO
O2(g)	-88.70	-1.36	87.34	O2
Pb(OH)2(C)	-1.80	6.79	8.59	Pb(OH)2
Pb2O(OH)2	-12.62	13.58	26.20	Pb2O(OH)2
Pb2O3	-48.14	12.90	61.04	Pb2O3
PbCrO4	-50.34	6.27	56.62	PbCrO4
PbMetal	3.21	7.47	4.26	Pb
PbO:0.3H2O	-6.19	6.79	12.98	PbO:0.33H2O
Plattnerite	-45.42	6.11	51.53	PbO2
Zincite	-3.27	8.56	11.83	ZnO
Zn(OH)2(A)	-3.89	8.56	12.45	Zn(OH)2
Zn(OH)2(B)	-3.19	8.56	11.75	Zn(OH)2
Zn(OH)2(C)	-3.64	8.56	12.20	Zn(OH)2

Zn(OH)2(E)	-2.94	8.56	11.50	Zn(OH)2
Zn(OH)2(G)	-3.15	8.56	11.71	Zn(OH)2
ZnMetal	-17.68	9.24	26.92	Zn
ZnO(Active)	-2.75	8.56	11.31	ZnO

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH310a Nov 2012  
SOLUTION 1  
    pH 11.2 charge  
    temp 12.7  
    pe -2.445  
    units mg/L  
    Cd 0.00013  
    Cr 0.033 as CrO4-2  
    Pb 0.0007  
    Zn 0.0061  
END

-----  
TITLE  
-----

BH301a Nov 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Cd	1.157e-09	1.157e-09
Cr	2.845e-07	2.845e-07
Pb	3.379e-09	3.379e-09
Zn	9.331e-08	9.331e-08

-----Description of solution-----

pH = 7.811    Charge balance  
 pe = -2.445  
 Activity of water = 1.000  
 Ionic strength = 3.368e-07  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 7.647e-07  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.700  
 Electrical balance (eq) = -4.326e-18  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = -0.00  
 Iterations = 12  
 Total H = 1.110124e+02  
 Total O = 5.550622e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	2.468e-07	2.467e-07	-6.608	-6.608	-0.000
H+	1.546e-08	1.545e-08	-7.811	-7.811	-0.000
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
Cd	1.157e-09				
Cd+2	1.154e-09	1.151e-09	-8.938	-8.939	-0.001
CdOH+	2.395e-12	2.393e-12	-11.621	-11.621	-0.000
Cd(OH)2	2.154e-14	2.154e-14	-13.667	-13.667	0.000
Cd(OH)3-	1.565e-19	1.564e-19	-18.805	-18.806	-0.000
Cd2OH+3	1.593e-20	1.583e-20	-19.798	-19.800	-0.003
Cd(OH)4-2	9.046e-26	9.022e-26	-25.044	-25.045	-0.001
Cr(2)	1.820e-18				
Cr+2	1.820e-18	1.815e-18	-17.740	-17.741	-0.001
Cr(3)	2.845e-07				
Cr(OH)3	2.347e-07	2.347e-07	-6.629	-6.629	0.000
Cr(OH)2+	4.895e-08	4.892e-08	-7.310	-7.311	-0.000
CrO2-	3.684e-10	3.681e-10	-9.434	-9.434	-0.000
Cr(OH)+2	3.159e-10	3.151e-10	-9.500	-9.502	-0.001
Cr(OH)4-	1.452e-10	1.451e-10	-9.838	-9.838	-0.000
Cr+3	2.115e-13	2.102e-13	-12.675	-12.677	-0.003
Cr(6)	4.141e-39				
CrO4-2	3.956e-39	3.946e-39	-38.403	-38.404	-0.001
HCrO4-	1.845e-40	1.843e-40	-39.734	-39.734	-0.000
H2CrO4	0.000e+00	0.000e+00	-48.375	-48.375	0.000
Cr2O7-2	0.000e+00	0.000e+00	-77.777	-77.778	-0.001
H(0)	2.981e-14				

BH310A Nov 12 - Eh=-0.15

H2	1.491e-14	1.491e-14	-13.827	-13.827	0.000
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-68.867	-68.867	0.000
Pb	3.379e-09				
PbOH+	1.857e-09	1.856e-09	-8.731	-8.731	-0.000
Pb+2	1.475e-09	1.471e-09	-8.831	-8.832	-0.001
Pb(OH)2	4.673e-11	4.673e-11	-10.330	-10.330	0.000
Pb(OH)3-	3.475e-14	3.473e-14	-13.459	-13.459	-0.000
Pb2OH+3	6.147e-17	6.111e-17	-16.211	-16.214	-0.003
Pb(OH)4-2	5.174e-18	5.161e-18	-17.286	-17.287	-0.001
Pb3(OH)4+2	1.077e-20	1.074e-20	-19.968	-19.969	-0.001
Zn	9.331e-08				
Zn+2	8.644e-08	8.621e-08	-7.063	-7.064	-0.001
Zn(OH)2	4.557e-09	4.557e-09	-8.341	-8.341	0.000
ZnOH+	2.314e-09	2.312e-09	-8.636	-8.636	-0.000
Zn(OH)3-	9.332e-13	9.326e-13	-12.030	-12.030	-0.000
Zn(OH)4-2	9.592e-18	9.566e-18	-17.018	-17.019	-0.001

-----Saturation indices-----

Phase	SI	log IAP	log KT	
Cd(Gamma)	-18.21	-4.05	14.16	Cd
Cd(OH)2(A)	-7.70	6.68	14.39	Cd(OH)2
Cd(OH)2(C)	-6.97	6.68	13.65	Cd(OH)2
CdMetal	-18.11	-4.05	14.06	Cd
Cr(OH)2	-13.21	-4.87	8.34	Cr(OH)2
Cr(OH)3(A)	1.25	0.50	-0.75	Cr(OH)3
Cr(OH)3(C)	-1.42	0.50	1.92	Cr(OH)3
Cr2O3	4.01	1.00	-3.01	Cr2O3
CrMetal	-46.18	-15.60	30.58	Cr
CrO3	-50.85	16.60	67.45	CrO3
Litharge	-6.45	6.79	13.24	PbO
Massicot	-6.65	6.79	13.44	PbO
Minium	-45.83	31.10	76.93	Pb3O4
Monteponite	-9.22	6.68	15.90	CdO
O2(g)	-65.88	21.46	87.34	O2
Pb(OH)2(C)	-1.80	6.79	8.59	Pb(OH)2
Pb2O(OH)2	-12.62	13.58	26.20	Pb2O(OH)2
Pb2O3	-36.73	24.31	61.04	Pb2O3
PbCrO4	-33.23	23.39	56.62	PbCrO4
PbMetal	-8.20	-3.94	4.26	Pb
PbO:0.3H2O	-6.19	6.79	12.98	PbO:0.33H2O
Plattnerite	-34.01	17.52	51.53	PbO2
Zincite	-3.27	8.56	11.83	ZnO
Zn(OH)2(A)	-3.89	8.56	12.45	Zn(OH)2
Zn(OH)2(B)	-3.19	8.56	11.75	Zn(OH)2
Zn(OH)2(C)	-3.64	8.56	12.20	Zn(OH)2

Zn(OH)2(E)	-2.94	8.56	11.50	Zn(OH)2
Zn(OH)2(G)	-3.15	8.56	11.71	Zn(OH)2
ZnMetal	-29.09	-2.17	26.92	Zn
ZnO(Active)	-2.75	8.56	11.31	ZnO

-----  
End of simulation.  
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-----  
Reading input data for simulation 2.  
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-----  
End of run.  
-----

No memory leaks



Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH310a Nov 2012  
SOLUTION 1  
    pH 11.2 charge  
    temp 12.7  
    pe -2.8525  
    units mg/L  
    Cd 0.00013  
    Cr 0.033 as CrO4-2  
    Pb 0.0007  
    Zn 0.0061  
END

-----  
TITLE  
-----

BH301a Nov 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Cd	1.157e-09	1.157e-09
Cr	2.845e-07	2.845e-07
Pb	3.379e-09	3.379e-09
Zn	9.331e-08	9.331e-08

## -----Description of solution-----

pH = 7.811    Charge balance  
 pe = -2.853  
 Activity of water = 1.000  
 Ionic strength = 3.368e-07  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 7.647e-07  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.700  
 Electrical balance (eq) = -4.325e-18  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = -0.00  
 Iterations = 12  
 Total H = 1.110124e+02  
 Total O = 5.550622e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	2.468e-07	2.467e-07	-6.608	-6.608	-0.000
H+	1.546e-08	1.545e-08	-7.811	-7.811	-0.000
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
Cd	1.157e-09				
Cd+2	1.154e-09	1.151e-09	-8.938	-8.939	-0.001
CdOH+	2.395e-12	2.393e-12	-11.621	-11.621	-0.000
Cd(OH)2	2.154e-14	2.154e-14	-13.667	-13.667	0.000
Cd(OH)3-	1.565e-19	1.564e-19	-18.805	-18.806	-0.000
Cd2OH+3	1.593e-20	1.583e-20	-19.798	-19.800	-0.003
Cd(OH)4-2	9.046e-26	9.022e-26	-25.044	-25.045	-0.001
Cr(2)	4.650e-18				
Cr+2	4.650e-18	4.638e-18	-17.333	-17.334	-0.001
Cr(3)	2.845e-07				
Cr(OH)3	2.347e-07	2.347e-07	-6.629	-6.629	0.000
Cr(OH)2+	4.895e-08	4.892e-08	-7.310	-7.311	-0.000
CrO2-	3.684e-10	3.681e-10	-9.434	-9.434	-0.000
Cr(OH)+2	3.159e-10	3.151e-10	-9.500	-9.502	-0.001
Cr(OH)4-	1.452e-10	1.451e-10	-9.838	-9.838	-0.000
Cr+3	2.115e-13	2.102e-13	-12.675	-12.677	-0.003
Cr(6)	2.370e-40				
CrO4-2	2.370e-40	2.364e-40	-39.625	-39.626	-0.001
HCrO4-	0.000e+00	0.000e+00	-40.957	-40.957	-0.000
H2CrO4	0.000e+00	0.000e+00	-49.597	-49.597	0.000
Cr2O7-2	0.000e+00	0.000e+00	-80.222	-80.223	-0.001
H(0)	1.947e-13				

H2	9.736e-14	9.736e-14	-13.012	-13.012	0.000
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-70.497	-70.497	0.000
Pb	3.379e-09				
PbOH+	1.857e-09	1.856e-09	-8.731	-8.731	-0.000
Pb+2	1.475e-09	1.471e-09	-8.831	-8.832	-0.001
Pb(OH)2	4.673e-11	4.673e-11	-10.330	-10.330	0.000
Pb(OH)3-	3.475e-14	3.473e-14	-13.459	-13.459	-0.000
Pb2OH+3	6.147e-17	6.111e-17	-16.211	-16.214	-0.003
Pb(OH)4-2	5.174e-18	5.161e-18	-17.286	-17.287	-0.001
Pb3(OH)4+2	1.077e-20	1.074e-20	-19.968	-19.969	-0.001
Zn	9.331e-08				
Zn+2	8.644e-08	8.621e-08	-7.063	-7.064	-0.001
Zn(OH)2	4.557e-09	4.557e-09	-8.341	-8.341	0.000
ZnOH+	2.314e-09	2.312e-09	-8.636	-8.636	-0.000
Zn(OH)3-	9.332e-13	9.326e-13	-12.030	-12.030	-0.000
Zn(OH)4-2	9.592e-18	9.566e-18	-17.018	-17.019	-0.001

## -----Saturation indices-----

Phase	SI	log IAP	log KT	
Cd(Gamma)	-17.40	-3.23	14.16	Cd
Cd(OH)2(A)	-7.70	6.68	14.39	Cd(OH)2
Cd(OH)2(C)	-6.97	6.68	13.65	Cd(OH)2
CdMetal	-17.29	-3.23	14.06	Cd
Cr(OH)2	-12.80	-4.46	8.34	Cr(OH)2
Cr(OH)3(A)	1.25	0.50	-0.75	Cr(OH)3
Cr(OH)3(C)	-1.42	0.50	1.92	Cr(OH)3
Cr2O3	4.01	1.00	-3.01	Cr2O3
CrMetal	-44.95	-14.38	30.58	Cr
CrO3	-52.08	15.38	67.45	CrO3
Litharge	-6.45	6.79	13.24	PbO
Massicot	-6.65	6.79	13.44	PbO
Minium	-46.65	30.29	76.93	Pb3O4
Monteponite	-9.22	6.68	15.90	CdO
O2(g)	-67.51	19.83	87.34	O2
Pb(OH)2(C)	-1.80	6.79	8.59	Pb(OH)2
Pb2O(OH)2	-12.62	13.58	26.20	Pb2O(OH)2
Pb2O3	-37.54	23.50	61.04	Pb2O3
PbCrO4	-34.45	22.17	56.62	PbCrO4
PbMetal	-7.38	-3.13	4.26	Pb
PbO:0.3H2O	-6.19	6.79	12.98	PbO:0.33H2O
Plattnerite	-34.82	16.71	51.53	PbO2
Zincite	-3.27	8.56	11.83	ZnO
Zn(OH)2(A)	-3.89	8.56	12.45	Zn(OH)2
Zn(OH)2(B)	-3.19	8.56	11.75	Zn(OH)2
Zn(OH)2(C)	-3.64	8.56	12.20	Zn(OH)2

Zn(OH)2(E)	-2.94	8.56	11.50	Zn(OH)2
Zn(OH)2(G)	-3.15	8.56	11.71	Zn(OH)2
ZnMetal	-28.28	-1.36	26.92	Zn
ZnO(Active)	-2.75	8.56	11.31	ZnO

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH310a Nov 2012  
SOLUTION 1  
    pH 11.2 charge  
    temp 12.7  
    pe 0.163  
    units mg/L  
    Cd 0.00013  
    Cr 0.033 as CrO4-2  
    Pb 0.0007  
    Zn 0.0061  
END

-----  
TITLE  
-----

BH301a Nov 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Cd	1.157e-09	1.157e-09
Cr	2.845e-07	2.845e-07
Pb	3.379e-09	3.379e-09
Zn	9.331e-08	9.331e-08

## -----Description of solution-----

pH = 7.811    Charge balance  
 pe = 0.163  
 Activity of water = 1.000  
 Ionic strength = 3.368e-07  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 7.647e-07  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.700  
 Electrical balance (eq) = -3.318e-20  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = -0.00  
 Iterations = 12  
 Total H = 1.110124e+02  
 Total O = 5.550622e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	2.468e-07	2.467e-07	-6.608	-6.608	-0.000
H+	1.546e-08	1.545e-08	-7.811	-7.811	-0.000
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
Cd	1.157e-09				
Cd+2	1.154e-09	1.151e-09	-8.938	-8.939	-0.001
CdOH+	2.395e-12	2.393e-12	-11.621	-11.621	-0.000
Cd(OH)2	2.154e-14	2.154e-14	-13.667	-13.667	0.000
Cd(OH)3-	1.565e-19	1.564e-19	-18.805	-18.806	-0.000
Cd2OH+3	1.593e-20	1.583e-20	-19.798	-19.800	-0.003
Cd(OH)4-2	9.046e-26	9.022e-26	-25.044	-25.045	-0.001
Cr(2)	4.487e-21				
Cr+2	4.487e-21	4.475e-21	-20.348	-20.349	-0.001
Cr(3)	2.845e-07				
Cr(OH)3	2.347e-07	2.347e-07	-6.629	-6.629	0.000
Cr(OH)2+	4.895e-08	4.892e-08	-7.310	-7.311	-0.000
CrO2-	3.684e-10	3.681e-10	-9.434	-9.434	-0.000
Cr(OH)+2	3.159e-10	3.151e-10	-9.500	-9.502	-0.001
Cr(OH)4-	1.452e-10	1.451e-10	-9.838	-9.838	-0.000
Cr+3	2.115e-13	2.102e-13	-12.675	-12.677	-0.003
Cr(6)	2.761e-31				
CrO4-2	2.638e-31	2.631e-31	-30.579	-30.580	-0.001
HCrO4-	1.230e-32	1.229e-32	-31.910	-31.910	-0.000
H2CrO4	0.000e+00	0.000e+00	-40.551	-40.551	0.000
Cr2O7-2	0.000e+00	0.000e+00	-62.129	-62.130	-0.001
H(0)	1.813e-19				

H2	9.065e-20	9.065e-20	-19.043	-19.043	0.000
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-58.435	-58.435	0.000
Pb	3.379e-09				
PbOH+	1.857e-09	1.856e-09	-8.731	-8.731	-0.000
Pb+2	1.475e-09	1.471e-09	-8.831	-8.832	-0.001
Pb(OH)2	4.673e-11	4.673e-11	-10.330	-10.330	0.000
Pb(OH)3-	3.475e-14	3.473e-14	-13.459	-13.459	-0.000
Pb2OH+3	6.147e-17	6.111e-17	-16.211	-16.214	-0.003
Pb(OH)4-2	5.174e-18	5.161e-18	-17.286	-17.287	-0.001
Pb3(OH)4+2	1.077e-20	1.074e-20	-19.968	-19.969	-0.001
Zn	9.331e-08				
Zn+2	8.644e-08	8.621e-08	-7.063	-7.064	-0.001
Zn(OH)2	4.557e-09	4.557e-09	-8.341	-8.341	0.000
ZnOH+	2.314e-09	2.312e-09	-8.636	-8.636	-0.000
Zn(OH)3-	9.332e-13	9.326e-13	-12.030	-12.030	-0.000
Zn(OH)4-2	9.592e-18	9.566e-18	-17.018	-17.019	-0.001

## -----Saturation indices-----

Phase	SI	log IAP	log KT	
Cd(Gamma)	-23.43	-9.26	14.16	Cd
Cd(OH)2(A)	-7.70	6.68	14.39	Cd(OH)2
Cd(OH)2(C)	-6.97	6.68	13.65	Cd(OH)2
CdMetal	-23.32	-9.26	14.06	Cd
Cr(OH)2	-15.81	-7.47	8.34	Cr(OH)2
Cr(OH)3(A)	1.25	0.50	-0.75	Cr(OH)3
Cr(OH)3(C)	-1.42	0.50	1.92	Cr(OH)3
Cr2O3	4.01	1.00	-3.01	Cr2O3
CrMetal	-54.00	-23.42	30.58	Cr
CrO3	-43.03	24.42	67.45	CrO3
Litharge	-6.45	6.79	13.24	PbO
Massicot	-6.65	6.79	13.44	PbO
Minium	-40.61	36.32	76.93	Pb3O4
Monteponite	-9.22	6.68	15.90	CdO
O2(g)	-55.44	31.90	87.34	O2
Pb(OH)2(C)	-1.80	6.79	8.59	Pb(OH)2
Pb2O(OH)2	-12.62	13.58	26.20	Pb2O(OH)2
Pb2O3	-31.51	29.53	61.04	Pb2O3
PbCrO4	-25.40	31.21	56.62	PbCrO4
PbMetal	-13.42	-9.16	4.26	Pb
PbO:0.3H2O	-6.19	6.79	12.98	PbO:0.33H2O
Plattnerite	-28.79	22.74	51.53	PbO2
Zincite	-3.27	8.56	11.83	ZnO
Zn(OH)2(A)	-3.89	8.56	12.45	Zn(OH)2
Zn(OH)2(B)	-3.19	8.56	11.75	Zn(OH)2
Zn(OH)2(C)	-3.64	8.56	12.20	Zn(OH)2

Zn(OH)2(E)	-2.94	8.56	11.50	Zn(OH)2
Zn(OH)2(G)	-3.15	8.56	11.71	Zn(OH)2
ZnMetal	-34.31	-7.39	26.92	Zn
ZnO(Active)	-2.75	8.56	11.31	ZnO

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks



Database file: minteq.dat

-----  
Reading data base.  
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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

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Reading input data for simulation 1.  
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TITLE BH310a Nov 2012  
SOLUTION 1  
pH 11.2 charge  
temp 12.7  
pe 0.815  
units mg/L  
Cd 0.00013  
Cr 0.033 as CrO4-2  
Pb 0.0007  
Zn 0.0061  
END

-----  
TITLE  
-----

BH301a Nov 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Cd	1.157e-09	1.157e-09
Cr	2.845e-07	2.845e-07
Pb	3.379e-09	3.379e-09
Zn	9.331e-08	9.331e-08

## -----Description of solution-----

pH = 7.811    Charge balance  
 pe = 0.815  
 Activity of water = 1.000  
 Ionic strength = 3.368e-07  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 7.647e-07  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.700  
 Electrical balance (eq) = -3.611e-20  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = -0.00  
 Iterations = 12  
 Total H = 1.110124e+02  
 Total O = 5.550622e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	2.468e-07	2.467e-07	-6.608	-6.608	-0.000
H+	1.546e-08	1.545e-08	-7.811	-7.811	-0.000
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
Cd	1.157e-09				
Cd+2	1.154e-09	1.151e-09	-8.938	-8.939	-0.001
CdOH+	2.395e-12	2.393e-12	-11.621	-11.621	-0.000
Cd(OH)2	2.154e-14	2.154e-14	-13.667	-13.667	0.000
Cd(OH)3-	1.565e-19	1.564e-19	-18.805	-18.806	-0.000
Cd2OH+3	1.593e-20	1.583e-20	-19.798	-19.800	-0.003
Cd(OH)4-2	9.046e-26	9.022e-26	-25.044	-25.045	-0.001
Cr(2)	9.999e-22				
Cr+2	9.999e-22	9.973e-22	-21.000	-21.001	-0.001
Cr(3)	2.845e-07				
Cr(OH)3	2.347e-07	2.347e-07	-6.629	-6.629	0.000
Cr(OH)2+	4.895e-08	4.892e-08	-7.310	-7.311	-0.000
CrO2-	3.684e-10	3.681e-10	-9.434	-9.434	-0.000
Cr(OH)+2	3.159e-10	3.151e-10	-9.500	-9.502	-0.001
Cr(OH)4-	1.452e-10	1.451e-10	-9.838	-9.838	-0.000
Cr+3	2.115e-13	2.102e-13	-12.675	-12.677	-0.003
Cr(6)	2.495e-29				
CrO4-2	2.384e-29	2.378e-29	-28.623	-28.624	-0.001
HCrO4-	1.111e-30	1.111e-30	-29.954	-29.954	-0.000
H2CrO4	2.543e-39	2.543e-39	-38.595	-38.595	0.000
Cr2O7-2	0.000e+00	0.000e+00	-58.217	-58.218	-0.001
H(0)	9.004e-21				

H2	4.502e-21	4.502e-21	-20.347	-20.347	0.000
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-55.827	-55.827	0.000
Pb	3.379e-09				
PbOH+	1.857e-09	1.856e-09	-8.731	-8.731	-0.000
Pb+2	1.475e-09	1.471e-09	-8.831	-8.832	-0.001
Pb(OH)2	4.673e-11	4.673e-11	-10.330	-10.330	0.000
Pb(OH)3-	3.475e-14	3.473e-14	-13.459	-13.459	-0.000
Pb2OH+3	6.147e-17	6.111e-17	-16.211	-16.214	-0.003
Pb(OH)4-2	5.174e-18	5.161e-18	-17.286	-17.287	-0.001
Pb3(OH)4+2	1.077e-20	1.074e-20	-19.968	-19.969	-0.001
Zn	9.331e-08				
Zn+2	8.644e-08	8.621e-08	-7.063	-7.064	-0.001
Zn(OH)2	4.557e-09	4.557e-09	-8.341	-8.341	0.000
ZnOH+	2.314e-09	2.312e-09	-8.636	-8.636	-0.000
Zn(OH)3-	9.332e-13	9.326e-13	-12.030	-12.030	-0.000
Zn(OH)4-2	9.592e-18	9.566e-18	-17.018	-17.019	-0.001

## -----Saturation indices-----

Phase	SI	log IAP	log KT	
Cd(Gamma)	-24.73	-10.57	14.16	Cd
Cd(OH)2(A)	-7.70	6.68	14.39	Cd(OH)2
Cd(OH)2(C)	-6.97	6.68	13.65	Cd(OH)2
CdMetal	-24.63	-10.57	14.06	Cd
Cr(OH)2	-16.47	-8.13	8.34	Cr(OH)2
Cr(OH)3(A)	1.25	0.50	-0.75	Cr(OH)3
Cr(OH)3(C)	-1.42	0.50	1.92	Cr(OH)3
Cr2O3	4.01	1.00	-3.01	Cr2O3
CrMetal	-55.96	-25.38	30.58	Cr
CrO3	-41.07	26.38	67.45	CrO3
Litharge	-6.45	6.79	13.24	PbO
Massicot	-6.65	6.79	13.44	PbO
Minium	-39.31	37.62	76.93	Pb3O4
Monteponite	-9.22	6.68	15.90	CdO
O2(g)	-52.84	34.50	87.34	O2
Pb(OH)2(C)	-1.80	6.79	8.59	Pb(OH)2
Pb2O(OH)2	-12.62	13.58	26.20	Pb2O(OH)2
Pb2O3	-30.21	30.83	61.04	Pb2O3
PbCrO4	-23.45	33.17	56.62	PbCrO4
PbMetal	-14.72	-10.46	4.26	Pb
PbO:0.3H2O	-6.19	6.79	12.98	PbO:0.33H2O
Plattnerite	-27.49	24.04	51.53	PbO2
Zincite	-3.27	8.56	11.83	ZnO
Zn(OH)2(A)	-3.89	8.56	12.45	Zn(OH)2
Zn(OH)2(B)	-3.19	8.56	11.75	Zn(OH)2
Zn(OH)2(C)	-3.64	8.56	12.20	Zn(OH)2

Zn(OH)2(E)	-2.94	8.56	11.50	Zn(OH)2
Zn(OH)2(G)	-3.15	8.56	11.71	Zn(OH)2
ZnMetal	-35.61	-8.69	26.92	Zn
ZnO(Active)	-2.75	8.56	11.31	ZnO

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH310a Nov 2012  
SOLUTION 1  
pH 11.2 charge  
temp 12.7  
pe 1.63  
units mg/L  
Cd 0.00013  
Cr 0.033 as CrO4-2  
Pb 0.0007  
Zn 0.0061  
END

-----  
TITLE  
-----

BH301a Nov 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Cd	1.157e-09	1.157e-09
Cr	2.845e-07	2.845e-07
Pb	3.379e-09	3.379e-09
Zn	9.331e-08	9.331e-08

## -----Description of solution-----

pH = 7.811    Charge balance  
 pe = 1.630  
 Activity of water = 1.000  
 Ionic strength = 3.368e-07  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 7.647e-07  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.700  
 Electrical balance (eq) = -4.958e-20  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = -0.00  
 Iterations = 12  
 Total H = 1.110124e+02  
 Total O = 5.550622e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	2.468e-07	2.467e-07	-6.608	-6.608	-0.000
H+	1.546e-08	1.545e-08	-7.811	-7.811	-0.000
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
Cd	1.157e-09				
Cd+2	1.154e-09	1.151e-09	-8.938	-8.939	-0.001
CdOH+	2.395e-12	2.393e-12	-11.621	-11.621	-0.000
Cd(OH)2	2.154e-14	2.154e-14	-13.667	-13.667	0.000
Cd(OH)3-	1.565e-19	1.564e-19	-18.805	-18.806	-0.000
Cd2OH+3	1.593e-20	1.583e-20	-19.798	-19.800	-0.003
Cd(OH)4-2	9.046e-26	9.022e-26	-25.044	-25.045	-0.001
Cr(2)	1.531e-22				
Cr+2	1.531e-22	1.527e-22	-21.815	-21.816	-0.001
Cr(3)	2.845e-07				
Cr(OH)3	2.347e-07	2.347e-07	-6.629	-6.629	0.000
Cr(OH)2+	4.895e-08	4.892e-08	-7.310	-7.311	-0.000
CrO2-	3.684e-10	3.681e-10	-9.434	-9.434	-0.000
Cr(OH)+2	3.159e-10	3.151e-10	-9.500	-9.502	-0.001
Cr(OH)4-	1.452e-10	1.451e-10	-9.838	-9.838	-0.000
Cr+3	2.115e-13	2.102e-13	-12.675	-12.677	-0.003
Cr(6)	6.952e-27				
CrO4-2	6.642e-27	6.624e-27	-26.178	-26.179	-0.001
HCrO4-	3.097e-28	3.095e-28	-27.509	-27.509	-0.000
H2CrO4	7.085e-37	7.085e-37	-36.150	-36.150	0.000
Cr2O7-2	0.000e+00	0.000e+00	-53.327	-53.328	-0.001
H(0)	2.111e-22				

H2	1.055e-22	1.055e-22	-21.977	-21.977	0.000
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-52.567	-52.567	0.000
Pb	3.379e-09				
PbOH+	1.857e-09	1.856e-09	-8.731	-8.731	-0.000
Pb+2	1.475e-09	1.471e-09	-8.831	-8.832	-0.001
Pb(OH)2	4.673e-11	4.673e-11	-10.330	-10.330	0.000
Pb(OH)3-	3.475e-14	3.473e-14	-13.459	-13.459	-0.000
Pb2OH+3	6.147e-17	6.111e-17	-16.211	-16.214	-0.003
Pb(OH)4-2	5.174e-18	5.161e-18	-17.286	-17.287	-0.001
Pb3(OH)4+2	1.077e-20	1.074e-20	-19.968	-19.969	-0.001
Zn	9.331e-08				
Zn+2	8.644e-08	8.621e-08	-7.063	-7.064	-0.001
Zn(OH)2	4.557e-09	4.557e-09	-8.341	-8.341	0.000
ZnOH+	2.314e-09	2.312e-09	-8.636	-8.636	-0.000
Zn(OH)3-	9.332e-13	9.326e-13	-12.030	-12.030	-0.000
Zn(OH)4-2	9.592e-18	9.566e-18	-17.018	-17.019	-0.001

## -----Saturation indices-----

Phase	SI	log IAP	log KT	
Cd(Gamma)	-26.36	-12.20	14.16	Cd
Cd(OH)2(A)	-7.70	6.68	14.39	Cd(OH)2
Cd(OH)2(C)	-6.97	6.68	13.65	Cd(OH)2
CdMetal	-26.26	-12.20	14.06	Cd
Cr(OH)2	-17.28	-8.94	8.34	Cr(OH)2
Cr(OH)3(A)	1.25	0.50	-0.75	Cr(OH)3
Cr(OH)3(C)	-1.42	0.50	1.92	Cr(OH)3
Cr2O3	4.01	1.00	-3.01	Cr2O3
CrMetal	-58.40	-27.82	30.58	Cr
CrO3	-38.63	28.82	67.45	CrO3
Litharge	-6.45	6.79	13.24	PbO
Massicot	-6.65	6.79	13.44	PbO
Minium	-37.68	39.25	76.93	Pb3O4
Monteponite	-9.22	6.68	15.90	CdO
O2(g)	-49.58	37.76	87.34	O2
Pb(OH)2(C)	-1.80	6.79	8.59	Pb(OH)2
Pb2O(OH)2	-12.62	13.58	26.20	Pb2O(OH)2
Pb2O3	-28.58	32.46	61.04	Pb2O3
PbCrO4	-21.00	35.61	56.62	PbCrO4
PbMetal	-16.35	-12.09	4.26	Pb
PbO:0.3H2O	-6.19	6.79	12.98	PbO:0.33H2O
Plattnerite	-25.86	25.67	51.53	PbO2
Zincite	-3.27	8.56	11.83	ZnO
Zn(OH)2(A)	-3.89	8.56	12.45	Zn(OH)2
Zn(OH)2(B)	-3.19	8.56	11.75	Zn(OH)2
Zn(OH)2(C)	-3.64	8.56	12.20	Zn(OH)2

Zn(OH)2(E)	-2.94	8.56	11.50	Zn(OH)2
Zn(OH)2(G)	-3.15	8.56	11.71	Zn(OH)2
ZnMetal	-37.24	-10.32	26.92	Zn
ZnO(Active)	-2.75	8.56	11.31	ZnO

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks



Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH310a Nov 2012  
SOLUTION 1  
    pH 11.2 charge  
    temp 12.7  
    pe 8.15  
    units mg/L  
    Cd 0.00013  
    Cr 0.033 as CrO4-2  
    Pb 0.0007  
    Zn 0.0061  
END

-----  
TITLE  
-----

BH301a Nov 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Cd	1.157e-09	1.157e-09
Cr	2.845e-07	2.845e-07
Pb	3.379e-09	3.379e-09
Zn	9.331e-08	9.331e-08

## -----Description of solution-----

pH = 7.674    Charge balance  
 pe = 8.150  
 Activity of water = 1.000  
 Ionic strength = 3.954e-07  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 6.371e-07  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.700  
 Electrical balance (eq) = -2.419e-18  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = -0.00  
 Iterations = 13  
 Total H = 1.110124e+02  
 Total O = 5.550622e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	1.802e-07	1.801e-07	-6.744	-6.745	-0.000
H+	2.118e-08	2.116e-08	-7.674	-7.674	-0.000
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
Cd	1.157e-09				
Cd+2	1.155e-09	1.152e-09	-8.937	-8.939	-0.001
CdOH+	1.749e-12	1.748e-12	-11.757	-11.758	-0.000
Cd(OH)2	1.148e-14	1.148e-14	-13.940	-13.940	0.000
Cd(OH)3-	6.092e-20	6.087e-20	-19.215	-19.216	-0.000
Cd2OH+3	1.164e-20	1.157e-20	-19.934	-19.937	-0.003
Cd(OH)4-2	2.571e-26	2.563e-26	-25.590	-25.591	-0.001
Cr(2)	9.500e-29				
Cr+2	9.500e-29	9.473e-29	-28.022	-28.024	-0.001
Cr(3)	2.420e-07				
Cr(OH)3	1.876e-07	1.876e-07	-6.727	-6.727	0.000
Cr(OH)2+	5.360e-08	5.356e-08	-7.271	-7.271	-0.000
Cr(OH)+2	4.739e-10	4.726e-10	-9.324	-9.326	-0.001
CrO2-	2.149e-10	2.148e-10	-9.668	-9.668	-0.000
Cr(OH)4-	8.471e-11	8.465e-11	-10.072	-10.072	-0.000
Cr+3	4.346e-13	4.318e-13	-12.362	-12.365	-0.003
Cr(6)	4.253e-08				
CrO4-2	3.997e-08	3.986e-08	-7.398	-7.399	-0.001
HCrO4-	2.553e-09	2.551e-09	-8.593	-8.593	-0.000
Cr2O7-2	3.200e-16	3.190e-16	-15.495	-15.496	-0.001
H2CrO4	7.999e-18	7.999e-18	-17.097	-17.097	0.000
H(0)	3.612e-35				

H2	1.806e-35	1.806e-35	-34.743	-34.743	0.000
O(0)	1.851e-27				
O2	9.253e-28	9.253e-28	-27.034	-27.034	0.000
Pb	3.379e-09				
Pb+2	1.745e-09	1.740e-09	-8.758	-8.759	-0.001
PbOH+	1.604e-09	1.603e-09	-8.795	-8.795	-0.000
Pb(OH)2	2.946e-11	2.946e-11	-10.531	-10.531	0.000
Pb(OH)3-	1.600e-14	1.598e-14	-13.796	-13.796	-0.000
Pb2OH+3	6.285e-17	6.244e-17	-16.202	-16.205	-0.003
Pb(OH)4-2	1.739e-18	1.734e-18	-17.760	-17.761	-0.001
Pb3(OH)4+2	5.065e-21	5.050e-21	-20.295	-20.297	-0.001
Zn	9.331e-08				
Zn+2	8.907e-08	8.882e-08	-7.050	-7.052	-0.001
Zn(OH)2	2.502e-09	2.502e-09	-8.602	-8.602	0.000
ZnOH+	1.740e-09	1.739e-09	-8.759	-8.760	-0.000
Zn(OH)3-	3.741e-13	3.738e-13	-12.427	-12.427	-0.000
Zn(OH)4-2	2.807e-18	2.799e-18	-17.552	-17.553	-0.001

## -----Saturation indices-----

Phase	SI	log IAP	log KT	
Cd(Gamma)	-39.40	-25.24	14.16	Cd
Cd(OH)2(A)	-7.98	6.41	14.39	Cd(OH)2
Cd(OH)2(C)	-7.24	6.41	13.65	Cd(OH)2
CdMetal	-39.30	-25.24	14.06	Cd
Cr(OH)2	-23.76	-86.05	-62.28	Cr(OH)2
Cr(OH)3(A)	1.15	-70.22	-71.37	Cr(OH)3
Cr(OH)3(C)	-1.52	-70.22	-68.70	Cr(OH)3
Cr2O3	3.82	-140.44	-144.26	Cr2O3
CrMetal	-77.65	-117.69	-40.05	Cr
CrO3	-19.58	-22.75	-3.17	CrO3
Litharge	-6.65	6.59	13.24	PbO
Massicot	-6.85	6.59	13.44	PbO
Minium	-25.51	51.42	76.93	Pb3O4
Monteponite	-9.49	6.41	15.90	CdO
O2(g)	-24.04	63.30	87.34	O2
Pb(OH)2(C)	-2.00	6.59	8.59	Pb(OH)2
Pb2O(OH)2	-13.02	13.18	26.20	Pb2O(OH)2
Pb2O3	-16.21	44.83	61.04	Pb2O3
PbCrO4	-2.15	-16.16	-14.01	PbCrO4
PbMetal	-29.32	-25.06	4.26	Pb
PbO:0.3H2O	-6.39	6.59	12.98	PbO:0.33H2O
Plattnerite	-13.29	38.24	51.53	PbO2
Zincite	-3.53	8.30	11.83	ZnO
Zn(OH)2(A)	-4.15	8.30	12.45	Zn(OH)2
Zn(OH)2(B)	-3.45	8.30	11.75	Zn(OH)2
Zn(OH)2(C)	-3.90	8.30	12.20	Zn(OH)2

Zn(OH)2(E)	-3.20	8.30	11.50	Zn(OH)2
Zn(OH)2(G)	-3.41	8.30	11.71	Zn(OH)2
ZnMetal	-50.27	-23.35	26.92	Zn
ZnO(Active)	-3.01	8.30	11.31	ZnO

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH310a Nov 2012  
SOLUTION 1  
    pH 11.2 charge  
    temp 12.7  
    pe 13.04  
    units mg/L  
    Cd 0.00013  
    Cr 0.033 as CrO4-2  
    Pb 0.0007  
    Zn 0.0061  
END

-----  
TITLE  
-----

BH301a Nov 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Cd	1.157e-09	1.157e-09
Cr	2.845e-07	2.845e-07
Pb	3.379e-09	3.379e-09
Zn	9.331e-08	9.331e-08

## -----Description of solution-----

pH = 6.581    Charge balance  
 pe = 13.040  
 Activity of water = 1.000  
 Ionic strength = 7.142e-07  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = -8.879e-08  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.700  
 Electrical balance (eq) = 1.113e-17  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = 0.00  
 Iterations = 16  
 Total H = 1.110124e+02  
 Total O = 5.550622e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
H+	2.626e-07	2.623e-07	-6.581	-6.581	-0.000
OH-	1.454e-08	1.453e-08	-7.837	-7.838	-0.000
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
Cd	1.157e-09				
Cd+2	1.156e-09	1.152e-09	-8.937	-8.939	-0.002
CdOH+	1.412e-13	1.411e-13	-12.850	-12.851	-0.000
Cd(OH)2	7.476e-17	7.476e-17	-16.126	-16.126	0.000
Cd2OH+3	9.420e-22	9.338e-22	-21.026	-21.030	-0.004
Cd(OH)3-	3.201e-23	3.197e-23	-22.495	-22.495	-0.000
Cd(OH)4-2	1.090e-30	1.086e-30	-29.962	-29.964	-0.002
Cr(2)	5.795e-39				
Cr+2	5.795e-39	5.772e-39	-38.237	-38.239	-0.002
Cr(3)	2.300e-15				
Cr(OH)2+	1.650e-15	1.649e-15	-14.782	-14.783	-0.000
Cr(OH)3	4.659e-16	4.659e-16	-15.332	-15.332	0.000
Cr(OH)+2	1.810e-16	1.803e-16	-15.742	-15.744	-0.002
Cr+3	2.060e-18	2.043e-18	-17.686	-17.690	-0.004
CrO2-	4.308e-20	4.304e-20	-19.366	-19.366	-0.000
Cr(OH)4-	1.698e-20	1.696e-20	-19.770	-19.771	-0.000
Cr(6)	2.845e-07				
CrO4-2	1.589e-07	1.582e-07	-6.799	-6.801	-0.002
HCrO4-	1.256e-07	1.255e-07	-6.901	-6.901	-0.000
Cr2O7-2	7.756e-13	7.726e-13	-12.110	-12.112	-0.002
H2CrO4	4.879e-15	4.879e-15	-14.312	-14.312	0.000
H(0)	0.000e+00				

H2	0.000e+00	0.000e+00	-42.337	-42.337	0.000
O(0)	2.846e-12				
O2	1.423e-12	1.423e-12	-11.847	-11.847	0.000
Pb	3.379e-09				
Pb+2	3.145e-09	3.133e-09	-8.502	-8.504	-0.002
PbOH+	2.331e-10	2.328e-10	-9.633	-9.633	-0.000
Pb(OH)2	3.453e-13	3.453e-13	-12.462	-12.462	0.000
Pb2OH+3	1.647e-17	1.633e-17	-16.783	-16.787	-0.004
Pb(OH)3-	1.513e-17	1.511e-17	-16.820	-16.821	-0.000
Pb(OH)4-2	1.328e-22	1.323e-22	-21.877	-21.879	-0.002
Pb3(OH)4+2	1.254e-24	1.249e-24	-23.902	-23.903	-0.002
Zn	9.331e-08				
Zn+2	9.315e-08	9.279e-08	-7.031	-7.032	-0.002
ZnOH+	1.467e-10	1.466e-10	-9.834	-9.834	-0.000
Zn(OH)2	1.701e-11	1.701e-11	-10.769	-10.769	0.000
Zn(OH)3-	2.053e-16	2.051e-16	-15.688	-15.688	-0.000
Zn(OH)4-2	1.244e-22	1.239e-22	-21.905	-21.907	-0.002

## -----Saturation indices-----

Phase	SI	log IAP	log KT	
Cd(Gamma)	-49.18	-35.02	14.16	Cd
Cd(OH)2(A)	-10.16	4.22	14.39	Cd(OH)2
Cd(OH)2(C)	-9.43	4.22	13.65	Cd(OH)2
CdMetal	-49.08	-35.02	14.06	Cd
Cr(OH)2	-36.16	-98.45	-62.28	Cr(OH)2
Cr(OH)3(A)	-7.45	-78.83	-71.37	Cr(OH)3
Cr(OH)3(C)	-10.13	-78.83	-68.70	Cr(OH)3
Cr2O3	-13.39	-157.65	-144.26	Cr2O3
CrMetal	-97.64	-137.69	-40.05	Cr
CrO3	-16.79	-19.96	-3.17	CrO3
Litharge	-8.58	4.66	13.24	PbO
Massicot	-8.78	4.66	13.44	PbO
Minium	-23.71	53.22	76.93	Pb3O4
Monteponite	-11.68	4.22	15.90	CdO
O2(g)	-8.86	78.48	87.34	O2
Pb(OH)2(C)	-3.93	4.66	8.59	Pb(OH)2
Pb2O(OH)2	-16.88	9.32	26.20	Pb2O(OH)2
Pb2O3	-12.48	48.56	61.04	Pb2O3
PbCrO4	-1.30	-15.30	-14.01	PbCrO4
PbMetal	-38.84	-34.58	4.26	Pb
PbO:0.3H2O	-8.32	4.66	12.98	PbO:0.33H2O
Plattnerite	-7.63	43.90	51.53	PbO2
Zincite	-5.70	6.13	11.83	ZnO
Zn(OH)2(A)	-6.32	6.13	12.45	Zn(OH)2
Zn(OH)2(B)	-5.62	6.13	11.75	Zn(OH)2
Zn(OH)2(C)	-6.07	6.13	12.20	Zn(OH)2

Zn(OH)2(E)	-5.37	6.13	11.50	Zn(OH)2
Zn(OH)2(G)	-5.58	6.13	11.71	Zn(OH)2
ZnMetal	-60.03	-33.11	26.92	Zn
ZnO(Active)	-5.18	6.13	11.31	ZnO

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks



Database file: minteq.dat

-----  
Reading data base.  
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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a Low  
SOLUTION 1  
pH 10.05 charge  
temp 14.04  
pe 8.15  
units mg/L  
Al 0.0422  
As 0.00163 as H3AsO4  
Ba 0.109  
B 2.360  
Cd 0.00013  
Ca 717  
C 26.3  
Cl 16500  
Cu 0.00204  
Cr 0.123  
Pb 0.0007  
Mg 690  
Ni 0.00594  
N 0.82 as N03-  
K 342  
Na 10100  
S 2020 as SO4-2  
V 0.0229  
Zn 0.0061  
END

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TITLE  
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BH310a Low

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Beginning of initial solution calculations.  
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Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.613e-06	1.613e-06
As	1.184e-08	1.184e-08
B	2.252e-04	2.252e-04
Ba	8.185e-07	8.185e-07
C	4.445e-04	4.445e-04
Ca	1.845e-02	1.845e-02
Cd	1.193e-09	1.193e-09
Cl	4.800e-01	4.800e-01
Cr	2.440e-06	2.440e-06
Cu	3.311e-08	3.311e-08
K	9.021e-03	9.021e-03
Mg	2.927e-02	2.927e-02
N	2.013e-05	2.013e-05
Na	4.531e-01	4.531e-01
Ni	1.043e-07	1.043e-07
Pb	3.484e-09	3.484e-09
S	2.169e-02	2.169e-02
V	4.636e-07	4.636e-07
Zn	9.624e-08	9.624e-08

-----Description of solution-----

pH = 12.453    Charge balance  
pe = 8.150  
Activity of water = 0.983  
Ionic strength = 5.752e-01  
Mass of water (kg) = 1.000e+00  
Total alkalinity (eq/kg) = 3.418e-02  
Total CO2 (mol/kg) = 4.445e-04  
Temperature (deg C) = 14.040  
Electrical balance (eq) = -7.075e-14  
Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|)$  = -0.00  
Iterations = 8  
Total H = 1.110459e+02  
Total O = 5.562810e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	1.892e-02	1.185e-02	-1.723	-1.926	-0.203
H+	4.623e-13	3.527e-13	-12.335	-12.453	-0.118
H2O	5.551e+01	9.826e-01	-0.008	-0.008	0.000
Al	1.613e-06				
Al(OH)4-	1.613e-06	1.067e-06	-5.792	-5.972	-0.179
Al(OH)3	5.729e-11	6.541e-11	-10.242	-10.184	0.058
Al(OH)2+	2.710e-17	1.865e-17	-16.567	-16.729	-0.162
AlOH+2	1.787e-24	4.006e-25	-23.748	-24.397	-0.649
Al+3	3.454e-31	3.024e-32	-30.462	-31.519	-1.058
AlSO4+	9.233e-32	6.107e-32	-31.035	-31.214	-0.179
Al(SO4)2-	1.554e-32	1.028e-32	-31.809	-31.988	-0.179
As(3)	0.000e+00				
HAsO3-2	0.000e+00	0.000e+00	-42.993	-43.511	-0.518
AsO3-3	0.000e+00	0.000e+00	-43.476	-44.641	-1.165
H2AsO3-	0.000e+00	0.000e+00	-43.518	-43.647	-0.129
H3AsO3	0.000e+00	0.000e+00	-46.746	-46.689	0.057
H4AsO3+	0.000e+00	0.000e+00	-59.317	-59.446	-0.129
As(5)	1.184e-08				
AsO4-3	1.137e-08	7.770e-10	-7.944	-9.110	-1.165
HAsO4-2	4.714e-10	1.430e-10	-9.327	-9.845	-0.518
H2AsO4-	4.091e-16	3.036e-16	-15.388	-15.518	-0.129
H3AsO4	1.472e-26	1.681e-26	-25.832	-25.775	0.057
B	2.252e-04				
H2BO3-	2.251e-04	1.312e-04	-3.648	-3.882	-0.234
H3BO3	8.668e-08	9.896e-08	-7.062	-7.005	0.058
Ba	8.185e-07				
Ba+2	8.070e-07	1.693e-07	-6.093	-6.771	-0.678
BaOH+	1.156e-08	7.824e-09	-7.937	-8.107	-0.170
C(4)	4.445e-04				
NaCO3-	1.223e-04	8.417e-05	-3.913	-4.075	-0.162
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CO3-2	1.127e-04	2.526e-05	-3.948	-4.598	-0.649
MgCO3	9.260e-05	1.057e-04	-4.033	-3.976	0.058
HCO3-	3.569e-07	2.456e-07	-6.447	-6.610	-0.162
NaHCO3	2.994e-08	3.418e-08	-7.524	-7.466	0.058
MgHCO3+	2.107e-08	1.358e-08	-7.676	-7.867	-0.191
CaHCO3+	1.176e-08	8.275e-09	-7.930	-8.082	-0.151
NiCO3	5.739e-13	6.552e-13	-12.241	-12.184	0.058
H2CO3	1.526e-13	1.742e-13	-12.816	-12.759	0.058
CdCO3	9.778e-14	1.116e-13	-13.010	-12.952	0.058
Ni(CO3)2-2	9.479e-14	2.876e-14	-13.023	-13.541	-0.518
Zn(CO3)2-2	3.447e-16	1.046e-16	-15.463	-15.981	-0.518
ZnCO3	1.696e-16	1.937e-16	-15.771	-15.713	0.058
PbCO3	3.167e-17	3.615e-17	-16.499	-16.442	0.058

CuCO3	1.720e-17	1.964e-17	-16.764	-16.707	0.058
Pb(CO3)2-2	7.560e-18	2.294e-18	-17.121	-17.639	-0.5
Cu(CO3)2-2	2.058e-18	6.245e-19	-17.687	-18.204	-0.5
CdHCO3+	5.316e-19	3.946e-19	-18.274	-18.404	-0.1
NiHCO3+	1.239e-19	9.199e-20	-18.907	-19.036	-0.12
Cd(CO3)3-4	5.566e-20	4.717e-22	-19.254	-21.326	-2.0
ZnHCO3+	1.158e-21	8.598e-22	-20.936	-21.066	-0.1
CuHCO3+	1.737e-23	1.289e-23	-22.760	-22.890	-0.1
PbHCO3+	1.567e-23	1.163e-23	-22.805	-22.935	-0.1
Ca	1.845e-02				
Ca+2	1.492e-02	4.549e-03	-1.826	-2.342	-0.516
CaOH+	1.782e-03	1.254e-03	-2.749	-2.902	-0.153
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
CaCO3	1.165e-04	1.330e-04	-3.934	-3.876	0.058
CaHCO3+	1.176e-08	8.275e-09	-7.930	-8.082	-0.15
Cd	1.193e-09				
Cd(OH)2	5.356e-10	6.114e-10	-9.271	-9.214	0.058
CdOHCl	3.803e-10	4.341e-10	-9.420	-9.362	0.058
Cd(OH)3-	2.575e-10	1.911e-10	-9.589	-9.719	-0.129
Cd(OH)4-2	1.564e-11	4.747e-12	-10.806	-11.324	-0.51
CdOH+	2.368e-12	1.757e-12	-11.626	-11.755	-0.129
CdCl+	6.478e-13	4.808e-13	-12.189	-12.318	-0.129
CdCl2	4.993e-13	5.700e-13	-12.302	-12.244	0.058
CdCl3-	1.208e-13	8.966e-14	-12.918	-13.047	-0.129
CdCO3	9.778e-14	1.116e-13	-13.010	-12.952	0.058
Cd+2	5.811e-14	1.763e-14	-13.236	-13.754	-0.518
CdSO4	9.205e-15	1.051e-14	-14.036	-13.978	0.058
Cd(SO4)2-2	9.018e-16	2.736e-16	-15.045	-15.563	-0.5
CdNO3+	1.015e-18	7.530e-19	-17.994	-18.123	-0.12
CdHCO3+	5.316e-19	3.946e-19	-18.274	-18.404	-0.1
Cd(CO3)3-4	5.566e-20	4.717e-22	-19.254	-21.326	-2.0
Cd2OH+3	2.560e-24	1.749e-25	-23.592	-24.757	-1.16
CdHS+	0.000e+00	0.000e+00	-148.010	-148.139	-0.1
Cd(HS)2	0.000e+00	0.000e+00	-286.392	-286.335	0.0
Cd(HS)3-	0.000e+00	0.000e+00	-428.581	-428.710	-0.1
Cd(HS)4-2	0.000e+00	0.000e+00	-570.558	-571.076	-0.
Cl	4.800e-01				
Cl-	4.800e-01	2.966e-01	-0.319	-0.528	-0.209
CdOHCl	3.803e-10	4.341e-10	-9.420	-9.362	0.058
ZnOHCl	9.209e-13	1.051e-12	-12.036	-11.978	0.058
CdCl+	6.478e-13	4.808e-13	-12.189	-12.318	-0.129
CdCl2	4.993e-13	5.700e-13	-12.302	-12.244	0.058
CdCl3-	1.208e-13	8.966e-14	-12.918	-13.047	-0.129
NiCl+	3.504e-15	2.600e-15	-14.455	-14.585	-0.129
NiCl2	2.458e-15	2.806e-15	-14.609	-14.552	0.058
ZnCl+	2.880e-17	1.857e-17	-16.541	-16.731	-0.191
ZnCl2	4.825e-18	5.509e-18	-17.316	-17.259	0.058
ZnCl3-	2.656e-18	1.712e-18	-17.576	-17.766	-0.191

ZnCl4-2	1.106e-18	2.320e-19	-17.956	-18.635	-0.678
PbCl+	9.880e-19	7.333e-19	-18.005	-18.135	-0.129
PbCl2	3.734e-19	4.263e-19	-18.428	-18.370	0.058
PbCl3-	1.258e-19	9.340e-20	-18.900	-19.030	-0.129
CuCl+	1.027e-19	6.619e-20	-18.989	-19.179	-0.191
PbCl4-2	4.012e-20	1.217e-20	-19.397	-19.915	-0.518
CuCl3-2	2.963e-20	6.217e-21	-19.528	-20.206	-0.678
CuCl2-	2.143e-20	1.382e-20	-19.669	-19.860	-0.191
CuCl2	8.165e-21	9.321e-21	-20.088	-20.031	0.058
CuCl3-	1.244e-23	8.017e-24	-22.905	-23.096	-0.191
CrO3Cl-	3.150e-25	2.338e-25	-24.502	-24.631	-0.129
CuCl4-2	8.311e-26	1.744e-26	-25.080	-25.759	-0.678
VOCl+	0.000e+00	0.000e+00	-44.487	-44.616	-0.129
CrOHCl2	0.000e+00	0.000e+00	-46.003	-45.946	0.058
CrCl+2	0.000e+00	0.000e+00	-50.552	-51.070	-0.518
CrCl2+	0.000e+00	0.000e+00	-52.304	-52.433	-0.129
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-439.233	-439.751	-1.058
Cr(2)	0.000e+00				
Cr+2	0.000e+00	0.000e+00	-65.161	-65.679	-0.518
Cr(3)	1.058e-28				
CrO2-	7.613e-29	5.650e-29	-28.118	-28.248	-0.129
Cr(OH)4-	2.897e-29	2.150e-29	-28.538	-28.668	-0.129
Cr(OH)3	7.077e-31	8.080e-31	-30.150	-30.093	0.058
Cr(OH)2+	5.271e-36	3.912e-36	-35.278	-35.408	-0.129
Cr(OH)+2	0.000e+00	0.000e+00	-41.715	-42.233	-0.518
CrOHSO4	0.000e+00	0.000e+00	-42.289	-42.232	0.058
CrOHCl2	0.000e+00	0.000e+00	-46.003	-45.946	0.058
Cr+3	0.000e+00	0.000e+00	-48.949	-50.114	-1.165
CrCl+2	0.000e+00	0.000e+00	-50.552	-51.070	-0.518
CrSO4+	0.000e+00	0.000e+00	-51.504	-51.634	-0.129
CrCl2+	0.000e+00	0.000e+00	-52.304	-52.433	-0.129
CrNO3+2	0.000e+00	0.000e+00	-56.047	-56.565	-0.518
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-81.687	-82.205	-1.058
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-86.544	-86.487	-1.058
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-296.557	-296.687	-1.058
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-366.888	-367.406	-1.058
Cr(NH3)6+3	0.000e+00	0.000e+00	-438.836	-440.001	-1.058
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-439.233	-439.751	-1.058
Cr(6)	2.440e-06				
CrO4-2	1.772e-06	3.060e-07	-5.752	-6.514	-0.763
NaCrO4-	6.539e-07	4.853e-07	-6.184	-6.314	-0.129
KCrO4-	1.430e-08	1.062e-08	-7.845	-7.974	-0.129
HCrO4-	4.429e-13	3.287e-13	-12.354	-12.483	-0.129
Cr2O7-2	1.709e-23	5.185e-24	-22.767	-23.285	-0.518
CrO3Cl-	3.150e-25	2.338e-25	-24.502	-24.631	-0.129
CrO3SO4-2	2.787e-25	8.457e-26	-24.555	-25.073	-0.518
H2CrO4	1.494e-26	1.705e-26	-25.826	-25.768	0.058
Cu(1)	5.107e-20				

CuCl3-2	2.963e-20	6.217e-21	-19.528	-20.206	-0.678
CuCl2-	2.143e-20	1.382e-20	-19.669	-19.860	-0.191
Cu+	8.295e-25	4.836e-25	-24.081	-24.316	-0.234
Cu(2)	3.311e-08				
Cu(OH)2	2.056e-08	2.348e-08	-7.687	-7.629	0.058
Cu(OH)4-2	7.222e-09	2.191e-09	-8.141	-8.659	-0.518
Cu(OH)3-	5.323e-09	3.951e-09	-8.274	-8.403	-0.129
CuOH+	6.256e-15	4.033e-15	-14.204	-14.394	-0.191
CuCO3	1.720e-17	1.964e-17	-16.764	-16.707	0.058
Cu(CO3)2-2	2.058e-18	6.245e-19	-17.687	-18.204	-0.5
Cu+2	1.254e-18	1.447e-19	-17.902	-18.839	-0.938
CuCl+	1.027e-19	6.619e-20	-18.989	-19.179	-0.191
CuSO4	5.301e-20	6.052e-20	-19.276	-19.218	0.058
CuCl2	8.165e-21	9.321e-21	-20.088	-20.031	0.058
CuHCO3+	1.737e-23	1.289e-23	-22.760	-22.890	-0.191
CuCl3-	1.244e-23	8.017e-24	-22.905	-23.096	-0.191
Cu2(OH)2+2	7.580e-24	2.300e-24	-23.120	-23.638	-0.5
CuCl4-2	8.311e-26	1.744e-26	-25.080	-25.759	-0.678
Cu(S4)2-3	0.000e+00	0.000e+00	-284.621	-285.131	-0.5
CuS4S5-3	0.000e+00	0.000e+00	-285.386	-285.861	-0.5
Cu(HS)3-	0.000e+00	0.000e+00	-426.478	-426.607	-0.191
H(0)	0.000e+00				
H2	0.000e+00	0.000e+00	-44.364	-44.306	0.058
K	9.021e-03				
K+	8.918e-03	5.510e-03	-2.050	-2.259	-0.209
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
KCrO4-	1.430e-08	1.062e-08	-7.845	-7.974	-0.129
Mg	2.927e-02				
Mg+2	1.520e-02	5.190e-03	-1.818	-2.285	-0.467
MgOH+	1.234e-02	8.832e-03	-1.909	-2.054	-0.145
MgSO4	1.637e-03	1.868e-03	-2.786	-2.729	0.058
MgCO3	9.260e-05	1.057e-04	-4.033	-3.976	0.058
MgHCO3+	2.107e-08	1.358e-08	-7.676	-7.867	-0.191
N(-3)	0.000e+00				
NH3	0.000e+00	0.000e+00	-67.507	-67.449	0.058
NH4+	0.000e+00	0.000e+00	-70.074	-70.308	-0.234
NH4SO4-	0.000e+00	0.000e+00	-71.683	-71.853	-0.191
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-296.557	-296.687	
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-366.888	-367.406	
Cr(NH3)6+3	0.000e+00	0.000e+00	-438.836	-440.001	-1
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-439.233	-439.751	-1
N(3)	6.486e-17				
NO2-	6.486e-17	4.813e-17	-16.188	-16.318	-0.129
N(5)	2.013e-05				
NO3-	2.013e-05	1.219e-05	-4.696	-4.914	-0.218
CdNO3+	1.015e-18	7.530e-19	-17.994	-18.123	-0.129
PbNO3+	2.001e-23	1.485e-23	-22.699	-22.828	-0.129
VO2NO3	6.133e-35	7.002e-35	-34.212	-34.155	0.058

CrNO3+2	0.000e+00	0.000e+00	-56.047	-56.565	-0.5
Na	4.531e-01				
Na+	4.482e-01	3.191e-01	-0.349	-0.496	-0.148
NaSO4-	4.791e-03	3.296e-03	-2.320	-2.482	-0.162
NaCO3-	1.223e-04	8.417e-05	-3.913	-4.075	-0.162
NaCrO4-	6.539e-07	4.853e-07	-6.184	-6.314	-0.129
NaHCO3	2.994e-08	3.418e-08	-7.524	-7.466	0.058
Ni	1.043e-07				
Ni(OH)3-	1.020e-07	7.568e-08	-6.992	-7.121	-0.129
Ni(OH)2	2.379e-09	2.716e-09	-8.624	-8.566	0.058
NiOH+	8.147e-13	6.047e-13	-12.089	-12.218	-0.129
NiCO3	5.739e-13	6.552e-13	-12.241	-12.184	0.058
Ni(CO3)2-2	9.479e-14	2.876e-14	-13.023	-13.541	-0.51
Ni+2	1.153e-14	3.499e-15	-13.938	-14.456	-0.518
NiCl+	3.504e-15	2.600e-15	-14.455	-14.585	-0.129
NiCl2	2.458e-15	2.806e-15	-14.609	-14.552	0.058
NiSO4	1.200e-15	1.370e-15	-14.921	-14.863	0.058
Ni(SO4)2-2	5.926e-19	1.798e-19	-18.227	-18.745	-0.51
NiHCO3+	1.239e-19	9.199e-20	-18.907	-19.036	-0.12
O(0)	6.143e-08				
O2	3.071e-08	3.506e-08	-7.513	-7.455	0.058
Pb	3.484e-09				
Pb(OH)4-2	3.271e-09	9.925e-10	-8.485	-9.003	-0.518
Pb(OH)3-	2.090e-10	1.551e-10	-9.680	-9.809	-0.129
Pb(OH)2	4.248e-12	4.850e-12	-11.372	-11.314	0.058
PbOH+	6.028e-15	4.474e-15	-14.220	-14.349	-0.129
PbCO3	3.167e-17	3.615e-17	-16.499	-16.442	0.058
Pb(CO3)2-2	7.560e-18	2.294e-18	-17.121	-17.639	-0.51
PbCl+	9.880e-19	7.333e-19	-18.005	-18.135	-0.129
PbCl2	3.734e-19	4.263e-19	-18.428	-18.370	0.058
Pb+2	2.714e-19	8.235e-20	-18.566	-19.084	-0.518
PbCl3-	1.258e-19	9.340e-20	-18.900	-19.030	-0.129
PbSO4	8.986e-20	1.026e-19	-19.046	-18.989	0.058
PbCl4-2	4.012e-20	1.217e-20	-19.397	-19.915	-0.518
Pb(SO4)2-2	3.931e-21	1.193e-21	-20.406	-20.923	-0.51
PbNO3+	2.001e-23	1.485e-23	-22.699	-22.828	-0.12
PbHCO3+	1.567e-23	1.163e-23	-22.805	-22.935	-0.12
Pb2OH+3	1.207e-31	8.248e-33	-30.918	-32.084	-1.16
Pb3(OH)4+2	2.653e-32	8.050e-33	-31.576	-32.094	-0.5
Pb(HS)2	0.000e+00	0.000e+00	-292.983	-292.925	0.0
Pb(HS)3-	0.000e+00	0.000e+00	-436.051	-436.181	-0.1
S(-2)	0.000e+00				
S5-2	0.000e+00	0.000e+00	-141.440	-141.958	-0.518
S6-2	0.000e+00	0.000e+00	-141.466	-141.984	-0.518
S4-2	0.000e+00	0.000e+00	-141.685	-142.203	-0.518
HS-	0.000e+00	0.000e+00	-144.352	-144.556	-0.203
S-2	0.000e+00	0.000e+00	-144.681	-145.359	-0.678
S3-2	0.000e+00	0.000e+00	-145.158	-145.676	-0.518

S2-2	0.000e+00	0.000e+00	-146.432	-146.950	-0.518
CdHS+	0.000e+00	0.000e+00	-148.010	-148.139	-0.119
H2S	0.000e+00	0.000e+00	-149.966	-149.908	0.058
Cu(S4)2-3	0.000e+00	0.000e+00	-284.621	-285.131	-0.510
CuS4S5-3	0.000e+00	0.000e+00	-285.386	-285.861	-0.475
Cd(HS)2	0.000e+00	0.000e+00	-286.392	-286.335	0.057
Zn(HS)2	0.000e+00	0.000e+00	-290.644	-290.587	0.057
Pb(HS)2	0.000e+00	0.000e+00	-292.983	-292.925	0.058
Cu(HS)3-	0.000e+00	0.000e+00	-426.478	-426.607	-0.129
Cd(HS)3-	0.000e+00	0.000e+00	-428.581	-428.710	-0.129
Zn(HS)3-	0.000e+00	0.000e+00	-433.853	-433.982	-0.129
Pb(HS)3-	0.000e+00	0.000e+00	-436.051	-436.181	-0.129
Cd(HS)4-2	0.000e+00	0.000e+00	-570.558	-571.076	-0.518
S(6)	2.169e-02				
SO4-2	1.352e-02	2.215e-03	-1.869	-2.655	-0.786
NaSO4-	4.791e-03	3.296e-03	-2.320	-2.482	-0.162
MgSO4	1.637e-03	1.868e-03	-2.786	-2.729	0.058
CaSO4	1.636e-03	1.867e-03	-2.786	-2.729	0.058
KSO4-	1.022e-04	7.033e-05	-3.991	-4.153	-0.162
HSO4-	8.502e-14	5.624e-14	-13.070	-13.250	-0.179
CdSO4	9.205e-15	1.051e-14	-14.036	-13.978	0.058
NiSO4	1.200e-15	1.370e-15	-14.921	-14.863	0.058
Cd(SO4)2-2	9.018e-16	2.736e-16	-15.045	-15.563	-0.518
ZnSO4	1.601e-17	1.828e-17	-16.796	-16.738	0.058
Zn(SO4)2-2	1.184e-18	3.593e-19	-17.927	-18.445	-0.518
Ni(SO4)2-2	5.926e-19	1.798e-19	-18.227	-18.745	-0.518
PbSO4	8.986e-20	1.026e-19	-19.046	-18.989	0.058
CuSO4	5.301e-20	6.052e-20	-19.276	-19.218	0.058
Pb(SO4)2-2	3.931e-21	1.193e-21	-20.406	-20.923	-0.518
CrO3SO4-2	2.787e-25	8.457e-26	-24.555	-25.073	-0.518
VO2SO4-	2.367e-30	1.756e-30	-29.626	-29.755	-0.129
AlSO4+	9.233e-32	6.107e-32	-31.035	-31.214	-0.179
Al(SO4)2-	1.554e-32	1.028e-32	-31.809	-31.988	-0.179
CrOHSO4	0.000e+00	0.000e+00	-42.289	-42.232	0.058
VOSO4	0.000e+00	0.000e+00	-44.474	-44.417	0.058
CrSO4+	0.000e+00	0.000e+00	-51.504	-51.634	-0.129
NH4SO4-	0.000e+00	0.000e+00	-71.683	-71.853	-0.129
VSO4+	0.000e+00	0.000e+00	-72.144	-72.273	-0.129
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-81.687	-82.205	-0.518
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-86.544	-86.487	-0.518
V(2)	0.000e+00				
VOH+	0.000e+00	0.000e+00	-76.753	-76.883	-0.129
V+2	0.000e+00	0.000e+00	-83.170	-83.688	-0.518
V(3)	0.000e+00				
V(OH)3	0.000e+00	0.000e+00	-44.801	-44.744	0.058
V(OH)2+	0.000e+00	0.000e+00	-51.869	-51.999	-0.129
VOH+2	0.000e+00	0.000e+00	-60.657	-61.175	-0.518
V+3	0.000e+00	0.000e+00	-69.893	-71.059	-1.165



VSO4+	0.000e+00	0.000e+00	-72.144	-72.273	-0.12
V2(OH)3+3	0.000e+00	0.000e+00	-111.117	-112.283	-1
V2(OH)2+4	0.000e+00	0.000e+00	-118.906	-120.978	-2
V(4)	6.146e-38				
V(OH)3+	6.146e-38	4.561e-38	-37.211	-37.341	-0.12
VO+2	0.000e+00	0.000e+00	-43.590	-44.108	-0.51
VOSO4	0.000e+00	0.000e+00	-44.474	-44.417	0.05
VOCI+	0.000e+00	0.000e+00	-44.487	-44.616	-0.12
H2V2O4+2	0.000e+00	0.000e+00	-69.249	-69.767	-0.1
V(5)	4.636e-07				
HVO4-2	3.035e-07	9.210e-08	-6.518	-7.036	-0.518
VO4-3	1.598e-07	1.092e-08	-6.796	-7.962	-1.165
V2O7-4	1.157e-10	9.803e-13	-9.937	-12.009	-2.072
HV2O7-3	2.912e-11	1.989e-12	-10.536	-11.701	-1.16
H2VO4-	6.336e-12	4.702e-12	-11.198	-11.328	-0.12
H3VO4	9.370e-21	1.070e-20	-20.028	-19.971	0.058
H3V2O7-	1.130e-24	8.384e-25	-23.947	-24.077	-0.12
V3O9-3	3.515e-27	2.402e-28	-26.454	-27.619	-1.165
VO2+	2.083e-29	1.546e-29	-28.681	-28.811	-0.129
VO2SO4-	2.367e-30	1.756e-30	-29.626	-29.755	-0.12
VO2NO3	6.133e-35	7.002e-35	-34.212	-34.155	0.05
V4O12-4	4.259e-35	3.609e-37	-34.371	-36.443	-2.07
V10O28-6	0.000e+00	0.000e+00	-101.795	-106.457	-4.
HV10O28-5	0.000e+00	0.000e+00	-110.094	-113.331	-3
H2V10O28-4	0.000e+00	0.000e+00	-119.470	-121.542	-.
Zn	9.624e-08				
Zn(OH)4-2	4.826e-08	1.464e-08	-7.316	-7.834	-0.518
Zn(OH)3-	4.468e-08	3.316e-08	-7.350	-7.479	-0.129
Zn(OH)2	3.297e-09	3.764e-09	-8.482	-8.424	0.058
ZnOHCl	9.209e-13	1.051e-12	-12.036	-11.978	0.05
ZnOH+	6.672e-14	4.952e-14	-13.176	-13.305	-0.12
Zn(CO3)2-2	3.447e-16	1.046e-16	-15.463	-15.981	-0.5
ZnCO3	1.696e-16	1.937e-16	-15.771	-15.713	0.058
Zn+2	1.567e-16	3.842e-17	-15.805	-16.415	-0.611
ZnCl+	2.880e-17	1.857e-17	-16.541	-16.731	-0.191
ZnSO4	1.601e-17	1.828e-17	-16.796	-16.738	0.058
ZnCl2	4.825e-18	5.509e-18	-17.316	-17.259	0.058
ZnCl3-	2.656e-18	1.712e-18	-17.576	-17.766	-0.191
Zn(SO4)2-2	1.184e-18	3.593e-19	-17.927	-18.445	-0.51
ZnCl4-2	1.106e-18	2.320e-19	-17.956	-18.635	-0.678
ZnHCO3+	1.158e-21	8.598e-22	-20.936	-21.066	-0.12
Zn(HS)2	0.000e+00	0.000e+00	-290.644	-290.587	0.0
Zn(HS)3-	0.000e+00	0.000e+00	-433.853	-433.982	-0.1

-----Saturation indices-----

Phase            SI log IAP   log KT

(NH4)2CrO4 -147.47 -395.75 -248.28 (NH4)2CrO4  
 Al(OH)3(a) -5.32 5.82 11.14 Al(OH)3  
 Al2O3 -11.33 11.65 22.98 Al2O3  
 Al4(OH)10SO4 -26.98 -4.28 22.70 Al4(OH)10SO4  
 AlAsO4:2H2O -24.75 -19.95 4.80 AlAsO4:2H2O  
 AlOHSO4 -18.50 -21.73 -3.23 AlOHSO4  
 AlumK -33.81 -39.18 -5.37 KAl(SO4)2:12H2O  
 Alunite -26.00 -27.46 -1.46 KAl3(SO4)2(OH)6  
 Anglesite -13.89 -21.74 -7.85 PbSO4  
 Anhydrite -0.47 -5.00 -4.53 CaSO4  
 Anilite -140.19 -212.64 -72.45 Cu0.25Cu1.5S  
 Antlerite -17.68 -9.39 8.29 Cu3(OH)4SO4  
 Aragonite 1.33 -6.94 -8.27 CaCO3  
 Arsenolite -183.51 -267.84 -84.34 As4O6  
 Artinite 5.30 15.70 10.40 MgCO3:Mg(OH)2:3H2O  
 As2O5 -58.38 -51.53 6.85 As2O5  
 Atacamite -8.73 -0.87 7.86 Cu2(OH)3Cl  
 Azurite -24.57 -40.82 -16.26 Cu3(OH)2(CO3)2  
 Ba3(AsO4)2 11.84 2.85 -8.98 Ba3(AsO4)2  
 BaCrO4 -3.44 -13.29 -9.85 BaCrO4  
 Barite 0.73 -9.43 -10.15 BaSO4  
 Bianchite -17.36 -19.12 -1.76 ZnSO4:6H2O  
 Blaubleil -129.76 -189.80 -60.04 Cu0.9Cu0.2S  
 Blaubleill -135.58 -200.34 -64.76 Cu0.6Cu0.8S  
 Boehmite -3.54 5.82 9.36 AlOOH  
 Brochantite -18.68 -3.34 15.34 Cu4(OH)6SO4  
 Brucite 5.09 22.61 17.51 Mg(OH)2  
 Bunsenite -2.68 10.44 13.12 NiO  
 Ca2V2O7 -3.09 6.19 9.28 CaVO3.5  
 Ca3(AsO4)2:6H2O -6.21 16.09 22.30 Ca3(AsO4)2:6H2O  
 Ca3(VO4)2 -2.99 17.47 20.46 Ca1.5VO4  
 Ca\_Vanadate -8.20 -5.08 3.11 Ca0.5VO3  
 CaCrO4 -6.77 -8.86 -2.09 CaCrO4  
 Calcite 1.48 -6.94 -8.42 CaCO3  
 Cd(BO2)2 -12.68 -2.84 9.84 Cd(BO2)2  
 Cd(Gamma) -44.15 -30.05 14.10 Cd  
 Cd(OH)2(A) -3.17 11.14 14.31 Cd(OH)2  
 Cd(OH)2(C) -2.51 11.14 13.65 Cd(OH)2  
 Cd3(OH)2(SO4)2 -28.39 -21.68 6.71 Cd3(OH)2(SO4)2  
 Cd3(OH)4SO4 -16.70 5.86 22.56 Cd3(OH)4SO4  
 Cd4(OH)6SO4 -11.40 17.00 28.40 Cd4(OH)6SO4  
 CdCl2 -14.25 -14.81 -0.55 CdCl2  
 CdCl2:2.5H2O -12.84 -14.83 -1.99 CdCl2:2.5H2O  
 CdCl2:H2O -13.16 -14.82 -1.66 CdCl2:H2O  
 CdMetal -44.05 -30.05 13.99 Cd  
 CdOHCl -5.56 -1.84 3.73 CdOHCl  
 CdSO4 -16.72 -16.41 0.31 CdSO4  
 CdSO4:2.67H2O -14.68 -16.43 -1.75 CdSO4:2.67H2O

CdSO4:H2O -14.97 -16.42 -1.45 CdSO4:H2O  
 Cerrusite -10.42 -23.68 -13.27 PbCO3  
 CH4(g) -152.49 -194.30 -41.81 CH4  
 Chalcanthite -18.85 -21.53 -2.68 CuSO4:5H2O  
 Chalcocite -144.73 -221.42 -76.69 Cu2S  
 Claudetite -183.27 -267.84 -84.57 As4O6  
 CO2(g) -11.32 -29.50 -18.17 CO2  
 Cotunnite -15.21 -20.14 -4.93 PbCl2  
 Covellite -127.23 -186.28 -59.05 CuS  
 Cr(OH)2 -51.85 -113.81 -61.97 Cr(OH)2  
 Cr(OH)3(A) -22.21 -93.22 -71.01 Cr(OH)3  
 Cr(OH)3(C) -24.86 -93.22 -68.36 Cr(OH)3  
 Cr2O3 -42.85 -186.42 -143.57 Cr2O3  
 CrCl2 -83.15 -139.76 -56.61 CrCl2  
 CrCl3 -76.16 -132.14 -55.98 CrCl3  
 CrMetal -115.18 -155.00 -39.82 Cr  
 CrO3 -28.24 -31.41 -3.18 CrO3  
 Cu(OH)2 -3.02 6.05 9.07 Cu(OH)2  
 Cu2(OH)3NO3 -14.98 -5.26 9.73 Cu2(OH)3NO3  
 Cu2SO4 -49.46 -56.63 -7.17 Cu2SO4  
 Cu3(AsO4)2:6H2O -39.50 -33.40 6.10 Cu3(AsO4)2:6H2O  
 CuCO3 -13.81 -23.44 -9.63 CuCO3  
 CuCrO4 -19.88 -25.35 -5.48 CuCrO4  
 CuMetal -23.23 -35.14 -11.91 Cu  
 CuOCuSO4 -27.96 -15.44 12.53 CuO:CuSO4  
 Cuprite -22.01 -29.08 -7.07 Cu2O  
 CuSO4 -25.01 -21.49 3.52 CuSO4  
 Diaspore -1.74 5.82 7.56 AlOOH  
 Djurleite -143.51 -219.10 -75.60 Cu0.066Cu1.868S  
 Dolomite 2.95 -13.82 -16.77 CaMg(CO3)2  
 Epsomite -2.77 -4.99 -2.22 MgSO4:7H2O  
 Galena -135.51 -186.53 -51.02 PbS  
 Gibbsite(C) -3.59 5.82 9.41 Al(OH)3  
 Goslarite -17.07 -19.12 -2.05 ZnSO4:7H2O  
 Greenockite -129.47 -181.20 -51.73 CdS  
 Gypsum -0.16 -5.01 -4.86 CaSO4:2H2O  
 Halite -2.58 -1.02 1.56 NaCl  
 Huntite 1.66 -27.59 -29.25 CaMg3(CO3)4  
 Hydrcerrusite -24.10 -41.56 -17.46 Pb(OH)2:2PbCO3  
 Hydromagnesite 2.35 -4.95 -7.31 Mg5(CO3)4(OH)2:4H2O  
 K2Cr2O7 -26.27 -42.44 -16.18 K2Cr2O7  
 K2CrO4 -10.92 -11.03 -0.11 K2CrO4  
 Langite -21.25 -3.35 17.90 Cu4(OH)6SO4:H2O  
 Larnakite -15.83 -15.93 -0.10 PbO:PbSO4  
 Laurionite -7.79 -7.17 0.62 PbOHCl  
 Lime -11.54 22.56 34.09 CaO  
 Litharge -7.36 5.81 13.18 PbO  
 Magnesite 0.97 -6.88 -7.86 MgCO3

Malachite	-12.64	-17.39	-4.74	Cu <sub>2</sub> (OH) <sub>2</sub> CO <sub>3</sub>
Massicot	-7.57	5.81	13.38	PbO
Melanothallite	-23.97	-19.90	4.07	CuCl <sub>2</sub>
Mg <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-7.78	6.25	14.03	MgVO <sub>3.5</sub>
Mg_Vanadate	-11.15	-5.06	6.10	Mg <sub>0.5</sub> VO <sub>3</sub>
MgCr <sub>2</sub> O <sub>4</sub>	-36.48	-163.80	-127.32	MgCr <sub>2</sub> O <sub>4</sub>
MgCrO <sub>4</sub>	-14.77	-8.80	5.97	MgCrO <sub>4</sub>
Millerite	-138.45	-181.90	-43.45	NiS
Minium	-17.93	58.64	76.56	Pb <sub>3</sub> O <sub>4</sub>
Mirabilite	-2.08	-3.72	-1.65	Na <sub>2</sub> SO <sub>4</sub> :10H <sub>2</sub> O
Monteponite	-4.67	11.14	15.81	CdO
Morenosite	-14.72	-17.16	-2.44	NiSO <sub>4</sub> :7H <sub>2</sub> O
Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-28.87	-38.92	-10.04	Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
Na <sub>2</sub> CrO <sub>4</sub>	-10.90	-7.51	3.39	Na <sub>2</sub> CrO <sub>4</sub>
Na <sub>3</sub> VO <sub>4</sub>	-18.69	19.50	38.18	Na <sub>3</sub> VO <sub>4</sub>
Na <sub>4</sub> V <sub>2</sub> O <sub>7</sub>	-11.83	7.54	19.37	Na <sub>2</sub> VO <sub>3.5</sub>
Na_Vanadate	-8.32	-4.41	3.91	NaVO <sub>3</sub>
Nantokite	-17.80	-27.52	-9.71	CuCl
Natron	-3.91	-5.67	-1.75	Na <sub>2</sub> CO <sub>3</sub> :10H <sub>2</sub> O
Nesquehonite	-1.45	-6.91	-5.46	MgCO <sub>3</sub> :3H <sub>2</sub> O
NH <sub>4</sub> VO <sub>3</sub>	-77.02	-198.53	-121.51	NH <sub>4</sub> VO <sub>3</sub>
Ni(OH) <sub>2</sub>	0.49	10.43	9.95	Ni(OH) <sub>2</sub>
Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-35.96	-20.26	15.70	Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-17.81	14.19	32.00	Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
NiCO <sub>3</sub>	-12.49	-19.05	-6.56	NiCO <sub>3</sub>
O <sub>2</sub> (g)	-4.47	82.40	86.86	O <sub>2</sub>
Oripment	-501.07	-710.95	-209.88	As <sub>2</sub> S <sub>3</sub>
Otavite	-4.63	-18.35	-13.72	CdCO <sub>3</sub>
Pb(BO <sub>2</sub> ) <sub>2</sub>	-15.95	-8.17	7.77	Pb(BO <sub>2</sub> ) <sub>2</sub>
Pb(OH) <sub>2</sub> (C)	-2.74	5.81	8.54	Pb(OH) <sub>2</sub>
Pb <sub>2</sub> (OH) <sub>3</sub> Cl	-10.15	-1.36	8.79	Pb <sub>2</sub> (OH) <sub>3</sub> Cl
Pb <sub>2</sub> O(OH) <sub>2</sub>	-14.58	11.62	26.20	Pb <sub>2</sub> O(OH) <sub>2</sub>
Pb <sub>2</sub> O <sub>3</sub>	-8.22	52.82	61.04	Pb <sub>2</sub> O <sub>3</sub>
Pb <sub>2</sub> OCO <sub>3</sub>	-17.69	-17.87	-0.18	Pb <sub>2</sub> OCO <sub>3</sub>
Pb <sub>2</sub> V <sub>2</sub> O <sub>7</sub>	-9.69	-10.55	-0.86	PbVO <sub>3.5</sub>
Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>	-39.89	-34.09	5.80	Pb <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>
Pb <sub>3</sub> (VO <sub>4</sub> ) <sub>2</sub>	-10.95	-7.64	3.31	Pb <sub>1.5</sub> VO <sub>4</sub>
Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>	-23.81	-12.06	11.76	Pb <sub>3</sub> O <sub>2</sub> CO <sub>3</sub>
Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>	-21.09	-10.11	10.98	Pb <sub>3</sub> O <sub>2</sub> SO <sub>4</sub>
Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-25.42	-4.32	21.10	Pb <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>	-27.38	-4.30	23.08	Pb <sub>4</sub> O <sub>3</sub> SO <sub>4</sub>
PbCrO <sub>4</sub>	-11.63	-25.60	-13.97	PbCrO <sub>4</sub>
PbMetal	-39.64	-35.38	4.26	Pb
PbO:0.3H <sub>2</sub> O	-7.17	5.81	12.98	PbO:0.33H <sub>2</sub> O
Periclase	0.09	22.61	22.52	MgO
Phosgenite	-24.01	-43.82	-19.81	PbCl <sub>2</sub> :PbCO <sub>3</sub>
Plattnerite	-4.27	47.01	51.28	PbO <sub>2</sub>
Portlandite	-0.99	22.55	23.53	Ca(OH) <sub>2</sub>

Realgar	-203.68	-279.90	-76.23	AsS
Retgersite	-15.09	-17.16	-2.07	NiSO4:6H2O
Smithsonite	-11.13	-21.01	-9.88	ZnCO3
Sphalerite	-136.67	-183.86	-47.19	ZnS
Spinel	-4.56	34.27	38.83	MgAl2O4
SULFUR	-113.81	-151.15	-37.33	S
Tenorite	-1.99	6.06	8.05	CuO
Thenardite	-3.48	-3.65	-0.16	Na2SO4
Thermonatrite	-5.80	-5.60	0.20	Na2CO3:H2O
V(OH)3	-41.37	-57.57	-16.20	V(OH)3
V2O3	-39.16	-57.56	-18.40	VO1.5
V2O4	-23.87	-36.96	-13.09	VO2
V2O5	-15.76	-16.36	-0.60	VO2.5
V3O5	-101.36	-152.08	-50.72	V3O5
V4O7	-126.28	-189.04	-62.77	V4O7
V6O13	-117.89	-180.57	-62.68	V6O13
VCl2	-99.24	-104.11	-4.88	VCl2
VCl3	-95.60	-96.49	-0.89	VCl3
VMetal	-139.62	-119.36	20.26	V
VO	-68.18	-78.16	-9.98	VO
VO(OH)2	-25.07	-36.97	-11.90	VO(OH)2
VO2Cl	-32.42	-29.34	3.08	VO2Cl
VOCl	-56.83	-70.54	-13.71	VOCl
VOCl2	-58.74	-62.91	-4.17	VOCl2
VOSO4(C)	-50.91	-64.51	-13.60	VOSO4
Witherite	-2.77	-11.37	-8.60	BaCO3
Wurtzite	-138.69	-183.86	-45.17	ZnS
Zincite	-3.27	8.48	11.75	ZnO
Zincosite	-22.62	-19.07	3.55	ZnSO4
Zn(BO2)2	-13.79	-5.50	8.29	Zn(BO2)2
Zn(NO3)2:6H2O	-29.57	-26.29	3.29	Zn(NO3)2:6H2O
Zn(OH)2(A)	-3.98	8.47	12.45	Zn(OH)2
Zn(OH)2(B)	-3.28	8.47	11.75	Zn(OH)2
Zn(OH)2(C)	-3.73	8.47	12.20	Zn(OH)2
Zn(OH)2(E)	-3.03	8.47	11.50	Zn(OH)2
Zn(OH)2(G)	-3.24	8.47	11.71	Zn(OH)2
Zn2(OH)2SO4	-18.10	-10.60	7.50	Zn2(OH)2SO4
Zn2(OH)3Cl	-11.22	3.98	15.20	Zn2(OH)3Cl
Zn3(AsO4)2:2.5H2O	-39.75	-26.10	13.65	Zn3(AsO4)2:2.5H2O
Zn3O(SO4)2	-50.41	-29.66	20.75	Zn3O(SO4)2
Zn4(OH)6SO4	-22.05	6.35	28.40	Zn4(OH)6SO4
Zn5(OH)8Cl2	-22.07	16.43	38.50	Zn5(OH)8Cl2
ZnCl2	-24.99	-17.47	7.52	ZnCl2
ZnCO3:H2O	-10.76	-21.02	-10.26	ZnCO3:H2O
ZnMetal	-59.50	-32.72	26.79	Zn
ZnO(Active)	-2.83	8.48	11.31	ZnO
ZnS(A)	-139.36	-183.86	-44.50	ZnS
ZnSO4:H2O	-18.81	-19.08	-0.27	ZnSO4:H2O

-----  
End of simulation.  
-----

-----  
Reading input data for simulation 2.  
-----

-----  
End of run.  
-----

No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a Low  
SOLUTION 1  
pH 6.90 charge  
temp 15.88  
pe -3.26  
units mg/L  
Al 0.0412  
As 0.00233 as H3AsO4  
Ba 0.292  
B 1.470  
Ca 970  
C 8.62  
Cl 17300  
Cr 0.00466  
Mg 839  
Mn 13.300 as Mn+2  
Ni 0.000115  
N 20.8 as NH4+  
K 291  
Se 0.00101  
Na 2260  
S 1560 as SO4-2  
Zn 0.000125

END

-----  
TITLE  
-----

BH301a Low  
-----

Beginning of initial solution calculations.

Initial solution 1.

WARNING: Error: maximum iterations exceeded, 100

ERROR: The program has failed to converge to a numerical solution.

The following equations were not satisfied:

ERROR: A(H2O) Activity of water has not converged. Residual: 7.434e-01

-----Solution composition-----

Elements	Molality	Moles
Al	1.563e-06	1.563e-06
As	1.681e-08	1.681e-08
B	1.392e-04	1.392e-04
Ba	2.177e-06	2.177e-06
C	1.446e-04	1.446e-04
Ca	2.478e-02	2.478e-02
Cl	4.996e-01	4.996e-01
Cr	9.176e-08	9.176e-08
K	7.619e-03	7.619e-03
Mg	3.533e-02	3.533e-02
Mn	2.479e-04	2.479e-04
N	1.181e-03	1.181e-03
Na	1.006e-01	1.006e-01
Ni	2.005e-09	2.005e-09
S	1.663e-02	1.663e-02
Se	1.310e-08	1.310e-08
Zn	1.958e-09	1.958e-09

-----Description of solution-----

pH = 0.687    Charge balance  
pe = -3.260  
Activity of water = 0.100  
Ionic strength = 5.598e-01  
Mass of water (kg) = 1.000e+00  
Total alkalinity (eq/kg) = -2.694e-01  
Total CO2 (mol/kg) = 1.446e-04  
Temperature (deg C) = 15.880  
Electrical balance (eq) = -1.290e-16  
Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|)$  = -0.00  
Iterations = 101  
Total H = 3.027544e+02



Total O = 5.550707e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
H+	2.694e-01	2.057e-01	-0.570	-0.687	-0.117
OH-	3.824e-15	2.400e-15	-14.417	-14.620	-0.202
H2O	5.551e+01	1.000e-01	-1.000	-1.000	0.000
Al	1.563e-06				
Al+3	1.563e-06	1.375e-07	-5.806	-6.862	-1.056
AlOH+2	1.612e-12	3.631e-13	-11.793	-12.440	-0.647
Al(OH)2+	3.749e-18	2.583e-18	-17.426	-17.588	-0.162
Al(OH)3	1.390e-24	1.581e-24	-23.857	-23.801	0.056
Al(OH)4-	1.111e-32	7.359e-33	-31.954	-32.133	-0.179
AlSO4+	0.000e+00	0.000e+00	-70.769	-70.948	-0.179
Al(SO4)2-	0.000e+00	0.000e+00	-135.942	-136.121	-0.179
As(3)	1.681e-08				
H3AsO3	1.453e-08	1.653e-08	-7.838	-7.782	0.056
H4AsO3+	2.275e-09	1.684e-09	-8.643	-8.774	-0.131
H2AsO3-	4.528e-17	3.353e-17	-16.344	-16.475	-0.131
HAsO3-2	2.855e-28	8.582e-29	-27.544	-28.066	-0.522
AsO3-3	1.742e-40	0.000e+00	-39.759	-40.934	-1.175
As(5)	7.900e-35				
H3AsO4	7.548e-35	8.586e-35	-34.122	-34.066	0.056
H2AsO4-	3.526e-36	2.611e-36	-35.453	-35.583	-0.131
HAsO4-2	0.000e+00	0.000e+00	-41.150	-41.672	-0.522
AsO4-3	0.000e+00	0.000e+00	-51.507	-52.682	-1.175
B	1.392e-04				
H3BO3	1.392e-04	1.584e-04	-3.856	-3.800	0.056
H2BO3-	6.379e-13	3.730e-13	-12.195	-12.428	-0.233
Ba	2.177e-06				
Ba+2	2.177e-06	4.594e-07	-5.662	-6.338	-0.676
BaOH+	6.469e-21	4.384e-21	-20.189	-20.358	-0.169
C(4)	1.446e-04				
H2CO3	1.446e-04	1.645e-04	-3.840	-3.784	0.056
HCO3-	5.647e-10	3.890e-10	-9.248	-9.410	-0.162
MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152
NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
CO3-2	3.193e-19	7.194e-20	-18.496	-19.143	-0.647
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162

NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
Ca	2.478e-02				
Ca+2	2.478e-02	7.547e-03	-1.606	-2.122	-0.516
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152
CaOH+	6.062e-16	4.270e-16	-15.217	-15.370	-0.152
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
CaSO4	0.000e+00	0.000e+00	-66.960	-66.904	0.056
Cl	4.996e-01				
Cl-	4.995e-01	3.093e-01	-0.301	-0.510	-0.208
MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169
MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056
MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
CrOHCl2	1.839e-17	2.092e-17	-16.735	-16.679	0.056
ZnOHCl	1.637e-18	1.862e-18	-17.786	-17.730	0.056
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
CrO3Cl-	0.000e+00	0.000e+00	-89.797	-89.928	-0.131
Cr(2)	1.871e-12				
Cr+2	1.871e-12	5.626e-13	-11.728	-12.250	-0.522
Cr(3)	9.176e-08				
Cr+3	8.925e-08	5.971e-09	-7.049	-8.224	-1.175
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
Cr(OH)+2	3.305e-13	9.934e-14	-12.481	-13.003	-0.522
CrOHCl2	1.839e-17	2.092e-17	-16.735	-16.679	0.056
Cr(OH)2+	1.565e-19	1.159e-19	-18.806	-18.936	-0.131
Cr(OH)3	3.672e-27	4.177e-27	-26.435	-26.379	0.056
CrO2-	6.646e-36	4.921e-36	-35.177	-35.308	-0.131
Cr(OH)4-	2.619e-38	1.940e-38	-37.582	-37.712	-0.131
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-58.559	-58.690	-0.131
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-60.747	-61.269	-0.522
Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
CrSO4+	0.000e+00	0.000e+00	-73.979	-74.109	-0.131
CrOHSO4	0.000e+00	0.000e+00	-77.460	-77.404	0.056
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-87.625	-88.147	-0.522
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-156.887	-156.831	0.056
CrNO3+2	0.000e+00	0.000e+00	-157.992	-158.514	-0.522

Cr(6)	0.000e+00					
CrO3Cl-	0.000e+00	0.000e+00	-89.797	-89.928	-0.131	
HCrO4-	0.000e+00	0.000e+00	-90.421	-90.552	-0.131	
H2CrO4	0.000e+00	0.000e+00	-92.132	-92.076	0.056	
CrO4-2	0.000e+00	0.000e+00	-95.594	-96.353	-0.759	
NaCrO4-	0.000e+00	0.000e+00	-96.671	-96.802	-0.131	
KCrO4-	0.000e+00	0.000e+00	-97.750	-97.880	-0.131	
CrO3SO4-2	0.000e+00	0.000e+00	-154.268	-154.790	-0.522	
Cr2O7-2	0.000e+00	0.000e+00	-177.932	-178.454	-0.522	
H(0)	1.914e+02					
H2	9.572e+01	1.089e+02	1.981	2.037	0.056	
K	7.619e-03					
K+	7.619e-03	4.718e-03	-2.118	-2.326	-0.208	
KSO4-	0.000e+00	0.000e+00	-68.446	-68.608	-0.162	
KCrO4-	0.000e+00	0.000e+00	-97.750	-97.880	-0.131	
Mg	3.533e-02					
Mg+2	3.533e-02	1.203e-02	-1.452	-1.920	-0.468	
MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190	
MgOH+	5.916e-15	4.237e-15	-14.228	-14.373	-0.145	
MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056	
MgSO4	0.000e+00	0.000e+00	-66.815	-66.759	0.056	
Mn(2)	2.479e-04					
Mn+2	1.672e-04	4.116e-05	-3.777	-4.386	-0.609	
MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169	
MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056	
MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169	
MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169	
MnOH+	3.526e-16	2.390e-16	-15.453	-15.622	-0.169	
MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056	
Mn(OH)3-	1.107e-40	0.000e+00	-39.956	-40.125	-0.169	
MnSO4	0.000e+00	0.000e+00	-69.288	-69.232	0.056	
MnSeO4	0.000e+00	0.000e+00	-111.554	-111.498	0.056	
Mn(NO3)2	0.000e+00	0.000e+00	-301.384	-301.328	0.056	
Mn(3)	3.154e-32					
Mn+3	3.154e-32	2.775e-33	-31.501	-32.557	-1.056	
Mn(6)	0.000e+00					
MnO4-2	0.000e+00	0.000e+00	-137.165	-137.840	-0.676	
Mn(7)	0.000e+00					
MnO4-	0.000e+00	0.000e+00	-150.883	-151.100	-0.217	
N(-3)	1.181e-03					
NH4+	1.181e-03	6.904e-04	-2.928	-3.161	-0.233	
NH3	8.646e-13	9.835e-13	-12.063	-12.007	0.056	
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-58.559	-58.690	-0.131	
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-60.747	-61.269	-0.522	
Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175	
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522	
NH4SO4-	0.000e+00	0.000e+00	-68.939	-69.108	-0.169	
N(3)	0.000e+00					

NO2-	0.000e+00	0.000e+00	-112.917	-113.047	-0.131
N(5)	0.000e+00				
NO3-	0.000e+00	0.000e+00	-148.559	-148.776	-0.217
CrNO3+2	0.000e+00	0.000e+00	-157.992	-158.514	-0.522
Mn(NO3)2	0.000e+00	0.000e+00	-301.384	-301.328	0.056
Na	1.006e-01				
Na+	1.006e-01	7.161e-02	-0.997	-1.145	-0.148
NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162
NaSO4-	0.000e+00	0.000e+00	-67.366	-67.528	-0.162
NaCrO4-	0.000e+00	0.000e+00	-96.671	-96.802	-0.131
Ni	2.005e-09				
Ni+2	1.298e-09	3.901e-10	-8.887	-9.409	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
NiOH+	1.825e-20	1.351e-20	-19.739	-19.869	-0.131
NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
Ni(OH)2	8.109e-30	9.224e-30	-29.091	-29.035	0.056
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Ni(OH)3-	0.000e+00	0.000e+00	-40.218	-40.348	-0.131
NiSO4	0.000e+00	0.000e+00	-74.267	-74.211	0.056
NiSeO4	0.000e+00	0.000e+00	-116.358	-116.302	0.056
Ni(SO4)2-2	0.000e+00	0.000e+00	-141.980	-142.502	-0.522
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-101.546	-101.490	0.056
S(-2)	1.663e-02				
H2S	1.663e-02	1.891e-02	-1.779	-1.723	0.056
HS-	1.244e-08	7.808e-09	-7.905	-8.107	-0.202
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
S5-2	1.956e-17	5.879e-18	-16.709	-17.231	-0.522
S6-2	1.661e-17	4.993e-18	-16.780	-17.302	-0.522
S4-2	1.117e-17	3.358e-18	-16.952	-17.474	-0.522
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
S-2	1.141e-20	2.407e-21	-19.943	-20.618	-0.676
S3-2	3.792e-21	1.140e-21	-20.421	-20.943	-0.522
S2-2	2.040e-22	6.134e-23	-21.690	-22.212	-0.522
S(6)	0.000e+00				
HSO4-	0.000e+00	0.000e+00	-65.686	-65.865	-0.179
SO4-2	0.000e+00	0.000e+00	-66.275	-67.057	-0.782
MgSO4	0.000e+00	0.000e+00	-66.815	-66.759	0.056
CaSO4	0.000e+00	0.000e+00	-66.960	-66.904	0.056
NaSO4-	0.000e+00	0.000e+00	-67.366	-67.528	-0.162
KSO4-	0.000e+00	0.000e+00	-68.446	-68.608	-0.162
NH4SO4-	0.000e+00	0.000e+00	-68.939	-69.108	-0.169
MnSO4	0.000e+00	0.000e+00	-69.288	-69.232	0.056
AlSO4+	0.000e+00	0.000e+00	-70.769	-70.948	-0.179
CrSO4+	0.000e+00	0.000e+00	-73.979	-74.109	-0.131

ZnSO4	0.000e+00	0.000e+00	-74.201	-74.145	0.056
NiSO4	0.000e+00	0.000e+00	-74.267	-74.211	0.056
CrOHSO4	0.000e+00	0.000e+00	-77.460	-77.404	0.056
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-87.625	-88.147	-0.522
Al(SO4)2-	0.000e+00	0.000e+00	-135.942	-136.121	-0.179
Zn(SO4)2-2	0.000e+00	0.000e+00	-139.739	-140.261	-0.522
Ni(SO4)2-2	0.000e+00	0.000e+00	-141.980	-142.502	-0.522
CrO3SO4-2	0.000e+00	0.000e+00	-154.268	-154.790	-0.522
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-156.887	-156.831	0.056
Se(-2)	1.310e-08				
H2Se	1.308e-08	1.488e-08	-7.883	-7.827	0.056
HSe-	1.574e-11	1.165e-11	-10.803	-10.934	-0.131
MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056
Se-2	1.139e-25	3.423e-26	-24.944	-25.466	-0.522
Se(4)	0.000e+00				
SeO3-2	0.000e+00	0.000e+00	-73.861	-74.383	-0.522
Se(6)	0.000e+00				
H2SeO3	0.000e+00	0.000e+00	-64.692	-64.636	0.056
HSeO3-	0.000e+00	0.000e+00	-66.430	-66.560	-0.131
HSeO4-	0.000e+00	0.000e+00	-108.199	-108.329	-0.131
SeO4-2	0.000e+00	0.000e+00	-108.692	-109.451	-0.759
MnSeO4	0.000e+00	0.000e+00	-111.554	-111.498	0.056
NiSeO4	0.000e+00	0.000e+00	-116.358	-116.302	0.056
ZnSeO4	0.000e+00	0.000e+00	-116.732	-116.676	0.056
Zn(SeO4)2-2	0.000e+00	0.000e+00	-227.878	-228.400	-0.522
Zn	1.958e-09				
Zn+2	1.519e-09	3.740e-10	-8.819	-9.427	-0.609
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
ZnOHCl	1.637e-18	1.862e-18	-17.786	-17.730	0.056
ZnOH+	1.319e-19	9.767e-20	-18.880	-19.010	-0.131
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Zn(OH)2	9.807e-28	1.116e-27	-27.008	-26.952	0.056
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
Zn(OH)3-	2.317e-39	1.715e-39	-38.635	-38.766	-0.131
Zn(OH)4-2	0.000e+00	0.000e+00	-51.357	-51.879	-0.522
ZnSO4	0.000e+00	0.000e+00	-74.201	-74.145	0.056
ZnSeO4	0.000e+00	0.000e+00	-116.732	-116.676	0.056
Zn(SO4)2-2	0.000e+00	0.000e+00	-139.739	-140.261	-0.522
Zn(SeO4)2-2	0.000e+00	0.000e+00	-227.878	-228.400	-0.522

-----Saturation indices-----

Phase	SI	log IAP	log KT	
(NH <sub>4</sub> ) <sub>2</sub> CrO <sub>4</sub>	-103.03	-32.92	70.11	(NH <sub>4</sub> ) <sub>2</sub> CrO <sub>4</sub>
Al(OH) <sub>3</sub> (a)	-18.81	-7.80	11.01	Al(OH) <sub>3</sub>
Al <sub>2</sub> O <sub>3</sub>	-35.58	-12.60	22.98	Al <sub>2</sub> O <sub>3</sub>
Al <sub>4</sub> (OH) <sub>10</sub> SO <sub>4</sub>	-120.33	-62.58	57.75	Al <sub>4</sub> (OH) <sub>10</sub> SO <sub>4</sub>
AlAsO <sub>4</sub> :2H <sub>2</sub> O	-45.67	-20.73	24.94	AlAsO <sub>4</sub> :2H <sub>2</sub> O
AlOHSO <sub>4</sub>	-71.00	-39.18	31.82	AlOHSO <sub>4</sub>
AlumK	-149.96	-85.20	64.76	KAl(SO <sub>4</sub> ) <sub>2</sub> :12H <sub>2</sub> O
Alunite	-157.47	-88.80	68.67	KAl <sub>3</sub> (SO <sub>4</sub> ) <sub>2</sub> (OH) <sub>6</sub>
Anhydrite	-64.63	-34.13	30.50	CaSO <sub>4</sub>
Aragonite	-12.98	-21.27	-8.28	CaCO <sub>3</sub>
Arsenolite	-21.99	-25.13	-3.13	As <sub>4</sub> O <sub>6</sub>
Artinite	-36.87	-26.61	10.26	MgCO <sub>3</sub> :Mg(OH) <sub>2</sub> :3H <sub>2</sub> O
As <sub>2</sub> O <sub>5</sub>	-71.96	-24.86	47.10	As <sub>2</sub> O <sub>5</sub>
Ba <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>	-74.05	-42.75	31.31	Ba <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>
BaCrO <sub>4</sub>	-92.88	-32.93	59.94	BaCrO <sub>4</sub>
Barite	-63.27	-38.34	24.93	BaSO <sub>4</sub>
BaSeO <sub>3</sub>	-76.52	-35.02	41.50	BaSeO <sub>3</sub>
BaSeO <sub>4</sub>	-110.55	-41.17	69.38	BaSeO <sub>4</sub>
Bianchite	-80.72	-47.43	33.29	ZnSO <sub>4</sub> :6H <sub>2</sub> O
Birnessite	-53.16	-10.16	43.00	MnO <sub>2</sub>
Bixbyite	-63.73	-14.17	49.56	Mn <sub>2</sub> O <sub>3</sub>
Boehmite	-16.03	-6.80	9.23	AlOOH
Brucite	-19.94	-2.55	17.39	Mg(OH) <sub>2</sub>
Bunsenite	-22.04	-9.04	13.00	NiO
Ca <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :6H <sub>2</sub> O	-98.68	-36.10	62.58	Ca <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :6H <sub>2</sub> O
CaCrO <sub>4</sub>	-96.36	-28.72	67.64	CaCrO <sub>4</sub>
Calcite	-12.84	-21.27	-8.43	CaCO <sub>3</sub>
CaSeO <sub>3</sub> :2H <sub>2</sub> O	-72.92	-32.81	40.11	CaSeO <sub>3</sub> :2H <sub>2</sub> O
CaSeO <sub>4</sub> :2H <sub>2</sub> O	-110.61	-38.95	71.65	CaSeO <sub>4</sub> :2H <sub>2</sub> O
CH <sub>4</sub> (g)	44.58	3.07	-41.51	CH <sub>4</sub>
Claudetite	-21.75	-25.13	-3.37	As <sub>4</sub> O <sub>6</sub>
CO <sub>2</sub> (g)	-1.34	-19.52	-18.17	CO <sub>2</sub>
Cr(OH) <sub>2</sub>	-23.89	-15.68	8.22	Cr(OH) <sub>2</sub>
Cr(OH) <sub>3</sub> (A)	-18.50	-19.25	-0.75	Cr(OH) <sub>3</sub>
Cr(OH) <sub>3</sub> (C)	-21.11	-19.25	1.87	Cr(OH) <sub>3</sub>
Cr <sub>2</sub> O <sub>3</sub>	-32.39	-35.50	-3.11	Cr <sub>2</sub> O <sub>3</sub>
CrCl <sub>2</sub>	-29.59	-16.07	13.52	CrCl <sub>2</sub>
CrCl <sub>3</sub>	-33.98	-19.84	14.14	CrCl <sub>3</sub>
CrMetal	-38.77	-8.53	30.24	Cr
CrO <sub>3</sub>	-93.55	-26.97	66.58	CrO <sub>3</sub>
Diaspore	-14.24	-6.80	7.44	AlOOH
Dolomite	-25.52	-42.33	-16.81	CaMg(CO <sub>3</sub> ) <sub>2</sub>
Epsomite	-73.77	-40.93	32.85	MgSO <sub>4</sub> :7H <sub>2</sub> O
Gibbsite(C)	-17.10	-7.80	9.30	Al(OH) <sub>3</sub>
Goslarite	-81.45	-48.43	33.01	ZnSO <sub>4</sub> :7H <sub>2</sub> O
Gypsum	-66.32	-36.13	30.20	CaSO <sub>4</sub> :2H <sub>2</sub> O

Halite	-3.22	-1.65	1.56	NaCl
Hausmannite	-81.58	-18.18	63.39	Mn <sub>3</sub> O <sub>4</sub>
Huntite	-55.08	-84.45	-29.37	CaMg <sub>3</sub> (CO <sub>3</sub> ) <sub>4</sub>
Hydromagnesite	-83.24	-90.80	-7.56	Mg <sub>5</sub> (CO <sub>3</sub> ) <sub>4</sub> (OH) <sub>2</sub> :4H <sub>2</sub> O
K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-181.64	-58.22	123.43	K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
K <sub>2</sub> CrO <sub>4</sub>	-100.91	-31.25	69.67	K <sub>2</sub> CrO <sub>4</sub>
Lime	-35.62	-1.75	33.87	CaO
Magnesite	-13.18	-21.06	-7.89	MgCO <sub>3</sub>
Manganite	-32.26	-7.58	24.67	MnOOH
MgCr <sub>2</sub> O <sub>4</sub>	-50.05	-37.04	13.00	MgCr <sub>2</sub> O <sub>4</sub>
MgCrO <sub>4</sub>	-104.14	-28.51	75.63	MgCrO <sub>4</sub>
MgSeO <sub>3</sub> :6H <sub>2</sub> O	-77.80	-36.61	41.19	MgSeO <sub>3</sub> :6H <sub>2</sub> O
Millerite	-8.73	-16.83	-8.10	NiS
Mirabilite	-77.79	-44.30	33.50	Na <sub>2</sub> SO <sub>4</sub> :10H <sub>2</sub> O
Mn <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>	-261.48	-111.31	150.17	Mn <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>
Mn <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-97.67	-44.89	52.78	Mn <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
MnCl <sub>2</sub> :4H <sub>2</sub> O	-11.71	-9.40	2.31	MnCl <sub>2</sub> :4H <sub>2</sub> O
MnS(Green)	-15.74	-11.81	3.93	MnS
MnSe	-20.29	-14.63	5.66	MnSe
MnSeO <sub>3</sub>	-71.47	-33.07	38.40	MnSeO <sub>3</sub>
MnSeO <sub>3</sub> :2H <sub>2</sub> O	-73.19	-35.07	38.12	MnSeO <sub>3</sub> :2H <sub>2</sub> O
MnSO <sub>4</sub>	-74.47	-36.39	38.08	MnSO <sub>4</sub>
Morenosite	-81.04	-48.41	32.62	NiSO <sub>4</sub> :7H <sub>2</sub> O
Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-185.35	-55.85	129.50	Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
Na <sub>2</sub> CrO <sub>4</sub>	-102.01	-28.88	73.13	Na <sub>2</sub> CrO <sub>4</sub>
Natron	-29.76	-31.43	-1.68	Na <sub>2</sub> CO <sub>3</sub> :10H <sub>2</sub> O
Nesquehonite	-18.58	-24.06	-5.49	MgCO <sub>3</sub> :3H <sub>2</sub> O
Ni(OH) <sub>2</sub>	-20.13	-10.04	10.10	Ni(OH) <sub>2</sub>
Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-115.94	-59.96	55.98	Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-138.57	-71.52	67.05	Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
NiCO <sub>3</sub>	-21.94	-28.55	-6.61	NiCO <sub>3</sub>
NiSe	-1.92	-19.66	-17.74	NiSe
NiSeO <sub>3</sub> :2H <sub>2</sub> O	-80.27	-40.09	40.17	NiSeO <sub>3</sub> :2H <sub>2</sub> O
Nsutite	-52.57	-10.16	42.42	MnO <sub>2</sub>
O <sub>2</sub> (g)	-98.51	-12.29	86.22	O <sub>2</sub>
Oripment	26.94	-35.95	-62.89	As <sub>2</sub> S <sub>3</sub>
Periclase	-23.89	-1.55	22.35	MgO
Portlandite	-26.13	-2.75	23.38	Ca(OH) <sub>2</sub>
Pyrocroite	-20.62	-5.01	15.61	Mn(OH) <sub>2</sub>
Pyrolusite	-51.61	-10.16	41.45	MnO <sub>2</sub>
Realgar	9.45	-11.00	-20.45	AsS
Retgersite	-80.40	-47.41	32.99	NiSO <sub>4</sub> :6H <sub>2</sub> O
Rhodochrosite	-13.17	-23.53	-10.36	MnCO <sub>3</sub>
Se(A)	-9.60	-16.77	-7.17	Se
Se(hex)	-8.98	-16.77	-7.78	Se
SeO <sub>2</sub>	-66.36	-29.06	37.30	SeO <sub>2</sub>
SeO <sub>3</sub>	-131.68	-35.21	96.47	SeO <sub>3</sub>
Smithsonite	-18.67	-28.57	-9.90	ZnCO <sub>3</sub>

Sphalerite	-5.04	-16.85	-11.81	ZnS
Spinel	-52.54	-14.15	38.39	MgAl <sub>2</sub> O <sub>4</sub>
SULFUR	-11.93	-13.94	-2.01	S
Thenardite	-69.18	-34.30	34.89	Na <sub>2</sub> SO <sub>4</sub>
Thermonatrite	-22.62	-22.43	0.19	Na <sub>2</sub> CO <sub>3</sub> :H <sub>2</sub> O
Witherite	-16.89	-25.48	-8.59	BaCO <sub>3</sub>
Wurtzite	-7.05	-16.85	-9.80	ZnS
Zincite	-20.70	-9.05	11.65	ZnO
Zincosite	-79.94	-41.43	38.51	ZnSO <sub>4</sub>
Zn(BO <sub>2</sub> ) <sub>2</sub>	-21.94	-13.65	8.29	Zn(BO <sub>2</sub> ) <sub>2</sub>
Zn(NO <sub>3</sub> ) <sub>2</sub> :6H <sub>2</sub> O	-316.29	-66.17	250.12	Zn(NO <sub>3</sub> ) <sub>2</sub> :6H <sub>2</sub> O
Zn(OH) <sub>2</sub> (A)	-22.50	-10.05	12.45	Zn(OH) <sub>2</sub>
Zn(OH) <sub>2</sub> (B)	-21.80	-10.05	11.75	Zn(OH) <sub>2</sub>
Zn(OH) <sub>2</sub> (C)	-22.25	-10.05	12.20	Zn(OH) <sub>2</sub>
Zn(OH) <sub>2</sub> (E)	-21.55	-10.05	11.50	Zn(OH) <sub>2</sub>
Zn(OH) <sub>2</sub> (G)	-21.76	-10.05	11.71	Zn(OH) <sub>2</sub>
Zn <sub>2</sub> (OH) <sub>2</sub> SO <sub>4</sub>	-94.04	-51.49	42.55	Zn <sub>2</sub> (OH) <sub>2</sub> SO <sub>4</sub>
Zn <sub>2</sub> (OH) <sub>3</sub> Cl	-35.50	-20.30	15.20	Zn <sub>2</sub> (OH) <sub>3</sub> Cl
Zn <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :2.5H <sub>2</sub> O	-108.44	-54.52	53.93	Zn <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :2.5H <sub>2</sub> O
Zn <sub>3</sub> O(SO <sub>4</sub> ) <sub>2</sub>	-182.48	-91.92	90.56	Zn <sub>3</sub> O(SO <sub>4</sub> ) <sub>2</sub>
Zn <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-135.04	-71.59	63.45	Zn <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
Zn <sub>5</sub> (OH) <sub>8</sub> Cl <sub>2</sub>	-89.16	-50.66	38.50	Zn <sub>5</sub> (OH) <sub>8</sub> Cl <sub>2</sub>
ZnCl <sub>2</sub>	-17.88	-10.45	7.43	ZnCl <sub>2</sub>
ZnCO <sub>3</sub> :H <sub>2</sub> O	-19.31	-29.57	-10.26	ZnCO <sub>3</sub> :H <sub>2</sub> O
ZnMetal	-29.51	-2.91	26.61	Zn
ZnO(Active)	-20.36	-9.05	11.31	ZnO
ZnS(A)	-7.71	-16.85	-9.14	ZnS
ZnSe	-8.16	-19.67	-11.51	ZnSe
ZnSO <sub>4</sub> :H <sub>2</sub> O	-77.16	-42.43	34.73	ZnSO <sub>4</sub> :H <sub>2</sub> O

ERROR: Model failed to converge for initial solution.

Stopping.

utilities.c(828) 0x9a74618: freed in PHRQ\_free\_all



Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a Low  
SOLUTION 1  
pH 6.90 charge  
temp 15.88  
pe -1.63  
units mg/L  
Al 0.0412  
As 0.00233 as H3AsO4  
Ba 0.292  
B 1.470  
Ca 970  
C 8.62  
Cl 17300  
Cr 0.00466  
Mg 839  
Mn 13.300 as Mn+2  
Ni 0.000115  
N 20.8 as NH4+  
K 291  
Se 0.00101  
Na 2260  
S 1560 as SO4-2  
Zn 0.000125

END

-----  
TITLE  
-----

BH301a Low  
-----

Beginning of initial solution calculations.

-----  
Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.563e-06	1.563e-06
As	1.681e-08	1.681e-08
B	1.392e-04	1.392e-04
Ba	2.177e-06	2.177e-06
C	1.446e-04	1.446e-04
Ca	2.478e-02	2.478e-02
Cl	4.996e-01	4.996e-01
Cr	9.176e-08	9.176e-08
K	7.619e-03	7.619e-03
Mg	3.533e-02	3.533e-02
Mn	2.479e-04	2.479e-04
N	1.181e-03	1.181e-03
Na	1.006e-01	1.006e-01
Ni	2.005e-09	2.005e-09
S	1.663e-02	1.663e-02
Se	1.310e-08	1.310e-08
Zn	1.958e-09	1.958e-09

-----Description of solution-----

pH = 0.687    Charge balance  
pe = -1.630  
Activity of water = 0.983  
Ionic strength = 5.598e-01  
Mass of water (kg) = 1.000e+00  
Total alkalinity (eq/kg) = -2.694e-01  
Total CO2 (mol/kg) = 1.446e-04  
Temperature (deg C) = 15.880  
Electrical balance (eq) = 1.707e-17  
Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|) = 0.00$   
Iterations = 17  
Total H = 1.114257e+02  
Total O = 5.550707e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
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H+	2.694e-01	2.057e-01	-0.570	-0.687	-0.117
OH-	3.758e-14	2.359e-14	-13.425	-13.627	-0.202
H2O	5.551e+01	9.829e-01	-0.008	-0.008	0.000
Al	1.563e-06				
Al+3	1.563e-06	1.375e-07	-5.806	-6.862	-1.056
AlOH+2	1.584e-11	3.569e-12	-10.800	-11.447	-0.647
Al(OH)2+	3.622e-16	2.495e-16	-15.441	-15.603	-0.162
Al(OH)3	1.320e-21	1.501e-21	-20.880	-20.824	0.056
Al(OH)4-	1.036e-28	6.867e-29	-27.984	-28.163	-0.179
AlSO4+	0.000e+00	0.000e+00	-53.759	-53.938	-0.179
Al(SO4)2-	0.000e+00	0.000e+00	-101.922	-102.101	-0.179
As(3)	1.681e-08				
H3AsO3	1.453e-08	1.653e-08	-7.838	-7.782	0.056
H4AsO3+	2.275e-09	1.684e-09	-8.643	-8.774	-0.131
H2AsO3-	4.528e-17	3.353e-17	-16.344	-16.475	-0.131
HAsO3-2	2.855e-28	8.582e-29	-27.544	-28.066	-0.522
AsO3-3	1.742e-40	0.000e+00	-39.759	-40.934	-1.175
As(5)	1.413e-30				
H3AsO4	1.350e-30	1.536e-30	-29.870	-29.814	0.056
H2AsO4-	6.306e-32	4.669e-32	-31.200	-31.331	-0.131
HAsO4-2	1.266e-37	3.804e-38	-36.898	-37.420	-0.522
AsO4-3	0.000e+00	0.000e+00	-47.255	-48.429	-1.175
B	1.392e-04				
H3BO3	1.392e-04	1.584e-04	-3.856	-3.800	0.056
H2BO3-	6.379e-13	3.730e-13	-12.195	-12.428	-0.233
Ba	2.177e-06				
Ba+2	2.177e-06	4.594e-07	-5.662	-6.338	-0.676
BaOH+	6.358e-20	4.309e-20	-19.197	-19.366	-0.169
C(4)	1.446e-04				
H2CO3	1.446e-04	1.645e-04	-3.840	-3.784	0.056
HCO3-	5.647e-10	3.890e-10	-9.248	-9.410	-0.162
MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152
NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
CO3-2	3.193e-19	7.194e-20	-18.496	-19.143	-0.647
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162
NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
Ca	2.478e-02				
Ca+2	2.478e-02	7.547e-03	-1.606	-2.122	-0.516
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152

CaOH+	5.958e-15	4.197e-15	-14.225	-14.377	-0.152
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
CaSO4	0.000e+00	0.000e+00	-49.950	-49.894	0.056
Cl	4.996e-01				
Cl-	4.995e-01	3.093e-01	-0.301	-0.510	-0.208
MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169
MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056
MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
CrOHCl2	1.807e-16	2.056e-16	-15.743	-15.687	0.056
ZnOHCl	1.609e-17	1.830e-17	-16.793	-16.737	0.056
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.52
CrO3Cl-	0.000e+00	0.000e+00	-81.930	-82.060	-0.131
Cr(2)	4.387e-14				
Cr+2	4.387e-14	1.319e-14	-13.358	-13.880	-0.522
Cr(3)	9.176e-08				
Cr+3	8.924e-08	5.971e-09	-7.049	-8.224	-1.175
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
Cr(OH)+2	3.248e-12	9.763e-13	-11.488	-12.010	-0.522
CrOHCl2	1.807e-16	2.056e-16	-15.743	-15.687	0.056
Cr(OH)2+	1.512e-17	1.119e-17	-16.821	-16.951	-0.131
Cr(OH)3	3.486e-24	3.966e-24	-23.458	-23.402	0.056
CrO2-	6.421e-34	4.754e-34	-33.192	-33.323	-0.131
Cr(OH)4-	2.444e-34	1.810e-34	-33.612	-33.742	-0.131
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.574	-56.705	-0.1
CrSO4+	0.000e+00	0.000e+00	-56.969	-57.099	-0.131
CrOHSO4	0.000e+00	0.000e+00	-59.458	-59.402	0.056
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.755	-60.277	-0.5
Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.52
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-68.631	-69.153	-0.5
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-120.882	-120.826	0.
CrNO3+2	0.000e+00	0.000e+00	-141.975	-142.497	-0.52
Cr(6)	0.000e+00				
HCrO4-	0.000e+00	0.000e+00	-81.561	-81.692	-0.131
CrO3Cl-	0.000e+00	0.000e+00	-81.930	-82.060	-0.131
H2CrO4	0.000e+00	0.000e+00	-83.272	-83.216	0.056
CrO4-2	0.000e+00	0.000e+00	-86.734	-87.493	-0.759
NaCrO4-	0.000e+00	0.000e+00	-87.811	-87.942	-0.131
KCrO4-	0.000e+00	0.000e+00	-88.890	-89.020	-0.131

	CrO3SO4-2	0.000e+00	0.000e+00	-129.390	-129.912	-0.522
	Cr2O7-2	0.000e+00	0.000e+00	-161.204	-161.726	-0.522
H(0)	1.052e-01					
	H2	5.260e-02	5.984e-02	-1.279	-1.223	0.056
K	7.619e-03					
	K+	7.619e-03	4.718e-03	-2.118	-2.326	-0.208
	KSO4-	0.000e+00	0.000e+00	-51.436	-51.598	-0.162
	KCrO4-	0.000e+00	0.000e+00	-88.890	-89.020	-0.131
Mg	3.533e-02					
	Mg+2	3.533e-02	1.203e-02	-1.452	-1.920	-0.468
	MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190
	MgOH+	5.815e-14	4.164e-14	-13.235	-13.380	-0.145
	MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056
	MgSO4	0.000e+00	0.000e+00	-49.805	-49.749	0.056
Mn(2)	2.479e-04					
	Mn+2	1.672e-04	4.116e-05	-3.777	-4.386	-0.609
	MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169
	MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056
	MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169
	MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169
	MnOH+	3.465e-15	2.349e-15	-14.460	-14.629	-0.169
	MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056
	Mn(OH)3-	1.051e-37	7.121e-38	-36.979	-37.147	-0.169
	MnSO4	0.000e+00	0.000e+00	-52.278	-52.222	0.056
	MnSeO4	0.000e+00	0.000e+00	-94.544	-94.488	0.056
	Mn(NO3)2	0.000e+00	0.000e+00	-269.349	-269.293	0.056
Mn(3)	1.346e-30					
	Mn+3	1.346e-30	1.184e-31	-29.871	-30.927	-1.056
Mn(6)	0.000e+00					
	MnO4-2	0.000e+00	0.000e+00	-126.675	-127.350	-0.676
Mn(7)	0.000e+00					
	MnO4-	0.000e+00	0.000e+00	-138.763	-138.980	-0.217
N(-3)	1.181e-03					
	NH4+	1.181e-03	6.904e-04	-2.928	-3.161	-0.233
	NH3	8.646e-13	9.835e-13	-12.063	-12.007	0.056
	NH4SO4-	0.000e+00	0.000e+00	-51.929	-52.098	-0.169
	Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.574	-56.705	-0.169
	Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.755	-60.277	-0.169
	Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175
	Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
N(3)	0.000e+00					
	NO2-	0.000e+00	0.000e+00	-101.152	-101.282	-0.131
N(5)	0.000e+00					
	NO3-	0.000e+00	0.000e+00	-132.542	-132.758	-0.217
	CrNO3+2	0.000e+00	0.000e+00	-141.975	-142.497	-0.522
	Mn(NO3)2	0.000e+00	0.000e+00	-269.349	-269.293	0.056
Na	1.006e-01					
	Na+	1.006e-01	7.161e-02	-0.997	-1.145	-0.148

NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162
NaSO4-	0.000e+00	0.000e+00	-50.356	-50.518	-0.162
NaCrO4-	0.000e+00	0.000e+00	-87.811	-87.942	-0.131
Ni	2.005e-09				
Ni+2	1.298e-09	3.901e-10	-8.887	-9.409	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
NiOH+	1.794e-19	1.328e-19	-18.746	-18.877	-0.131
NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
Ni(OH)2	7.833e-28	8.911e-28	-27.106	-27.050	0.056
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Ni(OH)3-	5.751e-38	4.259e-38	-37.240	-37.371	-0.131
NiSO4	0.000e+00	0.000e+00	-57.257	-57.201	0.056
NiSeO4	0.000e+00	0.000e+00	-99.348	-99.292	0.056
Ni(SO4)2-2	0.000e+00	0.000e+00	-107.960	-108.482	-0.522
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-93.041	-92.985	0.056
S(-2)	1.663e-02				
H2S	1.663e-02	1.891e-02	-1.779	-1.723	0.056
HS-	1.244e-08	7.808e-09	-7.905	-8.107	-0.202
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
S5-2	1.956e-17	5.879e-18	-16.709	-17.231	-0.522
S6-2	1.661e-17	4.993e-18	-16.780	-17.302	-0.522
S4-2	1.117e-17	3.358e-18	-16.952	-17.474	-0.522
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
S-2	1.141e-20	2.407e-21	-19.943	-20.618	-0.676
S3-2	3.792e-21	1.140e-21	-20.421	-20.943	-0.522
S2-2	2.040e-22	6.134e-23	-21.690	-22.212	-0.522
S(6)	0.000e+00				
HSO4-	0.000e+00	0.000e+00	-48.676	-48.855	-0.179
SO4-2	0.000e+00	0.000e+00	-49.265	-50.047	-0.782
MgSO4	0.000e+00	0.000e+00	-49.805	-49.749	0.056
CaSO4	0.000e+00	0.000e+00	-49.950	-49.894	0.056
NaSO4-	0.000e+00	0.000e+00	-50.356	-50.518	-0.162
KSO4-	0.000e+00	0.000e+00	-51.436	-51.598	-0.162
NH4SO4-	0.000e+00	0.000e+00	-51.929	-52.098	-0.169
MnSO4	0.000e+00	0.000e+00	-52.278	-52.222	0.056
AlSO4+	0.000e+00	0.000e+00	-53.759	-53.938	-0.179
CrSO4+	0.000e+00	0.000e+00	-56.969	-57.099	-0.131
ZnSO4	0.000e+00	0.000e+00	-57.191	-57.135	0.056
NiSO4	0.000e+00	0.000e+00	-57.257	-57.201	0.056
CrOHSO4	0.000e+00	0.000e+00	-59.458	-59.402	0.056
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-68.631	-69.153	-0.522
Al(SO4)2-	0.000e+00	0.000e+00	-101.922	-102.101	-0.179
Zn(SO4)2-2	0.000e+00	0.000e+00	-105.719	-106.241	-0.522
Ni(SO4)2-2	0.000e+00	0.000e+00	-107.960	-108.482	-0.522

Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-120.882	-120.826	0.
CrO3SO4-2	0.000e+00	0.000e+00	-129.390	-129.912	-0.522
Se(-2)	1.310e-08				
H2Se	1.308e-08	1.488e-08	-7.883	-7.827	0.056
HSe-	1.574e-11	1.165e-11	-10.803	-10.934	-0.131
MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056
Se-2	1.139e-25	3.423e-26	-24.944	-25.466	-0.522
Se(4)	0.000e+00				
SeO3-2	0.000e+00	0.000e+00	-61.104	-61.626	-0.522
Se(6)	0.000e+00				
H2SeO3	0.000e+00	0.000e+00	-51.935	-51.879	0.056
HSeO3-	0.000e+00	0.000e+00	-53.672	-53.803	-0.131
HSeO4-	0.000e+00	0.000e+00	-91.189	-91.319	-0.131
SeO4-2	0.000e+00	0.000e+00	-91.682	-92.441	-0.759
MnSeO4	0.000e+00	0.000e+00	-94.544	-94.488	0.056
NiSeO4	0.000e+00	0.000e+00	-99.348	-99.292	0.056
ZnSeO4	0.000e+00	0.000e+00	-99.722	-99.666	0.056
Zn(SeO4)2-2	0.000e+00	0.000e+00	-193.858	-194.380	-0.522
Zn	1.958e-09				
Zn+2	1.519e-09	3.740e-10	-8.819	-9.427	-0.609
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
ZnOHCl	1.609e-17	1.830e-17	-16.793	-16.737	0.056
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
ZnOH+	1.296e-18	9.600e-19	-17.887	-18.018	-0.131
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Zn(OH)2	9.474e-26	1.078e-25	-25.023	-24.967	0.056
Zn(OH)3-	2.200e-36	1.629e-36	-35.658	-35.788	-0.131
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
Zn(OH)4-2	0.000e+00	0.000e+00	-47.387	-47.909	-0.522
ZnSO4	0.000e+00	0.000e+00	-57.191	-57.135	0.056
ZnSeO4	0.000e+00	0.000e+00	-99.722	-99.666	0.056
Zn(SO4)2-2	0.000e+00	0.000e+00	-105.719	-106.241	-0.522
Zn(SeO4)2-2	0.000e+00	0.000e+00	-193.858	-194.380	-0.522

-----Saturation indices-----

Phase	SI	log IAP	log KT	
(NH4)2CrO4	-94.17	-24.06	70.11	(NH4)2CrO4
Al(OH)3(a)	-15.83	-4.82	11.01	Al(OH)3
Al2O3	-32.60	-9.62	22.98	Al2O3
Al4(OH)10SO4	-93.40	-35.65	57.75	Al4(OH)10SO4
AlAsO4:2H2O	-39.43	-14.49	24.94	AlAsO4:2H2O

AlOHSO4	-53.00	-21.18	31.82	AlOHSO4
AlumK	-104.03	-39.27	64.76	KAl(SO4)2·12H2O
Alunite	-117.49	-48.83	68.67	KAl3(SO4)2(OH)6
Anhydrite	-47.62	-17.12	30.50	CaSO4
Aragonite	-12.98	-21.27	-8.28	CaCO3
Arsenolite	-27.95	-31.08	-3.13	As4O6
Artinite	-31.91	-21.65	10.26	MgCO3:Mg(OH)2:3H2O
As2O5	-66.43	-19.33	47.10	As2O5
Ba3(AsO4)2	-65.55	-34.24	31.31	Ba3(AsO4)2
BaCrO4	-84.02	-24.07	59.94	BaCrO4
Barite	-46.26	-21.33	24.93	BaSO4
BaSeO3	-63.76	-22.27	41.50	BaSeO3
BaSeO4	-93.54	-24.16	69.38	BaSeO4
Bianchite	-57.76	-24.47	33.29	ZnSO4·6H2O
Birnessite	-47.92	-4.91	43.00	MnO2
Bixbyite	-57.50	-7.93	49.56	Mn2O3
Boehmite	-14.04	-4.82	9.23	AlOOH
Brucite	-17.95	-0.56	17.39	Mg(OH)2
Bunsenite	-21.05	-8.04	13.00	NiO
Ca3(AsO4)2·6H2O	-84.22	-21.64	62.58	Ca3(AsO4)2·6H2O
CaCrO4	-87.50	-19.86	67.64	CaCrO4
Calcite	-12.84	-21.27	-8.43	CaCO3
CaSeO3·2H2O	-58.17	-18.07	40.11	CaSeO3·2H2O
CaSeO4·2H2O	-91.61	-19.96	71.65	CaSeO4·2H2O
CH4(g)	28.56	-12.95	-41.51	CH4
Claudetite	-27.71	-31.08	-3.37	As4O6
CO2(g)	-2.34	-20.51	-18.17	CO2
Cr(OH)2	-23.54	-15.32	8.22	Cr(OH)2
Cr(OH)3(A)	-15.52	-16.27	-0.75	Cr(OH)3
Cr(OH)3(C)	-18.14	-16.27	1.87	Cr(OH)3
Cr2O3	-29.41	-32.52	-3.11	Cr2O3
CrCl2	-31.22	-17.70	13.52	CrCl2
CrCl3	-33.98	-19.84	14.14	CrCl3
CrMetal	-43.66	-13.42	30.24	Cr
CrO3	-85.68	-19.10	66.58	CrO3
Diaspore	-12.26	-4.82	7.44	AlOOH
Dolomite	-25.52	-42.33	-16.81	CaMg(CO3)2
Epsomite	-49.81	-16.97	32.85	MgSO4·7H2O
Gibbsite(C)	-14.12	-4.82	9.30	Al(OH)3
Goslarite	-57.49	-24.48	33.01	ZnSO4·7H2O
Gypsum	-47.33	-17.13	30.20	CaSO4·2H2O
Halite	-3.22	-1.65	1.56	NaCl
Hausmannite	-74.35	-10.95	63.39	Mn3O4
Huntite	-55.08	-84.45	-29.37	CaMg3(CO3)4
Hydromagnesite	-77.28	-84.84	-7.56	Mg5(CO3)4(OH)2·4H2O
K2Cr2O7	-164.91	-41.49	123.43	K2Cr2O7
K2CrO4	-92.05	-22.39	69.67	K2CrO4
Lime	-34.62	-0.76	33.87	CaO



Magnesite -13.18 -21.06 -7.89 MgCO<sub>3</sub>  
 Manganite -28.64 -3.97 24.67 MnOOH  
 MgCr<sub>2</sub>O<sub>4</sub> -46.08 -33.07 13.00 MgCr<sub>2</sub>O<sub>4</sub>  
 MgCrO<sub>4</sub> -95.28 -19.65 75.63 MgCrO<sub>4</sub>  
 MgSeO<sub>3</sub>:6H<sub>2</sub>O -59.08 -17.89 41.19 MgSeO<sub>3</sub>:6H<sub>2</sub>O  
 Millerite -8.73 -16.83 -8.10 NiS  
 Mirabilite -50.86 -17.36 33.50 Na<sub>2</sub>SO<sub>4</sub>:10H<sub>2</sub>O  
 Mn<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> -207.19 -57.02 150.17 Mn<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>  
 Mn<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O -81.22 -28.45 52.78 Mn<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O  
 MnCl<sub>2</sub>:4H<sub>2</sub>O -7.74 -5.43 2.31 MnCl<sub>2</sub>:4H<sub>2</sub>O  
 MnS(Green) -15.74 -11.81 3.93 MnS  
 MnSe -20.29 -14.63 5.66 MnSe  
 MnSeO<sub>3</sub> -58.71 -20.31 38.40 MnSeO<sub>3</sub>  
 MnSeO<sub>3</sub>:2H<sub>2</sub>O -58.45 -20.33 38.12 MnSeO<sub>3</sub>:2H<sub>2</sub>O  
 MnSO<sub>4</sub> -57.46 -19.38 38.08 MnSO<sub>4</sub>  
 Morenosite -57.08 -24.46 32.62 NiSO<sub>4</sub>:7H<sub>2</sub>O  
 Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> -168.62 -39.13 129.50 Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>  
 Na<sub>2</sub>CrO<sub>4</sub> -93.15 -20.02 73.13 Na<sub>2</sub>CrO<sub>4</sub>  
 Natron -19.83 -21.51 -1.68 Na<sub>2</sub>CO<sub>3</sub>:10H<sub>2</sub>O  
 Nesquehonite -15.60 -21.09 -5.49 MgCO<sub>3</sub>:3H<sub>2</sub>O  
 Ni(OH)<sub>2</sub> -18.15 -8.05 10.10 Ni(OH)<sub>2</sub>  
 Ni<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O -99.49 -43.52 55.98 Ni<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O  
 Ni<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub> -115.61 -48.55 67.05 Ni<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub>  
 NiCO<sub>3</sub> -21.94 -28.55 -6.61 NiCO<sub>3</sub>  
 NiSe -1.92 -19.66 -17.74 NiSe  
 NiSeO<sub>3</sub>:2H<sub>2</sub>O -65.53 -25.35 40.17 NiSeO<sub>3</sub>:2H<sub>2</sub>O  
 Nsutite -47.33 -4.91 42.42 MnO<sub>2</sub>  
 O<sub>2</sub>(g) -90.00 -3.79 86.22 O<sub>2</sub>  
 Oripment 20.99 -41.90 -62.89 As<sub>2</sub>S<sub>3</sub>  
 Periclase -22.90 -0.55 22.35 MgO  
 Portlandite -24.15 -0.76 23.38 Ca(OH)<sub>2</sub>  
 Pyrocroite -18.64 -3.03 15.61 Mn(OH)<sub>2</sub>  
 Pyrolusite -46.36 -4.91 41.45 MnO<sub>2</sub>  
 Realgar 4.84 -15.61 -20.45 AsS  
 Retgersite -57.44 -24.45 32.99 NiSO<sub>4</sub>:6H<sub>2</sub>O  
 Rhodochrosite -13.17 -23.53 -10.36 MnCO<sub>3</sub>  
 Se(A) -6.34 -13.51 -7.17 Se  
 Se(hex) -5.72 -13.51 -7.78 Se  
 SeO<sub>2</sub> -54.60 -17.29 37.30 SeO<sub>2</sub>  
 SeO<sub>3</sub> -115.66 -19.19 96.47 SeO<sub>3</sub>  
 Smithsonite -18.67 -28.57 -9.90 ZnCO<sub>3</sub>  
 Sphalerite -5.04 -16.85 -11.81 ZnS  
 Spinel -48.57 -10.18 38.39 MgAl<sub>2</sub>O<sub>4</sub>  
 SULFUR -8.67 -10.68 -2.01 S  
 Thenardite -52.17 -17.29 34.89 Na<sub>2</sub>SO<sub>4</sub>  
 Thermonatrite -21.63 -21.44 0.19 Na<sub>2</sub>CO<sub>3</sub>:H<sub>2</sub>O  
 Witherite -16.89 -25.48 -8.59 BaCO<sub>3</sub>  
 Wurtzite -7.05 -16.85 -9.80 ZnS

Zincite -19.71 -8.06 11.65 ZnO  
Zincosite -62.93 -24.42 38.51 ZnSO4  
Zn(BO2)2 -23.93 -15.64 8.29 Zn(BO2)2  
Zn(NO3)2:6H2O -278.30 -28.18 250.12 Zn(NO3)2:6H2O  
Zn(OH)2(A) -20.52 -8.07 12.45 Zn(OH)2  
Zn(OH)2(B) -19.82 -8.07 11.75 Zn(OH)2  
Zn(OH)2(C) -20.27 -8.07 12.20 Zn(OH)2  
Zn(OH)2(E) -19.57 -8.07 11.50 Zn(OH)2  
Zn(OH)2(G) -19.78 -8.07 11.71 Zn(OH)2  
Zn2(OH)2SO4 -75.04 -32.49 42.55 Zn2(OH)2SO4  
Zn2(OH)3Cl -32.53 -17.33 15.20 Zn2(OH)3Cl  
Zn3(AsO4)2:2.5H2O -97.46 -43.53 53.93 Zn3(AsO4)2:2.5H2O  
Zn3O(SO4)2 -147.46 -56.91 90.56 Zn3O(SO4)2  
Zn4(OH)6SO4 -112.08 -48.63 63.45 Zn4(OH)6SO4  
Zn5(OH)8Cl2 -81.22 -42.72 38.50 Zn5(OH)8Cl2  
ZnCl2 -17.88 -10.45 7.43 ZnCl2  
ZnCO3:H2O -18.32 -28.58 -10.26 ZnCO3:H2O  
ZnMetal -32.77 -6.17 26.61 Zn  
ZnO(Active) -19.37 -8.06 11.31 ZnO  
ZnS(A) -7.71 -16.85 -9.14 ZnS  
ZnSe -8.16 -19.67 -11.51 ZnSe  
ZnSO4:H2O -59.16 -24.43 34.73 ZnSO4:H2O

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a Low  
SOLUTION 1  
pH 6.90 charge  
temp 15.88  
pe 0  
units mg/L  
Al 0.0412  
As 0.00233 as H3AsO4  
Ba 0.292  
B 1.470  
Ca 970  
C 8.62  
Cl 17300  
Cr 0.00466  
Mg 839  
Mn 13.300 as Mn+2  
Ni 0.000115  
N 20.8 as NH4+  
K 291  
Se 0.00101  
Na 2260  
S 1560 as SO4-2  
Zn 0.000125

END

-----  
TITLE  
-----

BH301a Low  
-----

Beginning of initial solution calculations.

-----  
Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.563e-06	1.563e-06
As	1.681e-08	1.681e-08
B	1.392e-04	1.392e-04
Ba	2.177e-06	2.177e-06
C	1.446e-04	1.446e-04
Ca	2.478e-02	2.478e-02
Cl	4.996e-01	4.996e-01
Cr	9.176e-08	9.176e-08
K	7.619e-03	7.619e-03
Mg	3.533e-02	3.533e-02
Mn	2.479e-04	2.479e-04
N	1.181e-03	1.181e-03
Na	1.006e-01	1.006e-01
Ni	2.005e-09	2.005e-09
S	1.663e-02	1.663e-02
Se	1.310e-08	1.310e-08
Zn	1.958e-09	1.958e-09

-----Description of solution-----

pH = 0.687    Charge balance  
pe = 0.000  
Activity of water = 0.984  
Ionic strength = 5.598e-01  
Mass of water (kg) = 1.000e+00  
Total alkalinity (eq/kg) = -2.694e-01  
Total CO2 (mol/kg) = 1.446e-04  
Temperature (deg C) = 15.880  
Electrical balance (eq) = -3.089e-17  
Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|)$  = -0.00  
Iterations = 20  
Total H = 1.113206e+02  
Total O = 5.550707e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
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H+	2.694e-01	2.057e-01	-0.570	-0.687	-0.117
OH-	3.762e-14	2.361e-14	-13.425	-13.627	-0.202
H2O	5.551e+01	9.838e-01	-0.007	-0.007	0.000
Al	1.563e-06				
Al+3	1.563e-06	1.375e-07	-5.806	-6.862	-1.056
AlOH+2	1.585e-11	3.572e-12	-10.800	-11.447	-0.647
Al(OH)2+	3.628e-16	2.500e-16	-15.440	-15.602	-0.162
Al(OH)3	1.323e-21	1.505e-21	-20.878	-20.822	0.056
Al(OH)4-	1.040e-28	6.892e-29	-27.983	-28.162	-0.179
AlSO4+	0.000e+00	0.000e+00	-40.718	-40.896	-0.179
Al(SO4)2-	0.000e+00	0.000e+00	-75.839	-76.018	-0.179
As(3)	1.681e-08				
H3AsO3	1.453e-08	1.653e-08	-7.838	-7.782	0.056
H4AsO3+	2.275e-09	1.684e-09	-8.643	-8.774	-0.131
H2AsO3-	4.528e-17	3.353e-17	-16.344	-16.475	-0.131
HAsO3-2	2.855e-28	8.582e-29	-27.544	-28.066	-0.522
AsO3-3	1.742e-40	0.000e+00	-39.759	-40.934	-1.175
As(5)	2.574e-27				
H3AsO4	2.459e-27	2.797e-27	-26.609	-26.553	0.056
H2AsO4-	1.148e-28	8.504e-29	-27.940	-28.070	-0.131
HAsO4-2	2.305e-34	6.929e-35	-33.637	-34.159	-0.522
AsO4-3	0.000e+00	0.000e+00	-43.995	-45.169	-1.175
B	1.392e-04				
H3BO3	1.392e-04	1.584e-04	-3.856	-3.800	0.056
H2BO3-	6.379e-13	3.730e-13	-12.195	-12.428	-0.233
Ba	2.177e-06				
Ba+2	2.177e-06	4.594e-07	-5.662	-6.338	-0.676
BaOH+	6.363e-20	4.313e-20	-19.196	-19.365	-0.169
C(4)	1.446e-04				
H2CO3	1.446e-04	1.645e-04	-3.840	-3.784	0.056
HCO3-	5.647e-10	3.890e-10	-9.248	-9.410	-0.162
MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152
NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
CO3-2	3.193e-19	7.194e-20	-18.496	-19.143	-0.647
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162
NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
Ca	2.478e-02				
Ca+2	2.478e-02	7.547e-03	-1.606	-2.122	-0.516
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152

CaOH+	5.963e-15	4.201e-15	-14.225	-14.377	-0.152
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
CaSO4	1.235e-37	1.405e-37	-36.908	-36.852	0.056
Cl	4.996e-01				
Cl-	4.995e-01	3.093e-01	-0.301	-0.510	-0.208
MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169
MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056
MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
CrOHCl2	1.809e-16	2.058e-16	-15.743	-15.687	0.056
ZnOHCl	1.610e-17	1.832e-17	-16.793	-16.737	0.056
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
CrO3Cl-	0.000e+00	0.000e+00	-77.039	-77.169	-0.131
Cr(2)	1.028e-15				
Cr+2	1.028e-15	3.091e-16	-14.988	-15.510	-0.522
Cr(3)	9.176e-08				
Cr+3	8.924e-08	5.971e-09	-7.049	-8.224	-1.175
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
Cr(OH)+2	3.251e-12	9.772e-13	-11.488	-12.010	-0.522
CrOHCl2	1.809e-16	2.058e-16	-15.743	-15.687	0.056
Cr(OH)2+	1.514e-17	1.121e-17	-16.820	-16.950	-0.131
Cr(OH)3	3.495e-24	3.976e-24	-23.456	-23.401	0.056
CrO2-	6.432e-34	4.763e-34	-33.192	-33.322	-0.131
Cr(OH)4-	2.453e-34	1.816e-34	-33.610	-33.741	-0.131
CrSO4+	0.000e+00	0.000e+00	-43.927	-44.058	-0.131
CrOHSO4	0.000e+00	0.000e+00	-46.416	-46.360	0.056
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-55.588	-56.110	-0.522
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.573	-56.704	-0.131
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.754	-60.276	-0.522
Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-94.798	-94.743	0.056
CrNO3+2	0.000e+00	0.000e+00	-128.934	-129.456	-0.522
Cr(6)	0.000e+00				
HCrO4-	0.000e+00	0.000e+00	-76.670	-76.800	-0.131
CrO3Cl-	0.000e+00	0.000e+00	-77.039	-77.169	-0.131
H2CrO4	0.000e+00	0.000e+00	-78.380	-78.324	0.056
CrO4-2	0.000e+00	0.000e+00	-81.842	-82.602	-0.759
NaCrO4-	0.000e+00	0.000e+00	-82.920	-83.050	-0.131
KCrO4-	0.000e+00	0.000e+00	-83.998	-84.129	-0.131

	CrO3SO4-2	0.000e+00	0.000e+00	-111.458	-111.980	-0.522
	Cr2O7-2	0.000e+00	0.000e+00	-151.421	-151.943	-0.522
H(0)	5.781e-05					
	H2	2.891e-05	3.288e-05	-4.539	-4.483	0.056
K	7.619e-03					
	K+	7.619e-03	4.718e-03	-2.118	-2.326	-0.208
	KSO4-	4.035e-39	2.780e-39	-38.394	-38.556	-0.162
	KCrO4-	0.000e+00	0.000e+00	-83.998	-84.129	-0.131
Mg	3.533e-02					
	Mg+2	3.533e-02	1.203e-02	-1.452	-1.920	-0.468
	MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190
	MgOH+	5.820e-14	4.168e-14	-13.235	-13.380	-0.145
	MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056
	MgSO4	1.725e-37	1.962e-37	-36.763	-36.707	0.056
Mn(2)	2.479e-04					
	Mn+2	1.672e-04	4.116e-05	-3.777	-4.386	-0.609
	MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169
	MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056
	MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169
	MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169
	MnOH+	3.468e-15	2.351e-15	-14.460	-14.629	-0.169
	MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056
	Mn(OH)3-	1.053e-37	7.140e-38	-36.977	-37.146	-0.169
	MnSO4	5.796e-40	6.594e-40	-39.237	-39.181	0.056
	MnSeO4	0.000e+00	0.000e+00	-81.502	-81.446	0.056
	Mn(NO3)2	0.000e+00	0.000e+00	-243.266	-243.210	0.056
Mn(3)	5.740e-29					
	Mn+3	5.740e-29	5.050e-30	-28.241	-29.297	-1.056
Mn(6)	0.000e+00					
	MnO4-2	0.000e+00	0.000e+00	-120.153	-120.829	-0.676
Mn(7)	0.000e+00					
	MnO4-	0.000e+00	0.000e+00	-130.611	-130.828	-0.217
N(-3)	1.181e-03					
	NH4+	1.181e-03	6.904e-04	-2.928	-3.161	-0.233
	NH3	8.646e-13	9.835e-13	-12.063	-12.007	0.056
	NH4SO4-	1.297e-39	8.789e-40	-38.887	-39.056	-0.169
	Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.573	-56.704	-0.131
	Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.754	-60.276	-0.522
	Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175
	Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
N(3)	0.000e+00					
	NO2-	0.000e+00	0.000e+00	-91.371	-91.501	-0.131
N(5)	0.000e+00					
	NO3-	0.000e+00	0.000e+00	-119.500	-119.717	-0.217
	CrNO3+2	0.000e+00	0.000e+00	-128.934	-129.456	-0.522
	Mn(NO3)2	0.000e+00	0.000e+00	-243.266	-243.210	0.056
Na	1.006e-01					
	Na+	1.006e-01	7.161e-02	-0.997	-1.145	-0.148

NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162
NaSO4-	4.850e-38	3.341e-38	-37.314	-37.476	-0.162
NaCrO4-	0.000e+00	0.000e+00	-82.920	-83.050	-0.131
Ni	2.005e-09				
Ni+2	1.298e-09	3.901e-10	-8.887	-9.409	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
NiOH+	1.796e-19	1.330e-19	-18.746	-18.876	-0.131
NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
Ni(OH)2	7.847e-28	8.927e-28	-27.105	-27.049	0.056
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Ni(OH)3-	5.767e-38	4.270e-38	-37.239	-37.370	-0.131
NiSO4	0.000e+00	0.000e+00	-44.215	-44.159	0.056
Ni(SO4)2-2	0.000e+00	0.000e+00	-81.877	-82.399	-0.522
NiSeO4	0.000e+00	0.000e+00	-86.307	-86.251	0.056
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-86.520	-86.464	0.056
S(-2)	1.663e-02				
H2S	1.663e-02	1.891e-02	-1.779	-1.723	0.056
HS-	1.244e-08	7.808e-09	-7.905	-8.107	-0.202
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
S5-2	1.956e-17	5.879e-18	-16.709	-17.231	-0.522
S6-2	1.661e-17	4.993e-18	-16.780	-17.302	-0.522
S4-2	1.117e-17	3.358e-18	-16.952	-17.474	-0.522
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
S-2	1.141e-20	2.407e-21	-19.943	-20.618	-0.676
S3-2	3.792e-21	1.140e-21	-20.421	-20.943	-0.522
S2-2	2.040e-22	6.134e-23	-21.690	-22.212	-0.522
S(6)	3.267e-36				
HSO4-	2.319e-36	1.537e-36	-35.635	-35.813	-0.179
SO4-2	5.976e-37	9.882e-38	-36.224	-37.005	-0.782
MgSO4	1.725e-37	1.962e-37	-36.763	-36.707	0.056
CaSO4	1.235e-37	1.405e-37	-36.908	-36.852	0.056
NaSO4-	4.850e-38	3.341e-38	-37.314	-37.476	-0.162
KSO4-	4.035e-39	2.780e-39	-38.394	-38.556	-0.162
NH4SO4-	1.297e-39	8.789e-40	-38.887	-39.056	-0.169
MnSO4	5.796e-40	6.594e-40	-39.237	-39.181	0.056
AlSO4+	0.000e+00	0.000e+00	-40.718	-40.896	-0.179
CrSO4+	0.000e+00	0.000e+00	-43.927	-44.058	-0.131
ZnSO4	0.000e+00	0.000e+00	-44.150	-44.094	0.056
NiSO4	0.000e+00	0.000e+00	-44.215	-44.159	0.056
CrOHSO4	0.000e+00	0.000e+00	-46.416	-46.360	0.056
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-55.588	-56.110	-0.522
Al(SO4)2-	0.000e+00	0.000e+00	-75.839	-76.018	-0.179
Zn(SO4)2-2	0.000e+00	0.000e+00	-79.635	-80.157	-0.522
Ni(SO4)2-2	0.000e+00	0.000e+00	-81.877	-82.399	-0.522



Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-94.798	-94.743	0.056
CrO3SO4-2	0.000e+00	0.000e+00	-111.458	-111.980	-0.522
Se(-2)	1.310e-08				
H2Se	1.308e-08	1.488e-08	-7.883	-7.827	0.056
HSe-	1.574e-11	1.165e-11	-10.803	-10.934	-0.131
MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056
Se-2	1.139e-25	3.423e-26	-24.944	-25.466	-0.522
Se(4)	0.000e+00				
SeO3-2	0.000e+00	0.000e+00	-51.322	-51.844	-0.522
Se(6)	0.000e+00				
H2SeO3	0.000e+00	0.000e+00	-42.154	-42.098	0.056
HSeO3-	0.000e+00	0.000e+00	-43.891	-44.022	-0.131
HSeO4-	0.000e+00	0.000e+00	-78.147	-78.278	-0.131
SeO4-2	0.000e+00	0.000e+00	-78.640	-79.400	-0.759
MnSeO4	0.000e+00	0.000e+00	-81.502	-81.446	0.056
NiSeO4	0.000e+00	0.000e+00	-86.307	-86.251	0.056
ZnSeO4	0.000e+00	0.000e+00	-86.681	-86.625	0.056
Zn(SeO4)2-2	0.000e+00	0.000e+00	-167.775	-168.297	-0.522
Zn	1.958e-09				
Zn+2	1.519e-09	3.740e-10	-8.819	-9.427	-0.609
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
ZnOHCl	1.610e-17	1.832e-17	-16.793	-16.737	0.056
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
ZnOH+	1.298e-18	9.609e-19	-17.887	-18.017	-0.131
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Zn(OH)2	9.491e-26	1.080e-25	-25.023	-24.967	0.056
Zn(OH)3-	2.206e-36	1.633e-36	-35.656	-35.787	-0.131
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
ZnSO4	0.000e+00	0.000e+00	-44.150	-44.094	0.056
Zn(OH)4-2	0.000e+00	0.000e+00	-47.385	-47.907	-0.522
Zn(SO4)2-2	0.000e+00	0.000e+00	-79.635	-80.157	-0.522
ZnSeO4	0.000e+00	0.000e+00	-86.681	-86.625	0.056
Zn(SeO4)2-2	0.000e+00	0.000e+00	-167.775	-168.297	-0.522

-----Saturation indices-----

Phase	SI	log IAP	log KT	
(NH4)2CrO4	-89.28	-19.17	70.11	(NH4)2CrO4
Al(OH)3(a)	-15.83	-4.82	11.01	Al(OH)3
Al2O3	-32.60	-9.62	22.98	Al2O3
Al4(OH)10SO4	-80.35	-22.60	57.75	Al4(OH)10SO4
AlAsO4:2H2O	-36.17	-11.23	24.94	AlAsO4:2H2O

AlOHSO4	-39.96	-8.14	31.82	AlOHSO4
AlumK	-77.95	-13.18	64.76	KAl(SO4)2:12H2O
Alunite	-91.41	-22.74	68.67	KAl3(SO4)2(OH)6
Anhydrite	-34.58	-4.08	30.50	CaSO4
Aragonite	-12.98	-21.27	-8.28	CaCO3
Arsenolite	-27.95	-31.08	-3.13	As4O6
Artinite	-31.91	-21.64	10.26	MgCO3:Mg(OH)2:3H2O
As2O5	-59.91	-12.81	47.10	As2O5
Ba3(AsO4)2	-59.03	-27.72	31.31	Ba3(AsO4)2
BaCrO4	-79.12	-19.18	59.94	BaCrO4
Barite	-33.22	-8.29	24.93	BaSO4
BaSeO3	-53.98	-12.48	41.50	BaSeO3
BaSeO4	-80.50	-11.12	69.38	BaSeO4
Bianchite	-44.71	-11.42	33.29	ZnSO4:6H2O
Birnessite	-44.65	-1.65	43.00	MnO2
Bixbyite	-54.24	-4.67	49.56	Mn2O3
Boehmite	-14.04	-4.82	9.23	AlOOH
Brucite	-17.95	-0.56	17.39	Mg(OH)2
Bunsenite	-21.05	-8.04	13.00	NiO
Ca3(AsO4)2:6H2O	-77.69	-15.12	62.58	Ca3(AsO4)2:6H2O
CaCrO4	-82.61	-14.97	67.64	CaCrO4
Calcite	-12.84	-21.27	-8.43	CaCO3
CaSeO3:2H2O	-48.39	-8.28	40.11	CaSeO3:2H2O
CaSeO4:2H2O	-78.57	-6.92	71.65	CaSeO4:2H2O
CH4(g)	15.52	-25.99	-41.51	CH4
Claudetite	-27.71	-31.08	-3.37	As4O6
CO2(g)	-2.34	-20.51	-18.17	CO2
Cr(OH)2	-25.17	-16.95	8.22	Cr(OH)2
Cr(OH)3(A)	-15.52	-16.27	-0.75	Cr(OH)3
Cr(OH)3(C)	-18.14	-16.27	1.87	Cr(OH)3
Cr2O3	-29.41	-32.52	-3.11	Cr2O3
CrCl2	-32.85	-19.33	13.52	CrCl2
CrCl3	-33.98	-19.84	14.14	CrCl3
CrMetal	-48.55	-18.31	30.24	Cr
CrO3	-80.79	-14.21	66.58	CrO3
Diaspore	-12.26	-4.82	7.44	AlOOH
Dolomite	-25.52	-42.33	-16.81	CaMg(CO3)2
Epsomite	-36.77	-3.92	32.85	MgSO4:7H2O
Gibbsite(C)	-14.12	-4.82	9.30	Al(OH)3
Goslarite	-44.45	-11.43	33.01	ZnSO4:7H2O
Gypsum	-34.29	-4.09	30.20	CaSO4:2H2O
Halite	-3.22	-1.65	1.56	NaCl
Hausmannite	-71.08	-7.69	63.39	Mn3O4
Huntite	-55.08	-84.45	-29.37	CaMg3(CO3)4
Hydromagnesite	-77.28	-84.84	-7.56	Mg5(CO3)4(OH)2:4H2O
K2Cr2O7	-155.13	-31.71	123.43	K2Cr2O7
K2CrO4	-87.16	-17.50	69.67	K2CrO4
Lime	-34.62	-0.76	33.87	CaO

Magnesite	-13.18	-21.06	-7.89	MgCO <sub>3</sub>
Manganite	-27.01	-2.34	24.67	MnOOH
MgCr <sub>2</sub> O <sub>4</sub>	-46.07	-33.07	13.00	MgCr <sub>2</sub> O <sub>4</sub>
MgCrO <sub>4</sub>	-90.39	-14.76	75.63	MgCrO <sub>4</sub>
MgSeO <sub>3</sub> :6H <sub>2</sub> O	-49.30	-8.11	41.19	MgSeO <sub>3</sub> :6H <sub>2</sub> O
Millerite	-8.73	-16.83	-8.10	NiS
Mirabilite	-37.81	-4.32	33.50	Na <sub>2</sub> SO <sub>4</sub> :10H <sub>2</sub> O
Mn <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>	-164.80	-14.63	150.17	Mn <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>
Mn <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-74.70	-21.92	52.78	Mn <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
MnCl <sub>2</sub> :4H <sub>2</sub> O	-7.74	-5.43	2.31	MnCl <sub>2</sub> :4H <sub>2</sub> O
MnS(Green)	-15.74	-11.81	3.93	MnS
MnSe	-20.29	-14.63	5.66	MnSe
MnSeO <sub>3</sub>	-48.93	-10.53	38.40	MnSeO <sub>3</sub>
MnSeO <sub>3</sub> :2H <sub>2</sub> O	-48.67	-10.55	38.12	MnSeO <sub>3</sub> :2H <sub>2</sub> O
MnSO <sub>4</sub>	-44.42	-6.34	38.08	MnSO <sub>4</sub>
Morenosite	-44.04	-11.41	32.62	NiSO <sub>4</sub> :7H <sub>2</sub> O
Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-158.84	-29.34	129.50	Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
Na <sub>2</sub> CrO <sub>4</sub>	-88.26	-15.13	73.13	Na <sub>2</sub> CrO <sub>4</sub>
Natron	-19.83	-21.50	-1.68	Na <sub>2</sub> CO <sub>3</sub> :10H <sub>2</sub> O
Nesquehonite	-15.60	-21.08	-5.49	MgCO <sub>3</sub> :3H <sub>2</sub> O
Ni(OH) <sub>2</sub>	-18.15	-8.05	10.10	Ni(OH) <sub>2</sub>
Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-92.97	-36.99	55.98	Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-102.56	-35.51	67.05	Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
NiCO <sub>3</sub>	-21.94	-28.55	-6.61	NiCO <sub>3</sub>
NiSe	-1.92	-19.66	-17.74	NiSe
NiSeO <sub>3</sub> :2H <sub>2</sub> O	-55.74	-15.57	40.17	NiSeO <sub>3</sub> :2H <sub>2</sub> O
Nsutite	-44.07	-1.65	42.42	MnO <sub>2</sub>
O <sub>2</sub> (g)	-83.48	2.73	86.22	O <sub>2</sub>
Oripment	20.98	-41.90	-62.89	As <sub>2</sub> S <sub>3</sub>
Periclase	-22.90	-0.55	22.35	MgO
Portlandite	-24.15	-0.76	23.38	Ca(OH) <sub>2</sub>
Pyrocroite	-18.64	-3.03	15.61	Mn(OH) <sub>2</sub>
Pyrolusite	-43.10	-1.65	41.45	MnO <sub>2</sub>
Realgar	3.21	-17.24	-20.45	AsS
Retgersite	-44.39	-11.41	32.99	NiSO <sub>4</sub> :6H <sub>2</sub> O
Rhodochrosite	-13.17	-23.53	-10.36	MnCO <sub>3</sub>
Se(A)	-3.08	-10.25	-7.17	Se
Se(hex)	-2.46	-10.25	-7.78	Se
SeO <sub>2</sub>	-44.82	-7.51	37.30	SeO <sub>2</sub>
SeO <sub>3</sub>	-102.62	-6.15	96.47	SeO <sub>3</sub>
Smithsonite	-18.67	-28.57	-9.90	ZnCO <sub>3</sub>
Sphalerite	-5.04	-16.85	-11.81	ZnS
Spinel	-48.57	-10.18	38.39	MgAl <sub>2</sub> O <sub>4</sub>
SULFUR	-5.41	-7.42	-2.01	S
Thenardite	-39.13	-4.24	34.89	Na <sub>2</sub> SO <sub>4</sub>
Thermonatrite	-21.63	-21.44	0.19	Na <sub>2</sub> CO <sub>3</sub> :H <sub>2</sub> O
Witherite	-16.89	-25.48	-8.59	BaCO <sub>3</sub>
Wurtzite	-7.05	-16.85	-9.80	ZnS

Zincite -19.71 -8.06 11.65 ZnO  
Zincosite -49.89 -11.38 38.51 ZnSO4  
Zn(BO2)2 -23.93 -15.64 8.29 Zn(BO2)2  
Zn(NO3)2:6H2O -252.22 -2.10 250.12 Zn(NO3)2:6H2O  
Zn(OH)2(A) -20.52 -8.07 12.45 Zn(OH)2  
Zn(OH)2(B) -19.82 -8.07 11.75 Zn(OH)2  
Zn(OH)2(C) -20.27 -8.07 12.20 Zn(OH)2  
Zn(OH)2(E) -19.57 -8.07 11.50 Zn(OH)2  
Zn(OH)2(G) -19.78 -8.07 11.71 Zn(OH)2  
Zn2(OH)2SO4 -62.00 -19.45 42.55 Zn2(OH)2SO4  
Zn2(OH)3Cl -32.52 -17.32 15.20 Zn2(OH)3Cl  
Zn3(AsO4)2:2.5H2O -90.93 -37.01 53.93 Zn3(AsO4)2:2.5H2O  
Zn3O(SO4)2 -121.38 -30.82 90.56 Zn3O(SO4)2  
Zn4(OH)6SO4 -99.04 -35.58 63.45 Zn4(OH)6SO4  
Zn5(OH)8Cl2 -81.22 -42.72 38.50 Zn5(OH)8Cl2  
ZnCl2 -17.88 -10.45 7.43 ZnCl2  
ZnCO3:H2O -18.32 -28.58 -10.26 ZnCO3:H2O  
ZnMetal -36.03 -9.43 26.61 Zn  
ZnO(Active) -19.37 -8.06 11.31 ZnO  
ZnS(A) -7.71 -16.85 -9.14 ZnS  
ZnSe -8.16 -19.67 -11.51 ZnSe  
ZnSO4:H2O -46.12 -11.39 34.73 ZnSO4:H2O

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a Low  
SOLUTION 1  
pH 6.90 charge  
temp 15.88  
pe -0.815  
units mg/L  
Al 0.0412  
As 0.00233 as H3AsO4  
Ba 0.292  
B 1.470  
Ca 970  
C 8.62  
Cl 17300  
Cr 0.00466  
Mg 839  
Mn 13.300 as Mn+2  
Ni 0.000115  
N 20.8 as NH4+  
K 291  
Se 0.00101  
Na 2260  
S 1560 as SO4-2  
Zn 0.000125

END

-----  
TITLE  
-----

BH301a Low  
-----

Beginning of initial solution calculations.

-----  
Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.563e-06	1.563e-06
As	1.681e-08	1.681e-08
B	1.392e-04	1.392e-04
Ba	2.177e-06	2.177e-06
C	1.446e-04	1.446e-04
Ca	2.478e-02	2.478e-02
Cl	4.996e-01	4.996e-01
Cr	9.176e-08	9.176e-08
K	7.619e-03	7.619e-03
Mg	3.533e-02	3.533e-02
Mn	2.479e-04	2.479e-04
N	1.181e-03	1.181e-03
Na	1.006e-01	1.006e-01
Ni	2.005e-09	2.005e-09
S	1.663e-02	1.663e-02
Se	1.310e-08	1.310e-08
Zn	1.958e-09	1.958e-09

-----Description of solution-----

pH = 0.687    Charge balance  
pe = -0.815  
Activity of water = 0.984  
Ionic strength = 5.598e-01  
Mass of water (kg) = 1.000e+00  
Total alkalinity (eq/kg) = -2.694e-01  
Total CO2 (mol/kg) = 1.446e-04  
Temperature (deg C) = 15.880  
Electrical balance (eq) = 2.687e-17  
Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|) = 0.00$   
Iterations = 17  
Total H = 1.113230e+02  
Total O = 5.550707e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
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H+	2.694e-01	2.057e-01	-0.570	-0.687	-0.117
OH-	3.762e-14	2.361e-14	-13.425	-13.627	-0.202
H2O	5.551e+01	9.837e-01	-0.007	-0.007	0.000
Al	1.563e-06				
Al+3	1.563e-06	1.375e-07	-5.806	-6.862	-1.056
AlOH+2	1.585e-11	3.572e-12	-10.800	-11.447	-0.647
Al(OH)2+	3.628e-16	2.500e-16	-15.440	-15.602	-0.162
Al(OH)3	1.323e-21	1.505e-21	-20.878	-20.822	0.056
Al(OH)4-	1.040e-28	6.892e-29	-27.983	-28.162	-0.179
AlSO4+	0.000e+00	0.000e+00	-47.238	-47.416	-0.179
Al(SO4)2-	0.000e+00	0.000e+00	-88.879	-89.058	-0.179
As(3)	1.681e-08				
H3AsO3	1.453e-08	1.653e-08	-7.838	-7.782	0.056
H4AsO3+	2.275e-09	1.684e-09	-8.643	-8.774	-0.131
H2AsO3-	4.528e-17	3.353e-17	-16.344	-16.475	-0.131
HAsO3-2	2.855e-28	8.582e-29	-27.544	-28.066	-0.522
AsO3-3	1.742e-40	0.000e+00	-39.759	-40.934	-1.175
As(5)	6.033e-29				
H3AsO4	5.764e-29	6.556e-29	-28.239	-28.183	0.056
H2AsO4-	2.692e-30	1.993e-30	-29.570	-29.700	-0.131
HAsO4-2	5.403e-36	1.624e-36	-35.267	-35.789	-0.522
AsO4-3	0.000e+00	0.000e+00	-45.625	-46.799	-1.175
B	1.392e-04				
H3BO3	1.392e-04	1.584e-04	-3.856	-3.800	0.056
H2BO3-	6.379e-13	3.730e-13	-12.195	-12.428	-0.233
Ba	2.177e-06				
Ba+2	2.177e-06	4.594e-07	-5.662	-6.338	-0.676
BaOH+	6.363e-20	4.313e-20	-19.196	-19.365	-0.169
C(4)	1.446e-04				
H2CO3	1.446e-04	1.645e-04	-3.840	-3.784	0.056
HCO3-	5.647e-10	3.890e-10	-9.248	-9.410	-0.162
MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152
NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
CO3-2	3.193e-19	7.194e-20	-18.496	-19.143	-0.647
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162
NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
Ca	2.478e-02				
Ca+2	2.478e-02	7.547e-03	-1.606	-2.122	-0.516
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152

CaOH+	5.963e-15	4.201e-15	-14.225	-14.377	-0.152
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
CaSO4	0.000e+00	0.000e+00	-43.428	-43.372	0.056
Cl	4.996e-01				
Cl-	4.995e-01	3.093e-01	-0.301	-0.510	-0.208
MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169
MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056
MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
CrOHCl2	1.809e-16	2.058e-16	-15.743	-15.687	0.056
ZnOHCl	1.610e-17	1.832e-17	-16.793	-16.737	0.056
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
CrO3Cl-	0.000e+00	0.000e+00	-79.484	-79.614	-0.131
Cr(2)	6.717e-15				
Cr+2	6.717e-15	2.019e-15	-14.173	-14.695	-0.522
Cr(3)	9.176e-08				
Cr+3	8.924e-08	5.971e-09	-7.049	-8.224	-1.175
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
Cr(OH)+2	3.251e-12	9.772e-13	-11.488	-12.010	-0.522
CrOHCl2	1.809e-16	2.058e-16	-15.743	-15.687	0.056
Cr(OH)2+	1.514e-17	1.121e-17	-16.820	-16.950	-0.131
Cr(OH)3	3.495e-24	3.976e-24	-23.457	-23.401	0.056
CrO2-	6.432e-34	4.763e-34	-33.192	-33.322	-0.131
Cr(OH)4-	2.453e-34	1.816e-34	-33.610	-33.741	-0.131
CrSO4+	0.000e+00	0.000e+00	-50.447	-50.578	-0.131
CrOHSO4	0.000e+00	0.000e+00	-52.936	-52.880	0.056
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.573	-56.704	-0.131
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.754	-60.276	-0.522
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-62.108	-62.630	-0.522
Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-107.839	-107.783	0.056
CrNO3+2	0.000e+00	0.000e+00	-135.454	-135.976	-0.522
Cr(6)	0.000e+00				
HCrO4-	0.000e+00	0.000e+00	-79.115	-79.245	-0.131
CrO3Cl-	0.000e+00	0.000e+00	-79.484	-79.614	-0.131
H2CrO4	0.000e+00	0.000e+00	-80.825	-80.769	0.056
CrO4-2	0.000e+00	0.000e+00	-84.287	-85.047	-0.759
NaCrO4-	0.000e+00	0.000e+00	-85.365	-85.495	-0.131
KCrO4-	0.000e+00	0.000e+00	-86.443	-86.574	-0.131



CrO3SO4-2	0.000e+00	0.000e+00	-120.423	-120.945	-0.522
Cr2O7-2	0.000e+00	0.000e+00	-156.311	-156.833	-0.522
H(0)	2.466e-03				
H2	1.233e-03	1.403e-03	-2.909	-2.853	0.056
K	7.619e-03				
K+	7.619e-03	4.718e-03	-2.118	-2.326	-0.208
KSO4-	0.000e+00	0.000e+00	-44.914	-45.076	-0.162
KCrO4-	0.000e+00	0.000e+00	-86.443	-86.574	-0.131
Mg	3.533e-02				
Mg+2	3.533e-02	1.203e-02	-1.452	-1.920	-0.468
MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190
MgOH+	5.820e-14	4.168e-14	-13.235	-13.380	-0.145
MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056
MgSO4	0.000e+00	0.000e+00	-43.283	-43.227	0.056
Mn(2)	2.479e-04				
Mn+2	1.672e-04	4.116e-05	-3.777	-4.386	-0.609
MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169
MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056
MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169
MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169
MnOH+	3.468e-15	2.351e-15	-14.460	-14.629	-0.169
MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056
Mn(OH)3-	1.053e-37	7.140e-38	-36.977	-37.146	-0.169
MnSO4	0.000e+00	0.000e+00	-45.757	-45.701	0.056
MnSeO4	0.000e+00	0.000e+00	-88.022	-87.966	0.056
Mn(NO3)2	0.000e+00	0.000e+00	-256.306	-256.250	0.056
Mn(3)	8.788e-30				
Mn+3	8.788e-30	7.732e-31	-29.056	-30.112	-1.056
Mn(6)	0.000e+00				
MnO4-2	0.000e+00	0.000e+00	-123.413	-124.089	-0.676
Mn(7)	0.000e+00				
MnO4-	0.000e+00	0.000e+00	-134.687	-134.903	-0.217
N(-3)	1.181e-03				
NH4+	1.181e-03	6.904e-04	-2.928	-3.161	-0.233
NH3	8.646e-13	9.835e-13	-12.063	-12.007	0.056
NH4SO4-	0.000e+00	0.000e+00	-45.407	-45.576	-0.169
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.573	-56.704	-0.131
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.754	-60.276	-0.522
Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
N(3)	0.000e+00				
NO2-	0.000e+00	0.000e+00	-96.261	-96.392	-0.131
N(5)	0.000e+00				
NO3-	0.000e+00	0.000e+00	-126.020	-126.237	-0.217
CrNO3+2	0.000e+00	0.000e+00	-135.454	-135.976	-0.522
Mn(NO3)2	0.000e+00	0.000e+00	-256.306	-256.250	0.056
Na	1.006e-01				
Na+	1.006e-01	7.161e-02	-0.997	-1.145	-0.148

NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162
NaSO4-	0.000e+00	0.000e+00	-43.834	-43.996	-0.162
NaCrO4-	0.000e+00	0.000e+00	-85.365	-85.495	-0.131
Ni	2.005e-09				
Ni+2	1.298e-09	3.901e-10	-8.887	-9.409	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
NiOH+	1.796e-19	1.330e-19	-18.746	-18.876	-0.131
NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
Ni(OH)2	7.847e-28	8.926e-28	-27.105	-27.049	0.056
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Ni(OH)3-	5.767e-38	4.270e-38	-37.239	-37.370	-0.131
NiSO4	0.000e+00	0.000e+00	-50.735	-50.679	0.056
NiSeO4	0.000e+00	0.000e+00	-92.827	-92.771	0.056
Ni(SO4)2-2	0.000e+00	0.000e+00	-94.917	-95.439	-0.522
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-89.780	-89.724	0.056
S(-2)	1.663e-02				
H2S	1.663e-02	1.891e-02	-1.779	-1.723	0.056
HS-	1.244e-08	7.808e-09	-7.905	-8.107	-0.202
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
S5-2	1.956e-17	5.879e-18	-16.709	-17.231	-0.522
S6-2	1.661e-17	4.993e-18	-16.780	-17.302	-0.522
S4-2	1.117e-17	3.358e-18	-16.952	-17.474	-0.522
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
S-2	1.141e-20	2.407e-21	-19.943	-20.618	-0.676
S3-2	3.792e-21	1.140e-21	-20.421	-20.943	-0.522
S2-2	2.040e-22	6.134e-23	-21.690	-22.212	-0.522
S(6)	0.000e+00				
HSO4-	0.000e+00	0.000e+00	-42.155	-42.333	-0.179
SO4-2	0.000e+00	0.000e+00	-42.744	-43.525	-0.782
MgSO4	0.000e+00	0.000e+00	-43.283	-43.227	0.056
CaSO4	0.000e+00	0.000e+00	-43.428	-43.372	0.056
NaSO4-	0.000e+00	0.000e+00	-43.834	-43.996	-0.162
KSO4-	0.000e+00	0.000e+00	-44.914	-45.076	-0.162
NH4SO4-	0.000e+00	0.000e+00	-45.407	-45.576	-0.169
MnSO4	0.000e+00	0.000e+00	-45.757	-45.701	0.056
AlSO4+	0.000e+00	0.000e+00	-47.238	-47.416	-0.179
CrSO4+	0.000e+00	0.000e+00	-50.447	-50.578	-0.131
ZnSO4	0.000e+00	0.000e+00	-50.670	-50.614	0.056
NiSO4	0.000e+00	0.000e+00	-50.735	-50.679	0.056
CrOHSO4	0.000e+00	0.000e+00	-52.936	-52.880	0.056
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-62.108	-62.630	-0.522
Al(SO4)2-	0.000e+00	0.000e+00	-88.879	-89.058	-0.179
Zn(SO4)2-2	0.000e+00	0.000e+00	-92.676	-93.198	-0.522
Ni(SO4)2-2	0.000e+00	0.000e+00	-94.917	-95.439	-0.522

Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-107.839	-107.783	0.056
CrO3SO4-2	0.000e+00	0.000e+00	-120.423	-120.945	-0.522
Se(-2)	1.310e-08				
H2Se	1.308e-08	1.488e-08	-7.883	-7.827	0.056
HSe-	1.574e-11	1.165e-11	-10.803	-10.934	-0.131
MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056
Se-2	1.139e-25	3.423e-26	-24.944	-25.466	-0.522
Se(4)	0.000e+00				
SeO3-2	0.000e+00	0.000e+00	-56.212	-56.734	-0.522
Se(6)	0.000e+00				
H2SeO3	0.000e+00	0.000e+00	-47.044	-46.988	0.056
HSeO3-	0.000e+00	0.000e+00	-48.781	-48.912	-0.131
HSeO4-	0.000e+00	0.000e+00	-84.667	-84.798	-0.131
SeO4-2	0.000e+00	0.000e+00	-85.160	-85.920	-0.759
MnSeO4	0.000e+00	0.000e+00	-88.022	-87.966	0.056
NiSeO4	0.000e+00	0.000e+00	-92.827	-92.771	0.056
ZnSeO4	0.000e+00	0.000e+00	-93.201	-93.145	0.056
Zn(SeO4)2-2	0.000e+00	0.000e+00	-180.815	-181.337	-0.522
Zn	1.958e-09				
Zn+2	1.519e-09	3.740e-10	-8.819	-9.427	-0.609
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
ZnOHCl	1.610e-17	1.832e-17	-16.793	-16.737	0.056
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
ZnOH+	1.298e-18	9.608e-19	-17.887	-18.017	-0.131
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Zn(OH)2	9.491e-26	1.080e-25	-25.023	-24.967	0.056
Zn(OH)3-	2.206e-36	1.633e-36	-35.656	-35.787	-0.131
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
Zn(OH)4-2	0.000e+00	0.000e+00	-47.385	-47.907	-0.522
ZnSO4	0.000e+00	0.000e+00	-50.670	-50.614	0.056
Zn(SO4)2-2	0.000e+00	0.000e+00	-92.676	-93.198	-0.522
ZnSeO4	0.000e+00	0.000e+00	-93.201	-93.145	0.056
Zn(SeO4)2-2	0.000e+00	0.000e+00	-180.815	-181.337	-0.522

-----Saturation indices-----

Phase	SI	log IAP	log KT	
(NH4)2CrO4	-91.72	-21.61	70.11	(NH4)2CrO4
Al(OH)3(a)	-15.83	-4.82	11.01	Al(OH)3
Al2O3	-32.60	-9.62	22.98	Al2O3
Al4(OH)10SO4	-86.87	-29.12	57.75	Al4(OH)10SO4
AlAsO4:2H2O	-37.80	-12.86	24.94	AlAsO4:2H2O

AlOHSO4	-46.48	-14.66	31.82	AlOHSO4
AlumK	-90.99	-26.22	64.76	KAl(SO4)2:12H2O
Alunite	-104.45	-35.78	68.67	KAl3(SO4)2(OH)6
Anhydrite	-41.10	-10.60	30.50	CaSO4
Aragonite	-12.98	-21.27	-8.28	CaCO3
Arsenolite	-27.95	-31.08	-3.13	As4O6
Artinite	-31.91	-21.64	10.26	MgCO3:Mg(OH)2:3H2O
As2O5	-63.17	-16.07	47.10	As2O5
Ba3(AsO4)2	-62.29	-30.98	31.31	Ba3(AsO4)2
BaCrO4	-81.57	-21.63	59.94	BaCrO4
Barite	-39.74	-14.81	24.93	BaSO4
BaSeO3	-58.87	-17.37	41.50	BaSeO3
BaSeO4	-87.02	-17.64	69.38	BaSeO4
Bianchite	-51.23	-17.94	33.29	ZnSO4:6H2O
Birnessite	-46.28	-3.28	43.00	MnO2
Bixbyite	-55.87	-6.30	49.56	Mn2O3
Boehmite	-14.04	-4.82	9.23	AlOOH
Brucite	-17.95	-0.56	17.39	Mg(OH)2
Bunsenite	-21.05	-8.04	13.00	NiO
Ca3(AsO4)2:6H2O	-80.95	-18.38	62.58	Ca3(AsO4)2:6H2O
CaCrO4	-85.05	-17.41	67.64	CaCrO4
Calcite	-12.84	-21.27	-8.43	CaCO3
CaSeO3:2H2O	-53.28	-13.17	40.11	CaSeO3:2H2O
CaSeO4:2H2O	-85.09	-13.44	71.65	CaSeO4:2H2O
CH4(g)	22.04	-19.47	-41.51	CH4
Claudetite	-27.71	-31.08	-3.37	As4O6
CO2(g)	-2.34	-20.51	-18.17	CO2
Cr(OH)2	-24.35	-16.14	8.22	Cr(OH)2
Cr(OH)3(A)	-15.52	-16.27	-0.75	Cr(OH)3
Cr(OH)3(C)	-18.14	-16.27	1.87	Cr(OH)3
Cr2O3	-29.41	-32.52	-3.11	Cr2O3
CrCl2	-32.04	-18.51	13.52	CrCl2
CrCl3	-33.98	-19.84	14.14	CrCl3
CrMetal	-46.10	-15.86	30.24	Cr
CrO3	-83.23	-16.65	66.58	CrO3
Diaspore	-12.26	-4.82	7.44	AlOOH
Dolomite	-25.52	-42.33	-16.81	CaMg(CO3)2
Epsomite	-43.29	-10.44	32.85	MgSO4:7H2O
Gibbsite(C)	-14.12	-4.82	9.30	Al(OH)3
Goslarite	-50.97	-17.95	33.01	ZnSO4:7H2O
Gypsum	-40.81	-10.61	30.20	CaSO4:2H2O
Halite	-3.22	-1.65	1.56	NaCl
Hausmannite	-72.71	-9.32	63.39	Mn3O4
Huntite	-55.08	-84.45	-29.37	CaMg3(CO3)4
Hydromagnesite	-77.28	-84.84	-7.56	Mg5(CO3)4(OH)2:4H2O
K2Cr2O7	-160.02	-36.60	123.43	K2Cr2O7
K2CrO4	-89.61	-19.94	69.67	K2CrO4
Lime	-34.62	-0.76	33.87	CaO

Magnesite -13.18 -21.06 -7.89 MgCO<sub>3</sub>  
 Manganite -27.83 -3.15 24.67 MnOOH  
 MgCr<sub>2</sub>O<sub>4</sub> -46.07 -33.07 13.00 MgCr<sub>2</sub>O<sub>4</sub>  
 MgCrO<sub>4</sub> -92.84 -17.21 75.63 MgCrO<sub>4</sub>  
 MgSeO<sub>3</sub>:6H<sub>2</sub>O -54.19 -13.00 41.19 MgSeO<sub>3</sub>:6H<sub>2</sub>O  
 Millerite -8.73 -16.83 -8.10 NiS  
 Mirabilite -44.33 -10.84 33.50 Na<sub>2</sub>SO<sub>4</sub>:10H<sub>2</sub>O  
 Mn<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> -185.99 -35.82 150.17 Mn<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>  
 Mn<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O -77.96 -25.18 52.78 Mn<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O  
 MnCl<sub>2</sub>:4H<sub>2</sub>O -7.74 -5.43 2.31 MnCl<sub>2</sub>:4H<sub>2</sub>O  
 MnS(Green) -15.74 -11.81 3.93 MnS  
 MnSe -20.29 -14.63 5.66 MnSe  
 MnSeO<sub>3</sub> -53.82 -15.42 38.40 MnSeO<sub>3</sub>  
 MnSeO<sub>3</sub>:2H<sub>2</sub>O -53.56 -15.44 38.12 MnSeO<sub>3</sub>:2H<sub>2</sub>O  
 MnSO<sub>4</sub> -50.94 -12.86 38.08 MnSO<sub>4</sub>  
 Morenosite -50.56 -17.93 32.62 NiSO<sub>4</sub>:7H<sub>2</sub>O  
 Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> -163.73 -34.23 129.50 Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>  
 Na<sub>2</sub>CrO<sub>4</sub> -90.71 -17.58 73.13 Na<sub>2</sub>CrO<sub>4</sub>  
 Natron -19.83 -21.50 -1.68 Na<sub>2</sub>CO<sub>3</sub>:10H<sub>2</sub>O  
 Nesquehonite -15.60 -21.08 -5.49 MgCO<sub>3</sub>:3H<sub>2</sub>O  
 Ni(OH)<sub>2</sub> -18.15 -8.05 10.10 Ni(OH)<sub>2</sub>  
 Ni<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O -96.23 -40.25 55.98 Ni<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O  
 Ni<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub> -109.08 -42.03 67.05 Ni<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub>  
 NiCO<sub>3</sub> -21.94 -28.55 -6.61 NiCO<sub>3</sub>  
 NiSe -1.92 -19.66 -17.74 NiSe  
 NiSeO<sub>3</sub>:2H<sub>2</sub>O -60.63 -20.46 40.17 NiSeO<sub>3</sub>:2H<sub>2</sub>O  
 Nsutite -45.70 -3.28 42.42 MnO<sub>2</sub>  
 O<sub>2</sub>(g) -86.74 -0.53 86.22 O<sub>2</sub>  
 Oripment 20.98 -41.90 -62.89 As<sub>2</sub>S<sub>3</sub>  
 Periclase -22.90 -0.55 22.35 MgO  
 Portlandite -24.15 -0.76 23.38 Ca(OH)<sub>2</sub>  
 Pyrocroite -18.64 -3.03 15.61 Mn(OH)<sub>2</sub>  
 Pyrolusite -44.73 -3.28 41.45 MnO<sub>2</sub>  
 Realgar 4.03 -16.43 -20.45 AsS  
 Retgersite -50.91 -17.93 32.99 NiSO<sub>4</sub>:6H<sub>2</sub>O  
 Rhodochrosite -13.17 -23.53 -10.36 MnCO<sub>3</sub>  
 Se(A) -4.71 -11.88 -7.17 Se  
 Se(hex) -4.09 -11.88 -7.78 Se  
 SeO<sub>2</sub> -49.71 -12.40 37.30 SeO<sub>2</sub>  
 SeO<sub>3</sub> -109.14 -12.67 96.47 SeO<sub>3</sub>  
 Smithsonite -18.67 -28.57 -9.90 ZnCO<sub>3</sub>  
 Sphalerite -5.04 -16.85 -11.81 ZnS  
 Spinel -48.57 -10.18 38.39 MgAl<sub>2</sub>O<sub>4</sub>  
 SULFUR -7.04 -9.05 -2.01 S  
 Thenardite -45.65 -10.76 34.89 Na<sub>2</sub>SO<sub>4</sub>  
 Thermonatrite -21.63 -21.44 0.19 Na<sub>2</sub>CO<sub>3</sub>:H<sub>2</sub>O  
 Witherite -16.89 -25.48 -8.59 BaCO<sub>3</sub>  
 Wurtzite -7.05 -16.85 -9.80 ZnS

Zincite -19.71 -8.06 11.65 ZnO  
Zincosite -56.41 -17.90 38.51 ZnSO4  
Zn(BO2)2 -23.93 -15.64 8.29 Zn(BO2)2  
Zn(NO3)2:6H2O -265.26 -15.14 250.12 Zn(NO3)2:6H2O  
Zn(OH)2(A) -20.52 -8.07 12.45 Zn(OH)2  
Zn(OH)2(B) -19.82 -8.07 11.75 Zn(OH)2  
Zn(OH)2(C) -20.27 -8.07 12.20 Zn(OH)2  
Zn(OH)2(E) -19.57 -8.07 11.50 Zn(OH)2  
Zn(OH)2(G) -19.78 -8.07 11.71 Zn(OH)2  
Zn2(OH)2SO4 -68.52 -25.97 42.55 Zn2(OH)2SO4  
Zn2(OH)3Cl -32.52 -17.32 15.20 Zn2(OH)3Cl  
Zn3(AsO4)2:2.5H2O -94.19 -40.27 53.93 Zn3(AsO4)2:2.5H2O  
Zn3O(SO4)2 -134.42 -43.86 90.56 Zn3O(SO4)2  
Zn4(OH)6SO4 -105.56 -42.10 63.45 Zn4(OH)6SO4  
Zn5(OH)8Cl2 -81.22 -42.72 38.50 Zn5(OH)8Cl2  
ZnCl2 -17.88 -10.45 7.43 ZnCl2  
ZnCO3:H2O -18.32 -28.58 -10.26 ZnCO3:H2O  
ZnMetal -34.40 -7.80 26.61 Zn  
ZnO(Active) -19.37 -8.06 11.31 ZnO  
ZnS(A) -7.71 -16.85 -9.14 ZnS  
ZnSe -8.16 -19.67 -11.51 ZnSe  
ZnSO4:H2O -52.64 -17.91 34.73 ZnSO4:H2O

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a Low  
SOLUTION 1  
pH 6.90 charge  
temp 15.88  
pe -0.163  
units mg/L  
Al 0.0412  
As 0.00233 as H3AsO4  
Ba 0.292  
B 1.470  
Ca 970  
C 8.62  
Cl 17300  
Cr 0.00466  
Mg 839  
Mn 13.300 as Mn+2  
Ni 0.000115  
N 20.8 as NH4+  
K 291  
Se 0.00101  
Na 2260  
S 1560 as SO4-2  
Zn 0.000125

END

-----  
TITLE  
-----

BH301a Low  
-----

Beginning of initial solution calculations.

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.563e-06	1.563e-06
As	1.681e-08	1.681e-08
B	1.392e-04	1.392e-04
Ba	2.177e-06	2.177e-06
C	1.446e-04	1.446e-04
Ca	2.478e-02	2.478e-02
Cl	4.996e-01	4.996e-01
Cr	9.176e-08	9.176e-08
K	7.619e-03	7.619e-03
Mg	3.533e-02	3.533e-02
Mn	2.479e-04	2.479e-04
N	1.181e-03	1.181e-03
Na	1.006e-01	1.006e-01
Ni	2.005e-09	2.005e-09
S	1.663e-02	1.663e-02
Se	1.310e-08	1.310e-08
Zn	1.958e-09	1.958e-09

-----Description of solution-----

pH = 0.687    Charge balance  
pe = -0.163  
Activity of water = 0.984  
Ionic strength = 5.598e-01  
Mass of water (kg) = 1.000e+00  
Total alkalinity (eq/kg) = -2.694e-01  
Total CO2 (mol/kg) = 1.446e-04  
Temperature (deg C) = 15.880  
Electrical balance (eq) = 1.087e-16  
Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|) = 0.00$   
Iterations = 21  
Total H = 1.113207e+02  
Total O = 5.550707e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
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H+	2.694e-01	2.057e-01	-0.570	-0.687	-0.117
OH-	3.762e-14	2.361e-14	-13.425	-13.627	-0.202
H2O	5.551e+01	9.838e-01	-0.007	-0.007	0.000
Al	1.563e-06				
Al+3	1.563e-06	1.375e-07	-5.806	-6.862	-1.056
AlOH+2	1.585e-11	3.572e-12	-10.800	-11.447	-0.647
Al(OH)2+	3.628e-16	2.500e-16	-15.440	-15.602	-0.162
Al(OH)3	1.323e-21	1.505e-21	-20.878	-20.822	0.056
Al(OH)4-	1.040e-28	6.892e-29	-27.983	-28.162	-0.179
AlSO4+	0.000e+00	0.000e+00	-42.022	-42.200	-0.179
Al(SO4)2-	0.000e+00	0.000e+00	-78.447	-78.626	-0.179
As(3)	1.681e-08				
H3AsO3	1.453e-08	1.653e-08	-7.838	-7.782	0.056
H4AsO3+	2.275e-09	1.684e-09	-8.643	-8.774	-0.131
H2AsO3-	4.528e-17	3.353e-17	-16.344	-16.475	-0.131
HAsO3-2	2.855e-28	8.582e-29	-27.544	-28.066	-0.522
AsO3-3	1.742e-40	0.000e+00	-39.759	-40.934	-1.175
As(5)	1.215e-27				
H3AsO4	1.161e-27	1.320e-27	-26.935	-26.879	0.056
H2AsO4-	5.422e-29	4.014e-29	-28.266	-28.396	-0.131
HAsO4-2	1.088e-34	3.271e-35	-33.963	-34.485	-0.522
AsO4-3	0.000e+00	0.000e+00	-44.321	-45.495	-1.175
B	1.392e-04				
H3BO3	1.392e-04	1.584e-04	-3.856	-3.800	0.056
H2BO3-	6.379e-13	3.730e-13	-12.195	-12.428	-0.233
Ba	2.177e-06				
Ba+2	2.177e-06	4.594e-07	-5.662	-6.338	-0.676
BaOH+	6.363e-20	4.313e-20	-19.196	-19.365	-0.169
C(4)	1.446e-04				
H2CO3	1.446e-04	1.645e-04	-3.840	-3.784	0.056
HCO3-	5.647e-10	3.890e-10	-9.248	-9.410	-0.162
MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152
NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
CO3-2	3.193e-19	7.194e-20	-18.496	-19.143	-0.647
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162
NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
Ca	2.478e-02				
Ca+2	2.478e-02	7.547e-03	-1.606	-2.122	-0.516
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152

CaOH+	5.963e-15	4.201e-15	-14.225	-14.377	-0.152
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
CaSO4	6.132e-39	6.976e-39	-38.212	-38.156	0.056
Cl	4.996e-01				
Cl-	4.995e-01	3.093e-01	-0.301	-0.510	-0.208
MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169
MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056
MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
CrOHCl2	1.809e-16	2.058e-16	-15.743	-15.687	0.056
ZnOHCl	1.610e-17	1.832e-17	-16.793	-16.737	0.056
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.52
CrO3Cl-	0.000e+00	0.000e+00	-77.528	-77.658	-0.131
Cr(2)	1.497e-15				
Cr+2	1.497e-15	4.499e-16	-14.825	-15.347	-0.522
Cr(3)	9.176e-08				
Cr+3	8.924e-08	5.971e-09	-7.049	-8.224	-1.175
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
Cr(OH)+2	3.251e-12	9.772e-13	-11.488	-12.010	-0.522
CrOHCl2	1.809e-16	2.058e-16	-15.743	-15.687	0.056
Cr(OH)2+	1.514e-17	1.121e-17	-16.820	-16.950	-0.131
Cr(OH)3	3.495e-24	3.976e-24	-23.456	-23.401	0.056
CrO2-	6.432e-34	4.763e-34	-33.192	-33.322	-0.131
Cr(OH)4-	2.453e-34	1.816e-34	-33.610	-33.741	-0.131
CrSO4+	0.000e+00	0.000e+00	-45.231	-45.362	-0.131
CrOHSO4	0.000e+00	0.000e+00	-47.720	-47.664	0.056
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.573	-56.704	-0.131
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-56.892	-57.414	-0.131
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.754	-60.276	-0.52
Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.52
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-97.406	-97.351	0.056
CrNO3+2	0.000e+00	0.000e+00	-130.238	-130.760	-0.52
Cr(6)	0.000e+00				
HCrO4-	0.000e+00	0.000e+00	-77.159	-77.289	-0.131
CrO3Cl-	0.000e+00	0.000e+00	-77.528	-77.658	-0.131
H2CrO4	0.000e+00	0.000e+00	-78.869	-78.813	0.056
CrO4-2	0.000e+00	0.000e+00	-82.331	-83.091	-0.759
NaCrO4-	0.000e+00	0.000e+00	-83.409	-83.539	-0.131
KCrO4-	0.000e+00	0.000e+00	-84.487	-84.618	-0.131

CrO3SO4-2	0.000e+00	0.000e+00	-113.251	-113.773	-0.5
Cr2O7-2	0.000e+00	0.000e+00	-152.399	-152.921	-0.522
H(0)	1.225e-04				
H2	6.123e-05	6.966e-05	-4.213	-4.157	0.056
K	7.619e-03				
K+	7.619e-03	4.718e-03	-2.118	-2.326	-0.208
KSO4-	2.004e-40	1.380e-40	-39.698	-39.860	-0.162
KCrO4-	0.000e+00	0.000e+00	-84.487	-84.618	-0.131
Mg	3.533e-02				
Mg+2	3.533e-02	1.203e-02	-1.452	-1.920	-0.468
MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190
MgOH+	5.820e-14	4.168e-14	-13.235	-13.380	-0.145
MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056
MgSO4	8.564e-39	9.743e-39	-38.067	-38.011	0.056
Mn(2)	2.479e-04				
Mn+2	1.672e-04	4.116e-05	-3.777	-4.386	-0.609
MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169
MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056
MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169
MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169
MnOH+	3.468e-15	2.351e-15	-14.460	-14.629	-0.169
MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056
Mn(OH)3-	1.053e-37	7.140e-38	-36.977	-37.146	-0.169
MnSO4	0.000e+00	0.000e+00	-40.541	-40.485	0.056
MnSeO4	0.000e+00	0.000e+00	-82.806	-82.750	0.056
Mn(NO3)2	0.000e+00	0.000e+00	-245.874	-245.818	0.05
Mn(3)	3.944e-29				
Mn+3	3.944e-29	3.470e-30	-28.404	-29.460	-1.056
Mn(6)	0.000e+00				
MnO4-2	0.000e+00	0.000e+00	-120.805	-121.481	-0.676
Mn(7)	0.000e+00				
MnO4-	0.000e+00	0.000e+00	-131.426	-131.643	-0.217
N(-3)	1.181e-03				
NH4+	1.181e-03	6.904e-04	-2.928	-3.161	-0.233
NH3	8.646e-13	9.835e-13	-12.063	-12.007	0.056
NH4SO4-	0.000e+00	0.000e+00	-40.191	-40.360	-0.169
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.573	-56.704	-0.1
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.754	-60.276	-0.5
Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.52
N(3)	0.000e+00				
NO2-	0.000e+00	0.000e+00	-92.349	-92.479	-0.131
N(5)	0.000e+00				
NO3-	0.000e+00	0.000e+00	-120.804	-121.021	-0.217
CrNO3+2	0.000e+00	0.000e+00	-130.238	-130.760	-0.52
Mn(NO3)2	0.000e+00	0.000e+00	-245.874	-245.818	0.05
Na	1.006e-01				
Na+	1.006e-01	7.161e-02	-0.997	-1.145	-0.148

NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162
NaSO4-	2.408e-39	1.659e-39	-38.618	-38.780	-0.162
NaCrO4-	0.000e+00	0.000e+00	-83.409	-83.539	-0.131
Ni	2.005e-09				
Ni+2	1.298e-09	3.901e-10	-8.887	-9.409	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
NiOH+	1.796e-19	1.330e-19	-18.746	-18.876	-0.131
NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
Ni(OH)2	7.847e-28	8.927e-28	-27.105	-27.049	0.056
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Ni(OH)3-	5.767e-38	4.270e-38	-37.239	-37.370	-0.131
NiSO4	0.000e+00	0.000e+00	-45.519	-45.463	0.056
Ni(SO4)2-2	0.000e+00	0.000e+00	-84.485	-85.007	-0.522
NiSeO4	0.000e+00	0.000e+00	-87.611	-87.555	0.056
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-87.172	-87.116	0.056
S(-2)	1.663e-02				
H2S	1.663e-02	1.891e-02	-1.779	-1.723	0.056
HS-	1.244e-08	7.808e-09	-7.905	-8.107	-0.202
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
S5-2	1.956e-17	5.879e-18	-16.709	-17.231	-0.522
S6-2	1.661e-17	4.993e-18	-16.780	-17.302	-0.522
S4-2	1.117e-17	3.358e-18	-16.952	-17.474	-0.522
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
S-2	1.141e-20	2.407e-21	-19.943	-20.618	-0.676
S3-2	3.792e-21	1.140e-21	-20.421	-20.943	-0.522
S2-2	2.040e-22	6.134e-23	-21.690	-22.212	-0.522
S(6)	1.622e-37				
HSO4-	1.152e-37	7.632e-38	-36.939	-37.117	-0.179
SO4-2	2.968e-38	4.907e-39	-37.528	-38.309	-0.782
MgSO4	8.564e-39	9.743e-39	-38.067	-38.011	0.056
CaSO4	6.132e-39	6.976e-39	-38.212	-38.156	0.056
NaSO4-	2.408e-39	1.659e-39	-38.618	-38.780	-0.162
KSO4-	2.004e-40	1.380e-40	-39.698	-39.860	-0.162
NH4SO4-	0.000e+00	0.000e+00	-40.191	-40.360	-0.169
MnSO4	0.000e+00	0.000e+00	-40.541	-40.485	0.056
AlSO4+	0.000e+00	0.000e+00	-42.022	-42.200	-0.179
CrSO4+	0.000e+00	0.000e+00	-45.231	-45.362	-0.131
ZnSO4	0.000e+00	0.000e+00	-45.454	-45.398	0.056
NiSO4	0.000e+00	0.000e+00	-45.519	-45.463	0.056
CrOHSO4	0.000e+00	0.000e+00	-47.720	-47.664	0.056
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-56.892	-57.414	-0.179
Al(SO4)2-	0.000e+00	0.000e+00	-78.447	-78.626	-0.179
Zn(SO4)2-2	0.000e+00	0.000e+00	-82.243	-82.765	-0.522
Ni(SO4)2-2	0.000e+00	0.000e+00	-84.485	-85.007	-0.522

Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-97.406	-97.351	0.0
CrO3SO4-2	0.000e+00	0.000e+00	-113.251	-113.773	-0.5
Se(-2)	1.310e-08				
H2Se	1.308e-08	1.488e-08	-7.883	-7.827	0.056
HSe-	1.574e-11	1.165e-11	-10.803	-10.934	-0.131
MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056
Se-2	1.139e-25	3.423e-26	-24.944	-25.466	-0.522
Se(4)	0.000e+00				
SeO3-2	0.000e+00	0.000e+00	-52.300	-52.822	-0.522
Se(6)	0.000e+00				
H2SeO3	0.000e+00	0.000e+00	-43.132	-43.076	0.056
HSeO3-	0.000e+00	0.000e+00	-44.869	-45.000	-0.131
HSeO4-	0.000e+00	0.000e+00	-79.451	-79.582	-0.131
SeO4-2	0.000e+00	0.000e+00	-79.944	-80.704	-0.759
MnSeO4	0.000e+00	0.000e+00	-82.806	-82.750	0.056
NiSeO4	0.000e+00	0.000e+00	-87.611	-87.555	0.056
ZnSeO4	0.000e+00	0.000e+00	-87.985	-87.929	0.056
Zn(SeO4)2-2	0.000e+00	0.000e+00	-170.383	-170.905	-0.5
Zn	1.958e-09				
Zn+2	1.519e-09	3.740e-10	-8.819	-9.427	-0.609
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
ZnOHCl	1.610e-17	1.832e-17	-16.793	-16.737	0.056
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
ZnOH+	1.298e-18	9.609e-19	-17.887	-18.017	-0.131
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Zn(OH)2	9.491e-26	1.080e-25	-25.023	-24.967	0.056
Zn(OH)3-	2.206e-36	1.633e-36	-35.656	-35.787	-0.131
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
ZnSO4	0.000e+00	0.000e+00	-45.454	-45.398	0.056
Zn(OH)4-2	0.000e+00	0.000e+00	-47.385	-47.907	-0.522
Zn(SO4)2-2	0.000e+00	0.000e+00	-82.243	-82.765	-0.522
ZnSeO4	0.000e+00	0.000e+00	-87.985	-87.929	0.056
Zn(SeO4)2-2	0.000e+00	0.000e+00	-170.383	-170.905	-0.5

-----Saturation indices-----

Phase	SI	log IAP	log KT	
(NH4)2CrO4	-89.77	-19.65	70.11	(NH4)2CrO4
Al(OH)3(a)	-15.83	-4.82	11.01	Al(OH)3
Al2O3	-32.60	-9.62	22.98	Al2O3
Al4(OH)10SO4	-81.66	-23.91	57.75	Al4(OH)10SO4
AlAsO4:2H2O	-36.49	-11.56	24.94	AlAsO4:2H2O

AlOHSO4	-41.26	-9.44	31.82	AlOHSO4
AlumK	-80.55	-15.79	64.76	KAl(SO4)2·12H2O
Alunite	-94.01	-25.35	68.67	KAl3(SO4)2(OH)6
Anhydrite	-35.88	-5.38	30.50	CaSO4
Aragonite	-12.98	-21.27	-8.28	CaCO3
Arsenolite	-27.95	-31.08	-3.13	As4O6
Artinite	-31.91	-21.64	10.26	MgCO3·Mg(OH)2·3H2O
As2O5	-60.56	-13.46	47.10	As2O5
Ba3(AsO4)2	-59.68	-28.37	31.31	Ba3(AsO4)2
BaCrO4	-79.61	-19.67	59.94	BaCrO4
Barite	-34.53	-9.60	24.93	BaSO4
BaSeO3	-54.96	-13.46	41.50	BaSeO3
BaSeO4	-81.81	-12.42	69.38	BaSeO4
Bianchite	-46.02	-12.73	33.29	ZnSO4·6H2O
Birnessite	-44.98	-1.98	43.00	MnO2
Bixbyite	-54.56	-5.00	49.56	Mn2O3
Boehmite	-14.04	-4.82	9.23	AlOOH
Brucite	-17.95	-0.56	17.39	Mg(OH)2
Bunsenite	-21.05	-8.04	13.00	NiO
Ca3(AsO4)2·6H2O	-78.35	-15.77	62.58	Ca3(AsO4)2·6H2O
CaCrO4	-83.10	-15.45	67.64	CaCrO4
Calcite	-12.84	-21.27	-8.43	CaCO3
CaSeO3·2H2O	-49.37	-9.26	40.11	CaSeO3·2H2O
CaSeO4·2H2O	-79.87	-8.22	71.65	CaSeO4·2H2O
CH4(g)	16.82	-24.69	-41.51	CH4
Claudetite	-27.71	-31.08	-3.37	As4O6
CO2(g)	-2.34	-20.51	-18.17	CO2
Cr(OH)2	-25.00	-16.79	8.22	Cr(OH)2
Cr(OH)3(A)	-15.52	-16.27	-0.75	Cr(OH)3
Cr(OH)3(C)	-18.14	-16.27	1.87	Cr(OH)3
Cr2O3	-29.41	-32.52	-3.11	Cr2O3
CrCl2	-32.69	-19.17	13.52	CrCl2
CrCl3	-33.98	-19.84	14.14	CrCl3
CrMetal	-48.06	-17.82	30.24	Cr
CrO3	-81.28	-14.70	66.58	CrO3
Diaspore	-12.26	-4.82	7.44	AlOOH
Dolomite	-25.52	-42.33	-16.81	CaMg(CO3)2
Epsomite	-38.07	-5.23	32.85	MgSO4·7H2O
Gibbsite(C)	-14.12	-4.82	9.30	Al(OH)3
Goslarite	-45.75	-12.74	33.01	ZnSO4·7H2O
Gypsum	-35.59	-5.39	30.20	CaSO4·2H2O
Halite	-3.22	-1.65	1.56	NaCl
Hausmannite	-71.41	-8.02	63.39	Mn3O4
Huntite	-55.08	-84.45	-29.37	CaMg3(CO3)4
Hydromagnesite	-77.28	-84.84	-7.56	Mg5(CO3)4(OH)2·4H2O
K2Cr2O7	-156.11	-32.68	123.43	K2Cr2O7
K2CrO4	-87.65	-17.98	69.67	K2CrO4
Lime	-34.62	-0.76	33.87	CaO

Magnesite	-13.18	-21.06	-7.89	MgCO <sub>3</sub>
Manganite	-27.18	-2.50	24.67	MnOOH
MgCr <sub>2</sub> O <sub>4</sub>	-46.07	-33.07	13.00	MgCr <sub>2</sub> O <sub>4</sub>
MgCrO <sub>4</sub>	-90.88	-15.25	75.63	MgCrO <sub>4</sub>
MgSeO <sub>3</sub> :6H <sub>2</sub> O	-50.28	-9.09	41.19	MgSeO <sub>3</sub> :6H <sub>2</sub> O
Millerite	-8.73	-16.83	-8.10	NiS
Mirabilite	-39.12	-5.62	33.50	Na <sub>2</sub> SO <sub>4</sub> :10H <sub>2</sub> O
Mn <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>	-169.04	-18.87	150.17	Mn <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>
Mn <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-75.35	-22.57	52.78	Mn <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
MnCl <sub>2</sub> :4H <sub>2</sub> O	-7.74	-5.43	2.31	MnCl <sub>2</sub> :4H <sub>2</sub> O
MnS(Green)	-15.74	-11.81	3.93	MnS
MnSe	-20.29	-14.63	5.66	MnSe
MnSeO <sub>3</sub>	-49.91	-11.51	38.40	MnSeO <sub>3</sub>
MnSeO <sub>3</sub> :2H <sub>2</sub> O	-49.65	-11.52	38.12	MnSeO <sub>3</sub> :2H <sub>2</sub> O
MnSO <sub>4</sub>	-45.72	-7.64	38.08	MnSO <sub>4</sub>
Morenosite	-45.34	-12.72	32.62	NiSO <sub>4</sub> :7H <sub>2</sub> O
Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-159.82	-30.32	129.50	Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
Na <sub>2</sub> CrO <sub>4</sub>	-88.75	-15.62	73.13	Na <sub>2</sub> CrO <sub>4</sub>
Natron	-19.83	-21.50	-1.68	Na <sub>2</sub> CO <sub>3</sub> :10H <sub>2</sub> O
Nesquehonite	-15.60	-21.08	-5.49	MgCO <sub>3</sub> :3H <sub>2</sub> O
Ni(OH) <sub>2</sub>	-18.15	-8.05	10.10	Ni(OH) <sub>2</sub>
Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-93.62	-37.64	55.98	Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-103.87	-36.81	67.05	Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
NiCO <sub>3</sub>	-21.94	-28.55	-6.61	NiCO <sub>3</sub>
NiSe	-1.92	-19.66	-17.74	NiSe
NiSeO <sub>3</sub> :2H <sub>2</sub> O	-56.72	-16.55	40.17	NiSeO <sub>3</sub> :2H <sub>2</sub> O
Nsutite	-44.39	-1.98	42.42	MnO <sub>2</sub>
O <sub>2</sub> (g)	-84.13	2.08	86.22	O <sub>2</sub>
Oripment	20.98	-41.90	-62.89	As <sub>2</sub> S <sub>3</sub>
Periclase	-22.90	-0.55	22.35	MgO
Portlandite	-24.15	-0.76	23.38	Ca(OH) <sub>2</sub>
Pyrocroite	-18.64	-3.03	15.61	Mn(OH) <sub>2</sub>
Pyrolusite	-43.43	-1.98	41.45	MnO <sub>2</sub>
Realgar	3.37	-17.08	-20.45	AsS
Retgersite	-45.70	-12.71	32.99	NiSO <sub>4</sub> :6H <sub>2</sub> O
Rhodochrosite	-13.17	-23.53	-10.36	MnCO <sub>3</sub>
Se(A)	-3.40	-10.57	-7.17	Se
Se(hex)	-2.79	-10.57	-7.78	Se
SeO <sub>2</sub>	-45.80	-8.49	37.30	SeO <sub>2</sub>
SeO <sub>3</sub>	-103.92	-7.45	96.47	SeO <sub>3</sub>
Smithsonite	-18.67	-28.57	-9.90	ZnCO <sub>3</sub>
Sphalerite	-5.04	-16.85	-11.81	ZnS
Spinel	-48.57	-10.18	38.39	MgAl <sub>2</sub> O <sub>4</sub>
SULFUR	-5.73	-7.75	-2.01	S
Thenardite	-40.43	-5.55	34.89	Na <sub>2</sub> SO <sub>4</sub>
Thermonatrite	-21.63	-21.44	0.19	Na <sub>2</sub> CO <sub>3</sub> :H <sub>2</sub> O
Witherite	-16.89	-25.48	-8.59	BaCO <sub>3</sub>
Wurtzite	-7.05	-16.85	-9.80	ZnS

Zincite -19.71 -8.06 11.65 ZnO  
Zincosite -51.19 -12.69 38.51 ZnSO4  
Zn(BO2)2 -23.93 -15.64 8.29 Zn(BO2)2  
Zn(NO3)2:6H2O -254.82 -4.71 250.12 Zn(NO3)2:6H2O  
Zn(OH)2(A) -20.52 -8.07 12.45 Zn(OH)2  
Zn(OH)2(B) -19.82 -8.07 11.75 Zn(OH)2  
Zn(OH)2(C) -20.27 -8.07 12.20 Zn(OH)2  
Zn(OH)2(E) -19.57 -8.07 11.50 Zn(OH)2  
Zn(OH)2(G) -19.78 -8.07 11.71 Zn(OH)2  
Zn2(OH)2SO4 -63.30 -20.75 42.55 Zn2(OH)2SO4  
Zn2(OH)3Cl -32.52 -17.32 15.20 Zn2(OH)3Cl  
Zn3(AsO4)2:2.5H2O -91.59 -37.66 53.93 Zn3(AsO4)2:2.5H2O  
Zn3O(SO4)2 -123.99 -33.43 90.56 Zn3O(SO4)2  
Zn4(OH)6SO4 -100.34 -36.89 63.45 Zn4(OH)6SO4  
Zn5(OH)8Cl2 -81.22 -42.72 38.50 Zn5(OH)8Cl2  
ZnCl2 -17.88 -10.45 7.43 ZnCl2  
ZnCO3:H2O -18.32 -28.58 -10.26 ZnCO3:H2O  
ZnMetal -35.71 -9.10 26.61 Zn  
ZnO(Active) -19.37 -8.06 11.31 ZnO  
ZnS(A) -7.71 -16.85 -9.14 ZnS  
ZnSe -8.16 -19.67 -11.51 ZnSe  
ZnSO4:H2O -47.42 -12.69 34.73 ZnSO4:H2O

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks



Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a Low  
SOLUTION 1  
pH 6.90 charge  
temp 15.88  
pe 0.163  
units mg/L  
Al 0.0412  
As 0.00233 as H3AsO4  
Ba 0.292  
B 1.470  
Ca 970  
C 8.62  
Cl 17300  
Cr 0.00466  
Mg 839  
Mn 13.300 as Mn+2  
Ni 0.000115  
N 20.8 as NH4+  
K 291  
Se 0.00101  
Na 2260  
S 1560 as SO4-2  
Zn 0.000125

END

-----  
TITLE  
-----

BH301a Low  
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Beginning of initial solution calculations.

-----  
Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.563e-06	1.563e-06
As	1.681e-08	1.681e-08
B	1.392e-04	1.392e-04
Ba	2.177e-06	2.177e-06
C	1.446e-04	1.446e-04
Ca	2.478e-02	2.478e-02
Cl	4.996e-01	4.996e-01
Cr	9.176e-08	9.176e-08
K	7.619e-03	7.619e-03
Mg	3.533e-02	3.533e-02
Mn	2.479e-04	2.479e-04
N	1.181e-03	1.181e-03
Na	1.006e-01	1.006e-01
Ni	2.005e-09	2.005e-09
S	1.663e-02	1.663e-02
Se	1.310e-08	1.310e-08
Zn	1.958e-09	1.958e-09

-----Description of solution-----

pH = 0.687    Charge balance  
pe = 0.163  
Activity of water = 0.984  
Ionic strength = 5.598e-01  
Mass of water (kg) = 1.000e+00  
Total alkalinity (eq/kg) = -2.694e-01  
Total CO2 (mol/kg) = 1.446e-04  
Temperature (deg C) = 15.880  
Electrical balance (eq) = -2.057e-18  
Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|) = -0.00$   
Iterations = 18  
Total H = 1.113206e+02  
Total O = 5.550707e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
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H+	2.694e-01	2.057e-01	-0.570	-0.687	-0.117
OH-	3.762e-14	2.361e-14	-13.425	-13.627	-0.202
H2O	5.551e+01	9.838e-01	-0.007	-0.007	0.000
Al	1.563e-06				
Al+3	1.563e-06	1.375e-07	-5.806	-6.862	-1.056
AlOH+2	1.585e-11	3.572e-12	-10.800	-11.447	-0.647
Al(OH)2+	3.628e-16	2.500e-16	-15.440	-15.602	-0.162
Al(OH)3	1.323e-21	1.505e-21	-20.878	-20.822	0.056
Al(OH)4-	1.040e-28	6.892e-29	-27.983	-28.162	-0.179
AlSO4+	3.857e-40	2.556e-40	-39.414	-39.592	-0.179
Al(SO4)2-	0.000e+00	0.000e+00	-73.231	-73.410	-0.179
As(3)	1.681e-08				
H3AsO3	1.453e-08	1.653e-08	-7.838	-7.782	0.056
H4AsO3+	2.275e-09	1.684e-09	-8.643	-8.774	-0.131
H2AsO3-	4.528e-17	3.353e-17	-16.344	-16.475	-0.131
HAsO3-2	2.855e-28	8.582e-29	-27.544	-28.066	-0.522
AsO3-3	1.742e-40	0.000e+00	-39.759	-40.934	-1.175
As(5)	5.452e-27				
H3AsO4	5.208e-27	5.925e-27	-26.283	-26.227	0.056
H2AsO4-	2.433e-28	1.801e-28	-27.614	-27.744	-0.131
HAsO4-2	4.883e-34	1.468e-34	-33.311	-33.833	-0.522
AsO4-3	0.000e+00	0.000e+00	-43.669	-44.843	-1.175
B	1.392e-04				
H3BO3	1.392e-04	1.584e-04	-3.856	-3.800	0.056
H2BO3-	6.379e-13	3.730e-13	-12.195	-12.428	-0.233
Ba	2.177e-06				
Ba+2	2.177e-06	4.594e-07	-5.662	-6.338	-0.676
BaOH+	6.363e-20	4.313e-20	-19.196	-19.365	-0.169
C(4)	1.446e-04				
H2CO3	1.446e-04	1.645e-04	-3.840	-3.784	0.056
HCO3-	5.647e-10	3.890e-10	-9.248	-9.410	-0.162
MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152
NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
CO3-2	3.193e-19	7.194e-20	-18.496	-19.143	-0.647
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162
NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
Ca	2.478e-02				
Ca+2	2.478e-02	7.547e-03	-1.606	-2.122	-0.516
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152

CaOH+	5.963e-15	4.201e-15	-14.225	-14.377	-0.152
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
CaSO4	2.487e-36	2.829e-36	-35.604	-35.548	0.056
Cl	4.996e-01				
Cl-	4.995e-01	3.093e-01	-0.301	-0.510	-0.208
MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169
MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056
MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
CrOHCl2	1.809e-16	2.058e-16	-15.743	-15.687	0.056
ZnOHCl	1.610e-17	1.832e-17	-16.793	-16.737	0.056
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
CrO3Cl-	0.000e+00	0.000e+00	-76.550	-76.680	-0.131
Cr(2)	7.066e-16				
Cr+2	7.066e-16	2.124e-16	-15.151	-15.673	-0.522
Cr(3)	9.176e-08				
Cr+3	8.924e-08	5.971e-09	-7.049	-8.224	-1.175
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
Cr(OH)+2	3.251e-12	9.772e-13	-11.488	-12.010	-0.522
CrOHCl2	1.809e-16	2.058e-16	-15.743	-15.687	0.056
Cr(OH)2+	1.514e-17	1.121e-17	-16.820	-16.950	-0.131
Cr(OH)3	3.495e-24	3.976e-24	-23.456	-23.401	0.056
CrO2-	6.432e-34	4.763e-34	-33.192	-33.322	-0.131
Cr(OH)4-	2.453e-34	1.816e-34	-33.610	-33.741	-0.131
CrSO4+	0.000e+00	0.000e+00	-42.623	-42.754	-0.131
CrOHSO4	0.000e+00	0.000e+00	-45.112	-45.056	0.056
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-54.284	-54.806	-0.522
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.573	-56.704	-0.131
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.754	-60.276	-0.522
Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-92.190	-92.135	0.056
CrNO3+2	0.000e+00	0.000e+00	-127.630	-128.152	-0.522
Cr(6)	0.000e+00				
HCrO4-	0.000e+00	0.000e+00	-76.181	-76.311	-0.131
CrO3Cl-	0.000e+00	0.000e+00	-76.550	-76.680	-0.131
H2CrO4	0.000e+00	0.000e+00	-77.891	-77.835	0.056
CrO4-2	0.000e+00	0.000e+00	-81.353	-82.113	-0.759
NaCrO4-	0.000e+00	0.000e+00	-82.431	-82.561	-0.131
KCrO4-	0.000e+00	0.000e+00	-83.509	-83.640	-0.131

	CrO3SO4-2	0.000e+00	0.000e+00	-109.665	-110.187	-0.522
	Cr2O7-2	0.000e+00	0.000e+00	-150.443	-150.965	-0.522
H(0)	2.729e-05					
	H2	1.365e-05	1.552e-05	-4.865	-4.809	0.056
K	7.619e-03					
	K+	7.619e-03	4.718e-03	-2.118	-2.326	-0.208
	KSO4-	8.125e-38	5.598e-38	-37.090	-37.252	-0.162
	KCrO4-	0.000e+00	0.000e+00	-83.509	-83.640	-0.131
Mg	3.533e-02					
	Mg+2	3.533e-02	1.203e-02	-1.452	-1.920	-0.468
	MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190
	MgOH+	5.820e-14	4.168e-14	-13.235	-13.380	-0.145
	MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056
	MgSO4	3.473e-36	3.951e-36	-35.459	-35.403	0.056
Mn(2)	2.479e-04					
	Mn+2	1.672e-04	4.116e-05	-3.777	-4.386	-0.609
	MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169
	MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056
	MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169
	MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169
	MnOH+	3.468e-15	2.351e-15	-14.460	-14.629	-0.169
	MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056
	Mn(OH)3-	1.053e-37	7.140e-38	-36.977	-37.146	-0.169
	MnSO4	1.167e-38	1.328e-38	-37.933	-37.877	0.056
	MnSeO4	0.000e+00	0.000e+00	-80.198	-80.142	0.056
	Mn(NO3)2	0.000e+00	0.000e+00	-240.658	-240.602	0.056
Mn(3)	8.354e-29					
	Mn+3	8.354e-29	7.350e-30	-28.078	-29.134	-1.056
Mn(6)	0.000e+00					
	MnO4-2	0.000e+00	0.000e+00	-119.501	-120.177	-0.676
Mn(7)	0.000e+00					
	MnO4-	0.000e+00	0.000e+00	-129.796	-130.013	-0.217
N(-3)	1.181e-03					
	NH4+	1.181e-03	6.904e-04	-2.928	-3.161	-0.233
	NH3	8.646e-13	9.835e-13	-12.063	-12.007	0.056
	NH4SO4-	2.611e-38	1.770e-38	-37.583	-37.752	-0.169
	Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.573	-56.704	-0.131
	Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.754	-60.276	-0.522
	Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175
	Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
N(3)	0.000e+00					
	NO2-	0.000e+00	0.000e+00	-90.393	-90.523	-0.131
N(5)	0.000e+00					
	NO3-	0.000e+00	0.000e+00	-118.196	-118.413	-0.217
	CrNO3+2	0.000e+00	0.000e+00	-127.630	-128.152	-0.522
	Mn(NO3)2	0.000e+00	0.000e+00	-240.658	-240.602	0.056
Na	1.006e-01					
	Na+	1.006e-01	7.161e-02	-0.997	-1.145	-0.148

NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162
NaSO4-	9.766e-37	6.729e-37	-36.010	-36.172	-0.162
NaCrO4-	0.000e+00	0.000e+00	-82.431	-82.561	-0.131
Ni	2.005e-09				
Ni+2	1.298e-09	3.901e-10	-8.887	-9.409	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
NiOH+	1.796e-19	1.330e-19	-18.746	-18.876	-0.131
NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
Ni(OH)2	7.847e-28	8.927e-28	-27.105	-27.049	0.056
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Ni(OH)3-	5.767e-38	4.270e-38	-37.239	-37.370	-0.131
NiSO4	0.000e+00	0.000e+00	-42.911	-42.855	0.056
Ni(SO4)2-2	0.000e+00	0.000e+00	-79.269	-79.791	-0.522
NiSeO4	0.000e+00	0.000e+00	-85.003	-84.947	0.056
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-85.868	-85.812	0.056
S(-2)	1.663e-02				
H2S	1.663e-02	1.891e-02	-1.779	-1.723	0.056
HS-	1.244e-08	7.808e-09	-7.905	-8.107	-0.202
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
S5-2	1.956e-17	5.879e-18	-16.709	-17.231	-0.522
S6-2	1.661e-17	4.993e-18	-16.780	-17.302	-0.522
S4-2	1.117e-17	3.358e-18	-16.952	-17.474	-0.522
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
S-2	1.141e-20	2.407e-21	-19.943	-20.618	-0.676
S3-2	3.792e-21	1.140e-21	-20.421	-20.943	-0.522
S2-2	2.040e-22	6.134e-23	-21.690	-22.212	-0.522
S(6)	6.580e-35				
HSO4-	4.671e-35	3.095e-35	-34.331	-34.509	-0.179
SO4-2	1.203e-35	1.990e-36	-34.920	-35.701	-0.782
MgSO4	3.473e-36	3.951e-36	-35.459	-35.403	0.056
CaSO4	2.487e-36	2.829e-36	-35.604	-35.548	0.056
NaSO4-	9.766e-37	6.729e-37	-36.010	-36.172	-0.162
KSO4-	8.125e-38	5.598e-38	-37.090	-37.252	-0.162
NH4SO4-	2.611e-38	1.770e-38	-37.583	-37.752	-0.169
MnSO4	1.167e-38	1.328e-38	-37.933	-37.877	0.056
AlSO4+	3.857e-40	2.556e-40	-39.414	-39.592	-0.179
CrSO4+	0.000e+00	0.000e+00	-42.623	-42.754	-0.131
ZnSO4	0.000e+00	0.000e+00	-42.846	-42.790	0.056
NiSO4	0.000e+00	0.000e+00	-42.911	-42.855	0.056
CrOHSO4	0.000e+00	0.000e+00	-45.112	-45.056	0.056
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-54.284	-54.806	-0.522
Al(SO4)2-	0.000e+00	0.000e+00	-73.231	-73.410	-0.179
Zn(SO4)2-2	0.000e+00	0.000e+00	-77.027	-77.549	-0.522
Ni(SO4)2-2	0.000e+00	0.000e+00	-79.269	-79.791	-0.522

Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-92.190	-92.135	0.056
CrO3SO4-2	0.000e+00	0.000e+00	-109.665	-110.187	-0.522
Se(-2)	1.310e-08				
H2Se	1.308e-08	1.488e-08	-7.883	-7.827	0.056
HSe-	1.574e-11	1.165e-11	-10.803	-10.934	-0.131
MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056
Se-2	1.139e-25	3.423e-26	-24.944	-25.466	-0.522
Se(4)	0.000e+00				
SeO3-2	0.000e+00	0.000e+00	-50.344	-50.866	-0.522
Se(6)	0.000e+00				
H2SeO3	0.000e+00	0.000e+00	-41.176	-41.120	0.056
HSeO3-	0.000e+00	0.000e+00	-42.913	-43.044	-0.131
HSeO4-	0.000e+00	0.000e+00	-76.843	-76.974	-0.131
SeO4-2	0.000e+00	0.000e+00	-77.336	-78.096	-0.759
MnSeO4	0.000e+00	0.000e+00	-80.198	-80.142	0.056
NiSeO4	0.000e+00	0.000e+00	-85.003	-84.947	0.056
ZnSeO4	0.000e+00	0.000e+00	-85.377	-85.321	0.056
Zn(SeO4)2-2	0.000e+00	0.000e+00	-165.167	-165.689	-0.522
Zn	1.958e-09				
Zn+2	1.519e-09	3.740e-10	-8.819	-9.427	-0.609
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
ZnOHCl	1.610e-17	1.832e-17	-16.793	-16.737	0.056
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
ZnOH+	1.298e-18	9.609e-19	-17.887	-18.017	-0.131
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Zn(OH)2	9.491e-26	1.080e-25	-25.023	-24.967	0.056
Zn(OH)3-	2.206e-36	1.633e-36	-35.656	-35.787	-0.131
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
ZnSO4	0.000e+00	0.000e+00	-42.846	-42.790	0.056
Zn(OH)4-2	0.000e+00	0.000e+00	-47.385	-47.907	-0.522
Zn(SO4)2-2	0.000e+00	0.000e+00	-77.027	-77.549	-0.522
ZnSeO4	0.000e+00	0.000e+00	-85.377	-85.321	0.056
Zn(SeO4)2-2	0.000e+00	0.000e+00	-165.167	-165.689	-0.522

-----Saturation indices-----

Phase	SI	log IAP	log KT	
(NH4)2CrO4	-88.79	-18.68	70.11	(NH4)2CrO4
Al(OH)3(a)	-15.83	-4.82	11.01	Al(OH)3
Al2O3	-32.60	-9.62	22.98	Al2O3
Al4(OH)10SO4	-79.05	-21.30	57.75	Al4(OH)10SO4
AlAsO4:2H2O	-35.84	-10.90	24.94	AlAsO4:2H2O

AlOHSO4	-38.65	-6.83	31.82	AlOHSO4
AlumK	-75.34	-10.57	64.76	KAl(SO4)2·12H2O
Alunite	-88.80	-20.13	68.67	KAl3(SO4)2(OH)6
Anhydrite	-33.27	-2.77	30.50	CaSO4
Aragonite	-12.98	-21.27	-8.28	CaCO3
Arsenolite	-27.95	-31.08	-3.13	As4O6
Artinite	-31.91	-21.64	10.26	MgCO3:Mg(OH)2:3H2O
As2O5	-59.26	-12.16	47.10	As2O5
Ba3(AsO4)2	-58.38	-27.07	31.31	Ba3(AsO4)2
BaCrO4	-78.63	-18.69	59.94	BaCrO4
Barite	-31.92	-6.99	24.93	BaSO4
BaSeO3	-53.00	-11.51	41.50	BaSeO3
BaSeO4	-79.20	-9.81	69.38	BaSeO4
Bianchite	-43.41	-10.12	33.29	ZnSO4·6H2O
Birnessite	-44.33	-1.33	43.00	MnO2
Bixbyite	-53.91	-4.35	49.56	Mn2O3
Boehmite	-14.04	-4.82	9.23	AlOOH
Brucite	-17.95	-0.56	17.39	Mg(OH)2
Bunsenite	-21.05	-8.04	13.00	NiO
Ca3(AsO4)2·6H2O	-77.04	-14.47	62.58	Ca3(AsO4)2·6H2O
CaCrO4	-82.12	-14.48	67.64	CaCrO4
Calcite	-12.84	-21.27	-8.43	CaCO3
CaSeO3·2H2O	-47.41	-7.31	40.11	CaSeO3·2H2O
CaSeO4·2H2O	-77.26	-5.61	71.65	CaSeO4·2H2O
CH4(g)	14.22	-27.29	-41.51	CH4
Claudetite	-27.71	-31.08	-3.37	As4O6
CO2(g)	-2.34	-20.51	-18.17	CO2
Cr(OH)2	-25.33	-17.11	8.22	Cr(OH)2
Cr(OH)3(A)	-15.52	-16.27	-0.75	Cr(OH)3
Cr(OH)3(C)	-18.14	-16.27	1.87	Cr(OH)3
Cr2O3	-29.41	-32.52	-3.11	Cr2O3
CrCl2	-33.01	-19.49	13.52	CrCl2
CrCl3	-33.98	-19.84	14.14	CrCl3
CrMetal	-49.04	-18.80	30.24	Cr
CrO3	-80.30	-13.72	66.58	CrO3
Diaspore	-12.26	-4.82	7.44	AlOOH
Dolomite	-25.52	-42.33	-16.81	CaMg(CO3)2
Epsomite	-35.47	-2.62	32.85	MgSO4·7H2O
Gibbsite(C)	-14.12	-4.82	9.30	Al(OH)3
Goslarite	-43.14	-10.13	33.01	ZnSO4·7H2O
Gypsum	-32.98	-2.79	30.20	CaSO4·2H2O
Halite	-3.22	-1.65	1.56	NaCl
Hausmannite	-70.76	-7.36	63.39	Mn3O4
Huntite	-55.08	-84.45	-29.37	CaMg3(CO3)4
Hydromagnesite	-77.28	-84.84	-7.56	Mg5(CO3)4(OH)2·4H2O
K2Cr2O7	-154.15	-30.73	123.43	K2Cr2O7
K2CrO4	-86.67	-17.01	69.67	K2CrO4
Lime	-34.62	-0.76	33.87	CaO



Magnesite -13.18 -21.06 -7.89 MgCO<sub>3</sub>  
 Manganite -26.85 -2.18 24.67 MnOOH  
 MgCr<sub>2</sub>O<sub>4</sub> -46.07 -33.07 13.00 MgCr<sub>2</sub>O<sub>4</sub>  
 MgCrO<sub>4</sub> -89.90 -14.27 75.63 MgCrO<sub>4</sub>  
 MgSeO<sub>3</sub>:6H<sub>2</sub>O -48.32 -7.13 41.19 MgSeO<sub>3</sub>:6H<sub>2</sub>O  
 Millerite -8.73 -16.83 -8.10 NiS  
 Mirabilite -36.51 -3.01 33.50 Na<sub>2</sub>SO<sub>4</sub>:10H<sub>2</sub>O  
 Mn<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> -160.56 -10.40 150.17 Mn<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>  
 Mn<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O -74.05 -21.27 52.78 Mn<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O  
 MnCl<sub>2</sub>:4H<sub>2</sub>O -7.74 -5.43 2.31 MnCl<sub>2</sub>:4H<sub>2</sub>O  
 MnS(Green) -15.74 -11.81 3.93 MnS  
 MnSe -20.29 -14.63 5.66 MnSe  
 MnSeO<sub>3</sub> -47.95 -9.55 38.40 MnSeO<sub>3</sub>  
 MnSeO<sub>3</sub>:2H<sub>2</sub>O -47.69 -9.57 38.12 MnSeO<sub>3</sub>:2H<sub>2</sub>O  
 MnSO<sub>4</sub> -43.11 -5.04 38.08 MnSO<sub>4</sub>  
 Morenosite -42.73 -10.11 32.62 NiSO<sub>4</sub>:7H<sub>2</sub>O  
 Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> -157.86 -28.37 129.50 Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>  
 Na<sub>2</sub>CrO<sub>4</sub> -87.77 -14.64 73.13 Na<sub>2</sub>CrO<sub>4</sub>  
 Natron -19.83 -21.50 -1.68 Na<sub>2</sub>CO<sub>3</sub>:10H<sub>2</sub>O  
 Nesquehonite -15.60 -21.08 -5.49 MgCO<sub>3</sub>:3H<sub>2</sub>O  
 Ni(OH)<sub>2</sub> -18.15 -8.05 10.10 Ni(OH)<sub>2</sub>  
 Ni<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O -92.32 -36.34 55.98 Ni<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O  
 Ni<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub> -101.26 -34.21 67.05 Ni<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub>  
 NiCO<sub>3</sub> -21.94 -28.55 -6.61 NiCO<sub>3</sub>  
 NiSe -1.92 -19.66 -17.74 NiSe  
 NiSeO<sub>3</sub>:2H<sub>2</sub>O -54.77 -14.59 40.17 NiSeO<sub>3</sub>:2H<sub>2</sub>O  
 Nsutite -43.74 -1.33 42.42 MnO<sub>2</sub>  
 O<sub>2</sub>(g) -82.83 3.39 86.22 O<sub>2</sub>  
 Oripment 20.98 -41.90 -62.89 As<sub>2</sub>S<sub>3</sub>  
 Periclase -22.90 -0.55 22.35 MgO  
 Portlandite -24.15 -0.76 23.38 Ca(OH)<sub>2</sub>  
 Pyrocroite -18.64 -3.03 15.61 Mn(OH)<sub>2</sub>  
 Pyrolusite -42.77 -1.33 41.45 MnO<sub>2</sub>  
 Realgar 3.05 -17.40 -20.45 AsS  
 Retgersite -43.09 -10.10 32.99 NiSO<sub>4</sub>:6H<sub>2</sub>O  
 Rhodochrosite -13.17 -23.53 -10.36 MnCO<sub>3</sub>  
 Se(A) -2.75 -9.92 -7.17 Se  
 Se(hex) -2.14 -9.92 -7.78 Se  
 SeO<sub>2</sub> -43.84 -6.54 37.30 SeO<sub>2</sub>  
 SeO<sub>3</sub> -101.32 -4.84 96.47 SeO<sub>3</sub>  
 Smithsonite -18.67 -28.57 -9.90 ZnCO<sub>3</sub>  
 Sphalerite -5.04 -16.85 -11.81 ZnS  
 Spinel -48.57 -10.18 38.39 MgAl<sub>2</sub>O<sub>4</sub>  
 SULFUR -5.08 -7.09 -2.01 S  
 Thenardite -37.83 -2.94 34.89 Na<sub>2</sub>SO<sub>4</sub>  
 Thermonatrite -21.63 -21.44 0.19 Na<sub>2</sub>CO<sub>3</sub>:H<sub>2</sub>O  
 Witherite -16.89 -25.48 -8.59 BaCO<sub>3</sub>  
 Wurtzite -7.05 -16.85 -9.80 ZnS

Zincite -19.71 -8.06 11.65 ZnO  
Zincosite -48.58 -10.08 38.51 ZnSO4  
Zn(BO2)2 -23.93 -15.64 8.29 Zn(BO2)2  
Zn(NO3)2:6H2O -249.61 0.51 250.12 Zn(NO3)2:6H2O  
Zn(OH)2(A) -20.52 -8.07 12.45 Zn(OH)2  
Zn(OH)2(B) -19.82 -8.07 11.75 Zn(OH)2  
Zn(OH)2(C) -20.27 -8.07 12.20 Zn(OH)2  
Zn(OH)2(E) -19.57 -8.07 11.50 Zn(OH)2  
Zn(OH)2(G) -19.78 -8.07 11.71 Zn(OH)2  
Zn2(OH)2SO4 -60.70 -18.15 42.55 Zn2(OH)2SO4  
Zn2(OH)3Cl -32.52 -17.32 15.20 Zn2(OH)3Cl  
Zn3(AsO4)2:2.5H2O -90.28 -36.36 53.93 Zn3(AsO4)2:2.5H2O  
Zn3O(SO4)2 -118.77 -28.22 90.56 Zn3O(SO4)2  
Zn4(OH)6SO4 -97.73 -34.28 63.45 Zn4(OH)6SO4  
Zn5(OH)8Cl2 -81.22 -42.72 38.50 Zn5(OH)8Cl2  
ZnCl2 -17.88 -10.45 7.43 ZnCl2  
ZnCO3:H2O -18.32 -28.58 -10.26 ZnCO3:H2O  
ZnMetal -36.36 -9.75 26.61 Zn  
ZnO(Active) -19.37 -8.06 11.31 ZnO  
ZnS(A) -7.71 -16.85 -9.14 ZnS  
ZnSe -8.16 -19.67 -11.51 ZnSe  
ZnSO4:H2O -44.81 -10.08 34.73 ZnSO4:H2O

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a Low  
SOLUTION 1  
pH 6.90 charge  
temp 15.88  
pe 0.326  
units mg/L  
Al 0.0412  
As 0.00233 as H3AsO4  
Ba 0.292  
B 1.470  
Ca 970  
C 8.62  
Cl 17300  
Cr 0.00466  
Mg 839  
Mn 13.300 as Mn+2  
Ni 0.000115  
N 20.8 as NH4+  
K 291  
Se 0.00101  
Na 2260  
S 1560 as SO4-2  
Zn 0.000125

END

-----  
TITLE  
-----

BH301a Low  
-----

Beginning of initial solution calculations.

-----  
Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.563e-06	1.563e-06
As	1.681e-08	1.681e-08
B	1.392e-04	1.392e-04
Ba	2.177e-06	2.177e-06
C	1.446e-04	1.446e-04
Ca	2.478e-02	2.478e-02
Cl	4.996e-01	4.996e-01
Cr	9.176e-08	9.176e-08
K	7.619e-03	7.619e-03
Mg	3.533e-02	3.533e-02
Mn	2.479e-04	2.479e-04
N	1.181e-03	1.181e-03
Na	1.006e-01	1.006e-01
Ni	2.005e-09	2.005e-09
S	1.663e-02	1.663e-02
Se	1.310e-08	1.310e-08
Zn	1.958e-09	1.958e-09

-----Description of solution-----

pH = 0.687    Charge balance  
pe = 0.326  
Activity of water = 0.984  
Ionic strength = 5.598e-01  
Mass of water (kg) = 1.000e+00  
Total alkalinity (eq/kg) = -2.694e-01  
Total CO2 (mol/kg) = 1.446e-04  
Temperature (deg C) = 15.880  
Electrical balance (eq) = 8.067e-17  
Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|)$  = 0.00  
Iterations = 20  
Total H = 1.113205e+02  
Total O = 5.550707e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
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H+	2.694e-01	2.057e-01	-0.570	-0.687	-0.117
OH-	3.762e-14	2.361e-14	-13.425	-13.627	-0.202
H2O	5.551e+01	9.838e-01	-0.007	-0.007	0.000
Al	1.563e-06				
Al+3	1.563e-06	1.375e-07	-5.806	-6.862	-1.056
AlOH+2	1.585e-11	3.572e-12	-10.800	-11.447	-0.647
Al(OH)2+	3.628e-16	2.500e-16	-15.440	-15.602	-0.162
Al(OH)3	1.323e-21	1.505e-21	-20.878	-20.822	0.056
Al(OH)4-	1.040e-28	6.892e-29	-27.983	-28.162	-0.179
AlSO4+	7.768e-39	5.147e-39	-38.110	-38.288	-0.179
Al(SO4)2-	0.000e+00	0.000e+00	-70.623	-70.802	-0.179
As(3)	1.681e-08				
H3AsO3	1.453e-08	1.653e-08	-7.838	-7.782	0.056
H4AsO3+	2.275e-09	1.684e-09	-8.643	-8.774	-0.131
H2AsO3-	4.528e-17	3.353e-17	-16.344	-16.475	-0.131
HAsO3-2	2.855e-28	8.582e-29	-27.544	-28.066	-0.522
AsO3-3	1.742e-40	0.000e+00	-39.759	-40.934	-1.175
As(5)	1.155e-26				
H3AsO4	1.103e-26	1.255e-26	-25.957	-25.901	0.056
H2AsO4-	5.154e-28	3.816e-28	-27.288	-27.418	-0.131
HAsO4-2	1.034e-33	3.109e-34	-32.985	-33.507	-0.522
AsO4-3	0.000e+00	0.000e+00	-43.343	-44.517	-1.175
B	1.392e-04				
H3BO3	1.392e-04	1.584e-04	-3.856	-3.800	0.056
H2BO3-	6.379e-13	3.730e-13	-12.195	-12.428	-0.233
Ba	2.177e-06				
Ba+2	2.177e-06	4.594e-07	-5.662	-6.338	-0.676
BaOH+	6.363e-20	4.313e-20	-19.196	-19.365	-0.169
C(4)	1.446e-04				
H2CO3	1.446e-04	1.645e-04	-3.840	-3.784	0.056
HCO3-	5.647e-10	3.890e-10	-9.248	-9.410	-0.162
MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152
NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
CO3-2	3.193e-19	7.194e-20	-18.496	-19.143	-0.647
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162
NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
Ca	2.478e-02				
Ca+2	2.478e-02	7.547e-03	-1.606	-2.122	-0.516
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152

CaOH+	5.963e-15	4.201e-15	-14.225	-14.377	-0.152
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
CaSO4	5.007e-35	5.696e-35	-34.300	-34.244	0.056
Cl	4.996e-01				
Cl-	4.995e-01	3.093e-01	-0.301	-0.510	-0.208
MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169
MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056
MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
CrOHCl2	1.809e-16	2.058e-16	-15.743	-15.687	0.056
ZnOHCl	1.610e-17	1.832e-17	-16.793	-16.737	0.056
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
CrO3Cl-	0.000e+00	0.000e+00	-76.061	-76.191	-0.131
Cr(2)	4.855e-16				
Cr+2	4.855e-16	1.459e-16	-15.314	-15.836	-0.522
Cr(3)	9.176e-08				
Cr+3	8.924e-08	5.971e-09	-7.049	-8.224	-1.175
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
Cr(OH)+2	3.251e-12	9.772e-13	-11.488	-12.010	-0.522
CrOHCl2	1.809e-16	2.058e-16	-15.743	-15.687	0.056
Cr(OH)2+	1.514e-17	1.121e-17	-16.820	-16.950	-0.131
Cr(OH)3	3.495e-24	3.976e-24	-23.456	-23.401	0.056
CrO2-	6.432e-34	4.763e-34	-33.192	-33.322	-0.131
Cr(OH)4-	2.453e-34	1.816e-34	-33.610	-33.741	-0.131
CrSO4+	0.000e+00	0.000e+00	-41.319	-41.450	-0.131
CrOHSO4	0.000e+00	0.000e+00	-43.808	-43.752	0.056
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-52.980	-53.502	-0.522
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.573	-56.704	-0.131
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.754	-60.276	-0.522
Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-89.582	-89.527	0.056
CrNO3+2	0.000e+00	0.000e+00	-126.326	-126.848	-0.522
Cr(6)	0.000e+00				
HCrO4-	0.000e+00	0.000e+00	-75.692	-75.822	-0.131
CrO3Cl-	0.000e+00	0.000e+00	-76.061	-76.191	-0.131
H2CrO4	0.000e+00	0.000e+00	-77.402	-77.346	0.056
CrO4-2	0.000e+00	0.000e+00	-80.864	-81.624	-0.759
NaCrO4-	0.000e+00	0.000e+00	-81.942	-82.072	-0.131
KCrO4-	0.000e+00	0.000e+00	-83.020	-83.151	-0.131

	CrO3SO4-2	0.000e+00	0.000e+00	-107.872	-108.394	-0.522
	Cr2O7-2	0.000e+00	0.000e+00	-149.465	-149.987	-0.522
H(0)	1.288e-05					
	H2	6.442e-06	7.328e-06	-5.191	-5.135	0.056
K	7.619e-03					
	K+	7.619e-03	4.718e-03	-2.118	-2.326	-0.208
	KSO4-	1.636e-36	1.127e-36	-35.786	-35.948	-0.162
	KCrO4-	0.000e+00	0.000e+00	-83.020	-83.151	-0.131
Mg	3.533e-02					
	Mg+2	3.533e-02	1.203e-02	-1.452	-1.920	-0.468
	MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190
	MgOH+	5.820e-14	4.168e-14	-13.235	-13.380	-0.145
	MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056
	MgSO4	6.993e-35	7.956e-35	-34.155	-34.099	0.056
Mn(2)	2.479e-04					
	Mn+2	1.672e-04	4.116e-05	-3.777	-4.386	-0.609
	MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169
	MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056
	MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169
	MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169
	MnOH+	3.468e-15	2.351e-15	-14.460	-14.629	-0.169
	MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056
	MnSO4	2.350e-37	2.674e-37	-36.629	-36.573	0.056
	Mn(OH)3-	1.053e-37	7.140e-38	-36.977	-37.146	-0.169
	MnSeO4	0.000e+00	0.000e+00	-78.894	-78.838	0.056
	Mn(NO3)2	0.000e+00	0.000e+00	-238.050	-237.994	0.056
Mn(3)	1.216e-28					
	Mn+3	1.216e-28	1.070e-29	-27.915	-28.971	-1.056
Mn(6)	0.000e+00					
	MnO4-2	0.000e+00	0.000e+00	-118.849	-119.525	-0.676
Mn(7)	0.000e+00					
	MnO4-	0.000e+00	0.000e+00	-128.981	-129.198	-0.217
N(-3)	1.181e-03					
	NH4+	1.181e-03	6.904e-04	-2.928	-3.161	-0.233
	NH3	8.646e-13	9.835e-13	-12.063	-12.007	0.056
	NH4SO4-	5.258e-37	3.564e-37	-36.279	-36.448	-0.169
	Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.573	-56.704	-0.131
	Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.754	-60.276	-0.522
	Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175
	Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
N(3)	0.000e+00					
	NO2-	0.000e+00	0.000e+00	-89.415	-89.545	-0.131
N(5)	0.000e+00					
	NO3-	0.000e+00	0.000e+00	-116.892	-117.109	-0.217
	CrNO3+2	0.000e+00	0.000e+00	-126.326	-126.848	-0.522
	Mn(NO3)2	0.000e+00	0.000e+00	-238.050	-237.994	0.056
Na	1.006e-01					
	Na+	1.006e-01	7.161e-02	-0.997	-1.145	-0.148

NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162
NaSO4-	1.967e-35	1.355e-35	-34.706	-34.868	-0.162
NaCrO4-	0.000e+00	0.000e+00	-81.942	-82.072	-0.131
Ni	2.005e-09				
Ni+2	1.298e-09	3.901e-10	-8.887	-9.409	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
NiOH+	1.796e-19	1.330e-19	-18.746	-18.876	-0.131
NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
Ni(OH)2	7.847e-28	8.927e-28	-27.105	-27.049	0.056
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Ni(OH)3-	5.767e-38	4.270e-38	-37.239	-37.370	-0.131
NiSO4	0.000e+00	0.000e+00	-41.607	-41.551	0.056
Ni(SO4)2-2	0.000e+00	0.000e+00	-76.661	-77.183	-0.522
NiSeO4	0.000e+00	0.000e+00	-83.699	-83.643	0.056
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-85.216	-85.160	0.056
S(-2)	1.663e-02				
H2S	1.663e-02	1.891e-02	-1.779	-1.723	0.056
HS-	1.244e-08	7.808e-09	-7.905	-8.107	-0.202
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
S5-2	1.956e-17	5.879e-18	-16.709	-17.231	-0.522
S6-2	1.661e-17	4.993e-18	-16.780	-17.302	-0.522
S4-2	1.117e-17	3.358e-18	-16.952	-17.474	-0.522
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
S-2	1.141e-20	2.407e-21	-19.943	-20.618	-0.676
S3-2	3.792e-21	1.140e-21	-20.421	-20.943	-0.522
S2-2	2.040e-22	6.134e-23	-21.690	-22.212	-0.522
S(6)	1.325e-33				
HSO4-	9.405e-34	6.232e-34	-33.027	-33.205	-0.179
SO4-2	2.423e-34	4.007e-35	-33.616	-34.397	-0.782
MgSO4	6.993e-35	7.956e-35	-34.155	-34.099	0.056
CaSO4	5.007e-35	5.696e-35	-34.300	-34.244	0.056
NaSO4-	1.967e-35	1.355e-35	-34.706	-34.868	-0.162
KSO4-	1.636e-36	1.127e-36	-35.786	-35.948	-0.162
NH4SO4-	5.258e-37	3.564e-37	-36.279	-36.448	-0.169
MnSO4	2.350e-37	2.674e-37	-36.629	-36.573	0.056
AlSO4+	7.768e-39	5.147e-39	-38.110	-38.288	-0.179
CrSO4+	0.000e+00	0.000e+00	-41.319	-41.450	-0.131
ZnSO4	0.000e+00	0.000e+00	-41.542	-41.486	0.056
NiSO4	0.000e+00	0.000e+00	-41.607	-41.551	0.056
CrOHSO4	0.000e+00	0.000e+00	-43.808	-43.752	0.056
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-52.980	-53.502	-0.522
Al(SO4)2-	0.000e+00	0.000e+00	-70.623	-70.802	-0.179
Zn(SO4)2-2	0.000e+00	0.000e+00	-74.419	-74.941	-0.522
Ni(SO4)2-2	0.000e+00	0.000e+00	-76.661	-77.183	-0.522



Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-89.582	-89.527	0.056
CrO3SO4-2	0.000e+00	0.000e+00	-107.872	-108.394	-0.522
Se(-2)	1.310e-08				
H2Se	1.308e-08	1.488e-08	-7.883	-7.827	0.056
HSe-	1.574e-11	1.165e-11	-10.803	-10.934	-0.131
MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056
Se-2	1.139e-25	3.423e-26	-24.944	-25.466	-0.522
Se(4)	0.000e+00				
SeO3-2	0.000e+00	0.000e+00	-49.366	-49.888	-0.522
Se(6)	0.000e+00				
H2SeO3	0.000e+00	0.000e+00	-40.198	-40.142	0.056
HSeO3-	0.000e+00	0.000e+00	-41.935	-42.066	-0.131
HSeO4-	0.000e+00	0.000e+00	-75.539	-75.670	-0.131
SeO4-2	0.000e+00	0.000e+00	-76.032	-76.792	-0.759
MnSeO4	0.000e+00	0.000e+00	-78.894	-78.838	0.056
NiSeO4	0.000e+00	0.000e+00	-83.699	-83.643	0.056
ZnSeO4	0.000e+00	0.000e+00	-84.073	-84.017	0.056
Zn(SeO4)2-2	0.000e+00	0.000e+00	-162.559	-163.081	-0.522
Zn	1.958e-09				
Zn+2	1.519e-09	3.740e-10	-8.819	-9.427	-0.609
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
ZnOHCl	1.610e-17	1.832e-17	-16.793	-16.737	0.056
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
ZnOH+	1.298e-18	9.609e-19	-17.887	-18.017	-0.131
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Zn(OH)2	9.491e-26	1.080e-25	-25.023	-24.967	0.056
Zn(OH)3-	2.206e-36	1.633e-36	-35.656	-35.787	-0.131
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
ZnSO4	0.000e+00	0.000e+00	-41.542	-41.486	0.056
Zn(OH)4-2	0.000e+00	0.000e+00	-47.385	-47.907	-0.522
Zn(SO4)2-2	0.000e+00	0.000e+00	-74.419	-74.941	-0.522
ZnSeO4	0.000e+00	0.000e+00	-84.073	-84.017	0.056
Zn(SeO4)2-2	0.000e+00	0.000e+00	-162.559	-163.081	-0.522

-----Saturation indices-----

Phase	SI	log IAP	log KT	
(NH4)2CrO4	-88.30	-18.19	70.11	(NH4)2CrO4
Al(OH)3(a)	-15.83	-4.82	11.01	Al(OH)3
Al2O3	-32.60	-9.62	22.98	Al2O3
Al4(OH)10SO4	-77.75	-20.00	57.75	Al4(OH)10SO4
AlAsO4:2H2O	-35.52	-10.58	24.94	AlAsO4:2H2O

AlOHSO4	-37.35	-5.53	31.82	AlOHSO4
AlumK	-72.73	-7.97	64.76	KAl(SO4)2·12H2O
Alunite	-86.19	-17.52	68.67	KAl3(SO4)2(OH)6
Anhydrite	-31.97	-1.47	30.50	CaSO4
Aragonite	-12.98	-21.27	-8.28	CaCO3
Arsenolite	-27.95	-31.08	-3.13	As4O6
Artinite	-31.91	-21.64	10.26	MgCO3:Mg(OH)2:3H2O
As2O5	-58.61	-11.50	47.10	As2O5
Ba3(AsO4)2	-57.72	-26.42	31.31	Ba3(AsO4)2
BaCrO4	-78.15	-18.20	59.94	BaCrO4
Barite	-30.61	-5.68	24.93	BaSO4
BaSeO3	-52.03	-10.53	41.50	BaSeO3
BaSeO4	-77.89	-8.51	69.38	BaSeO4
Bianchite	-42.11	-8.82	33.29	ZnSO4:6H2O
Birnessite	-44.00	-1.00	43.00	MnO2
Bixbyite	-53.58	-4.02	49.56	Mn2O3
Boehmite	-14.04	-4.82	9.23	AlOOH
Brucite	-17.95	-0.56	17.39	Mg(OH)2
Bunsenite	-21.05	-8.04	13.00	NiO
Ca3(AsO4)2·6H2O	-76.39	-13.81	62.58	Ca3(AsO4)2·6H2O
CaCrO4	-81.63	-13.99	67.64	CaCrO4
Calcite	-12.84	-21.27	-8.43	CaCO3
CaSeO3·2H2O	-46.44	-6.33	40.11	CaSeO3·2H2O
CaSeO4·2H2O	-75.96	-4.31	71.65	CaSeO4·2H2O
CH4(g)	12.91	-28.60	-41.51	CH4
Claudetite	-27.71	-31.08	-3.37	As4O6
CO2(g)	-2.34	-20.51	-18.17	CO2
Cr(OH)2	-25.49	-17.28	8.22	Cr(OH)2
Cr(OH)3(A)	-15.52	-16.27	-0.75	Cr(OH)3
Cr(OH)3(C)	-18.14	-16.27	1.87	Cr(OH)3
Cr2O3	-29.41	-32.52	-3.11	Cr2O3
CrCl2	-33.18	-19.66	13.52	CrCl2
CrCl3	-33.98	-19.84	14.14	CrCl3
CrMetal	-49.53	-19.29	30.24	Cr
CrO3	-79.81	-13.23	66.58	CrO3
Diaspore	-12.26	-4.82	7.44	AlOOH
Dolomite	-25.52	-42.33	-16.81	CaMg(CO3)2
Epsomite	-34.16	-1.32	32.85	MgSO4:7H2O
Gibbsite(C)	-14.12	-4.82	9.30	Al(OH)3
Goslarite	-41.84	-8.82	33.01	ZnSO4:7H2O
Gypsum	-31.68	-1.48	30.20	CaSO4:2H2O
Halite	-3.22	-1.65	1.56	NaCl
Hausmannite	-70.43	-7.04	63.39	Mn3O4
Huntite	-55.08	-84.45	-29.37	CaMg3(CO3)4
Hydromagnesite	-77.28	-84.84	-7.56	Mg5(CO3)4(OH)2:4H2O
K2Cr2O7	-153.18	-29.75	123.43	K2Cr2O7
K2CrO4	-86.19	-16.52	69.67	K2CrO4
Lime	-34.62	-0.76	33.87	CaO

Magnesite	-13.18	-21.06	-7.89	MgCO <sub>3</sub>
Manganite	-26.69	-2.01	24.67	MnOOH
MgCr <sub>2</sub> O <sub>4</sub>	-46.07	-33.07	13.00	MgCr <sub>2</sub> O <sub>4</sub>
MgCrO <sub>4</sub>	-89.42	-13.79	75.63	MgCrO <sub>4</sub>
MgSeO <sub>3</sub> :6H <sub>2</sub> O	-47.34	-6.15	41.19	MgSeO <sub>3</sub> :6H <sub>2</sub> O
Millerite	-8.73	-16.83	-8.10	NiS
Mirabilite	-35.21	-1.71	33.50	Na <sub>2</sub> SO <sub>4</sub> :10H <sub>2</sub> O
Mn <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>	-156.33	-6.16	150.17	Mn <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>
Mn <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-73.39	-20.62	52.78	Mn <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
MnCl <sub>2</sub> :4H <sub>2</sub> O	-7.74	-5.43	2.31	MnCl <sub>2</sub> :4H <sub>2</sub> O
MnS(Green)	-15.74	-11.81	3.93	MnS
MnSe	-20.29	-14.63	5.66	MnSe
MnSeO <sub>3</sub>	-46.97	-8.58	38.40	MnSeO <sub>3</sub>
MnSeO <sub>3</sub> :2H <sub>2</sub> O	-46.71	-8.59	38.12	MnSeO <sub>3</sub> :2H <sub>2</sub> O
MnSO <sub>4</sub>	-41.81	-3.73	38.08	MnSO <sub>4</sub>
Morenosite	-41.43	-8.80	32.62	NiSO <sub>4</sub> :7H <sub>2</sub> O
Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-156.89	-27.39	129.50	Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
Na <sub>2</sub> CrO <sub>4</sub>	-87.28	-14.16	73.13	Na <sub>2</sub> CrO <sub>4</sub>
Natron	-19.83	-21.50	-1.68	Na <sub>2</sub> CO <sub>3</sub> :10H <sub>2</sub> O
Nesquehonite	-15.60	-21.08	-5.49	MgCO <sub>3</sub> :3H <sub>2</sub> O
Ni(OH) <sub>2</sub>	-18.15	-8.05	10.10	Ni(OH) <sub>2</sub>
Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-91.66	-35.69	55.98	Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-99.95	-32.90	67.05	Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
NiCO <sub>3</sub>	-21.94	-28.55	-6.61	NiCO <sub>3</sub>
NiSe	-1.92	-19.66	-17.74	NiSe
NiSeO <sub>3</sub> :2H <sub>2</sub> O	-53.79	-13.61	40.17	NiSeO <sub>3</sub> :2H <sub>2</sub> O
Nsutite	-43.42	-1.00	42.42	MnO <sub>2</sub>
O <sub>2</sub> (g)	-82.18	4.04	86.22	O <sub>2</sub>
Oripment	20.98	-41.90	-62.89	As <sub>2</sub> S <sub>3</sub>
Periclase	-22.90	-0.55	22.35	MgO
Portlandite	-24.15	-0.76	23.38	Ca(OH) <sub>2</sub>
Pyrocroite	-18.64	-3.03	15.61	Mn(OH) <sub>2</sub>
Pyrolusite	-42.45	-1.00	41.45	MnO <sub>2</sub>
Realgar	2.89	-17.57	-20.45	AsS
Retgersite	-41.78	-8.80	32.99	NiSO <sub>4</sub> :6H <sub>2</sub> O
Rhodochrosite	-13.17	-23.53	-10.36	MnCO <sub>3</sub>
Se(A)	-2.42	-9.59	-7.17	Se
Se(hex)	-1.81	-9.59	-7.78	Se
SeO <sub>2</sub>	-42.86	-5.56	37.30	SeO <sub>2</sub>
SeO <sub>3</sub>	-100.01	-3.54	96.47	SeO <sub>3</sub>
Smithsonite	-18.67	-28.57	-9.90	ZnCO <sub>3</sub>
Sphalerite	-5.04	-16.85	-11.81	ZnS
Spinel	-48.57	-10.18	38.39	MgAl <sub>2</sub> O <sub>4</sub>
SULFUR	-4.76	-6.77	-2.01	S
Thenardite	-36.52	-1.64	34.89	Na <sub>2</sub> SO <sub>4</sub>
Thermonatrite	-21.63	-21.44	0.19	Na <sub>2</sub> CO <sub>3</sub> :H <sub>2</sub> O
Witherite	-16.89	-25.48	-8.59	BaCO <sub>3</sub>
Wurtzite	-7.05	-16.85	-9.80	ZnS

Zincite -19.71 -8.06 11.65 ZnO  
Zincosite -47.28 -8.77 38.51 ZnSO4  
Zn(BO2)2 -23.93 -15.64 8.29 Zn(BO2)2  
Zn(NO3)2:6H2O -247.00 3.12 250.12 Zn(NO3)2:6H2O  
Zn(OH)2(A) -20.52 -8.07 12.45 Zn(OH)2  
Zn(OH)2(B) -19.82 -8.07 11.75 Zn(OH)2  
Zn(OH)2(C) -20.27 -8.07 12.20 Zn(OH)2  
Zn(OH)2(E) -19.57 -8.07 11.50 Zn(OH)2  
Zn(OH)2(G) -19.78 -8.07 11.71 Zn(OH)2  
Zn2(OH)2SO4 -59.39 -16.84 42.55 Zn2(OH)2SO4  
Zn2(OH)3Cl -32.52 -17.32 15.20 Zn2(OH)3Cl  
Zn3(AsO4)2:2.5H2O -89.63 -35.70 53.93 Zn3(AsO4)2:2.5H2O  
Zn3O(SO4)2 -116.16 -25.61 90.56 Zn3O(SO4)2  
Zn4(OH)6SO4 -96.43 -32.98 63.45 Zn4(OH)6SO4  
Zn5(OH)8Cl2 -81.22 -42.72 38.50 Zn5(OH)8Cl2  
ZnCl2 -17.88 -10.45 7.43 ZnCl2  
ZnCO3:H2O -18.32 -28.58 -10.26 ZnCO3:H2O  
ZnMetal -36.69 -10.08 26.61 Zn  
ZnO(Active) -19.37 -8.06 11.31 ZnO  
ZnS(A) -7.71 -16.85 -9.14 ZnS  
ZnSe -8.16 -19.67 -11.51 ZnSe  
ZnSO4:H2O -43.51 -8.78 34.73 ZnSO4:H2O

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End of simulation.  
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Reading input data for simulation 2.  
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End of run.  
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No memory leaks

Database file: minteq.dat

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Reading data base.  
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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

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Reading input data for simulation 1.  
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TITLE BH301a Low  
SOLUTION 1  
pH 6.90 charge  
temp 15.88  
pe 0.815  
units mg/L  
Al 0.0412  
As 0.00233 as H3AsO4  
Ba 0.292  
B 1.470  
Ca 970  
C 8.62  
Cl 17300  
Cr 0.00466  
Mg 839  
Mn 13.300 as Mn+2  
Ni 0.000115  
N 20.8 as NH4+  
K 291  
Se 0.00101  
Na 2260  
S 1560 as SO4-2  
Zn 0.000125

END

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TITLE  
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BH301a Low  
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Beginning of initial solution calculations.

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.563e-06	1.563e-06
As	1.681e-08	1.681e-08
B	1.392e-04	1.392e-04
Ba	2.177e-06	2.177e-06
C	1.446e-04	1.446e-04
Ca	2.478e-02	2.478e-02
Cl	4.996e-01	4.996e-01
Cr	9.176e-08	9.176e-08
K	7.619e-03	7.619e-03
Mg	3.533e-02	3.533e-02
Mn	2.479e-04	2.479e-04
N	1.181e-03	1.181e-03
Na	1.006e-01	1.006e-01
Ni	2.005e-09	2.005e-09
S	1.663e-02	1.663e-02
Se	1.310e-08	1.310e-08
Zn	1.958e-09	1.958e-09

-----Description of solution-----

pH = 0.687    Charge balance  
pe = 0.815  
Activity of water = 0.984  
Ionic strength = 5.598e-01  
Mass of water (kg) = 1.000e+00  
Total alkalinity (eq/kg) = -2.694e-01  
Total CO2 (mol/kg) = 1.446e-04  
Temperature (deg C) = 15.880  
Electrical balance (eq) = 2.450e-17  
Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|) = 0.00$   
Iterations = 16  
Total H = 1.113205e+02  
Total O = 5.550707e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
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H+	2.694e-01	2.057e-01	-0.570	-0.687	-0.117
OH-	3.762e-14	2.361e-14	-13.425	-13.627	-0.202
H2O	5.551e+01	9.838e-01	-0.007	-0.007	0.000
Al	1.563e-06				
Al+3	1.563e-06	1.375e-07	-5.806	-6.862	-1.056
AlOH+2	1.585e-11	3.572e-12	-10.800	-11.447	-0.647
Al(OH)2+	3.628e-16	2.500e-16	-15.440	-15.602	-0.162
Al(OH)3	1.323e-21	1.505e-21	-20.878	-20.822	0.056
Al(OH)4-	1.040e-28	6.892e-29	-27.983	-28.162	-0.179
AlSO4+	6.343e-35	4.203e-35	-34.198	-34.376	-0.179
Al(SO4)2-	0.000e+00	0.000e+00	-62.799	-62.978	-0.179
As(3)	1.681e-08				
H3AsO3	1.453e-08	1.653e-08	-7.838	-7.782	0.056
H4AsO3+	2.275e-09	1.684e-09	-8.643	-8.774	-0.131
H2AsO3-	4.528e-17	3.353e-17	-16.344	-16.475	-0.131
HAsO3-2	2.855e-28	8.582e-29	-27.544	-28.066	-0.522
AsO3-3	1.742e-40	0.000e+00	-39.759	-40.934	-1.175
As(5)	1.098e-25				
H3AsO4	1.049e-25	1.193e-25	-24.979	-24.923	0.056
H2AsO4-	4.899e-27	3.628e-27	-26.310	-26.440	-0.131
HAsO4-2	9.833e-33	2.956e-33	-32.007	-32.529	-0.522
AsO4-3	0.000e+00	0.000e+00	-42.365	-43.539	-1.175
B	1.392e-04				
H3BO3	1.392e-04	1.584e-04	-3.856	-3.800	0.056
H2BO3-	6.379e-13	3.730e-13	-12.195	-12.428	-0.233
Ba	2.177e-06				
Ba+2	2.177e-06	4.594e-07	-5.662	-6.338	-0.676
BaOH+	6.363e-20	4.313e-20	-19.196	-19.365	-0.169
C(4)	1.446e-04				
H2CO3	1.446e-04	1.645e-04	-3.840	-3.784	0.056
HCO3-	5.647e-10	3.890e-10	-9.248	-9.410	-0.162
MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152
NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
CO3-2	3.193e-19	7.194e-20	-18.496	-19.143	-0.647
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162
NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
Ca	2.478e-02				
Ca+2	2.478e-02	7.547e-03	-1.606	-2.122	-0.516
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152

CaOH+	5.963e-15	4.201e-15	-14.225	-14.377	-0.152
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
CaSO4	4.089e-31	4.652e-31	-30.388	-30.332	0.056
Cl	4.996e-01				
Cl-	4.995e-01	3.093e-01	-0.301	-0.510	-0.208
MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169
MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056
MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
CrOHCl2	1.809e-16	2.058e-16	-15.743	-15.687	0.056
ZnOHCl	1.610e-17	1.832e-17	-16.793	-16.737	0.056
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
CrO3Cl-	0.000e+00	0.000e+00	-74.594	-74.724	-0.131
Cr(2)	1.575e-16				
Cr+2	1.575e-16	4.733e-17	-15.803	-16.325	-0.522
Cr(3)	9.176e-08				
Cr+3	8.924e-08	5.971e-09	-7.049	-8.224	-1.175
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
Cr(OH)+2	3.251e-12	9.772e-13	-11.488	-12.010	-0.522
CrOHCl2	1.809e-16	2.058e-16	-15.743	-15.687	0.056
Cr(OH)2+	1.514e-17	1.121e-17	-16.820	-16.950	-0.131
Cr(OH)3	3.495e-24	3.976e-24	-23.456	-23.401	0.056
CrO2-	6.432e-34	4.763e-34	-33.192	-33.322	-0.131
Cr(OH)4-	2.453e-34	1.816e-34	-33.610	-33.741	-0.131
CrSO4+	3.916e-38	2.900e-38	-37.407	-37.538	-0.131
CrOHSO4	1.271e-40	1.446e-40	-39.896	-39.840	0.056
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-49.068	-49.590	-0.522
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.573	-56.704	-0.131
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.754	-60.276	-0.522
Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-81.758	-81.703	0.056
CrNO3+2	0.000e+00	0.000e+00	-122.414	-122.936	-0.522
Cr(6)	0.000e+00				
HCrO4-	0.000e+00	0.000e+00	-74.225	-74.355	-0.131
CrO3Cl-	0.000e+00	0.000e+00	-74.594	-74.724	-0.131
H2CrO4	0.000e+00	0.000e+00	-75.935	-75.879	0.056
CrO4-2	0.000e+00	0.000e+00	-79.397	-80.157	-0.759
NaCrO4-	0.000e+00	0.000e+00	-80.475	-80.605	-0.131
KCrO4-	0.000e+00	0.000e+00	-81.553	-81.684	-0.131



CrO3SO4-2	0.000e+00	0.000e+00	-102.493	-103.015	-0.522
Cr2O7-2	0.000e+00	0.000e+00	-146.531	-147.053	-0.522
H(0)	1.355e-06				
H2	6.776e-07	7.708e-07	-6.169	-6.113	0.056
K	7.619e-03				
K+	7.619e-03	4.718e-03	-2.118	-2.326	-0.208
KSO4-	1.336e-32	9.205e-33	-31.874	-32.036	-0.162
KCrO4-	0.000e+00	0.000e+00	-81.553	-81.684	-0.131
Mg	3.533e-02				
Mg+2	3.533e-02	1.203e-02	-1.452	-1.920	-0.468
MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190
MgOH+	5.820e-14	4.168e-14	-13.235	-13.380	-0.145
MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056
MgSO4	5.711e-31	6.496e-31	-30.243	-30.187	0.056
Mn(2)	2.479e-04				
Mn+2	1.672e-04	4.116e-05	-3.777	-4.386	-0.609
MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169
MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056
MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169
MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169
MnOH+	3.468e-15	2.351e-15	-14.460	-14.629	-0.169
MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056
MnSO4	1.919e-33	2.183e-33	-32.717	-32.661	0.056
Mn(OH)3-	1.053e-37	7.140e-38	-36.977	-37.146	-0.169
MnSeO4	0.000e+00	0.000e+00	-74.982	-74.926	0.056
Mn(NO3)2	0.000e+00	0.000e+00	-230.226	-230.170	0.056
Mn(3)	3.749e-28				
Mn+3	3.749e-28	3.298e-29	-27.426	-28.482	-1.056
Mn(6)	0.000e+00				
MnO4-2	0.000e+00	0.000e+00	-116.893	-117.569	-0.676
Mn(7)	0.000e+00				
MnO4-	0.000e+00	0.000e+00	-126.536	-126.753	-0.217
N(-3)	1.181e-03				
NH4+	1.181e-03	6.904e-04	-2.928	-3.161	-0.233
NH3	8.646e-13	9.835e-13	-12.063	-12.007	0.056
NH4SO4-	4.294e-33	2.910e-33	-32.367	-32.536	-0.169
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.573	-56.704	-0.131
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.754	-60.276	-0.522
Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
N(3)	0.000e+00				
NO2-	0.000e+00	0.000e+00	-86.481	-86.611	-0.131
N(5)	0.000e+00				
NO3-	0.000e+00	0.000e+00	-112.980	-113.197	-0.217
CrNO3+2	0.000e+00	0.000e+00	-122.414	-122.936	-0.522
Mn(NO3)2	0.000e+00	0.000e+00	-230.226	-230.170	0.056
Na	1.006e-01				
Na+	1.006e-01	7.161e-02	-0.997	-1.145	-0.148

NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162
NaSO4-	1.606e-31	1.106e-31	-30.794	-30.956	-0.162
NaCrO4-	0.000e+00	0.000e+00	-80.475	-80.605	-0.131
Ni	2.005e-09				
Ni+2	1.298e-09	3.901e-10	-8.887	-9.409	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
NiOH+	1.796e-19	1.330e-19	-18.746	-18.876	-0.131
NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
Ni(OH)2	7.847e-28	8.927e-28	-27.105	-27.049	0.056
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Ni(OH)3-	5.767e-38	4.270e-38	-37.239	-37.370	-0.131
NiSO4	2.018e-38	2.296e-38	-37.695	-37.639	0.056
Ni(SO4)2-2	0.000e+00	0.000e+00	-68.837	-69.359	-0.522
NiSeO4	0.000e+00	0.000e+00	-79.787	-79.731	0.056
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-83.260	-83.204	0.056
S(-2)	1.663e-02				
H2S	1.663e-02	1.891e-02	-1.779	-1.723	0.056
HS-	1.244e-08	7.808e-09	-7.905	-8.107	-0.202
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
S5-2	1.956e-17	5.879e-18	-16.709	-17.231	-0.522
S6-2	1.661e-17	4.993e-18	-16.780	-17.302	-0.522
S4-2	1.117e-17	3.358e-18	-16.952	-17.474	-0.522
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
S-2	1.141e-20	2.407e-21	-19.943	-20.618	-0.676
S3-2	3.792e-21	1.140e-21	-20.421	-20.943	-0.522
S2-2	2.040e-22	6.134e-23	-21.690	-22.212	-0.522
S(6)	1.082e-29				
HSO4-	7.680e-30	5.089e-30	-29.115	-29.293	-0.179
SO4-2	1.979e-30	3.272e-31	-29.704	-30.485	-0.782
MgSO4	5.711e-31	6.496e-31	-30.243	-30.187	0.056
CaSO4	4.089e-31	4.652e-31	-30.388	-30.332	0.056
NaSO4-	1.606e-31	1.106e-31	-30.794	-30.956	-0.162
KSO4-	1.336e-32	9.205e-33	-31.874	-32.036	-0.162
NH4SO4-	4.294e-33	2.910e-33	-32.367	-32.536	-0.169
MnSO4	1.919e-33	2.183e-33	-32.717	-32.661	0.056
AlSO4+	6.343e-35	4.203e-35	-34.198	-34.376	-0.179
CrSO4+	3.916e-38	2.900e-38	-37.407	-37.538	-0.131
ZnSO4	2.345e-38	2.668e-38	-37.630	-37.574	0.056
NiSO4	2.018e-38	2.296e-38	-37.695	-37.639	0.056
CrOHSO4	1.271e-40	1.446e-40	-39.896	-39.840	0.056
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-49.068	-49.590	-0.522
Al(SO4)2-	0.000e+00	0.000e+00	-62.799	-62.978	-0.179
Zn(SO4)2-2	0.000e+00	0.000e+00	-66.595	-67.117	-0.522
Ni(SO4)2-2	0.000e+00	0.000e+00	-68.837	-69.359	-0.522

Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-81.758	-81.703	0.056
CrO3SO4-2	0.000e+00	0.000e+00	-102.493	-103.015	-0.522
Se(-2)	1.310e-08				
H2Se	1.308e-08	1.488e-08	-7.883	-7.827	0.056
HSe-	1.574e-11	1.165e-11	-10.803	-10.934	-0.131
MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056
Se-2	1.139e-25	3.423e-26	-24.944	-25.466	-0.522
Se(4)	0.000e+00				
SeO3-2	0.000e+00	0.000e+00	-46.432	-46.954	-0.522
Se(6)	5.550e-38				
H2SeO3	5.450e-38	6.200e-38	-37.264	-37.208	0.056
HSeO3-	9.973e-40	7.384e-40	-39.001	-39.132	-0.131
HSeO4-	0.000e+00	0.000e+00	-71.627	-71.758	-0.131
SeO4-2	0.000e+00	0.000e+00	-72.120	-72.880	-0.759
MnSeO4	0.000e+00	0.000e+00	-74.982	-74.926	0.056
NiSeO4	0.000e+00	0.000e+00	-79.787	-79.731	0.056
ZnSeO4	0.000e+00	0.000e+00	-80.161	-80.105	0.056
Zn(SeO4)2-2	0.000e+00	0.000e+00	-154.735	-155.257	-0.522
Zn	1.958e-09				
Zn+2	1.519e-09	3.740e-10	-8.819	-9.427	-0.609
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
ZnOHCl	1.610e-17	1.832e-17	-16.793	-16.737	0.056
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
ZnOH+	1.298e-18	9.609e-19	-17.887	-18.017	-0.131
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Zn(OH)2	9.491e-26	1.080e-25	-25.023	-24.967	0.056
Zn(OH)3-	2.206e-36	1.633e-36	-35.656	-35.787	-0.131
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
ZnSO4	2.345e-38	2.668e-38	-37.630	-37.574	0.056
Zn(OH)4-2	0.000e+00	0.000e+00	-47.385	-47.907	-0.522
Zn(SO4)2-2	0.000e+00	0.000e+00	-66.595	-67.117	-0.522
ZnSeO4	0.000e+00	0.000e+00	-80.161	-80.105	0.056
Zn(SeO4)2-2	0.000e+00	0.000e+00	-154.735	-155.257	-0.522

-----Saturation indices-----

Phase	SI	log IAP	log KT	
(NH4)2CrO4	-86.83	-16.72	70.11	(NH4)2CrO4
Al(OH)3(a)	-15.83	-4.82	11.01	Al(OH)3
Al2O3	-32.60	-9.62	22.98	Al2O3
Al4(OH)10SO4	-73.83	-16.08	57.75	Al4(OH)10SO4
AlAsO4:2H2O	-34.54	-9.60	24.94	AlAsO4:2H2O

AlOHSO4	-33.44	-1.62	31.82	AlOHSO4
AlumK	-64.91	-0.14	64.76	KAl(SO4)2·12H2O
Alunite	-78.37	-9.70	68.67	KAl3(SO4)2(OH)6
Anhydrite	-28.06	2.44	30.50	CaSO4
Aragonite	-12.98	-21.27	-8.28	CaCO3
Arsenolite	-27.95	-31.08	-3.13	As4O6
Artinite	-31.91	-21.64	10.26	MgCO3:Mg(OH)2:3H2O
As2O5	-56.65	-9.55	47.10	As2O5
Ba3(AsO4)2	-55.77	-24.46	31.31	Ba3(AsO4)2
BaCrO4	-76.68	-16.74	59.94	BaCrO4
Barite	-26.70	-1.77	24.93	BaSO4
BaSeO3	-49.09	-7.59	41.50	BaSeO3
BaSeO4	-73.98	-4.60	69.38	BaSeO4
Bianchite	-38.19	-4.90	33.29	ZnSO4:6H2O
Birnessite	-43.02	-0.02	43.00	MnO2
Bixbyite	-52.61	-3.04	49.56	Mn2O3
Boehmite	-14.04	-4.82	9.23	AlOOH
Brucite	-17.95	-0.56	17.39	Mg(OH)2
Bunsenite	-21.05	-8.04	13.00	NiO
Ca3(AsO4)2·6H2O	-74.43	-11.86	62.58	Ca3(AsO4)2·6H2O
CaCrO4	-80.16	-12.52	67.64	CaCrO4
Calcite	-12.84	-21.27	-8.43	CaCO3
CaSeO3·2H2O	-43.50	-3.39	40.11	CaSeO3·2H2O
CaSeO4·2H2O	-72.05	-0.40	71.65	CaSeO4·2H2O
CH4(g)	9.00	-32.51	-41.51	CH4
Claudetite	-27.71	-31.08	-3.37	As4O6
CO2(g)	-2.34	-20.51	-18.17	CO2
Cr(OH)2	-25.98	-17.77	8.22	Cr(OH)2
Cr(OH)3(A)	-15.52	-16.27	-0.75	Cr(OH)3
Cr(OH)3(C)	-18.14	-16.27	1.87	Cr(OH)3
Cr2O3	-29.41	-32.52	-3.11	Cr2O3
CrCl2	-33.67	-20.14	13.52	CrCl2
CrCl3	-33.98	-19.84	14.14	CrCl3
CrMetal	-50.99	-20.75	30.24	Cr
CrO3	-78.34	-11.76	66.58	CrO3
Diaspore	-12.26	-4.82	7.44	AlOOH
Dolomite	-25.52	-42.33	-16.81	CaMg(CO3)2
Epsomite	-30.25	2.60	32.85	MgSO4·7H2O
Gibbsite(C)	-14.12	-4.82	9.30	Al(OH)3
Goslarite	-37.93	-4.91	33.01	ZnSO4·7H2O
Gypsum	-27.77	2.43	30.20	CaSO4·2H2O
Halite	-3.22	-1.65	1.56	NaCl
Hausmannite	-69.45	-6.06	63.39	Mn3O4
Huntite	-55.08	-84.45	-29.37	CaMg3(CO3)4
Hydromagnesite	-77.28	-84.84	-7.56	Mg5(CO3)4(OH)2·4H2O
K2Cr2O7	-150.24	-26.82	123.43	K2Cr2O7
K2CrO4	-84.72	-15.05	69.67	K2CrO4
Lime	-34.62	-0.76	33.87	CaO

Magnesite	-13.18	-21.06	-7.89	MgCO <sub>3</sub>
Manganite	-26.20	-1.52	24.67	MnOOH
MgCr <sub>2</sub> O <sub>4</sub>	-46.07	-33.07	13.00	MgCr <sub>2</sub> O <sub>4</sub>
MgCrO <sub>4</sub>	-87.95	-12.32	75.63	MgCrO <sub>4</sub>
MgSeO <sub>3</sub> :6H <sub>2</sub> O	-44.41	-3.22	41.19	MgSeO <sub>3</sub> :6H <sub>2</sub> O
Millerite	-8.73	-16.83	-8.10	NiS
Mirabilite	-31.29	2.20	33.50	Na <sub>2</sub> SO <sub>4</sub> :10H <sub>2</sub> O
Mn <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>	-143.61	6.56	150.17	Mn <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>
Mn <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-71.44	-18.66	52.78	Mn <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
MnCl <sub>2</sub> :4H <sub>2</sub> O	-7.74	-5.43	2.31	MnCl <sub>2</sub> :4H <sub>2</sub> O
MnS(Green)	-15.74	-11.81	3.93	MnS
MnSe	-20.29	-14.63	5.66	MnSe
MnSeO <sub>3</sub>	-44.04	-5.64	38.40	MnSeO <sub>3</sub>
MnSeO <sub>3</sub> :2H <sub>2</sub> O	-43.78	-5.66	38.12	MnSeO <sub>3</sub> :2H <sub>2</sub> O
MnSO <sub>4</sub>	-37.90	0.18	38.08	MnSO <sub>4</sub>
Morenosite	-37.52	-4.89	32.62	NiSO <sub>4</sub> :7H <sub>2</sub> O
Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-153.95	-24.45	129.50	Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
Na <sub>2</sub> CrO <sub>4</sub>	-85.82	-12.69	73.13	Na <sub>2</sub> CrO <sub>4</sub>
Natron	-19.83	-21.50	-1.68	Na <sub>2</sub> CO <sub>3</sub> :10H <sub>2</sub> O
Nesquehonite	-15.60	-21.08	-5.49	MgCO <sub>3</sub> :3H <sub>2</sub> O
Ni(OH) <sub>2</sub>	-18.15	-8.05	10.10	Ni(OH) <sub>2</sub>
Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O	-89.71	-33.73	55.98	Ni <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :8H <sub>2</sub> O
Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>	-96.04	-28.99	67.05	Ni <sub>4</sub> (OH) <sub>6</sub> SO <sub>4</sub>
NiCO <sub>3</sub>	-21.94	-28.55	-6.61	NiCO <sub>3</sub>
NiSe	-1.92	-19.66	-17.74	NiSe
NiSeO <sub>3</sub> :2H <sub>2</sub> O	-50.85	-10.68	40.17	NiSeO <sub>3</sub> :2H <sub>2</sub> O
Nsutite	-42.44	-0.02	42.42	MnO <sub>2</sub>
O <sub>2</sub> (g)	-80.22	5.99	86.22	O <sub>2</sub>
Oripment	20.98	-41.90	-62.89	As <sub>2</sub> S <sub>3</sub>
Periclase	-22.90	-0.55	22.35	MgO
Portlandite	-24.15	-0.76	23.38	Ca(OH) <sub>2</sub>
Pyrocroite	-18.64	-3.03	15.61	Mn(OH) <sub>2</sub>
Pyrolusite	-41.47	-0.02	41.45	MnO <sub>2</sub>
Realgar	2.40	-18.06	-20.45	As <sub>2</sub> S <sub>3</sub>
Retgersite	-37.87	-4.89	32.99	NiSO <sub>4</sub> :6H <sub>2</sub> O
Rhodochrosite	-13.17	-23.53	-10.36	MnCO <sub>3</sub>
Se(A)	-1.45	-8.62	-7.17	Se
Se(hex)	-0.83	-8.62	-7.78	Se
SeO <sub>2</sub>	-39.93	-2.62	37.30	SeO <sub>2</sub>
SeO <sub>3</sub>	-96.10	0.37	96.47	SeO <sub>3</sub>
Smithsonite	-18.67	-28.57	-9.90	ZnCO <sub>3</sub>
Sphalerite	-5.04	-16.85	-11.81	ZnS
Spinel	-48.57	-10.18	38.39	MgAl <sub>2</sub> O <sub>4</sub>
SULFUR	-3.78	-5.79	-2.01	S
Thenardite	-32.61	2.28	34.89	Na <sub>2</sub> SO <sub>4</sub>
Thermonatrite	-21.63	-21.44	0.19	Na <sub>2</sub> CO <sub>3</sub> :H <sub>2</sub> O
Witherite	-16.89	-25.48	-8.59	BaCO <sub>3</sub>
Wurtzite	-7.05	-16.85	-9.80	ZnS

Zincite -19.71 -8.06 11.65 ZnO  
Zincosite -43.37 -4.86 38.51 ZnSO4  
Zn(BO2)2 -23.93 -15.64 8.29 Zn(BO2)2  
Zn(NO3)2:6H2O -239.18 10.94 250.12 Zn(NO3)2:6H2O  
Zn(OH)2(A) -20.52 -8.07 12.45 Zn(OH)2  
Zn(OH)2(B) -19.82 -8.07 11.75 Zn(OH)2  
Zn(OH)2(C) -20.27 -8.07 12.20 Zn(OH)2  
Zn(OH)2(E) -19.57 -8.07 11.50 Zn(OH)2  
Zn(OH)2(G) -19.78 -8.07 11.71 Zn(OH)2  
Zn2(OH)2SO4 -55.48 -12.93 42.55 Zn2(OH)2SO4  
Zn2(OH)3Cl -32.52 -17.32 15.20 Zn2(OH)3Cl  
Zn3(AsO4)2:2.5H2O -87.67 -33.75 53.93 Zn3(AsO4)2:2.5H2O  
Zn3O(SO4)2 -108.34 -17.78 90.56 Zn3O(SO4)2  
Zn4(OH)6SO4 -92.52 -29.06 63.45 Zn4(OH)6SO4  
Zn5(OH)8Cl2 -81.22 -42.72 38.50 Zn5(OH)8Cl2  
ZnCl2 -17.88 -10.45 7.43 ZnCl2  
ZnCO3:H2O -18.32 -28.58 -10.26 ZnCO3:H2O  
ZnMetal -37.66 -11.06 26.61 Zn  
ZnO(Active) -19.37 -8.06 11.31 ZnO  
ZnS(A) -7.71 -16.85 -9.14 ZnS  
ZnSe -8.16 -19.67 -11.51 ZnSe  
ZnSO4:H2O -39.60 -4.87 34.73 ZnSO4:H2O

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a Low  
SOLUTION 1  
pH 6.90 charge  
temp 15.88  
pe 1.63  
units mg/L  
Al 0.0412  
As 0.00233 as H3AsO4  
Ba 0.292  
B 1.470  
Ca 970  
C 8.62  
Cl 17300  
Cr 0.00466  
Mg 839  
Mn 13.300 as Mn+2  
Ni 0.000115  
N 20.8 as NH4+  
K 291  
Se 0.00101  
Na 2260  
S 1560 as SO4-2  
Zn 0.000125

END

-----  
TITLE  
-----

BH301a Low  
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Beginning of initial solution calculations.

-----  
Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.563e-06	1.563e-06
As	1.681e-08	1.681e-08
B	1.392e-04	1.392e-04
Ba	2.177e-06	2.177e-06
C	1.446e-04	1.446e-04
Ca	2.478e-02	2.478e-02
Cl	4.996e-01	4.996e-01
Cr	9.176e-08	9.176e-08
K	7.619e-03	7.619e-03
Mg	3.533e-02	3.533e-02
Mn	2.479e-04	2.479e-04
N	1.181e-03	1.181e-03
Na	1.006e-01	1.006e-01
Ni	2.005e-09	2.005e-09
S	1.663e-02	1.663e-02
Se	1.310e-08	1.310e-08
Zn	1.958e-09	1.958e-09

-----Description of solution-----

pH = 0.687    Charge balance  
pe = 1.630  
Activity of water = 0.984  
Ionic strength = 5.598e-01  
Mass of water (kg) = 1.000e+00  
Total alkalinity (eq/kg) = -2.694e-01  
Total CO2 (mol/kg) = 1.446e-04  
Temperature (deg C) = 15.880  
Electrical balance (eq) = 5.224e-17  
Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|) = 0.00$   
Iterations = 18  
Total H = 1.113205e+02  
Total O = 5.550707e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
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H+	2.694e-01	2.057e-01	-0.570	-0.687	-0.117
OH-	3.762e-14	2.361e-14	-13.425	-13.627	-0.202
H2O	5.551e+01	9.838e-01	-0.007	-0.007	0.000
Al	1.563e-06				
Al+3	1.563e-06	1.375e-07	-5.806	-6.862	-1.056
AlOH+2	1.585e-11	3.572e-12	-10.800	-11.447	-0.647
Al(OH)2+	3.628e-16	2.500e-16	-15.440	-15.602	-0.162
Al(OH)3	1.323e-21	1.505e-21	-20.878	-20.822	0.056
AlSO4+	2.100e-28	1.392e-28	-27.678	-27.856	-0.179
Al(OH)4-	1.040e-28	6.892e-29	-27.983	-28.162	-0.179
Al(SO4)2-	0.000e+00	0.000e+00	-49.759	-49.938	-0.179
As(3)	1.681e-08				
H3AsO3	1.453e-08	1.653e-08	-7.838	-7.782	0.056
H4AsO3+	2.275e-09	1.684e-09	-8.643	-8.774	-0.131
H2AsO3-	4.528e-17	3.353e-17	-16.344	-16.475	-0.131
HAsO3-2	2.855e-28	8.582e-29	-27.544	-28.066	-0.522
AsO3-3	1.742e-40	0.000e+00	-39.759	-40.934	-1.175
As(5)	4.683e-24				
H3AsO4	4.474e-24	5.090e-24	-23.349	-23.293	0.056
H2AsO4-	2.090e-25	1.547e-25	-24.680	-24.810	-0.131
HAsO4-2	4.194e-31	1.261e-31	-30.377	-30.899	-0.522
AsO4-3	0.000e+00	0.000e+00	-40.735	-41.909	-1.175
B	1.392e-04				
H3BO3	1.392e-04	1.584e-04	-3.856	-3.800	0.056
H2BO3-	6.379e-13	3.730e-13	-12.195	-12.428	-0.233
Ba	2.177e-06				
Ba+2	2.177e-06	4.594e-07	-5.662	-6.338	-0.676
BaOH+	6.363e-20	4.313e-20	-19.196	-19.365	-0.169
C(4)	1.446e-04				
H2CO3	1.446e-04	1.645e-04	-3.840	-3.784	0.056
HCO3-	5.647e-10	3.890e-10	-9.248	-9.410	-0.162
MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152
NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
CO3-2	3.193e-19	7.194e-20	-18.496	-19.143	-0.647
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162
NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
Ca	2.478e-02				
Ca+2	2.478e-02	7.547e-03	-1.606	-2.122	-0.516
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152

CaOH+	5.963e-15	4.201e-15	-14.225	-14.377	-0.152
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
CaSO4	1.354e-24	1.540e-24	-23.868	-23.812	0.056
Cl	4.996e-01				
Cl-	4.995e-01	3.093e-01	-0.301	-0.510	-0.208
MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169
MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056
MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
CrOHCl2	1.809e-16	2.058e-16	-15.743	-15.687	0.056
ZnOHCl	1.610e-17	1.832e-17	-16.793	-16.737	0.056
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
CrO3Cl-	0.000e+00	0.000e+00	-72.149	-72.279	-0.131
Cr(2)	2.411e-17				
Cr+2	2.411e-17	7.247e-18	-16.618	-17.140	-0.522
Cr(3)	9.176e-08				
Cr+3	8.924e-08	5.971e-09	-7.049	-8.224	-1.175
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
Cr(OH)+2	3.251e-12	9.772e-13	-11.488	-12.010	-0.522
CrOHCl2	1.809e-16	2.058e-16	-15.743	-15.687	0.056
Cr(OH)2+	1.514e-17	1.121e-17	-16.820	-16.950	-0.131
Cr(OH)3	3.495e-24	3.976e-24	-23.456	-23.401	0.056
CrSO4+	1.297e-31	9.602e-32	-30.887	-31.018	-0.131
CrO2-	6.432e-34	4.763e-34	-33.192	-33.322	-0.131
CrOHSO4	4.210e-34	4.789e-34	-33.376	-33.320	0.056
Cr(OH)4-	2.453e-34	1.816e-34	-33.610	-33.741	-0.131
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-42.548	-43.070	-0.522
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.573	-56.704	-0.131
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.754	-60.276	-0.522
Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-68.718	-68.663	0.056
CrNO3+2	0.000e+00	0.000e+00	-115.894	-116.416	-0.522
Cr(6)	0.000e+00				
HCrO4-	0.000e+00	0.000e+00	-71.780	-71.910	-0.131
CrO3Cl-	0.000e+00	0.000e+00	-72.149	-72.279	-0.131
H2CrO4	0.000e+00	0.000e+00	-73.490	-73.434	0.056
CrO4-2	0.000e+00	0.000e+00	-76.952	-77.712	-0.759
NaCrO4-	0.000e+00	0.000e+00	-78.030	-78.160	-0.131
KCrO4-	0.000e+00	0.000e+00	-79.108	-79.239	-0.131

CrO3SO4-2	0.000e+00	0.000e+00	-93.528	-94.050	-0.522
Cr2O7-2	0.000e+00	0.000e+00	-141.641	-142.163	-0.522
H(0)	3.177e-08				
H2	1.589e-08	1.807e-08	-7.799	-7.743	0.056
K	7.619e-03				
K+	7.619e-03	4.718e-03	-2.118	-2.326	-0.208
KSO4-	4.424e-26	3.048e-26	-25.354	-25.516	-0.162
KCrO4-	0.000e+00	0.000e+00	-79.108	-79.239	-0.131
Mg	3.533e-02				
Mg+2	3.533e-02	1.203e-02	-1.452	-1.920	-0.468
MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190
MgOH+	5.820e-14	4.168e-14	-13.235	-13.380	-0.145
MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056
MgSO4	1.891e-24	2.151e-24	-23.723	-23.667	0.056
Mn(2)	2.479e-04				
Mn+2	1.672e-04	4.116e-05	-3.777	-4.386	-0.609
MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169
MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056
MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169
MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169
MnOH+	3.468e-15	2.351e-15	-14.460	-14.629	-0.169
MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056
MnSO4	6.356e-27	7.230e-27	-26.197	-26.141	0.056
Mn(OH)3-	1.053e-37	7.140e-38	-36.977	-37.146	-0.169
MnSeO4	0.000e+00	0.000e+00	-68.462	-68.406	0.056
Mn(NO3)2	0.000e+00	0.000e+00	-217.186	-217.130	0.056
Mn(3)	2.448e-27				
Mn+3	2.448e-27	2.154e-28	-26.611	-27.667	-1.056
Mn(6)	0.000e+00				
MnO4-2	0.000e+00	0.000e+00	-113.633	-114.309	-0.676
Mn(7)	0.000e+00				
MnO4-	0.000e+00	0.000e+00	-122.461	-122.678	-0.217
N(-3)	1.181e-03				
NH4+	1.181e-03	6.904e-04	-2.928	-3.161	-0.233
NH3	8.646e-13	9.835e-13	-12.063	-12.007	0.056
NH4SO4-	1.422e-26	9.636e-27	-25.847	-26.016	-0.169
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.573	-56.704	-0.131
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.754	-60.276	-0.522
Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
N(3)	0.000e+00				
NO2-	0.000e+00	0.000e+00	-81.591	-81.721	-0.131
N(5)	0.000e+00				
NO3-	0.000e+00	0.000e+00	-106.460	-106.677	-0.217
CrNO3+2	0.000e+00	0.000e+00	-115.894	-116.416	-0.522
Mn(NO3)2	0.000e+00	0.000e+00	-217.186	-217.130	0.056
Na	1.006e-01				
Na+	1.006e-01	7.161e-02	-0.997	-1.145	-0.148

NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162
NaSO4-	5.318e-25	3.664e-25	-24.274	-24.436	-0.162
NaCrO4-	0.000e+00	0.000e+00	-78.030	-78.160	-0.131
Ni	2.005e-09				
Ni+2	1.298e-09	3.901e-10	-8.887	-9.409	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
NiOH+	1.796e-19	1.330e-19	-18.746	-18.876	-0.131
NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
Ni(OH)2	7.847e-28	8.927e-28	-27.105	-27.049	0.056
NiSO4	6.682e-32	7.602e-32	-31.175	-31.119	0.056
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Ni(OH)3-	5.767e-38	4.270e-38	-37.239	-37.370	-0.131
Ni(SO4)2-2	0.000e+00	0.000e+00	-55.797	-56.319	-0.522
NiSeO4	0.000e+00	0.000e+00	-73.267	-73.211	0.056
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-80.000	-79.944	0.056
S(-2)	1.663e-02				
H2S	1.663e-02	1.891e-02	-1.779	-1.723	0.056
HS-	1.244e-08	7.808e-09	-7.905	-8.107	-0.202
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
S5-2	1.956e-17	5.879e-18	-16.709	-17.231	-0.522
S6-2	1.661e-17	4.993e-18	-16.780	-17.302	-0.522
S4-2	1.117e-17	3.358e-18	-16.952	-17.474	-0.522
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
S-2	1.141e-20	2.407e-21	-19.943	-20.618	-0.676
S3-2	3.792e-21	1.140e-21	-20.421	-20.943	-0.522
S2-2	2.040e-22	6.134e-23	-21.690	-22.212	-0.522
S(6)	3.583e-23				
HSO4-	2.543e-23	1.685e-23	-22.595	-22.773	-0.179
SO4-2	6.553e-24	1.084e-24	-23.184	-23.965	-0.782
MgSO4	1.891e-24	2.151e-24	-23.723	-23.667	0.056
CaSO4	1.354e-24	1.540e-24	-23.868	-23.812	0.056
NaSO4-	5.318e-25	3.664e-25	-24.274	-24.436	-0.162
KSO4-	4.424e-26	3.048e-26	-25.354	-25.516	-0.162
NH4SO4-	1.422e-26	9.636e-27	-25.847	-26.016	-0.169
MnSO4	6.356e-27	7.230e-27	-26.197	-26.141	0.056
AlSO4+	2.100e-28	1.392e-28	-27.678	-27.856	-0.179
CrSO4+	1.297e-31	9.602e-32	-30.887	-31.018	-0.131
ZnSO4	7.767e-32	8.835e-32	-31.110	-31.054	0.056
NiSO4	6.682e-32	7.602e-32	-31.175	-31.119	0.056
CrOHSO4	4.210e-34	4.789e-34	-33.376	-33.320	0.056
Cr2(OH)2SO4+2	0.000e+00	0.000e+00	-42.548	-43.070	-0.522
Al(SO4)2-	0.000e+00	0.000e+00	-49.759	-49.938	-0.179
Zn(SO4)2-2	0.000e+00	0.000e+00	-53.555	-54.077	-0.522
Ni(SO4)2-2	0.000e+00	0.000e+00	-55.797	-56.319	-0.522

Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-68.718	-68.663	0.056
CrO3SO4-2	0.000e+00	0.000e+00	-93.528	-94.050	-0.522
Se(-2)	1.310e-08				
H2Se	1.308e-08	1.488e-08	-7.883	-7.827	0.056
HSe-	1.574e-11	1.165e-11	-10.803	-10.934	-0.131
MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056
Se-2	1.139e-25	3.423e-26	-24.944	-25.466	-0.522
Se(4)	0.000e+00				
SeO3-2	0.000e+00	0.000e+00	-41.542	-42.064	-0.522
Se(6)	4.308e-33				
H2SeO3	4.230e-33	4.812e-33	-32.374	-32.318	0.056
HSeO3-	7.741e-35	5.732e-35	-34.111	-34.242	-0.131
HSeO4-	0.000e+00	0.000e+00	-65.107	-65.238	-0.131
SeO4-2	0.000e+00	0.000e+00	-65.600	-66.360	-0.759
MnSeO4	0.000e+00	0.000e+00	-68.462	-68.406	0.056
NiSeO4	0.000e+00	0.000e+00	-73.267	-73.211	0.056
ZnSeO4	0.000e+00	0.000e+00	-73.641	-73.585	0.056
Zn(SeO4)2-2	0.000e+00	0.000e+00	-141.695	-142.217	-0.522
Zn	1.958e-09				
Zn+2	1.519e-09	3.740e-10	-8.819	-9.427	-0.609
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
ZnOHCl	1.610e-17	1.832e-17	-16.793	-16.737	0.056
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
ZnOH+	1.298e-18	9.609e-19	-17.887	-18.017	-0.131
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Zn(OH)2	9.491e-26	1.080e-25	-25.023	-24.967	0.056
ZnSO4	7.767e-32	8.835e-32	-31.110	-31.054	0.056
Zn(OH)3-	2.206e-36	1.633e-36	-35.656	-35.787	-0.131
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
Zn(OH)4-2	0.000e+00	0.000e+00	-47.385	-47.907	-0.522
Zn(SO4)2-2	0.000e+00	0.000e+00	-53.555	-54.077	-0.522
ZnSeO4	0.000e+00	0.000e+00	-73.641	-73.585	0.056
Zn(SeO4)2-2	0.000e+00	0.000e+00	-141.695	-142.217	-0.522

-----Saturation indices-----

Phase	SI	log IAP	log KT	
(NH4)2CrO4	-84.39	-14.28	70.11	(NH4)2CrO4
Al(OH)3(a)	-15.83	-4.82	11.01	Al(OH)3
Al2O3	-32.60	-9.62	22.98	Al2O3
Al4(OH)10SO4	-67.31	-9.56	57.75	Al4(OH)10SO4
AlAsO4:2H2O	-32.91	-7.97	24.94	AlAsO4:2H2O

AlOHSO4	-26.92	4.90	31.82	AlOHSO4
AlumK	-51.87	12.90	64.76	KAl(SO4)2:12H2O
Alunite	-65.33	3.34	68.67	KAl3(SO4)2(OH)6
Anhydrite	-21.54	8.96	30.50	CaSO4
Aragonite	-12.98	-21.27	-8.28	CaCO3
Arsenolite	-27.95	-31.08	-3.13	As4O6
Artinite	-31.91	-21.64	10.26	MgCO3:Mg(OH)2:3H2O
As2O5	-53.39	-6.29	47.10	As2O5
Ba3(AsO4)2	-52.51	-21.20	31.31	Ba3(AsO4)2
BaCrO4	-74.23	-14.29	59.94	BaCrO4
Barite	-20.18	4.75	24.93	BaSO4
BaSeO3	-44.20	-2.70	41.50	BaSeO3
BaSeO4	-67.46	1.92	69.38	BaSeO4
Bianchite	-31.67	1.62	33.29	ZnSO4:6H2O
Birnessite	-41.39	1.61	43.00	MnO2
Bixbyite	-50.98	-1.41	49.56	Mn2O3
Boehmite	-14.04	-4.82	9.23	AlOOH
Brucite	-17.95	-0.56	17.39	Mg(OH)2
Bunsenite	-21.05	-8.04	13.00	NiO
Ca3(AsO4)2:6H2O	-71.17	-8.60	62.58	Ca3(AsO4)2:6H2O
CaCrO4	-77.72	-10.08	67.64	CaCrO4
Calcite	-12.84	-21.27	-8.43	CaCO3
CaSeO3:2H2O	-38.61	1.50	40.11	CaSeO3:2H2O
CaSeO4:2H2O	-65.53	6.12	71.65	CaSeO4:2H2O
CH4(g)	2.48	-39.03	-41.51	CH4
Claudetite	-27.71	-31.08	-3.37	As4O6
CO2(g)	-2.34	-20.51	-18.17	CO2
Cr(OH)2	-26.80	-18.58	8.22	Cr(OH)2
Cr(OH)3(A)	-15.52	-16.27	-0.75	Cr(OH)3
Cr(OH)3(C)	-18.14	-16.27	1.87	Cr(OH)3
Cr2O3	-29.41	-32.52	-3.11	Cr2O3
CrCl2	-34.48	-20.96	13.52	CrCl2
CrCl3	-33.98	-19.84	14.14	CrCl3
CrMetal	-53.44	-23.20	30.24	Cr
CrO3	-75.90	-9.32	66.58	CrO3
Diaspore	-12.26	-4.82	7.44	AlOOH
Dolomite	-25.52	-42.33	-16.81	CaMg(CO3)2
Epsomite	-23.73	9.12	32.85	MgSO4:7H2O
Gibbsite(C)	-14.12	-4.82	9.30	Al(OH)3
Goslarite	-31.41	1.61	33.01	ZnSO4:7H2O
Gypsum	-21.25	8.95	30.20	CaSO4:2H2O
Halite	-3.22	-1.65	1.56	NaCl
Hausmannite	-67.82	-4.43	63.39	Mn3O4
Huntite	-55.08	-84.45	-29.37	CaMg3(CO3)4
Hydromagnesite	-77.28	-84.84	-7.56	Mg5(CO3)4(OH)2:4H2O
K2Cr2O7	-145.35	-21.93	123.43	K2Cr2O7
K2CrO4	-82.27	-12.61	69.67	K2CrO4
Lime	-34.62	-0.76	33.87	CaO

Magnesite -13.18 -21.06 -7.89 MgCO<sub>3</sub>  
Manganite -25.38 -0.71 24.67 MnOOH  
MgCr<sub>2</sub>O<sub>4</sub> -46.07 -33.07 13.00 MgCr<sub>2</sub>O<sub>4</sub>  
MgCrO<sub>4</sub> -85.50 -9.87 75.63 MgCrO<sub>4</sub>  
MgSeO<sub>3</sub>:6H<sub>2</sub>O -39.52 1.67 41.19 MgSeO<sub>3</sub>:6H<sub>2</sub>O  
Millerite -8.73 -16.83 -8.10 NiS  
Mirabilite -24.77 8.72 33.50 Na<sub>2</sub>SO<sub>4</sub>:10H<sub>2</sub>O  
Mn<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> -122.42 27.75 150.17 Mn<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>  
Mn<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O -68.18 -15.40 52.78 Mn<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O  
MnCl<sub>2</sub>:4H<sub>2</sub>O -7.74 -5.43 2.31 MnCl<sub>2</sub>:4H<sub>2</sub>O  
MnS(Green) -15.74 -11.81 3.93 MnS  
MnSe -20.29 -14.63 5.66 MnSe  
MnSeO<sub>3</sub> -39.15 -0.75 38.40 MnSeO<sub>3</sub>  
MnSeO<sub>3</sub>:2H<sub>2</sub>O -38.89 -0.77 38.12 MnSeO<sub>3</sub>:2H<sub>2</sub>O  
MnSO<sub>4</sub> -31.38 6.70 38.08 MnSO<sub>4</sub>  
Morenosite -31.00 1.63 32.62 NiSO<sub>4</sub>:7H<sub>2</sub>O  
Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> -149.06 -19.56 129.50 Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>  
Na<sub>2</sub>CrO<sub>4</sub> -83.37 -10.24 73.13 Na<sub>2</sub>CrO<sub>4</sub>  
Natron -19.83 -21.50 -1.68 Na<sub>2</sub>CO<sub>3</sub>:10H<sub>2</sub>O  
Nesquehonite -15.60 -21.08 -5.49 MgCO<sub>3</sub>:3H<sub>2</sub>O  
Ni(OH)<sub>2</sub> -18.15 -8.05 10.10 Ni(OH)<sub>2</sub>  
Ni<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O -86.45 -30.47 55.98 Ni<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O  
Ni<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub> -89.52 -22.47 67.05 Ni<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub>  
NiCO<sub>3</sub> -21.94 -28.55 -6.61 NiCO<sub>3</sub>  
NiSe -1.92 -19.66 -17.74 NiSe  
NiSeO<sub>3</sub>:2H<sub>2</sub>O -45.96 -5.79 40.17 NiSeO<sub>3</sub>:2H<sub>2</sub>O  
Nsutite -40.81 1.61 42.42 MnO<sub>2</sub>  
O<sub>2</sub>(g) -76.96 9.25 86.22 O<sub>2</sub>  
Oripment 20.98 -41.90 -62.89 As<sub>2</sub>S<sub>3</sub>  
Periclase -22.90 -0.55 22.35 MgO  
Portlandite -24.15 -0.76 23.38 Ca(OH)<sub>2</sub>  
Pyrocroite -18.64 -3.03 15.61 Mn(OH)<sub>2</sub>  
Pyrolusite -39.84 1.61 41.45 MnO<sub>2</sub>  
Realgar 1.58 -18.87 -20.45 AsS  
Retgersite -31.35 1.63 32.99 NiSO<sub>4</sub>:6H<sub>2</sub>O  
Rhodochrosite -13.17 -23.53 -10.36 MnCO<sub>3</sub>  
Se(A) 0.18 -6.99 -7.17 Se  
Se(hex) 0.80 -6.99 -7.78 Se  
SeO<sub>2</sub> -35.04 2.27 37.30 SeO<sub>2</sub>  
SeO<sub>3</sub> -89.58 6.89 96.47 SeO<sub>3</sub>  
Smithsonite -18.67 -28.57 -9.90 ZnCO<sub>3</sub>  
Sphalerite -5.04 -16.85 -11.81 ZnS  
Spinel -48.57 -10.18 38.39 MgAl<sub>2</sub>O<sub>4</sub>  
SULFUR -2.15 -4.16 -2.01 S  
Thenardite -26.09 8.80 34.89 Na<sub>2</sub>SO<sub>4</sub>  
Thermonatrite -21.63 -21.44 0.19 Na<sub>2</sub>CO<sub>3</sub>:H<sub>2</sub>O  
Witherite -16.89 -25.48 -8.59 BaCO<sub>3</sub>  
Wurtzite -7.05 -16.85 -9.80 ZnS

Zincite -19.71 -8.06 11.65 ZnO  
Zincosite -36.85 1.66 38.51 ZnSO4  
Zn(BO2)2 -23.93 -15.64 8.29 Zn(BO2)2  
Zn(NO3)2:6H2O -226.14 23.98 250.12 Zn(NO3)2:6H2O  
Zn(OH)2(A) -20.52 -8.07 12.45 Zn(OH)2  
Zn(OH)2(B) -19.82 -8.07 11.75 Zn(OH)2  
Zn(OH)2(C) -20.27 -8.07 12.20 Zn(OH)2  
Zn(OH)2(E) -19.57 -8.07 11.50 Zn(OH)2  
Zn(OH)2(G) -19.78 -8.07 11.71 Zn(OH)2  
Zn2(OH)2SO4 -48.96 -6.41 42.55 Zn2(OH)2SO4  
Zn2(OH)3Cl -32.52 -17.32 15.20 Zn2(OH)3Cl  
Zn3(AsO4)2:2.5H2O -84.41 -30.49 53.93 Zn3(AsO4)2:2.5H2O  
Zn3O(SO4)2 -95.30 -4.74 90.56 Zn3O(SO4)2  
Zn4(OH)6SO4 -86.00 -22.54 63.45 Zn4(OH)6SO4  
Zn5(OH)8Cl2 -81.22 -42.72 38.50 Zn5(OH)8Cl2  
ZnCl2 -17.88 -10.45 7.43 ZnCl2  
ZnCO3:H2O -18.32 -28.58 -10.26 ZnCO3:H2O  
ZnMetal -39.29 -12.69 26.61 Zn  
ZnO(Active) -19.37 -8.06 11.31 ZnO  
ZnS(A) -7.71 -16.85 -9.14 ZnS  
ZnSe -8.16 -19.67 -11.51 ZnSe  
ZnSO4:H2O -33.08 1.65 34.73 ZnSO4:H2O

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks



Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a Low  
SOLUTION 1  
pH 6.90 charge  
temp 15.88  
pe 3.26  
units mg/L  
Al 0.0412  
As 0.00233 as H3AsO4  
Ba 0.292  
B 1.470  
Ca 970  
C 8.62  
Cl 17300  
Cr 0.00466  
Mg 839  
Mn 13.300 as Mn+2  
Ni 0.000115  
N 20.8 as NH4+  
K 291  
Se 0.00101  
Na 2260  
S 1560 as SO4-2  
Zn 0.000125

END

-----  
TITLE  
-----

BH301a Low  
-----

Beginning of initial solution calculations.

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.563e-06	1.563e-06
As	1.681e-08	1.681e-08
B	1.392e-04	1.392e-04
Ba	2.177e-06	2.177e-06
C	1.446e-04	1.446e-04
Ca	2.478e-02	2.478e-02
Cl	4.996e-01	4.996e-01
Cr	9.176e-08	9.176e-08
K	7.619e-03	7.619e-03
Mg	3.533e-02	3.533e-02
Mn	2.479e-04	2.479e-04
N	1.181e-03	1.181e-03
Na	1.006e-01	1.006e-01
Ni	2.005e-09	2.005e-09
S	1.663e-02	1.663e-02
Se	1.310e-08	1.310e-08
Zn	1.958e-09	1.958e-09

-----Description of solution-----

pH = 0.687    Charge balance  
pe = 3.260  
Activity of water = 0.984  
Ionic strength = 5.598e-01  
Mass of water (kg) = 1.000e+00  
Total alkalinity (eq/kg) = -2.694e-01  
Total CO2 (mol/kg) = 1.446e-04  
Temperature (deg C) = 15.880  
Electrical balance (eq) = 3.554e-17  
Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|) = 0.00$   
Iterations = 16  
Total H = 1.113205e+02  
Total O = 5.550707e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
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H+	2.694e-01	2.057e-01	-0.570	-0.687	-0.117
OH-	3.762e-14	2.361e-14	-13.425	-13.627	-0.202
H2O	5.551e+01	9.838e-01	-0.007	-0.007	0.000
Al	1.563e-06				
Al+3	1.563e-06	1.375e-07	-5.806	-6.862	-1.056
AlOH+2	1.585e-11	3.572e-12	-10.800	-11.447	-0.647
AlSO4+	2.303e-15	1.526e-15	-14.638	-14.816	-0.179
Al(OH)2+	3.628e-16	2.500e-16	-15.440	-15.602	-0.162
Al(OH)3	1.323e-21	1.505e-21	-20.878	-20.822	0.056
Al(SO4)2-	2.095e-24	1.388e-24	-23.679	-23.858	-0.179
Al(OH)4-	1.040e-28	6.892e-29	-27.983	-28.162	-0.179
As(3)	1.681e-08				
H3AsO3	1.453e-08	1.653e-08	-7.838	-7.782	0.056
H4AsO3+	2.275e-09	1.684e-09	-8.643	-8.774	-0.131
H2AsO3-	4.528e-17	3.353e-17	-16.344	-16.475	-0.131
HAsO3-2	2.855e-28	8.582e-29	-27.544	-28.066	-0.522
AsO3-3	1.742e-40	0.000e+00	-39.759	-40.934	-1.175
As(5)	8.522e-21				
H3AsO4	8.141e-21	9.261e-21	-20.089	-20.033	0.056
H2AsO4-	3.803e-22	2.816e-22	-21.420	-21.550	-0.131
HAsO4-2	7.633e-28	2.294e-28	-27.117	-27.639	-0.522
AsO4-3	3.353e-38	2.243e-39	-37.475	-38.649	-1.175
B	1.392e-04				
H3BO3	1.392e-04	1.584e-04	-3.856	-3.800	0.056
H2BO3-	6.379e-13	3.730e-13	-12.195	-12.428	-0.233
Ba	2.177e-06				
Ba+2	2.177e-06	4.594e-07	-5.662	-6.338	-0.676
BaOH+	6.363e-20	4.313e-20	-19.196	-19.365	-0.169
C(4)	1.446e-04				
H2CO3	1.446e-04	1.645e-04	-3.840	-3.784	0.056
HCO3-	5.647e-10	3.890e-10	-9.248	-9.410	-0.162
MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152
NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
CO3-2	3.193e-19	7.194e-20	-18.496	-19.143	-0.647
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162
NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
Ca	2.478e-02				
Ca+2	2.478e-02	7.547e-03	-1.606	-2.122	-0.516
CaHCO3+	3.266e-11	2.301e-11	-10.486	-10.638	-0.152

CaSO4	1.485e-11	1.689e-11	-10.828	-10.772	0.056
CaOH+	5.963e-15	4.201e-15	-14.225	-14.377	-0.152
CaCO3	5.681e-19	6.462e-19	-18.246	-18.190	0.056
Cl	4.996e-01				
Cl-	4.995e-01	3.093e-01	-0.301	-0.510	-0.208
MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169
MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056
MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
CrOHCl2	1.809e-16	2.058e-16	-15.743	-15.687	0.056
ZnOHCl	1.610e-17	1.832e-17	-16.793	-16.737	0.056
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
CrO3Cl-	0.000e+00	0.000e+00	-67.259	-67.389	-0.131
Cr(2)	5.652e-19				
Cr+2	5.652e-19	1.699e-19	-18.248	-18.770	-0.522
Cr(3)	9.176e-08				
Cr+3	8.924e-08	5.971e-09	-7.049	-8.224	-1.175
CrCl+2	2.461e-09	7.399e-10	-8.609	-9.131	-0.522
CrCl2+	4.746e-11	3.514e-11	-10.324	-10.454	-0.131
Cr(OH)+2	3.251e-12	9.772e-13	-11.488	-12.010	-0.522
CrOHCl2	1.809e-16	2.058e-16	-15.743	-15.687	0.056
Cr(OH)2+	1.514e-17	1.121e-17	-16.820	-16.950	-0.131
CrSO4+	1.422e-18	1.053e-18	-17.847	-17.978	-0.131
CrOHSO4	4.616e-21	5.251e-21	-20.336	-20.280	0.056
Cr(OH)3	3.495e-24	3.976e-24	-23.456	-23.401	0.056
Cr2(OH)2SO4+2	3.104e-30	9.329e-31	-29.508	-30.030	-0.522
CrO2-	6.432e-34	4.763e-34	-33.192	-33.322	-0.131
Cr(OH)4-	2.453e-34	1.816e-34	-33.610	-33.741	-0.131
Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-42.638	-42.583	0.056
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.573	-56.704	-0.131
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.754	-60.276	-0.522
Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
CrNO3+2	0.000e+00	0.000e+00	-102.854	-103.376	-0.522
Cr(6)	0.000e+00				
HCrO4-	0.000e+00	0.000e+00	-66.890	-67.020	-0.131
CrO3Cl-	0.000e+00	0.000e+00	-67.259	-67.389	-0.131
H2CrO4	0.000e+00	0.000e+00	-68.600	-68.544	0.056
CrO4-2	0.000e+00	0.000e+00	-72.062	-72.822	-0.759
NaCrO4-	0.000e+00	0.000e+00	-73.140	-73.270	-0.131
KCrO4-	0.000e+00	0.000e+00	-74.218	-74.349	-0.131

	CrO3SO4-2	0.000e+00	0.000e+00	-75.598	-76.120	-0.522
	Cr2O7-2	0.000e+00	0.000e+00	-131.861	-132.383	-0.522
H(0)	1.746e-11					
	H2	8.729e-12	9.930e-12	-11.059	-11.003	0.056
K	7.619e-03					
	K+	7.619e-03	4.718e-03	-2.118	-2.326	-0.208
	KSO4-	4.851e-13	3.342e-13	-12.314	-12.476	-0.162
	KCrO4-	0.000e+00	0.000e+00	-74.218	-74.349	-0.131
Mg	3.533e-02					
	Mg+2	3.533e-02	1.203e-02	-1.452	-1.920	-0.468
	MgHCO3+	7.876e-11	5.088e-11	-10.104	-10.293	-0.190
	MgSO4	2.073e-11	2.359e-11	-10.683	-10.627	0.056
	MgOH+	5.820e-14	4.168e-14	-13.235	-13.380	-0.145
	MgCO3	6.310e-19	7.178e-19	-18.200	-18.144	0.056
Mn(2)	2.479e-04					
	Mn+2	1.672e-04	4.116e-05	-3.777	-4.386	-0.609
	MnCl+	7.599e-05	5.151e-05	-4.119	-4.288	-0.169
	MnCl2	3.804e-06	4.327e-06	-5.420	-5.364	0.056
	MnCl3-	8.902e-07	6.034e-07	-6.051	-6.219	-0.169
	MnHCO3+	3.577e-13	2.425e-13	-12.446	-12.615	-0.169
	MnSO4	6.969e-14	7.928e-14	-13.157	-13.101	0.056
	MnOH+	3.468e-15	2.351e-15	-14.460	-14.629	-0.169
	MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056
	Mn(OH)3-	1.053e-37	7.140e-38	-36.977	-37.146	-0.169
	MnSeO4	0.000e+00	0.000e+00	-55.422	-55.366	0.056
	Mn(NO3)2	0.000e+00	0.000e+00	-191.106	-191.050	0.056
Mn(3)	1.044e-25					
	Mn+3	1.044e-25	9.189e-27	-24.981	-26.037	-1.056
Mn(6)	0.000e+00					
	MnO4-2	0.000e+00	0.000e+00	-107.113	-107.789	-0.676
Mn(7)	0.000e+00					
	MnO4-	0.000e+00	0.000e+00	-114.311	-114.528	-0.217
N(-3)	1.181e-03					
	NH4+	1.181e-03	6.904e-04	-2.928	-3.161	-0.233
	NH3	8.646e-13	9.835e-13	-12.063	-12.007	0.056
	NH4SO4-	1.559e-13	1.057e-13	-12.807	-12.976	-0.169
	Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.573	-56.704	-0.131
	Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.754	-60.276	-0.522
	Cr(NH3)6+3	0.000e+00	0.000e+00	-64.551	-65.725	-1.175
	Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-64.935	-65.457	-0.522
N(3)	0.000e+00					
	NO2-	0.000e+00	0.000e+00	-71.811	-71.941	-0.131
N(5)	0.000e+00					
	NO3-	0.000e+00	0.000e+00	-93.420	-93.637	-0.217
	CrNO3+2	0.000e+00	0.000e+00	-102.854	-103.376	-0.522
	Mn(NO3)2	0.000e+00	0.000e+00	-191.106	-191.050	0.056
Na	1.006e-01					
	Na+	1.006e-01	7.161e-02	-0.997	-1.145	-0.148

NaHCO3	1.120e-11	1.274e-11	-10.951	-10.895	0.056
NaSO4-	5.831e-12	4.017e-12	-11.234	-11.396	-0.162
NaCO3-	8.623e-20	5.941e-20	-19.064	-19.226	-0.162
NaCrO4-	0.000e+00	0.000e+00	-73.140	-73.270	-0.131
Ni	2.005e-09				
Ni+2	1.298e-09	3.901e-10	-8.887	-9.409	-0.522
NiCl+	4.084e-10	3.024e-10	-9.389	-9.519	-0.131
NiCl2	2.992e-10	3.404e-10	-9.524	-9.468	0.056
NiHCO3+	2.301e-17	1.704e-17	-16.638	-16.769	-0.131
NiSO4	7.327e-19	8.335e-19	-18.135	-18.079	0.056
NiOH+	1.796e-19	1.330e-19	-18.746	-18.876	-0.131
NiCO3	1.829e-22	2.081e-22	-21.738	-21.682	0.056
Ni(OH)2	7.847e-28	8.927e-28	-27.105	-27.049	0.056
Ni(SO4)2-2	1.918e-30	5.766e-31	-29.717	-30.239	-0.522
Ni(CO3)2-2	8.654e-38	2.601e-38	-37.063	-37.585	-0.522
Ni(OH)3-	5.767e-38	4.270e-38	-37.239	-37.370	-0.131
NiSeO4	0.000e+00	0.000e+00	-60.227	-60.171	0.056
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-73.480	-73.424	0.056
S(-2)	1.663e-02				
H2S	1.663e-02	1.891e-02	-1.779	-1.723	0.056
HS-	1.244e-08	7.808e-09	-7.905	-8.107	-0.202
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
S5-2	1.956e-17	5.879e-18	-16.709	-17.231	-0.522
S6-2	1.661e-17	4.993e-18	-16.780	-17.302	-0.522
S4-2	1.117e-17	3.358e-18	-16.952	-17.474	-0.522
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
S-2	1.141e-20	2.407e-21	-19.943	-20.618	-0.676
S3-2	3.792e-21	1.140e-21	-20.421	-20.943	-0.522
S2-2	2.040e-22	6.134e-23	-21.690	-22.212	-0.522
S(6)	3.928e-10				
HSO4-	2.789e-10	1.848e-10	-9.555	-9.733	-0.179
SO4-2	7.185e-11	1.188e-11	-10.144	-10.925	-0.782
MgSO4	2.073e-11	2.359e-11	-10.683	-10.627	0.056
CaSO4	1.485e-11	1.689e-11	-10.828	-10.772	0.056
NaSO4-	5.831e-12	4.017e-12	-11.234	-11.396	-0.162
KSO4-	4.851e-13	3.342e-13	-12.314	-12.476	-0.162
NH4SO4-	1.559e-13	1.057e-13	-12.807	-12.976	-0.169
MnSO4	6.969e-14	7.928e-14	-13.157	-13.101	0.056
AlSO4+	2.303e-15	1.526e-15	-14.638	-14.816	-0.179
CrSO4+	1.422e-18	1.053e-18	-17.847	-17.978	-0.131
ZnSO4	8.516e-19	9.687e-19	-18.070	-18.014	0.056
NiSO4	7.327e-19	8.335e-19	-18.135	-18.079	0.056
CrOHSO4	4.616e-21	5.251e-21	-20.336	-20.280	0.056
Al(SO4)2-	2.095e-24	1.388e-24	-23.679	-23.858	-0.179
Zn(SO4)2-2	3.346e-28	1.006e-28	-27.475	-27.997	-0.522
Cr2(OH)2SO4+2	3.104e-30	9.329e-31	-29.508	-30.030	-0.522
Ni(SO4)2-2	1.918e-30	5.766e-31	-29.717	-30.239	-0.522

Cr2(OH)2(SO4)2	0.000e+00	0.000e+00	-42.638	-42.583	0.056
CrO3SO4-2	0.000e+00	0.000e+00	-75.598	-76.120	-0.522
Se(-2)	1.310e-08				
H2Se	1.308e-08	1.488e-08	-7.883	-7.827	0.056
HSe-	1.574e-11	1.165e-11	-10.803	-10.934	-0.131
MnSe	3.701e-22	4.210e-22	-21.432	-21.376	0.056
Se-2	1.139e-25	3.423e-26	-24.944	-25.466	-0.522
Se(4)	1.728e-32				
SeO3-2	1.728e-32	5.195e-33	-31.762	-32.284	-0.522
Se(6)	2.596e-23				
H2SeO3	2.549e-23	2.900e-23	-22.594	-22.538	0.056
HSeO3-	4.665e-25	3.454e-25	-24.331	-24.462	-0.131
HSeO4-	0.000e+00	0.000e+00	-52.067	-52.198	-0.131
SeO4-2	0.000e+00	0.000e+00	-52.560	-53.320	-0.759
MnSeO4	0.000e+00	0.000e+00	-55.422	-55.366	0.056
NiSeO4	0.000e+00	0.000e+00	-60.227	-60.171	0.056
ZnSeO4	0.000e+00	0.000e+00	-60.601	-60.545	0.056
Zn(SeO4)2-2	0.000e+00	0.000e+00	-115.615	-116.137	-0.522
Zn	1.958e-09				
Zn+2	1.519e-09	3.740e-10	-8.819	-9.427	-0.609
ZnCl+	3.183e-10	2.056e-10	-9.497	-9.687	-0.190
ZnCl2	5.636e-11	6.412e-11	-10.249	-10.193	0.056
ZnCl3-	3.255e-11	2.103e-11	-10.487	-10.677	-0.190
Zn(HS)2	1.745e-11	1.985e-11	-10.758	-10.702	0.056
ZnCl4-2	1.430e-11	3.019e-12	-10.845	-11.520	-0.676
ZnHCO3+	1.877e-17	1.390e-17	-16.727	-16.857	-0.131
ZnOHCl	1.610e-17	1.832e-17	-16.793	-16.737	0.056
Zn(HS)3-	3.026e-18	2.241e-18	-17.519	-17.650	-0.131
ZnOH+	1.298e-18	9.609e-19	-17.887	-18.017	-0.131
ZnSO4	8.516e-19	9.687e-19	-18.070	-18.014	0.056
ZnCO3	4.719e-24	5.368e-24	-23.326	-23.270	0.056
Zn(OH)2	9.491e-26	1.080e-25	-25.023	-24.967	0.056
Zn(SO4)2-2	3.346e-28	1.006e-28	-27.475	-27.997	-0.522
Zn(OH)3-	2.206e-36	1.633e-36	-35.656	-35.787	-0.131
Zn(CO3)2-2	2.747e-38	8.257e-39	-37.561	-38.083	-0.522
Zn(OH)4-2	0.000e+00	0.000e+00	-47.385	-47.907	-0.522
ZnSeO4	0.000e+00	0.000e+00	-60.601	-60.545	0.056
Zn(SeO4)2-2	0.000e+00	0.000e+00	-115.615	-116.137	-0.522

-----Saturation indices-----

Phase	SI	log IAP	log KT	
(NH4)2CrO4	-79.50	-9.39	70.11	(NH4)2CrO4
Al(OH)3(a)	-15.83	-4.82	11.01	Al(OH)3
Al2O3	-32.60	-9.62	22.98	Al2O3
Al4(OH)10SO4	-54.27	-31.57	22.70	Al4(OH)10SO4
AlAsO4:2H2O	-29.65	-4.71	24.94	AlAsO4:2H2O

AlOHSO4	-13.88	-17.11	-3.23	AlOHSO4
AlumK	-25.79	-31.12	-5.34	KAl(SO4)2·12H2O
Alunite	-39.25	-40.68	-1.44	KAl3(SO4)2(OH)6
Anhydrite	-8.50	-13.05	-4.55	CaSO4
Aragonite	-12.98	-21.27	-8.28	CaCO3
Arsenolite	-27.95	-31.08	-3.13	As4O6
Artinite	-31.91	-21.64	10.26	MgCO3:Mg(OH)2:3H2O
As2O5	-46.87	0.23	47.10	As2O5
Ba3(AsO4)2	-45.99	-14.68	31.31	Ba3(AsO4)2
BaCrO4	-69.34	-9.40	59.94	BaCrO4
Barite	-7.14	-17.26	-10.12	BaSO4
BaSeO3	-34.42	7.08	41.50	BaSeO3
BaSeO4	-54.42	14.96	69.38	BaSeO4
Bianchite	-18.63	-20.40	-1.76	ZnSO4:6H2O
Birnessite	-38.13	4.87	43.00	MnO2
Bixbyite	-47.72	1.85	49.56	Mn2O3
Boehmite	-14.04	-4.82	9.23	AlOOH
Brucite	-17.95	-0.56	17.39	Mg(OH)2
Bunsenite	-21.05	-8.04	13.00	NiO
Ca3(AsO4)2·6H2O	-64.65	-2.08	62.58	Ca3(AsO4)2·6H2O
CaCrO4	-72.83	-5.19	67.64	CaCrO4
Calcite	-12.84	-21.27	-8.43	CaCO3
CaSeO3·2H2O	-28.83	11.28	40.11	CaSeO3·2H2O
CaSeO4·2H2O	-52.49	19.16	71.65	CaSeO4·2H2O
CH4(g)	-10.56	-52.07	-41.51	CH4
Claudetite	-27.71	-31.08	-3.37	As4O6
CO2(g)	-2.34	-20.51	-18.17	CO2
Cr(OH)2	-28.43	-20.21	8.22	Cr(OH)2
Cr(OH)3(A)	-15.52	-16.27	-0.75	Cr(OH)3
Cr(OH)3(C)	-18.14	-16.27	1.87	Cr(OH)3
Cr2O3	-29.41	-32.52	-3.11	Cr2O3
CrCl2	-36.11	-22.59	13.52	CrCl2
CrCl3	-33.98	-19.84	14.14	CrCl3
CrMetal	-58.33	-28.09	30.24	Cr
CrO3	-71.01	-4.43	66.58	CrO3
Diaspore	-12.26	-4.82	7.44	AlOOH
Dolomite	-25.52	-42.33	-16.81	CaMg(CO3)2
Epsomite	-10.69	-12.89	-2.21	MgSO4:7H2O
Gibbsite(C)	-14.12	-4.82	9.30	Al(OH)3
Goslarite	-18.37	-20.40	-2.04	ZnSO4:7H2O
Gypsum	-8.21	-13.06	-4.85	CaSO4:2H2O
Halite	-3.22	-1.65	1.56	NaCl
Hausmannite	-64.56	-1.17	63.39	Mn3O4
Huntite	-55.08	-84.45	-29.37	CaMg3(CO3)4
Hydromagnesite	-77.28	-84.84	-7.56	Mg5(CO3)4(OH)2:4H2O
K2Cr2O7	-135.57	-12.15	123.43	K2Cr2O7
K2CrO4	-77.38	-7.72	69.67	K2CrO4
Lime	-34.62	-0.76	33.87	CaO



Magnesite -13.18 -21.06 -7.89 MgCO<sub>3</sub>  
Manganite -23.75 0.92 24.67 MnOOH  
MgCr<sub>2</sub>O<sub>4</sub> -46.07 -33.07 13.00 MgCr<sub>2</sub>O<sub>4</sub>  
MgCrO<sub>4</sub> -80.61 -4.98 75.63 MgCrO<sub>4</sub>  
MgSeO<sub>3</sub>:6H<sub>2</sub>O -29.74 11.45 41.19 MgSeO<sub>3</sub>:6H<sub>2</sub>O  
Millerite -8.73 -51.88 -43.15 NiS  
Mirabilite -11.73 -13.29 -1.55 Na<sub>2</sub>SO<sub>4</sub>:10H<sub>2</sub>O  
Mn<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> -80.04 -35.03 45.01 Mn<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>  
Mn<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O -61.66 -8.88 52.78 Mn<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O  
MnCl<sub>2</sub>:4H<sub>2</sub>O -7.74 -5.43 2.31 MnCl<sub>2</sub>:4H<sub>2</sub>O  
MnS(Green) -15.74 -46.86 -31.12 MnS  
MnSe -20.29 -14.63 5.66 MnSe  
MnSeO<sub>3</sub> -29.37 9.03 38.40 MnSeO<sub>3</sub>  
MnSeO<sub>3</sub>:2H<sub>2</sub>O -29.11 9.01 38.12 MnSeO<sub>3</sub>:2H<sub>2</sub>O  
MnSO<sub>4</sub> -18.34 -15.31 3.03 MnSO<sub>4</sub>  
Morenosite -17.96 -20.38 -2.43 NiSO<sub>4</sub>:7H<sub>2</sub>O  
Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> -139.28 -9.78 129.50 Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>  
Na<sub>2</sub>CrO<sub>4</sub> -78.48 -5.35 73.13 Na<sub>2</sub>CrO<sub>4</sub>  
Natron -19.83 -21.50 -1.68 Na<sub>2</sub>CO<sub>3</sub>:10H<sub>2</sub>O  
Nesquehonite -15.60 -21.08 -5.49 MgCO<sub>3</sub>:3H<sub>2</sub>O  
Ni(OH)<sub>2</sub> -18.15 -8.05 10.10 Ni(OH)<sub>2</sub>  
Ni<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O -79.93 -23.95 55.98 Ni<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O  
Ni<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub> -76.48 -44.48 32.00 Ni<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub>  
NiCO<sub>3</sub> -21.94 -28.55 -6.61 NiCO<sub>3</sub>  
NiSe -1.92 -19.66 -17.74 NiSe  
NiSeO<sub>3</sub>:2H<sub>2</sub>O -36.18 3.99 40.17 NiSeO<sub>3</sub>:2H<sub>2</sub>O  
Nsutite -37.55 4.87 42.42 MnO<sub>2</sub>  
O<sub>2</sub>(g) -70.44 15.77 86.22 O<sub>2</sub>  
Oripment 20.98 -147.06 -168.04 As<sub>2</sub>S<sub>3</sub>  
Periclase -22.90 -0.55 22.35 MgO  
Portlandite -24.15 -0.76 23.38 Ca(OH)<sub>2</sub>  
Pyrocroite -18.64 -3.03 15.61 Mn(OH)<sub>2</sub>  
Pyrolusite -36.58 4.87 41.45 MnO<sub>2</sub>  
Realgar -0.05 -55.55 -55.50 AsS  
Retgersite -18.31 -20.38 -2.07 NiSO<sub>4</sub>:6H<sub>2</sub>O  
Rhodochrosite -13.17 -23.53 -10.36 MnCO<sub>3</sub>  
Se(A) 3.44 -3.73 -7.17 Se  
Se(hex) 4.06 -3.73 -7.78 Se  
SeO<sub>2</sub> -25.26 12.05 37.30 SeO<sub>2</sub>  
SeO<sub>3</sub> -76.54 19.93 96.47 SeO<sub>3</sub>  
Smithsonite -18.67 -28.57 -9.90 ZnCO<sub>3</sub>  
Sphalerite -5.04 -51.90 -46.86 ZnS  
Spinel -48.57 -10.18 38.39 MgAl<sub>2</sub>O<sub>4</sub>  
SULFUR 1.11 -35.95 -37.06 S  
Thenardite -13.05 -13.22 -0.17 Na<sub>2</sub>SO<sub>4</sub>  
Thermonatrite -21.63 -21.44 0.19 Na<sub>2</sub>CO<sub>3</sub>:H<sub>2</sub>O  
Witherite -16.89 -25.48 -8.59 BaCO<sub>3</sub>  
Wurtzite -7.05 -51.90 -44.85 ZnS

Zincite -19.71 -8.06 11.65 ZnO  
Zincosite -23.81 -20.35 3.45 ZnSO4  
Zn(BO2)2 -23.93 -15.64 8.29 Zn(BO2)2  
Zn(NO3)2:6H2O -200.06 50.06 250.12 Zn(NO3)2:6H2O  
Zn(OH)2(A) -20.52 -8.07 12.45 Zn(OH)2  
Zn(OH)2(B) -19.82 -8.07 11.75 Zn(OH)2  
Zn(OH)2(C) -20.27 -8.07 12.20 Zn(OH)2  
Zn(OH)2(E) -19.57 -8.07 11.50 Zn(OH)2  
Zn(OH)2(G) -19.78 -8.07 11.71 Zn(OH)2  
Zn2(OH)2SO4 -35.92 -28.42 7.50 Zn2(OH)2SO4  
Zn2(OH)3Cl -32.52 -17.32 15.20 Zn2(OH)3Cl  
Zn3(AsO4)2:2.5H2O -77.89 -23.97 53.93 Zn3(AsO4)2:2.5H2O  
Zn3O(SO4)2 -69.22 -48.77 20.45 Zn3O(SO4)2  
Zn4(OH)6SO4 -72.96 -44.56 28.40 Zn4(OH)6SO4  
Zn5(OH)8Cl2 -81.22 -42.72 38.50 Zn5(OH)8Cl2  
ZnCl2 -17.88 -10.45 7.43 ZnCl2  
ZnCO3:H2O -18.32 -28.58 -10.26 ZnCO3:H2O  
ZnMetal -42.55 -15.95 26.61 Zn  
ZnO(Active) -19.37 -8.06 11.31 ZnO  
ZnS(A) -7.71 -51.90 -44.19 ZnS  
ZnSe -8.16 -19.67 -11.51 ZnSe  
ZnSO4:H2O -20.04 -20.36 -0.32 ZnSO4:H2O

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a Low  
SOLUTION 1  
pH 6.90 charge  
temp 15.88  
pe 8.15  
units mg/L  
Al 0.0412  
As 0.00233 as H3AsO4  
Ba 0.292  
B 1.470  
Ca 970  
C 8.62  
Cl 17300  
Cr 0.00466  
Mg 839  
Mn 13.300 as Mn+2  
Ni 0.000115  
N 20.8 as NH4+  
K 291  
Se 0.00101  
Na 2260  
S 1560 as SO4-2  
Zn 0.000125

END

-----  
TITLE  
-----

BH301a Low  
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Beginning of initial solution calculations.

-----  
Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.563e-06	1.563e-06
As	1.681e-08	1.681e-08
B	1.392e-04	1.392e-04
Ba	2.177e-06	2.177e-06
C	1.446e-04	1.446e-04
Ca	2.478e-02	2.478e-02
Cl	4.996e-01	4.996e-01
Cr	9.176e-08	9.176e-08
K	7.619e-03	7.619e-03
Mg	3.533e-02	3.533e-02
Mn	2.479e-04	2.479e-04
N	1.181e-03	1.181e-03
Na	1.006e-01	1.006e-01
Ni	2.005e-09	2.005e-09
S	1.663e-02	1.663e-02
Se	1.310e-08	1.310e-08
Zn	1.958e-09	1.958e-09

-----Description of solution-----

pH = 0.655    Charge balance  
pe = 8.150  
Activity of water = 0.983  
Ionic strength = 5.795e-01  
Mass of water (kg) = 1.000e+00  
Total alkalinity (eq/kg) = -3.027e-01  
Total CO2 (mol/kg) = 1.446e-04  
Temperature (deg C) = 15.880  
Electrical balance (eq) = 2.393e-12  
Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|) = 0.00$   
Iterations = 15  
Total H = 1.113205e+02  
Total O = 5.557357e+01

-----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
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H+	2.906e-01	2.215e-01	-0.537	-0.655	-0.118
OH-	3.507e-14	2.191e-14	-13.455	-13.659	-0.204
H2O	5.551e+01	9.834e-01	-0.007	-0.007	0.000
Al	1.563e-06				
Al+3	1.474e-06	1.280e-07	-5.831	-6.893	-1.061
AlSO4+	8.604e-08	5.682e-08	-7.065	-7.246	-0.180
Al(SO4)2-	3.131e-09	2.068e-09	-8.504	-8.684	-0.180
AlOH+2	1.385e-11	3.086e-12	-10.859	-11.511	-0.652
Al(OH)2+	2.917e-16	2.004e-16	-15.535	-15.698	-0.163
Al(OH)3	9.802e-22	1.120e-21	-21.009	-20.951	0.058
Al(OH)4-	7.207e-29	4.760e-29	-28.142	-28.322	-0.180
As(3)	1.676e-08				
H3AsO3	1.434e-08	1.639e-08	-7.844	-7.786	0.058
H4AsO3+	2.424e-09	1.798e-09	-8.615	-8.745	-0.130
H2AsO3-	4.159e-17	3.086e-17	-16.381	-16.511	-0.130
HAsO3-2	2.420e-28	7.332e-29	-27.616	-28.135	-0.519
AsO3-3	1.358e-40	0.000e+00	-39.867	-41.034	-1.167
As(5)	4.352e-11				
H3AsO4	4.171e-11	4.766e-11	-10.380	-10.322	0.058
H2AsO4-	1.814e-12	1.345e-12	-11.741	-11.871	-0.130
HAsO4-2	3.360e-18	1.018e-18	-17.474	-17.992	-0.519
AsO4-3	1.357e-28	9.240e-30	-27.867	-29.034	-1.167
B	1.392e-04				
H3BO3	1.392e-04	1.591e-04	-3.856	-3.798	0.058
H2BO3-	5.983e-13	3.479e-13	-12.223	-12.459	-0.236
Ba	2.177e-06				
Ba+2	2.177e-06	4.538e-07	-5.662	-6.343	-0.681
BaOH+	5.853e-20	3.955e-20	-19.233	-19.403	-0.170
C(4)	1.446e-04				
H2CO3	1.446e-04	1.653e-04	-3.840	-3.782	0.058
HCO3-	5.281e-10	3.628e-10	-9.277	-9.440	-0.163
MgHCO3+	7.207e-11	4.638e-11	-10.142	-10.334	-0.191
CaHCO3+	2.976e-11	2.091e-11	-10.526	-10.680	-0.153
NaHCO3	1.037e-11	1.185e-11	-10.984	-10.926	0.058
MnHCO3+	3.290e-13	2.223e-13	-12.483	-12.653	-0.170
NiHCO3+	2.128e-17	1.579e-17	-16.672	-16.802	-0.130
ZnHCO3+	1.720e-17	1.276e-17	-16.764	-16.894	-0.130
MgCO3	5.316e-19	6.075e-19	-18.274	-18.216	0.058
CaCO3	4.772e-19	5.453e-19	-18.321	-18.263	0.058
CO3-2	2.795e-19	6.230e-20	-18.554	-19.206	-0.652
NaCO3-	7.467e-20	5.130e-20	-19.127	-19.290	-0.163
NiCO3	1.567e-22	1.790e-22	-21.805	-21.747	0.058
ZnCO3	4.005e-24	4.576e-24	-23.397	-23.339	0.058
Ni(CO3)2-2	6.398e-38	1.938e-38	-37.194	-37.713	-0.519
Zn(CO3)2-2	2.012e-38	6.095e-39	-37.696	-38.215	-0.519
Ca	2.478e-02				
Ca+2	2.420e-02	7.354e-03	-1.616	-2.133	-0.517
CaSO4	5.762e-04	6.584e-04	-3.239	-3.181	0.058

CaHCO3+	2.976e-11	2.091e-11	-10.526	-10.680	-0.153
CaOH+	5.407e-15	3.799e-15	-14.267	-14.420	-0.153
CaCO3	4.772e-19	5.453e-19	-18.321	-18.263	0.058
Cl	4.996e-01				
Cl-	4.995e-01	3.080e-01	-0.301	-0.511	-0.210
MnCl+	7.461e-05	5.042e-05	-4.127	-4.297	-0.170
MnCl2	3.691e-06	4.218e-06	-5.433	-5.375	0.058
MnCl3-	8.666e-07	5.856e-07	-6.062	-6.232	-0.170
CrCl+2	2.473e-09	7.491e-10	-8.607	-9.125	-0.519
NiCl+	4.033e-10	2.992e-10	-9.394	-9.524	-0.130
ZnCl+	3.132e-10	2.016e-10	-9.504	-9.696	-0.191
NiCl2	2.934e-10	3.353e-10	-9.532	-9.475	0.058
ZnCl2	5.477e-11	6.258e-11	-10.261	-10.204	0.058
CrCl2+	4.775e-11	3.542e-11	-10.321	-10.451	-0.130
ZnCl3-	3.176e-11	2.044e-11	-10.498	-10.690	-0.191
ZnCl4-2	1.401e-11	2.921e-12	-10.854	-11.534	-0.681
CrOHCl2	1.685e-16	1.925e-16	-15.773	-15.715	0.058
ZnOHCl	1.459e-17	1.667e-17	-16.836	-16.778	0.058
CrO3Cl-	0.000e+00	0.000e+00	-52.778	-52.908	-0.130
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-65.155	-65.674	-0.519
Cr(2)	7.346e-24				
Cr+2	7.346e-24	2.225e-24	-23.134	-23.653	-0.519
Cr(3)	9.176e-08				
Cr+3	8.918e-08	6.071e-09	-7.050	-8.217	-1.167
CrCl+2	2.473e-09	7.491e-10	-8.607	-9.125	-0.519
CrSO4+	5.773e-11	4.283e-11	-10.239	-10.368	-0.130
CrCl2+	4.775e-11	3.542e-11	-10.321	-10.451	-0.130
Cr(OH)+2	3.044e-12	9.222e-13	-11.517	-12.035	-0.519
CrOHSO4	1.735e-13	1.982e-13	-12.761	-12.703	0.058
CrOHCl2	1.685e-16	1.925e-16	-15.773	-15.715	0.058
Cr(OH)2+	1.324e-17	9.821e-18	-16.878	-17.008	-0.130
Cr2(OH)2SO4+2	1.097e-22	3.324e-23	-21.960	-22.478	-0.519
Cr(OH)3	2.828e-24	3.232e-24	-23.548	-23.491	0.058
Cr2(OH)2(SO4)2	3.262e-28	3.727e-28	-27.487	-27.429	0.058
CrO2-	4.846e-34	3.595e-34	-33.315	-33.444	-0.130
Cr(OH)4-	1.847e-34	1.370e-34	-33.734	-33.863	-0.130
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.780	-56.910	-0.130
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.968	-60.487	-0.519
CrNO3+2	0.000e+00	0.000e+00	-64.058	-64.576	-0.519
Cr(NH3)6+3	0.000e+00	0.000e+00	-64.773	-65.940	-1.167
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-65.155	-65.674	-0.519
Cr(6)	0.000e+00				
HCrO4-	0.000e+00	0.000e+00	-52.440	-52.570	-0.130
CrO3Cl-	0.000e+00	0.000e+00	-52.778	-52.908	-0.130
CrO3SO4-2	0.000e+00	0.000e+00	-53.516	-54.034	-0.519
H2CrO4	0.000e+00	0.000e+00	-54.119	-54.061	0.058
CrO4-2	0.000e+00	0.000e+00	-57.637	-58.403	-0.766
NaCrO4-	0.000e+00	0.000e+00	-58.723	-58.853	-0.130

KCrO4-	0.000e+00	0.000e+00	-59.804	-59.933	-0.130
Cr2O7-2	0.000e+00	0.000e+00	-102.963	-103.482	-0.519
H(0)	3.346e-21				
H2	1.673e-21	1.912e-21	-20.776	-20.719	0.058
K	7.619e-03				
K+	7.600e-03	4.686e-03	-2.119	-2.329	-0.210
KSO4-	1.933e-05	1.328e-05	-4.714	-4.877	-0.163
KCrO4-	0.000e+00	0.000e+00	-59.804	-59.933	-0.130
Mg	3.533e-02				
Mg+2	3.452e-02	1.176e-02	-1.462	-1.930	-0.468
MgSO4	8.071e-04	9.223e-04	-3.093	-3.035	0.058
MgHCO3+	7.207e-11	4.638e-11	-10.142	-10.334	-0.191
MgOH+	5.291e-14	3.781e-14	-13.276	-13.422	-0.146
MgCO3	5.316e-19	6.075e-19	-18.274	-18.216	0.058
Mn(2)	2.479e-04				
Mn+2	1.660e-04	4.046e-05	-3.780	-4.393	-0.613
MnCl+	7.461e-05	5.042e-05	-4.127	-4.297	-0.170
MnCl2	3.691e-06	4.218e-06	-5.433	-5.375	0.058
MnSO4	2.728e-06	3.118e-06	-5.564	-5.506	0.058
MnCl3-	8.666e-07	5.856e-07	-6.062	-6.232	-0.170
MnHCO3+	3.290e-13	2.223e-13	-12.483	-12.653	-0.170
MnOH+	3.174e-15	2.145e-15	-14.498	-14.669	-0.170
MnSeO4	8.405e-32	9.604e-32	-31.075	-31.018	0.058
MnSe	1.132e-36	1.293e-36	-35.946	-35.888	0.058
Mn(OH)3-	8.305e-38	5.612e-38	-37.081	-37.251	-0.170
Mn(NO3)2	0.000e+00	0.000e+00	-113.531	-113.473	0.058
Mn(3)	8.075e-21				
Mn+3	8.075e-21	7.012e-22	-20.093	-21.154	-1.061
Mn(6)	0.000e+00				
MnO4-2	0.000e+00	0.000e+00	-87.814	-88.495	-0.681
Mn(7)	0.000e+00				
MnO4-	0.000e+00	0.000e+00	-90.125	-90.344	-0.219
N(-3)	1.181e-03				
NH4+	1.174e-03	6.828e-04	-2.930	-3.166	-0.236
NH4SO4-	6.187e-06	4.181e-06	-5.209	-5.379	-0.170
NH3	7.903e-13	9.031e-13	-12.102	-12.044	0.058
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.780	-56.910	-0.130
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.968	-60.487	-0.519
Cr(NH3)6+3	0.000e+00	0.000e+00	-64.773	-65.940	-1.167
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-65.155	-65.674	-0.519
N(3)	0.000e+00				
NO2-	0.000e+00	0.000e+00	-42.735	-42.865	-0.130
N(5)	0.000e+00				
NO3-	0.000e+00	0.000e+00	-54.626	-54.845	-0.219
CrNO3+2	0.000e+00	0.000e+00	-64.058	-64.576	-0.519
Mn(NO3)2	0.000e+00	0.000e+00	-113.531	-113.473	0.058
Na	1.006e-01				
Na+	1.004e-01	7.142e-02	-0.998	-1.146	-0.148

NaSO4-	2.333e-04	1.603e-04	-3.632	-3.795	-0.163
NaHCO3	1.037e-11	1.185e-11	-10.984	-10.926	0.058
NaCO3-	7.467e-20	5.130e-20	-19.127	-19.290	-0.163
NaCrO4-	0.000e+00	0.000e+00	-58.723	-58.853	-0.130
Ni	2.005e-09				
Ni+2	1.280e-09	3.877e-10	-8.893	-9.412	-0.519
NiCl+	4.033e-10	2.992e-10	-9.394	-9.524	-0.130
NiCl2	2.934e-10	3.353e-10	-9.532	-9.475	0.058
NiSO4	2.900e-11	3.313e-11	-10.538	-10.480	0.058
Ni(SO4)2-2	3.027e-15	9.171e-16	-14.519	-15.038	-0.519
NiHCO3+	2.128e-17	1.579e-17	-16.672	-16.802	-0.130
NiOH+	1.653e-19	1.226e-19	-18.782	-18.911	-0.130
NiCO3	1.567e-22	1.790e-22	-21.805	-21.747	0.058
Ni(OH)2	6.686e-28	7.641e-28	-27.175	-27.117	0.058
NiSeO4	1.333e-36	1.523e-36	-35.875	-35.817	0.058
Ni(CO3)2-2	6.398e-38	1.938e-38	-37.194	-37.713	-0.519
Ni(OH)3-	4.572e-38	3.392e-38	-37.340	-37.470	-0.130
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-54.052	-53.994	0.058
S(-2)	1.057e-33				
H2S	1.057e-33	1.208e-33	-32.976	-32.918	0.058
HS-	7.409e-40	4.630e-40	-39.130	-39.334	-0.204
S5-2	0.000e+00	0.000e+00	-47.971	-48.490	-0.519
S6-2	0.000e+00	0.000e+00	-48.042	-48.561	-0.519
S4-2	0.000e+00	0.000e+00	-48.215	-48.733	-0.519
S-2	0.000e+00	0.000e+00	-51.197	-51.878	-0.681
S3-2	0.000e+00	0.000e+00	-51.684	-52.202	-0.519
S2-2	0.000e+00	0.000e+00	-52.953	-53.472	-0.519
Zn(HS)2	0.000e+00	0.000e+00	-73.221	-73.163	0.058
Zn(HS)3-	0.000e+00	0.000e+00	-111.208	-111.337	-0.130
S(6)	1.663e-02				
HSO4-	1.206e-02	7.962e-03	-1.919	-2.099	-0.180
SO4-2	2.924e-03	4.753e-04	-2.534	-3.323	-0.789
MgSO4	8.071e-04	9.223e-04	-3.093	-3.035	0.058
CaSO4	5.762e-04	6.584e-04	-3.239	-3.181	0.058
NaSO4-	2.333e-04	1.603e-04	-3.632	-3.795	-0.163
KSO4-	1.933e-05	1.328e-05	-4.714	-4.877	-0.163
NH4SO4-	6.187e-06	4.181e-06	-5.209	-5.379	-0.170
MnSO4	2.728e-06	3.118e-06	-5.564	-5.506	0.058
AlSO4+	8.604e-08	5.682e-08	-7.065	-7.246	-0.180
Al(SO4)2-	3.131e-09	2.068e-09	-8.504	-8.684	-0.180
CrSO4+	5.773e-11	4.283e-11	-10.239	-10.368	-0.130
ZnSO4	3.339e-11	3.816e-11	-10.476	-10.418	0.058
NiSO4	2.900e-11	3.313e-11	-10.538	-10.480	0.058
Zn(SO4)2-2	5.232e-13	1.585e-13	-12.281	-12.800	-0.519
CrOHSO4	1.735e-13	1.982e-13	-12.761	-12.703	0.058
Ni(SO4)2-2	3.027e-15	9.171e-16	-14.519	-15.038	-0.519
Cr2(OH)2SO4+2	1.097e-22	3.324e-23	-21.960	-22.478	-0.519



Cr2(OH)2(SO4)2	3.262e-28	3.727e-28	-27.487	-27.429	0.058
CrO3SO4-2	0.000e+00	0.000e+00	-53.516	-54.034	-0.519
Se(-2)	4.726e-23				
H2Se	4.721e-23	5.395e-23	-22.326	-22.268	0.058
HSe-	5.287e-26	3.922e-26	-25.277	-25.406	-0.130
MnSe	1.132e-36	1.293e-36	-35.946	-35.888	0.058
Se-2	3.531e-40	1.070e-40	-39.452	-39.971	-0.519
Se(4)	7.501e-18				
SeO3-2	7.501e-18	2.272e-18	-17.125	-17.644	-0.519
Se(6)	1.310e-08				
H2SeO3	1.288e-08	1.471e-08	-7.890	-7.832	0.058
HSeO3-	2.193e-10	1.627e-10	-9.659	-9.789	-0.130
HSeO4-	2.091e-28	1.551e-28	-27.680	-27.809	-0.130
SeO4-2	6.345e-29	1.088e-29	-28.198	-28.963	-0.766
MnSeO4	8.405e-32	9.604e-32	-31.075	-31.018	0.058
NiSeO4	1.333e-36	1.523e-36	-35.875	-35.817	0.058
ZnSeO4	5.580e-37	6.376e-37	-36.253	-36.195	0.058
Zn(SeO4)2-2	0.000e+00	0.000e+00	-66.912	-67.431	-0.519
Zn	1.958e-09				
Zn+2	1.510e-09	3.682e-10	-8.821	-9.434	-0.613
ZnCl+	3.132e-10	2.016e-10	-9.504	-9.696	-0.191
ZnCl2	5.477e-11	6.258e-11	-10.261	-10.204	0.058
ZnSO4	3.339e-11	3.816e-11	-10.476	-10.418	0.058
ZnCl3-	3.176e-11	2.044e-11	-10.498	-10.690	-0.191
ZnCl4-2	1.401e-11	2.921e-12	-10.854	-11.534	-0.681
Zn(SO4)2-2	5.232e-13	1.585e-13	-12.281	-12.800	-0.519
ZnHCO3+	1.720e-17	1.276e-17	-16.764	-16.894	-0.130
ZnOHCl	1.459e-17	1.667e-17	-16.836	-16.778	0.058
ZnOH+	1.183e-18	8.780e-19	-17.927	-18.056	-0.130
ZnCO3	4.005e-24	4.576e-24	-23.397	-23.339	0.058
Zn(OH)2	8.013e-26	9.157e-26	-25.096	-25.038	0.058
Zn(OH)3-	1.733e-36	1.286e-36	-35.761	-35.891	-0.130
ZnSeO4	5.580e-37	6.376e-37	-36.253	-36.195	0.058
Zn(CO3)2-2	2.012e-38	6.095e-39	-37.696	-38.215	-0.519
Zn(OH)4-2	0.000e+00	0.000e+00	-47.525	-48.044	-0.519
Zn(SeO4)2-2	0.000e+00	0.000e+00	-66.912	-67.431	-0.519
Zn(HS)2	0.000e+00	0.000e+00	-73.221	-73.163	0.058
Zn(HS)3-	0.000e+00	0.000e+00	-111.208	-111.337	-0.130

-----Saturation indices-----

Phase	SI	log IAP	log KT	
(NH4)2CrO4	-65.09	5.02	70.11	(NH4)2CrO4
Al(OH)3(a)	-15.96	-4.95	11.01	Al(OH)3
Al2O3	-32.86	-9.88	22.98	Al2O3
Al4(OH)10SO4	-47.12	-24.42	22.70	Al4(OH)10SO4
AlAsO4:2H2O	-20.07	-15.27	4.80	AlAsO4:2H2O

AlOHSO4	-6.34	-9.57	-3.23	AlOHSO4
AlumK	-10.62	-15.96	-5.34	KAl(SO4)2:12H2O
Alunite	-24.33	-25.77	-1.44	KAl3(SO4)2(OH)6
Anhydrite	-0.91	-5.46	-4.55	CaSO4
Aragonite	-13.06	-21.34	-8.28	CaCO3
Arsenolite	-27.97	-111.65	-83.69	As4O6
Artinite	-32.06	-21.79	10.26	MgCO3:Mg(OH)2:3H2O
As2O5	-27.45	-20.62	6.82	As2O5
Ba3(AsO4)2	-26.77	-35.75	-8.97	Ba3(AsO4)2
BaCrO4	-54.93	5.01	59.94	BaCrO4
Barite	0.46	-9.67	-10.12	BaSO4
BaSeO3	-19.79	-23.99	-4.20	BaSeO3
BaSeO4	-30.07	-6.38	23.69	BaSeO4
Bianchite	-11.04	-12.80	-1.76	ZnSO4:6H2O
Birnessite	-28.49	14.51	43.00	MnO2
Bixbyite	-38.14	11.42	49.56	Mn2O3
Boehmite	-14.17	-4.94	9.23	AlOOH
Brucite	-18.02	-0.64	17.39	Mg(OH)2
Bunsenite	-21.11	-8.11	13.00	NiO
Ca3(AsO4)2:6H2O	-45.46	-23.16	22.30	Ca3(AsO4)2:6H2O
CaCrO4	-58.42	9.22	67.64	CaCrO4
Calcite	-12.91	-21.34	-8.43	CaCO3
CaSeO3:2H2O	-14.20	-19.79	-5.59	CaSeO3:2H2O
CaSeO4:2H2O	-28.14	-2.19	25.95	CaSeO4:2H2O
CH4(g)	-49.42	-90.93	-41.51	CH4
Claudetite	-27.73	-111.65	-83.93	As4O6
CO2(g)	-2.34	-20.51	-18.17	CO2
Cr(OH)2	-33.37	-25.16	8.22	Cr(OH)2
Cr(OH)3(A)	-15.61	-16.36	-0.75	Cr(OH)3
Cr(OH)3(C)	-18.23	-16.36	1.87	Cr(OH)3
Cr2O3	-29.59	-32.70	-3.11	Cr2O3
CrCl2	-41.00	-27.48	13.52	CrCl2
CrCl3	-33.98	-19.84	14.14	CrCl3
CrMetal	-72.99	-42.75	30.24	Cr
CrO3	-56.52	10.05	66.58	CrO3
Diaspore	-12.39	-4.94	7.44	AlOOH
Dolomite	-25.67	-42.47	-16.81	CaMg(CO3)2
Epsomite	-3.10	-5.30	-2.21	MgSO4:7H2O
Gibbsite(C)	-14.25	-4.95	9.30	Al(OH)3
Goslarite	-10.77	-12.81	-2.04	ZnSO4:7H2O
Gypsum	-0.62	-5.47	-4.85	CaSO4:2H2O
Halite	-3.22	-1.66	1.56	NaCl
Hausmannite	-55.06	8.33	63.39	Mn3O4
Huntite	-55.37	-84.74	-29.37	CaMg3(CO3)4
Hydromagnesite	-77.65	-85.21	-7.56	Mg5(CO3)4(OH)2:4H2O
K2Cr2O7	-106.68	16.75	123.43	K2Cr2O7
K2CrO4	-62.97	6.70	69.67	K2CrO4
Lime	-34.70	-0.83	33.87	CaO

Magnesite -13.25 -21.14 -7.89 MgCO<sub>3</sub>  
 Manganite -18.97 5.71 24.67 MnOOH  
 MgCr<sub>2</sub>O<sub>4</sub> -46.33 -33.33 13.00 MgCr<sub>2</sub>O<sub>4</sub>  
 MgCrO<sub>4</sub> -66.20 9.43 75.63 MgCrO<sub>4</sub>  
 MgSeO<sub>3</sub>:6H<sub>2</sub>O -15.11 -19.62 -4.51 MgSeO<sub>3</sub>:6H<sub>2</sub>O  
 Millerite -39.99 -83.14 -43.15 NiS  
 Mirabilite -4.13 -5.69 -1.55 Na<sub>2</sub>SO<sub>4</sub>:10H<sub>2</sub>O  
 Mn<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> -47.47 -2.45 45.01 Mn<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>  
 Mn<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O -42.45 -29.95 12.50 Mn<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O  
 MnCl<sub>2</sub>:4H<sub>2</sub>O -7.75 -5.44 2.31 MnCl<sub>2</sub>:4H<sub>2</sub>O  
 MnS(Green) -47.01 -78.12 -31.12 MnS  
 MnSe -34.81 -74.84 -40.04 MnSe  
 MnSeO<sub>3</sub> -14.74 -22.04 -7.30 MnSeO<sub>3</sub>  
 MnSeO<sub>3</sub>:2H<sub>2</sub>O -14.48 -22.05 -7.57 MnSeO<sub>3</sub>:2H<sub>2</sub>O  
 MnSO<sub>4</sub> -10.74 -7.72 3.03 MnSO<sub>4</sub>  
 Morenosite -10.36 -12.79 -2.43 NiSO<sub>4</sub>:7H<sub>2</sub>O  
 Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> -110.38 19.12 129.50 Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>  
 Na<sub>2</sub>CrO<sub>4</sub> -64.06 9.06 73.13 Na<sub>2</sub>CrO<sub>4</sub>  
 Natron -19.90 -21.57 -1.68 Na<sub>2</sub>CO<sub>3</sub>:10H<sub>2</sub>O  
 Nesquehonite -15.67 -21.16 -5.49 MgCO<sub>3</sub>:3H<sub>2</sub>O  
 Ni(OH)<sub>2</sub> -18.21 -8.12 10.10 Ni(OH)<sub>2</sub>  
 Ni<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O -60.71 -45.01 15.70 Ni<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O  
 Ni<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub> -69.09 -37.09 32.00 Ni<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub>  
 NiCO<sub>3</sub> -22.01 -28.62 -6.61 NiCO<sub>3</sub>  
 NiSe -16.43 -79.86 -63.44 NiSe  
 NiSeO<sub>3</sub>:2H<sub>2</sub>O -21.55 -27.07 -5.52 NiSeO<sub>3</sub>:2H<sub>2</sub>O  
 Nsutite -27.90 14.51 42.42 MnO<sub>2</sub>  
 O<sub>2</sub>(g) -51.01 35.20 86.22 O<sub>2</sub>  
 Oripment -72.61 -280.92 -208.32 As<sub>2</sub>S<sub>3</sub>  
 Periclase -22.97 -0.63 22.35 MgO  
 Portlandite -24.22 -0.84 23.38 Ca(OH)<sub>2</sub>  
 Pyrocroite -18.71 -3.10 15.61 Mn(OH)<sub>2</sub>  
 Pyrolusite -26.94 14.51 41.45 MnO<sub>2</sub>  
 Realgar -36.10 -111.75 -75.64 AsS  
 Retgersite -10.71 -12.78 -2.07 NiSO<sub>4</sub>:6H<sub>2</sub>O  
 Rhodochrosite -13.24 -23.60 -10.36 MnCO<sub>3</sub>  
 Se(A) -1.28 -54.15 -52.87 Se  
 Se(hex) -0.67 -54.15 -53.48 Se  
 SeO<sub>2</sub> -10.55 -18.95 -8.39 SeO<sub>2</sub>  
 SeO<sub>3</sub> -52.12 -1.34 50.77 SeO<sub>3</sub>  
 Smithsonite -18.74 -28.64 -9.90 ZnCO<sub>3</sub>  
 Sphalerite -36.30 -83.16 -46.86 ZnS  
 Spinel -48.90 -10.51 38.39 MgAl<sub>2</sub>O<sub>4</sub>  
 SULFUR -20.37 -57.43 -37.06 S  
 Thenardite -5.45 -5.62 -0.17 Na<sub>2</sub>SO<sub>4</sub>  
 Thermonatrite -21.70 -21.51 0.19 Na<sub>2</sub>CO<sub>3</sub>:H<sub>2</sub>O  
 Witherite -16.96 -25.55 -8.59 BaCO<sub>3</sub>  
 Wurtzite -38.31 -83.16 -44.85 ZnS

Zincite -19.78 -8.13 11.65 ZnO  
Zincosite -16.21 -12.76 3.45 ZnSO4  
Zn(BO2)2 -24.00 -15.71 8.29 Zn(BO2)2  
Zn(NO3)2:6H2O -122.48 127.64 250.12 Zn(NO3)2:6H2O  
Zn(OH)2(A) -20.59 -8.14 12.45 Zn(OH)2  
Zn(OH)2(B) -19.89 -8.14 11.75 Zn(OH)2  
Zn(OH)2(C) -20.34 -8.14 12.20 Zn(OH)2  
Zn(OH)2(E) -19.64 -8.14 11.50 Zn(OH)2  
Zn(OH)2(G) -19.85 -8.14 11.71 Zn(OH)2  
Zn2(OH)2SO4 -28.40 -20.90 7.50 Zn2(OH)2SO4  
Zn2(OH)3Cl -32.64 -17.44 15.20 Zn2(OH)3Cl  
Zn3(AsO4)2:2.5H2O -58.69 -45.04 13.65 Zn3(AsO4)2:2.5H2O  
Zn3O(SO4)2 -54.10 -33.65 20.45 Zn3O(SO4)2  
Zn4(OH)6SO4 -65.57 -37.17 28.40 Zn4(OH)6SO4  
Zn5(OH)8Cl2 -81.51 -43.01 38.50 Zn5(OH)8Cl2  
ZnCl2 -17.89 -10.46 7.43 ZnCl2  
ZnCO3:H2O -18.39 -28.65 -10.26 ZnCO3:H2O  
ZnMetal -52.34 -25.73 26.61 Zn  
ZnO(Active) -19.44 -8.13 11.31 ZnO  
ZnS(A) -38.98 -83.16 -44.19 ZnS  
ZnSe -22.67 -79.88 -57.21 ZnSe  
ZnSO4:H2O -12.44 -12.76 -0.32 ZnSO4:H2O

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks

SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a Low  
SOLUTION 1  
pH 6.90 charge  
temp 15.88  
pe 13.04  
units mg/L  
Al 0.0412  
As 0.00233 as H3AsO4  
Ba 0.292  
B 1.470  
Ca 970  
C 8.62  
Cl 17300  
Cr 0.00466  
Mg 839  
Mn 13.300 as Mn+2  
Ni 0.000115  
N 20.8 as NH4+  
K 291  
Se 0.00101  
Na 2260  
S 1560 as SO4-2  
Zn 0.000125  
END

-----  
TITLE  
-----

BH301a Low

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Al	1.563e-06	1.563e-06
As	1.681e-08	1.681e-08
B	1.392e-04	1.392e-04
Ba	2.177e-06	2.177e-06
C	1.446e-04	1.446e-04
Ca	2.478e-02	2.478e-02
Cl	4.996e-01	4.996e-01
Cr	9.176e-08	9.176e-08
K	7.619e-03	7.619e-03
Mg	3.533e-02	3.533e-02
Mn	2.479e-04	2.479e-04
N	1.181e-03	1.181e-03
Na	1.006e-01	1.006e-01
Ni	2.005e-09	2.005e-09
S	1.663e-02	1.663e-02
Se	1.310e-08	1.310e-08
Zn	1.958e-09	1.958e-09

-----Description of solution-----

pH = 0.655    Charge balance  
 pe = 13.040  
 Activity of water = 0.983  
 Ionic strength = 5.795e-01  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = -3.027e-01  
 Total CO2 (mol/kg) = 1.446e-04  
 Temperature (deg C) = 15.880  
 Electrical balance (eq) = -4.878e-17  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = -0.00  
 Iterations = 18  
 Total H = 1.113205e+02  
 Total O = 5.557357e+01

-----Distribution of species-----

Species	Molality	Log	Log	Log	Gamma
		Activity	Molality	Activity	
H+	2.906e-01	2.215e-01	-0.537	-0.655	-0.118
OH-	3.507e-14	2.191e-14	-13.455	-13.659	-0.204
H2O	5.551e+01	9.834e-01	-0.007	-0.007	0.000
Al	1.563e-06				
Al+3	1.474e-06	1.280e-07	-5.831	-6.893	-1.061
AlSO4+	8.604e-08	5.682e-08	-7.065	-7.246	-0.180
Al(SO4)2-	3.131e-09	2.068e-09	-8.504	-8.684	-0.180

AlOH+2	1.385e-11	3.086e-12	-10.859	-11.511	-0.652
Al(OH)2+	2.917e-16	2.004e-16	-15.535	-15.698	-0.163
Al(OH)3	9.802e-22	1.120e-21	-21.009	-20.951	0.058
Al(OH)4-	7.207e-29	4.760e-29	-28.142	-28.322	-0.180
As(3)	1.074e-15				
H3AsO3	9.188e-16	1.050e-15	-15.037	-14.979	0.058
H4AsO3+	1.553e-16	1.152e-16	-15.809	-15.938	-0.130
H2AsO3-	2.665e-24	1.977e-24	-23.574	-23.704	-0.130
HAsO3-2	1.551e-35	4.699e-36	-34.809	-35.328	-0.519
AsO3-3	0.000e+00	0.000e+00	-47.060	-48.227	-1.167
As(5)	1.681e-08				
H3AsO4	1.611e-08	1.840e-08	-7.793	-7.735	0.058
H2AsO4-	7.003e-10	5.195e-10	-9.155	-9.284	-0.130
HAsO4-2	1.297e-15	3.930e-16	-14.887	-15.406	-0.519
AsO4-3	5.240e-26	3.568e-27	-25.281	-26.448	-1.167
B	1.392e-04				
H3BO3	1.392e-04	1.591e-04	-3.856	-3.798	0.058
H2BO3-	5.983e-13	3.479e-13	-12.223	-12.459	-0.236
Ba	2.177e-06				
Ba+2	2.177e-06	4.538e-07	-5.662	-6.343	-0.681
BaOH+	5.853e-20	3.955e-20	-19.233	-19.403	-0.170
C(4)	1.446e-04				
H2CO3	1.446e-04	1.653e-04	-3.840	-3.782	0.058
HCO3-	5.281e-10	3.628e-10	-9.277	-9.440	-0.163
MgHCO3+	7.207e-11	4.638e-11	-10.142	-10.334	-0.191
CaHCO3+	2.976e-11	2.091e-11	-10.526	-10.680	-0.153
NaHCO3	1.037e-11	1.185e-11	-10.984	-10.926	0.058
MnHCO3+	3.290e-13	2.223e-13	-12.483	-12.653	-0.170
NiHCO3+	2.128e-17	1.579e-17	-16.672	-16.802	-0.130
ZnHCO3+	1.720e-17	1.276e-17	-16.764	-16.894	-0.130
MgCO3	5.316e-19	6.075e-19	-18.274	-18.216	0.058
CaCO3	4.772e-19	5.453e-19	-18.321	-18.263	0.058
CO3-2	2.795e-19	6.230e-20	-18.554	-19.206	-0.652
NaCO3-	7.467e-20	5.130e-20	-19.127	-19.290	-0.163
NiCO3	1.567e-22	1.790e-22	-21.805	-21.747	0.058
ZnCO3	4.005e-24	4.576e-24	-23.397	-23.339	0.058
Ni(CO3)2-2	6.398e-38	1.938e-38	-37.194	-37.713	-0.519
Zn(CO3)2-2	2.012e-38	6.095e-39	-37.696	-38.215	-0.519
Ca	2.478e-02				
Ca+2	2.420e-02	7.354e-03	-1.616	-2.133	-0.517
CaSO4	5.762e-04	6.584e-04	-3.239	-3.181	0.058
CaHCO3+	2.976e-11	2.091e-11	-10.526	-10.680	-0.153
CaOH+	5.407e-15	3.799e-15	-14.267	-14.420	-0.153
CaCO3	4.772e-19	5.453e-19	-18.321	-18.263	0.058
Cl	4.996e-01				
Cl-	4.995e-01	3.080e-01	-0.301	-0.511	-0.210
MnCl+	7.461e-05	5.042e-05	-4.127	-4.297	-0.170
MnCl2	3.691e-06	4.218e-06	-5.433	-5.375	0.058

MnCl3-	8.666e-07	5.856e-07	-6.062	-6.232	-0.170
CrCl+2	2.473e-09	7.491e-10	-8.607	-9.125	-0.519
NiCl+	4.033e-10	2.992e-10	-9.394	-9.524	-0.130
ZnCl+	3.132e-10	2.016e-10	-9.504	-9.696	-0.191
NiCl2	2.934e-10	3.353e-10	-9.532	-9.475	0.058
ZnCl2	5.477e-11	6.258e-11	-10.261	-10.204	0.058
CrCl2+	4.775e-11	3.542e-11	-10.321	-10.451	-0.130
ZnCl3-	3.176e-11	2.044e-11	-10.498	-10.690	-0.191
ZnCl4-2	1.401e-11	2.921e-12	-10.854	-11.534	-0.681
CrOHCl2	1.685e-16	1.925e-16	-15.773	-15.715	0.058
ZnOHCl	1.459e-17	1.667e-17	-16.836	-16.778	0.058
CrO3Cl-	7.795e-39	5.783e-39	-38.108	-38.238	-0.130
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-65.155	-65.674	-0.519
Cr(2)	9.463e-29				
Cr+2	9.463e-29	2.867e-29	-28.024	-28.543	-0.519
Cr(3)	9.176e-08				
Cr+3	8.918e-08	6.071e-09	-7.050	-8.217	-1.167
CrCl+2	2.473e-09	7.491e-10	-8.607	-9.125	-0.519
CrSO4+	5.773e-11	4.283e-11	-10.239	-10.368	-0.130
CrCl2+	4.775e-11	3.542e-11	-10.321	-10.451	-0.130
Cr(OH)+2	3.044e-12	9.222e-13	-11.517	-12.035	-0.519
CrOHSO4	1.735e-13	1.982e-13	-12.761	-12.703	0.058
CrOHCl2	1.685e-16	1.925e-16	-15.773	-15.715	0.058
Cr(OH)2+	1.324e-17	9.821e-18	-16.878	-17.008	-0.130
Cr2(OH)2SO4+2	1.097e-22	3.324e-23	-21.960	-22.478	-0.519
Cr(OH)3	2.828e-24	3.232e-24	-23.548	-23.491	0.058
CrNO3+2	1.155e-25	3.498e-26	-24.938	-25.456	-0.519
Cr2(OH)2(SO4)2	3.262e-28	3.727e-28	-27.487	-27.429	0.058
CrO2-	4.846e-34	3.595e-34	-33.315	-33.444	-0.130
Cr(OH)4-	1.847e-34	1.370e-34	-33.734	-33.863	-0.130
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.780	-56.910	-0.130
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.968	-60.487	-0.519
Cr(NH3)6+3	0.000e+00	0.000e+00	-64.773	-65.940	-1.167
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-65.155	-65.674	-0.519
Cr(6)	2.657e-38				
HCrO4-	1.699e-38	1.260e-38	-37.770	-37.900	-0.130
CrO3Cl-	7.795e-39	5.783e-39	-38.108	-38.238	-0.130
CrO3SO4-2	1.427e-39	4.323e-40	-38.846	-39.364	-0.519
H2CrO4	3.558e-40	4.065e-40	-39.449	-39.391	0.058
CrO4-2	0.000e+00	0.000e+00	-42.967	-43.733	-0.766
NaCrO4-	0.000e+00	0.000e+00	-44.053	-44.183	-0.130
KCrO4-	0.000e+00	0.000e+00	-45.134	-45.263	-0.130
Cr2O7-2	0.000e+00	0.000e+00	-73.623	-74.142	-0.519
H(0)	5.553e-31				
H2	2.777e-31	3.173e-31	-30.556	-30.499	0.058
K	7.619e-03				
K+	7.600e-03	4.686e-03	-2.119	-2.329	-0.210
KSO4-	1.933e-05	1.328e-05	-4.714	-4.877	-0.163



KCrO4-	0.000e+00	0.000e+00	-45.134	-45.263	-0.130
Mg	3.533e-02				
Mg+2	3.452e-02	1.176e-02	-1.462	-1.930	-0.468
MgSO4	8.071e-04	9.223e-04	-3.093	-3.035	0.058
MgHCO3+	7.207e-11	4.638e-11	-10.142	-10.334	-0.191
MgOH+	5.291e-14	3.781e-14	-13.276	-13.422	-0.146
MgCO3	5.316e-19	6.075e-19	-18.274	-18.216	0.058
Mn(2)	2.479e-04				
Mn+2	1.660e-04	4.046e-05	-3.780	-4.393	-0.613
MnCl+	7.461e-05	5.042e-05	-4.127	-4.297	-0.170
MnCl2	3.691e-06	4.218e-06	-5.433	-5.375	0.058
MnSO4	2.728e-06	3.118e-06	-5.564	-5.506	0.058
MnCl3-	8.666e-07	5.856e-07	-6.062	-6.232	-0.170
MnHCO3+	3.290e-13	2.223e-13	-12.483	-12.653	-0.170
MnOH+	3.174e-15	2.145e-15	-14.498	-14.669	-0.170
MnSeO4	5.064e-22	5.787e-22	-21.295	-21.238	0.058
Mn(NO3)2	5.114e-36	5.844e-36	-35.291	-35.233	0.058
Mn(OH)3-	8.305e-38	5.612e-38	-37.081	-37.251	-0.170
MnSe	0.000e+00	0.000e+00	-65.286	-65.228	0.058
Mn(3)	6.269e-16				
Mn+3	6.269e-16	5.443e-17	-15.203	-16.264	-1.061
Mn(6)	0.000e+00				
MnO4-2	0.000e+00	0.000e+00	-68.254	-68.935	-0.681
Mn(7)	0.000e+00				
MnO4-	0.000e+00	0.000e+00	-65.675	-65.894	-0.219
N(-3)	1.181e-03				
NH4+	1.174e-03	6.828e-04	-2.930	-3.166	-0.236
NH4SO4-	6.187e-06	4.181e-06	-5.209	-5.379	-0.170
NH3	7.903e-13	9.031e-13	-12.102	-12.044	0.058
Cr(NH3)4(OH)2+	0.000e+00	0.000e+00	-56.780	-56.910	-0.130
Cr(NH3)5OH+2	0.000e+00	0.000e+00	-59.968	-60.487	-0.519
Cr(NH3)6+3	0.000e+00	0.000e+00	-64.773	-65.940	-1.167
Cr(NH3)6Cl+2	0.000e+00	0.000e+00	-65.155	-65.674	-0.519
N(3)	4.028e-14				
NO2-	4.028e-14	2.988e-14	-13.395	-13.525	-0.130
N(5)	3.119e-16				
NO3-	3.119e-16	1.885e-16	-15.506	-15.725	-0.219
CrNO3+2	1.155e-25	3.498e-26	-24.938	-25.456	-0.519
Mn(NO3)2	5.114e-36	5.844e-36	-35.291	-35.233	0.058
Na	1.006e-01				
Na+	1.004e-01	7.142e-02	-0.998	-1.146	-0.148
NaSO4-	2.333e-04	1.603e-04	-3.632	-3.795	-0.163
NaHCO3	1.037e-11	1.185e-11	-10.984	-10.926	0.058
NaCO3-	7.467e-20	5.130e-20	-19.127	-19.290	-0.163
NaCrO4-	0.000e+00	0.000e+00	-44.053	-44.183	-0.130
Ni	2.005e-09				
Ni+2	1.280e-09	3.877e-10	-8.893	-9.412	-0.519
NiCl+	4.033e-10	2.992e-10	-9.394	-9.524	-0.130

NiCl2	2.934e-10	3.353e-10	-9.532	-9.475	0.058
NiSO4	2.900e-11	3.313e-11	-10.538	-10.480	0.058
Ni(SO4)2-2	3.027e-15	9.171e-16	-14.519	-15.038	-0.519
NiHCO3+	2.128e-17	1.579e-17	-16.672	-16.802	-0.130
NiOH+	1.653e-19	1.226e-19	-18.782	-18.911	-0.130
NiCO3	1.567e-22	1.790e-22	-21.805	-21.747	0.058
NiSeO4	8.033e-27	9.180e-27	-26.095	-26.037	0.058
Ni(OH)2	6.686e-28	7.641e-28	-27.175	-27.117	0.058
Ni(CO3)2-2	6.398e-38	1.938e-38	-37.194	-37.713	-0.519
Ni(OH)3-	4.572e-38	3.392e-38	-37.340	-37.470	-0.130
O(0)	6.449e-35				
O2	3.224e-35	3.685e-35	-34.492	-34.434	0.058
S(-2)	0.000e+00				
H2S	0.000e+00	0.000e+00	-72.096	-72.038	0.058
HS-	0.000e+00	0.000e+00	-78.250	-78.454	-0.204
S5-2	0.000e+00	0.000e+00	-87.091	-87.610	-0.519
S6-2	0.000e+00	0.000e+00	-87.162	-87.681	-0.519
S4-2	0.000e+00	0.000e+00	-87.335	-87.853	-0.519
S-2	0.000e+00	0.000e+00	-90.317	-90.998	-0.681
S3-2	0.000e+00	0.000e+00	-90.804	-91.322	-0.519
S2-2	0.000e+00	0.000e+00	-92.073	-92.592	-0.519
Zn(HS)2	0.000e+00	0.000e+00	-151.461	-151.403	0.058
Zn(HS)3-	0.000e+00	0.000e+00	-228.568	-228.697	-0.130
S(6)	1.663e-02				
HSO4-	1.206e-02	7.962e-03	-1.919	-2.099	-0.180
SO4-2	2.924e-03	4.753e-04	-2.534	-3.323	-0.789
MgSO4	8.071e-04	9.223e-04	-3.093	-3.035	0.058
CaSO4	5.762e-04	6.584e-04	-3.239	-3.181	0.058
NaSO4-	2.333e-04	1.603e-04	-3.632	-3.795	-0.163
KSO4-	1.933e-05	1.328e-05	-4.714	-4.877	-0.163
NH4SO4-	6.187e-06	4.181e-06	-5.209	-5.379	-0.170
MnSO4	2.728e-06	3.118e-06	-5.564	-5.506	0.058
AlSO4+	8.604e-08	5.682e-08	-7.065	-7.246	-0.180
Al(SO4)2-	3.131e-09	2.068e-09	-8.504	-8.684	-0.180
CrSO4+	5.773e-11	4.283e-11	-10.239	-10.368	-0.130
ZnSO4	3.339e-11	3.816e-11	-10.476	-10.418	0.058
NiSO4	2.900e-11	3.313e-11	-10.538	-10.480	0.058
Zn(SO4)2-2	5.232e-13	1.585e-13	-12.281	-12.800	-0.519
CrOHSO4	1.735e-13	1.982e-13	-12.761	-12.703	0.058
Ni(SO4)2-2	3.027e-15	9.171e-16	-14.519	-15.038	-0.519
Cr2(OH)2SO4+2	1.097e-22	3.324e-23	-21.960	-22.478	-0.519
Cr2(OH)2(SO4)2	3.262e-28	3.727e-28	-27.487	-27.429	0.058
CrO3SO4-2	1.427e-39	4.323e-40	-38.846	-39.364	-0.519
Se(-2)	0.000e+00				
H2Se	0.000e+00	0.000e+00	-51.666	-51.608	0.058
HSe-	0.000e+00	0.000e+00	-54.617	-54.746	-0.130
MnSe	0.000e+00	0.000e+00	-65.286	-65.228	0.058
Se-2	0.000e+00	0.000e+00	-68.792	-69.311	-0.519

Se(4)	7.501e-18					
SeO3-2	7.501e-18	2.272e-18	-17.125	-17.644	-0.519	
Se(6)	1.310e-08					
H2SeO3	1.288e-08	1.471e-08	-7.890	-7.832	0.058	
HSeO3-	2.193e-10	1.627e-10	-9.659	-9.789	-0.130	
HSeO4-	1.260e-18	9.347e-19	-17.900	-18.029	-0.130	
SeO4-2	3.823e-19	6.556e-20	-18.418	-19.183	-0.766	
MnSeO4	5.064e-22	5.787e-22	-21.295	-21.238	0.058	
NiSeO4	8.033e-27	9.180e-27	-26.095	-26.037	0.058	
ZnSeO4	3.362e-27	3.842e-27	-26.473	-26.415	0.058	
Zn(SeO4)2-2	0.000e+00	0.000e+00	-47.352	-47.871	-0.519	
Zn	1.958e-09					
Zn+2	1.510e-09	3.682e-10	-8.821	-9.434	-0.613	
ZnCl+	3.132e-10	2.016e-10	-9.504	-9.696	-0.191	
ZnCl2	5.477e-11	6.258e-11	-10.261	-10.204	0.058	
ZnSO4	3.339e-11	3.816e-11	-10.476	-10.418	0.058	
ZnCl3-	3.176e-11	2.044e-11	-10.498	-10.690	-0.191	
ZnCl4-2	1.401e-11	2.921e-12	-10.854	-11.534	-0.681	
Zn(SO4)2-2	5.232e-13	1.585e-13	-12.281	-12.800	-0.519	
ZnHCO3+	1.720e-17	1.276e-17	-16.764	-16.894	-0.130	
ZnOHCl	1.459e-17	1.667e-17	-16.836	-16.778	0.058	
ZnOH+	1.183e-18	8.780e-19	-17.927	-18.056	-0.130	
ZnCO3	4.005e-24	4.576e-24	-23.397	-23.339	0.058	
Zn(OH)2	8.013e-26	9.157e-26	-25.096	-25.038	0.058	
ZnSeO4	3.362e-27	3.842e-27	-26.473	-26.415	0.058	
Zn(OH)3-	1.733e-36	1.286e-36	-35.761	-35.891	-0.130	
Zn(CO3)2-2	2.012e-38	6.095e-39	-37.696	-38.215	-0.519	
Zn(SeO4)2-2	0.000e+00	0.000e+00	-47.352	-47.871	-0.519	
Zn(OH)4-2	0.000e+00	0.000e+00	-47.525	-48.044	-0.519	
Zn(HS)2	0.000e+00	0.000e+00	-151.461	-151.403	0.058	
Zn(HS)3-	0.000e+00	0.000e+00	-228.568	-228.697	-0.130	

-----Saturation indices-----

Phase	SI	log IAP	log KT	
(NH4)2CrO4	-50.42	19.69	70.11	(NH4)2CrO4
Al(OH)3(a)	-15.96	-4.95	11.01	Al(OH)3
Al2O3	-32.86	-9.88	22.98	Al2O3
Al4(OH)10SO4	-47.12	-24.42	22.70	Al4(OH)10SO4
AlAsO4:2H2O	-17.48	-12.68	4.80	AlAsO4:2H2O
AlOHSO4	-6.34	-9.57	-3.23	AlOHSO4
AlumK	-10.62	-15.96	-5.34	KAl(SO4)2:12H2O
Alunite	-24.33	-25.77	-1.44	KAl3(SO4)2(OH)6
Anhydrite	-0.91	-5.46	-4.55	CaSO4
Aragonite	-13.06	-21.34	-8.28	CaCO3
Arsenolite	-56.74	-140.42	-83.69	As4O6
Artinite	-32.06	-21.79	10.26	MgCO3:Mg(OH)2:3H2O

As <sub>2</sub> O <sub>5</sub>	-22.27	-15.45	6.82	As <sub>2</sub> O <sub>5</sub>
Ba <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>	-21.60	-30.57	-8.97	Ba <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub>
BaCrO <sub>4</sub>	-40.26	19.68	59.94	BaCrO <sub>4</sub>
Barite	0.46	-9.67	-10.12	BaSO <sub>4</sub>
BaSeO <sub>3</sub>	-19.79	-52.91	-33.12	BaSeO <sub>3</sub>
BaSeO <sub>4</sub>	-20.29	-25.53	-5.24	BaSeO <sub>4</sub>
Bianchite	-11.04	-12.80	-1.76	ZnSO <sub>4</sub> :6H <sub>2</sub> O
Birnessite	-18.71	24.29	43.00	MnO <sub>2</sub>
Bixbyite	-28.36	21.20	49.56	Mn <sub>2</sub> O <sub>3</sub>
Boehmite	-14.17	-4.94	9.23	AlOOH
Brucite	-18.02	-0.64	17.39	Mg(OH) <sub>2</sub>
Bunsenite	-21.11	-8.11	13.00	NiO
Ca <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :6H <sub>2</sub> O	-40.29	-17.99	22.30	Ca <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> :6H <sub>2</sub> O
CaCrO <sub>4</sub>	-43.75	23.89	67.64	CaCrO <sub>4</sub>
Calcite	-12.91	-21.34	-8.43	CaCO <sub>3</sub>
CaSeO <sub>3</sub> :2H <sub>2</sub> O	-14.20	-48.71	-34.51	CaSeO <sub>3</sub> :2H <sub>2</sub> O
CaSeO <sub>4</sub> :2H <sub>2</sub> O	-18.36	-21.33	-2.97	CaSeO <sub>4</sub> :2H <sub>2</sub> O
CH <sub>4</sub> (g)	-88.54	-130.05	-41.51	CH <sub>4</sub>
Claudetite	-56.50	-140.42	-83.93	As <sub>4</sub> O <sub>6</sub>
CO <sub>2</sub> (g)	-2.34	-20.51	-18.17	CO <sub>2</sub>
Cr(OH) <sub>2</sub>	-38.26	-30.05	8.22	Cr(OH) <sub>2</sub>
Cr(OH) <sub>3</sub> (A)	-15.61	-16.36	-0.75	Cr(OH) <sub>3</sub>
Cr(OH) <sub>3</sub> (C)	-18.23	-16.36	1.87	Cr(OH) <sub>3</sub>
Cr <sub>2</sub> O <sub>3</sub>	-29.59	-32.70	-3.11	Cr <sub>2</sub> O <sub>3</sub>
CrCl <sub>2</sub>	-45.89	-32.37	13.52	CrCl <sub>2</sub>
CrCl <sub>3</sub>	-33.98	-19.84	14.14	CrCl <sub>3</sub>
CrMetal	-87.66	-57.42	30.24	Cr
CrO <sub>3</sub>	-41.85	24.72	66.58	CrO <sub>3</sub>
Diaspore	-12.39	-4.94	7.44	AlOOH
Dolomite	-25.67	-42.47	-16.81	CaMg(CO <sub>3</sub> ) <sub>2</sub>
Epsomite	-3.10	-5.30	-2.21	MgSO <sub>4</sub> :7H <sub>2</sub> O
Gibbsite(C)	-14.25	-4.95	9.30	Al(OH) <sub>3</sub>
Goslarite	-10.77	-12.81	-2.04	ZnSO <sub>4</sub> :7H <sub>2</sub> O
Gypsum	-0.62	-5.47	-4.85	CaSO <sub>4</sub> :2H <sub>2</sub> O
Halite	-3.22	-1.66	1.56	NaCl
Hausmannite	-45.28	18.11	63.39	Mn <sub>3</sub> O <sub>4</sub>
Huntite	-55.37	-84.74	-29.37	CaMg <sub>3</sub> (CO <sub>3</sub> ) <sub>4</sub>
Hydromagnesite	-77.65	-85.21	-7.56	Mg <sub>5</sub> (CO <sub>3</sub> ) <sub>4</sub> (OH) <sub>2</sub> :4H <sub>2</sub> O
K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	-77.34	46.09	123.43	K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
K <sub>2</sub> CrO <sub>4</sub>	-48.30	21.37	69.67	K <sub>2</sub> CrO <sub>4</sub>
Lime	-34.70	-0.83	33.87	CaO
Magnesite	-13.25	-21.14	-7.89	MgCO <sub>3</sub>
Manganite	-14.08	10.60	24.67	MnOOH
MgCr <sub>2</sub> O <sub>4</sub>	-46.33	-33.33	13.00	MgCr <sub>2</sub> O <sub>4</sub>
MgCrO <sub>4</sub>	-51.53	24.10	75.63	MgCrO <sub>4</sub>
MgSeO <sub>3</sub> :6H <sub>2</sub> O	-15.11	-48.54	-33.43	MgSeO <sub>3</sub> :6H <sub>2</sub> O
Millerite	-79.11	-122.26	-43.15	NiS
Mirabilite	-4.13	-5.69	-1.55	Na <sub>2</sub> SO <sub>4</sub> :10H <sub>2</sub> O

Mn<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> -37.69 7.33 45.01 Mn<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>  
Mn<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O -37.28 -24.78 12.50 Mn<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O  
MnCl<sub>2</sub>:4H<sub>2</sub>O -7.75 -5.44 2.31 MnCl<sub>2</sub>:4H<sub>2</sub>O  
MnS(Green) -86.13 -117.24 -31.12 MnS  
MnSe -64.15 -133.10 -68.96 MnSe  
MnSeO<sub>3</sub> -14.74 -50.96 -36.22 MnSeO<sub>3</sub>  
MnSeO<sub>3</sub>:2H<sub>2</sub>O -14.48 -50.97 -36.50 MnSeO<sub>3</sub>:2H<sub>2</sub>O  
MnSO<sub>4</sub> -10.74 -7.72 3.03 MnSO<sub>4</sub>  
Morenosite -10.36 -12.79 -2.43 NiSO<sub>4</sub>:7H<sub>2</sub>O  
Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> -81.04 48.46 129.50 Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>  
Na<sub>2</sub>CrO<sub>4</sub> -49.39 23.73 73.13 Na<sub>2</sub>CrO<sub>4</sub>  
Natron -19.90 -21.57 -1.68 Na<sub>2</sub>CO<sub>3</sub>:10H<sub>2</sub>O  
Nesquehonite -15.67 -21.16 -5.49 MgCO<sub>3</sub>:3H<sub>2</sub>O  
Ni(OH)<sub>2</sub> -18.21 -8.12 10.10 Ni(OH)<sub>2</sub>  
Ni<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O -55.54 -39.84 15.70 Ni<sub>3</sub>(AsO<sub>4</sub>)<sub>2</sub>:8H<sub>2</sub>O  
Ni<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub> -69.09 -37.09 32.00 Ni<sub>4</sub>(OH)<sub>6</sub>SO<sub>4</sub>  
NiCO<sub>3</sub> -22.01 -28.62 -6.61 NiCO<sub>3</sub>  
NiSe -45.77 -138.12 -92.36 NiSe  
NiSeO<sub>3</sub>:2H<sub>2</sub>O -21.55 -55.99 -34.45 NiSeO<sub>3</sub>:2H<sub>2</sub>O  
Nsutite -18.12 24.29 42.42 MnO<sub>2</sub>  
O<sub>2</sub>(g) -31.45 54.76 86.22 O<sub>2</sub>  
Oripment -204.35 -412.67 -208.32 As<sub>2</sub>S<sub>3</sub>  
Periclase -22.97 -0.63 22.35 MgO  
Portlandite -24.22 -0.84 23.38 Ca(OH)<sub>2</sub>  
Pyrocroite -18.71 -3.10 15.61 Mn(OH)<sub>2</sub>  
Pyrolusite -17.16 24.29 41.45 MnO<sub>2</sub>  
Realgar -87.31 -162.95 -75.64 AsS  
Retgersite -10.71 -12.78 -2.07 NiSO<sub>4</sub>:6H<sub>2</sub>O  
Rhodochrosite -13.24 -23.60 -10.36 MnCO<sub>3</sub>  
Se(A) -20.84 -102.63 -81.79 Se  
Se(hex) -20.23 -102.63 -82.40 Se  
SeO<sub>2</sub> -10.55 -47.87 -37.31 SeO<sub>2</sub>  
SeO<sub>3</sub> -42.34 -20.49 21.85 SeO<sub>3</sub>  
Smithsonite -18.74 -28.64 -9.90 ZnCO<sub>3</sub>  
Sphalerite -75.42 -122.28 -46.86 ZnS  
Spinel -48.90 -10.51 38.39 MgAl<sub>2</sub>O<sub>4</sub>  
SULFUR -49.71 -86.77 -37.06 S  
Thenardite -5.45 -5.62 -0.17 Na<sub>2</sub>SO<sub>4</sub>  
Thermonatrite -21.70 -21.51 0.19 Na<sub>2</sub>CO<sub>3</sub>:H<sub>2</sub>O  
Witherite -16.96 -25.55 -8.59 BaCO<sub>3</sub>  
Wurtzite -77.43 -122.28 -44.85 ZnS  
Zincite -19.78 -8.13 11.65 ZnO  
Zincosite -16.21 -12.76 3.45 ZnSO<sub>4</sub>  
Zn(BO<sub>2</sub>)<sub>2</sub> -24.00 -15.71 8.29 Zn(BO<sub>2</sub>)<sub>2</sub>  
Zn(NO<sub>3</sub>)<sub>2</sub>:6H<sub>2</sub>O -44.24 205.88 250.12 Zn(NO<sub>3</sub>)<sub>2</sub>:6H<sub>2</sub>O  
Zn(OH)<sub>2</sub>(A) -20.59 -8.14 12.45 Zn(OH)<sub>2</sub>  
Zn(OH)<sub>2</sub>(B) -19.89 -8.14 11.75 Zn(OH)<sub>2</sub>  
Zn(OH)<sub>2</sub>(C) -20.34 -8.14 12.20 Zn(OH)<sub>2</sub>

Zn(OH)2(E) -19.64 -8.14 11.50 Zn(OH)2  
Zn(OH)2(G) -19.85 -8.14 11.71 Zn(OH)2  
Zn2(OH)2SO4 -28.40 -20.90 7.50 Zn2(OH)2SO4  
Zn2(OH)3Cl -32.64 -17.44 15.20 Zn2(OH)3Cl  
Zn3(AsO4)2:2.5H2O -53.51 -39.86 13.65 Zn3(AsO4)2:2.5H2O  
Zn3O(SO4)2 -54.10 -33.65 20.45 Zn3O(SO4)2  
Zn4(OH)6SO4 -65.57 -37.17 28.40 Zn4(OH)6SO4  
Zn5(OH)8Cl2 -81.51 -43.01 38.50 Zn5(OH)8Cl2  
ZnCl2 -17.89 -10.46 7.43 ZnCl2  
ZnCO3:H2O -18.39 -28.65 -10.26 ZnCO3:H2O  
ZnMetal -62.12 -35.51 26.61 Zn  
ZnO(Active) -19.44 -8.13 11.31 ZnO  
ZnS(A) -78.10 -122.28 -44.19 ZnS  
ZnSe -52.01 -138.15 -86.13 ZnSe  
ZnSO4:H2O -12.44 -12.76 -0.32 ZnSO4:H2O

-----  
End of simulation.

-----  
Reading input data for simulation 2.

-----  
End of run.

-----  
No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a November 2012  
SOLUTION 1  
    pH 7.63 charge  
    temp 12.9  
    pe 0  
    units mg/L  
    Pb 0.0017  
    Mn 1.784 as Mn+2  
    Ni 0.0014  
    Zn 0.0096  
END

-----  
TITLE  
-----

BH301a November 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Mn	3.247e-05	3.247e-05
Ni	2.385e-08	2.385e-08
Pb	8.205e-09	8.205e-09
Zn	1.469e-07	1.469e-07

## -----Description of solution-----

pH = 10.192    Charge balance  
 pe = 0.000  
 Activity of water = 1.000  
 Ionic strength = 8.951e-05  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 6.530e-05  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.900  
 Electrical balance (eq) = 1.216e-19  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = 0.00  
 Iterations = 5  
 Total H = 1.110125e+02  
 Total O = 5.550628e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	6.098e-05	6.033e-05	-4.215	-4.219	-0.005
H+	6.491e-11	6.423e-11	-10.188	-10.192	-0.005
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
H(0)	6.622e-24				
H2	3.311e-24	3.311e-24	-23.480	-23.480	0.000
Mn(2)	3.247e-05				
Mn+2	2.852e-05	2.732e-05	-4.545	-4.563	-0.019
MnOH+	3.954e-06	3.912e-06	-5.403	-5.408	-0.005
Mn(OH)3-	1.652e-09	1.634e-09	-8.782	-8.787	-0.005
Mn(3)	5.884e-30				
Mn+3	5.884e-30	5.349e-30	-29.230	-29.272	-0.041
Mn(6)	0.000e+00				
MnO4-2	0.000e+00	0.000e+00	-46.098	-46.117	-0.019
Mn(7)	0.000e+00				
MnO4-	0.000e+00	0.000e+00	-56.321	-56.325	-0.005
Ni	2.385e-08				
Ni(OH)2	1.927e-08	1.927e-08	-7.715	-7.715	0.000
Ni(OH)3-	3.033e-09	3.001e-09	-8.518	-8.523	-0.005
Ni+2	8.299e-10	7.950e-10	-9.081	-9.100	-0.019
NiOH+	7.116e-10	7.040e-10	-9.148	-9.152	-0.005
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-49.490	-49.490	0.000
Pb	8.205e-09				
Pb(OH)2	6.056e-09	6.056e-09	-8.218	-8.218	0.000
Pb(OH)3-	1.094e-09	1.083e-09	-8.961	-8.966	-0.005



PbOH+	1.011e-09	9.998e-10	-8.995	-9.000	-0.005
Pb(OH)4-2	4.041e-11	3.870e-11	-10.394	-10.412	-0.019
Pb+2	3.438e-12	3.293e-12	-11.464	-11.482	-0.019
Pb3(OH)4+2	4.356e-19	4.173e-19	-18.361	-18.380	-0.019
Pb2OH+3	8.121e-20	7.372e-20	-19.090	-19.132	-0.042
Zn	1.469e-07				
Zn(OH)2	1.395e-07	1.395e-07	-6.855	-6.855	0.000
Zn(OH)3-	6.945e-09	6.871e-09	-8.158	-8.163	-0.005
ZnOH+	3.025e-10	2.992e-10	-9.519	-9.524	-0.005
Zn+2	4.761e-11	4.562e-11	-10.322	-10.341	-0.019
Zn(OH)4-2	1.770e-11	1.695e-11	-10.752	-10.771	-0.019

## -----Saturation indices-----

Phase	SI	log IAP	log KT	
Birnessite	-6.59	36.21	42.80	MnO2
Bixbyite	2.75	52.03	49.28	Mn2O3
Bunsenite	-1.91	11.28	13.19	NiO
Hausmannite	3.82	67.85	64.02	Mn3O4
Litharge	-4.33	8.90	13.23	PbO
Manganite	1.54	26.01	24.47	MnOOH
Massicot	-4.53	8.90	13.43	PbO
Minium	-29.78	47.09	76.88	Pb3O4
Ni(OH)2	1.43	11.28	9.86	Ni(OH)2
Nsutite	-6.01	36.21	42.21	MnO2
O2(g)	-46.50	40.77	87.27	O2
Pb(OH)2(C)	0.32	8.90	8.58	Pb(OH)2
Pb2O(OH)2	-8.40	17.80	26.20	Pb2O(OH)2
Pb2O3	-22.85	38.19	61.04	Pb2O3
PbMetal	-15.74	-11.48	4.26	Pb
PbO:0.3H2O	-4.08	8.90	12.98	PbO:0.33H2O
Plattnerite	-22.21	29.29	51.49	PbO2
Pyrocroite	0.03	15.82	15.79	Mn(OH)2
Pyrolusite	-5.27	36.21	41.47	MnO2
Zincite	-1.77	10.04	11.82	ZnO
Zn(OH)2(A)	-2.41	10.04	12.45	Zn(OH)2
Zn(OH)2(B)	-1.71	10.04	11.75	Zn(OH)2
Zn(OH)2(C)	-2.16	10.04	12.20	Zn(OH)2
Zn(OH)2(E)	-1.46	10.04	11.50	Zn(OH)2
Zn(OH)2(G)	-1.67	10.04	11.71	Zn(OH)2
ZnMetal	-37.24	-10.34	26.90	Zn
ZnO(Active)	-1.27	10.04	11.31	ZnO

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End of simulation.  
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Reading input data for simulation 2.  
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-----  
End of run.  
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No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a November 2012  
SOLUTION 1  
pH 7.63 charge  
temp 12.9  
pe -1.63  
units mg/L  
Pb 0.0017  
Mn 1.784 as Mn+2  
Ni 0.0014  
Zn 0.0096  
END

-----  
TITLE  
-----

BH301a November 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Mn	3.247e-05	3.247e-05
Ni	2.385e-08	2.385e-08
Pb	8.205e-09	8.205e-09
Zn	1.469e-07	1.469e-07

## -----Description of solution-----

pH = 10.192    Charge balance  
 pe = -1.630  
 Activity of water = 1.000  
 Ionic strength = 8.951e-05  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 6.530e-05  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.900  
 Electrical balance (eq) = 1.216e-19  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = 0.00  
 Iterations = 5  
 Total H = 1.110125e+02  
 Total O = 5.550628e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	6.098e-05	6.033e-05	-4.215	-4.219	-0.005
H+	6.491e-11	6.423e-11	-10.188	-10.192	-0.005
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
H(0)	1.205e-20				
H2	6.025e-21	6.025e-21	-20.220	-20.220	0.000
Mn(2)	3.247e-05				
Mn+2	2.852e-05	2.732e-05	-4.545	-4.563	-0.019
MnOH+	3.954e-06	3.912e-06	-5.403	-5.408	-0.005
Mn(OH)3-	1.652e-09	1.634e-09	-8.782	-8.787	-0.005
Mn(3)	1.379e-31				
Mn+3	1.379e-31	1.254e-31	-30.860	-30.902	-0.041
Mn(6)	0.000e+00				
MnO4-2	0.000e+00	0.000e+00	-52.618	-52.637	-0.019
Mn(7)	0.000e+00				
MnO4-	0.000e+00	0.000e+00	-64.471	-64.475	-0.005
Ni	2.385e-08				
Ni(OH)2	1.927e-08	1.927e-08	-7.715	-7.715	0.000
Ni(OH)3-	3.033e-09	3.001e-09	-8.518	-8.523	-0.005
Ni+2	8.299e-10	7.950e-10	-9.081	-9.100	-0.019
NiOH+	7.116e-10	7.040e-10	-9.148	-9.152	-0.005
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-56.010	-56.010	0.000
Pb	8.205e-09				
Pb(OH)2	6.056e-09	6.056e-09	-8.218	-8.218	0.000
Pb(OH)3-	1.094e-09	1.083e-09	-8.961	-8.966	-0.005

PbOH+	1.011e-09	9.998e-10	-8.995	-9.000	-0.005
Pb(OH)4-2	4.041e-11	3.870e-11	-10.394	-10.412	-0.019
Pb+2	3.438e-12	3.293e-12	-11.464	-11.482	-0.019
Pb3(OH)4+2	4.356e-19	4.173e-19	-18.361	-18.380	-0.019
Pb2OH+3	8.121e-20	7.372e-20	-19.090	-19.132	-0.042
Zn	1.469e-07				
Zn(OH)2	1.395e-07	1.395e-07	-6.855	-6.855	0.000
Zn(OH)3-	6.945e-09	6.871e-09	-8.158	-8.163	-0.005
ZnOH+	3.025e-10	2.992e-10	-9.519	-9.524	-0.005
Zn+2	4.761e-11	4.562e-11	-10.322	-10.341	-0.019
Zn(OH)4-2	1.770e-11	1.695e-11	-10.752	-10.771	-0.019

-----Saturation indices-----

Phase	SI	log IAP	log KT	
Birnessite	-9.85	32.95	42.80	MnO2
Bixbyite	-0.51	48.77	49.28	Mn2O3
Bunsenite	-1.91	11.28	13.19	NiO
Hausmannite	0.56	64.59	64.02	Mn3O4
Litharge	-4.33	8.90	13.23	PbO
Manganite	-0.09	24.38	24.47	MnOOH
Massicot	-4.53	8.90	13.43	PbO
Minium	-33.04	43.83	76.88	Pb3O4
Ni(OH)2	1.43	11.28	9.86	Ni(OH)2
Nsutite	-9.27	32.95	42.21	MnO2
O2(g)	-53.02	34.25	87.27	O2
Pb(OH)2(C)	0.32	8.90	8.58	Pb(OH)2
Pb2O(OH)2	-8.40	17.80	26.20	Pb2O(OH)2
Pb2O3	-26.11	34.93	61.04	Pb2O3
PbMetal	-12.48	-8.22	4.26	Pb
PbO:0.3H2O	-4.08	8.90	12.98	PbO:0.33H2O
Plattnerite	-25.47	26.03	51.49	PbO2
Pyrocroite	0.03	15.82	15.79	Mn(OH)2
Pyrolusite	-8.53	32.95	41.47	MnO2
Zincite	-1.77	10.04	11.82	ZnO
Zn(OH)2(A)	-2.41	10.04	12.45	Zn(OH)2
Zn(OH)2(B)	-1.71	10.04	11.75	Zn(OH)2
Zn(OH)2(C)	-2.16	10.04	12.20	Zn(OH)2
Zn(OH)2(E)	-1.46	10.04	11.50	Zn(OH)2
Zn(OH)2(G)	-1.67	10.04	11.71	Zn(OH)2
ZnMetal	-33.98	-7.08	26.90	Zn
ZnO(Active)	-1.27	10.04	11.31	ZnO

-----  
End of simulation.  
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Reading input data for simulation 2.  
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-----  
End of run.  
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No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
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SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a November 2012  
SOLUTION 1  
pH 7.63 charge  
temp 12.9  
pe -3.26  
units mg/L  
Pb 0.0017  
Mn 1.784 as Mn+2  
Ni 0.0014  
Zn 0.0096  
END

-----  
TITLE  
-----

BH301a November 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Mn	3.247e-05	3.247e-05
Ni	2.385e-08	2.385e-08
Pb	8.205e-09	8.205e-09
Zn	1.469e-07	1.469e-07

## -----Description of solution-----

pH = 10.192    Charge balance  
 pe = -3.260  
 Activity of water = 1.000  
 Ionic strength = 8.951e-05  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 6.530e-05  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.900  
 Electrical balance (eq) = 1.216e-19  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = 0.00  
 Iterations = 5  
 Total H = 1.110125e+02  
 Total O = 5.550628e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	6.098e-05	6.033e-05	-4.215	-4.219	-0.005
H+	6.491e-11	6.423e-11	-10.188	-10.192	-0.005
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
H(0)	2.193e-17				
H2	1.096e-17	1.096e-17	-16.960	-16.960	0.000
Mn(2)	3.247e-05				
Mn+2	2.852e-05	2.732e-05	-4.545	-4.563	-0.019
MnOH+	3.954e-06	3.912e-06	-5.403	-5.408	-0.005
Mn(OH)3-	1.652e-09	1.634e-09	-8.782	-8.787	-0.005
Mn(3)	3.233e-33				
Mn+3	3.233e-33	2.939e-33	-32.490	-32.532	-0.041
Mn(6)	0.000e+00				
MnO4-2	0.000e+00	0.000e+00	-59.138	-59.157	-0.019
Mn(7)	0.000e+00				
MnO4-	0.000e+00	0.000e+00	-72.621	-72.625	-0.005
Ni	2.385e-08				
Ni(OH)2	1.927e-08	1.927e-08	-7.715	-7.715	0.000
Ni(OH)3-	3.033e-09	3.001e-09	-8.518	-8.523	-0.005
Ni+2	8.299e-10	7.950e-10	-9.081	-9.100	-0.019
NiOH+	7.116e-10	7.040e-10	-9.148	-9.152	-0.005
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-62.530	-62.530	0.000
Pb	8.205e-09				
Pb(OH)2	6.056e-09	6.056e-09	-8.218	-8.218	0.000
Pb(OH)3-	1.094e-09	1.083e-09	-8.961	-8.966	-0.005



PbOH+	1.011e-09	9.998e-10	-8.995	-9.000	-0.005
Pb(OH)4-2	4.041e-11	3.870e-11	-10.394	-10.412	-0.019
Pb+2	3.438e-12	3.293e-12	-11.464	-11.482	-0.019
Pb3(OH)4+2	4.356e-19	4.173e-19	-18.361	-18.380	-0.019
Pb2OH+3	8.121e-20	7.372e-20	-19.090	-19.132	-0.042
Zn	1.469e-07				
Zn(OH)2	1.395e-07	1.395e-07	-6.855	-6.855	0.000
Zn(OH)3-	6.945e-09	6.871e-09	-8.158	-8.163	-0.005
ZnOH+	3.025e-10	2.992e-10	-9.519	-9.524	-0.005
Zn+2	4.761e-11	4.562e-11	-10.322	-10.341	-0.019
Zn(OH)4-2	1.770e-11	1.695e-11	-10.752	-10.771	-0.019

-----Saturation indices-----

Phase	SI	log IAP	log KT	
Birnessite	-13.11	29.69	42.80	MnO2
Bixbyite	-3.77	45.51	49.28	Mn2O3
Bunsenite	-1.91	11.28	13.19	NiO
Hausmannite	-2.70	61.33	64.02	Mn3O4
Litharge	-4.33	8.90	13.23	PbO
Manganite	-1.72	22.75	24.47	MnOOH
Massicot	-4.53	8.90	13.43	PbO
Minium	-36.30	40.57	76.88	Pb3O4
Ni(OH)2	1.43	11.28	9.86	Ni(OH)2
Nsutite	-12.53	29.69	42.21	MnO2
O2(g)	-59.54	27.73	87.27	O2
Pb(OH)2(C)	0.32	8.90	8.58	Pb(OH)2
Pb2O(OH)2	-8.40	17.80	26.20	Pb2O(OH)2
Pb2O3	-29.37	31.67	61.04	Pb2O3
PbMetal	-9.22	-4.96	4.26	Pb
PbO:0.3H2O	-4.08	8.90	12.98	PbO:0.33H2O
Plattnerite	-28.73	22.77	51.49	PbO2
Pyrocroite	0.03	15.82	15.79	Mn(OH)2
Pyrolusite	-11.79	29.69	41.47	MnO2
Zincite	-1.77	10.04	11.82	ZnO
Zn(OH)2(A)	-2.41	10.04	12.45	Zn(OH)2
Zn(OH)2(B)	-1.71	10.04	11.75	Zn(OH)2
Zn(OH)2(C)	-2.16	10.04	12.20	Zn(OH)2
Zn(OH)2(E)	-1.46	10.04	11.50	Zn(OH)2
Zn(OH)2(G)	-1.67	10.04	11.71	Zn(OH)2
ZnMetal	-30.72	-3.82	26.90	Zn
ZnO(Active)	-1.27	10.04	11.31	ZnO

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End of simulation.  
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Reading input data for simulation 2.  
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End of run.  
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No memory leaks

Database file: minteq.dat

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Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a November 2012  
SOLUTION 1  
    pH 7.63 charge  
    temp 12.9  
    pe -8.15  
    units mg/L  
    Pb 0.0017  
    Mn 1.784 as Mn+2  
    Ni 0.0014  
    Zn 0.0096  
END

-----  
TITLE  
-----

BH301a November 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Mn	3.247e-05	3.247e-05
Ni	2.385e-08	2.385e-08
Pb	8.205e-09	8.205e-09
Zn	1.469e-07	1.469e-07

## -----Description of solution-----

pH = 10.192    Charge balance  
 pe = -8.150  
 Activity of water = 1.000  
 Ionic strength = 8.951e-05  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 6.530e-05  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.900  
 Electrical balance (eq) = 4.707e-20  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = 0.00  
 Iterations = 5  
 Total H = 1.110125e+02  
 Total O = 5.550628e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	6.098e-05	6.033e-05	-4.215	-4.219	-0.005
H+	6.491e-11	6.423e-11	-10.188	-10.192	-0.005
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
H(0)	1.321e-07				
H2	6.607e-08	6.607e-08	-7.180	-7.180	0.000
Mn(2)	3.247e-05				
Mn+2	2.852e-05	2.732e-05	-4.545	-4.563	-0.019
MnOH+	3.954e-06	3.912e-06	-5.403	-5.408	-0.005
Mn(OH)3-	1.652e-09	1.634e-09	-8.782	-8.787	-0.005
Mn(3)	4.165e-38				
Mn+3	4.165e-38	3.787e-38	-37.380	-37.422	-0.041
Mn(6)	0.000e+00				
MnO4-2	0.000e+00	0.000e+00	-78.698	-78.717	-0.019
Mn(7)	0.000e+00				
MnO4-	0.000e+00	0.000e+00	-97.071	-97.075	-0.005
Ni	2.385e-08				
Ni(OH)2	1.927e-08	1.927e-08	-7.715	-7.715	0.000
Ni(OH)3-	3.033e-09	3.001e-09	-8.518	-8.523	-0.005
Ni+2	8.299e-10	7.950e-10	-9.081	-9.100	-0.019
NiOH+	7.116e-10	7.040e-10	-9.148	-9.152	-0.005
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-82.090	-82.090	0.000
Pb	8.205e-09				
Pb(OH)2	6.056e-09	6.056e-09	-8.218	-8.218	0.000
Pb(OH)3-	1.094e-09	1.083e-09	-8.961	-8.966	-0.005

PbOH+	1.011e-09	9.998e-10	-8.995	-9.000	-0.005
Pb(OH)4-2	4.041e-11	3.870e-11	-10.394	-10.412	-0.019
Pb+2	3.438e-12	3.293e-12	-11.464	-11.482	-0.019
Pb3(OH)4+2	4.356e-19	4.173e-19	-18.361	-18.380	-0.019
Pb2OH+3	8.121e-20	7.372e-20	-19.090	-19.132	-0.042
Zn	1.469e-07				
Zn(OH)2	1.395e-07	1.395e-07	-6.855	-6.855	0.000
Zn(OH)3-	6.945e-09	6.871e-09	-8.158	-8.163	-0.005
ZnOH+	3.025e-10	2.992e-10	-9.519	-9.524	-0.005
Zn+2	4.761e-11	4.562e-11	-10.322	-10.341	-0.019
Zn(OH)4-2	1.770e-11	1.695e-11	-10.752	-10.771	-0.019

-----Saturation indices-----

Phase	SI	log IAP	log KT	
Birnessite	-22.89	19.91	42.80	MnO2
Bixbyite	-13.55	35.73	49.28	Mn2O3
Bunsenite	-1.91	11.28	13.19	NiO
Hausmannite	-12.48	51.55	64.02	Mn3O4
Litharge	-4.33	8.90	13.23	PbO
Manganite	-6.61	17.86	24.47	MnOOH
Massicot	-4.53	8.90	13.43	PbO
Minium	-46.08	30.79	76.88	Pb3O4
Ni(OH)2	1.43	11.28	9.86	Ni(OH)2
Nsutite	-22.31	19.91	42.21	MnO2
O2(g)	-79.10	8.17	87.27	O2
Pb(OH)2(C)	0.32	8.90	8.58	Pb(OH)2
Pb2O(OH)2	-8.40	17.80	26.20	Pb2O(OH)2
Pb2O3	-39.15	21.89	61.04	Pb2O3
PbMetal	0.56	4.82	4.26	Pb
PbO:0.3H2O	-4.08	8.90	12.98	PbO:0.33H2O
Plattnerite	-38.51	12.99	51.49	PbO2
Pyrocroite	0.03	15.82	15.79	Mn(OH)2
Pyrolusite	-21.57	19.91	41.47	MnO2
Zincite	-1.77	10.04	11.82	ZnO
Zn(OH)2(A)	-2.41	10.04	12.45	Zn(OH)2
Zn(OH)2(B)	-1.71	10.04	11.75	Zn(OH)2
Zn(OH)2(C)	-2.16	10.04	12.20	Zn(OH)2
Zn(OH)2(E)	-1.46	10.04	11.50	Zn(OH)2
Zn(OH)2(G)	-1.67	10.04	11.71	Zn(OH)2
ZnMetal	-20.94	5.96	26.90	Zn
ZnO(Active)	-1.27	10.04	11.31	ZnO

-----  
End of simulation.  
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-----  
Reading input data for simulation 2.  
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-----  
End of run.  
-----

No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a November 2012  
SOLUTION 1  
pH 7.63 charge  
temp 12.9  
pe -11.41  
units mg/L  
Pb 0.0017  
Mn 1.784 as Mn+2  
Ni 0.0014  
Zn 0.0096  
END

-----  
TITLE  
-----

BH301a November 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Mn	3.247e-05	3.247e-05
Ni	2.385e-08	2.385e-08
Pb	8.205e-09	8.205e-09
Zn	1.469e-07	1.469e-07

## -----Description of solution-----

pH = 10.194    Charge balance  
 pe = -11.410  
 Activity of water = 0.996  
 Ionic strength = 8.951e-05  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 6.530e-05  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.900  
 Electrical balance (eq) = 9.126e-15  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = 0.00  
 Iterations = 14  
 Total H = 1.114468e+02  
 Total O = 5.550628e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	6.098e-05	6.033e-05	-4.215	-4.219	-0.005
H+	6.467e-11	6.399e-11	-10.189	-10.194	-0.005
H2O	5.551e+01	9.963e-01	-0.002	-0.002	0.000
H(0)	4.343e-01				
H2	2.172e-01	2.172e-01	-0.663	-0.663	0.000
Mn(2)	3.247e-05				
Mn+2	2.852e-05	2.732e-05	-4.545	-4.563	-0.019
MnOH+	3.954e-06	3.912e-06	-5.403	-5.408	-0.005
Mn(OH)3-	1.652e-09	1.634e-09	-8.782	-8.787	-0.005
Mn(3)	0.000e+00				
Mn+3	0.000e+00	0.000e+00	-40.640	-40.682	-0.041
Mn(6)	0.000e+00				
MnO4-2	0.000e+00	0.000e+00	-91.732	-91.750	-0.019
Mn(7)	0.000e+00				
MnO4-	0.000e+00	0.000e+00	-113.364	-113.369	-0.005
Ni	2.385e-08				
Ni(OH)2	1.927e-08	1.927e-08	-7.715	-7.715	0.000
Ni(OH)3-	3.033e-09	3.001e-09	-8.518	-8.523	-0.005
Ni+2	8.299e-10	7.950e-10	-9.081	-9.100	-0.019
NiOH+	7.116e-10	7.040e-10	-9.148	-9.152	-0.005
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-95.127	-95.127	0.000
Pb	8.205e-09				
Pb(OH)2	6.056e-09	6.056e-09	-8.218	-8.218	0.000
Pb(OH)3-	1.094e-09	1.083e-09	-8.961	-8.966	-0.005



PbOH+	1.011e-09	9.998e-10	-8.995	-9.000	-0.005
Pb(OH)4-2	4.041e-11	3.870e-11	-10.394	-10.412	-0.019
Pb+2	3.438e-12	3.293e-12	-11.464	-11.482	-0.019
Pb3(OH)4+2	4.356e-19	4.173e-19	-18.361	-18.380	-0.019
Pb2OH+3	8.121e-20	7.372e-20	-19.090	-19.132	-0.042
Zn	1.469e-07				
Zn(OH)2	1.395e-07	1.395e-07	-6.855	-6.855	0.000
Zn(OH)3-	6.945e-09	6.871e-09	-8.158	-8.163	-0.005
ZnOH+	3.025e-10	2.992e-10	-9.519	-9.524	-0.005
Zn+2	4.761e-11	4.562e-11	-10.322	-10.341	-0.019
Zn(OH)4-2	1.770e-11	1.695e-11	-10.752	-10.771	-0.019

-----Saturation indices-----

Phase	SI	log IAP	log KT	
Birnessite	-29.41	13.39	42.80	MnO2
Bixbyite	-20.07	29.21	49.28	Mn2O3
Bunsenite	-1.91	11.29	13.19	NiO
Hausmannite	-18.99	45.03	64.02	Mn3O4
Litharge	-4.32	8.90	13.23	PbO
Manganite	-9.87	14.60	24.47	MnOOH
Massicot	-4.53	8.90	13.43	PbO
Minium	-52.60	24.28	76.88	Pb3O4
Ni(OH)2	1.43	11.28	9.86	Ni(OH)2
Nsutite	-28.82	13.39	42.21	MnO2
O2(g)	-92.14	-4.87	87.27	O2
Pb(OH)2(C)	0.32	8.90	8.58	Pb(OH)2
Pb2O(OH)2	-8.39	17.81	26.20	Pb2O(OH)2
Pb2O3	-45.67	15.37	61.04	Pb2O3
PbMetal	7.08	11.34	4.26	Pb
PbO:0.3H2O	-4.08	8.90	12.98	PbO:0.33H2O
Plattnerite	-45.02	6.47	51.49	PbO2
Pyrocroite	0.03	15.82	15.79	Mn(OH)2
Pyrolusite	-28.09	13.39	41.47	MnO2
Zincite	-1.77	10.05	11.82	ZnO
Zn(OH)2(A)	-2.41	10.04	12.45	Zn(OH)2
Zn(OH)2(B)	-1.71	10.04	11.75	Zn(OH)2
Zn(OH)2(C)	-2.16	10.04	12.20	Zn(OH)2
Zn(OH)2(E)	-1.46	10.04	11.50	Zn(OH)2
Zn(OH)2(G)	-1.67	10.04	11.71	Zn(OH)2
ZnMetal	-14.42	12.48	26.90	Zn
ZnO(Active)	-1.26	10.05	11.31	ZnO

-----  
End of simulation.  
-----

-----  
Reading input data for simulation 2.  
-----

-----  
End of run.  
-----

No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a November 2012  
SOLUTION 1  
    pH 7.63 charge  
    temp 12.9  
    pe 11.41  
    units mg/L  
    Pb 0.0017  
    Mn 1.784 as Mn+2  
    Ni 0.0014  
    Zn 0.0096  
END

-----  
TITLE  
-----

BH301a November 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Mn	3.247e-05	3.247e-05
Ni	2.385e-08	2.385e-08
Pb	8.205e-09	8.205e-09
Zn	1.469e-07	1.469e-07

## -----Description of solution-----

pH = 9.534    Charge balance  
 pe = 11.410  
 Activity of water = 1.000  
 Ionic strength = 4.739e-05  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 1.415e-05  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.900  
 Electrical balance (eq) = 2.345e-14  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = 0.00  
 Iterations = 10  
 Total H = 1.110124e+02  
 Total O = 5.550630e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	1.335e-05	1.325e-05	-4.874	-4.878	-0.003
H+	2.947e-10	2.924e-10	-9.531	-9.534	-0.003
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
H(0)	0.000e+00				
H2	0.000e+00	0.000e+00	-44.983	-44.983	0.000
Mn(2)	1.576e-05				
Mn+2	1.529e-05	1.482e-05	-4.816	-4.829	-0.014
MnOH+	4.697e-07	4.660e-07	-6.328	-6.332	-0.003
Mn(OH)3-	9.467e-12	9.393e-12	-11.024	-11.027	-0.003
Mn(3)	7.996e-19				
Mn+3	7.996e-19	7.457e-19	-18.097	-18.127	-0.030
Mn(6)	1.011e-06				
MnO4-2	1.011e-06	9.801e-07	-5.995	-6.009	-0.014
Mn(7)	1.570e-05				
MnO4-	1.570e-05	1.558e-05	-4.804	-4.807	-0.003
Ni	2.385e-08				
Ni(OH)2	1.144e-08	1.144e-08	-7.942	-7.942	0.000
Ni+2	1.009e-08	9.783e-09	-7.996	-8.010	-0.014
NiOH+	1.918e-09	1.903e-09	-8.717	-8.721	-0.003
Ni(OH)3-	3.943e-10	3.912e-10	-9.404	-9.408	-0.003
O(0)	6.572e-07				
O2	3.286e-07	3.286e-07	-6.483	-6.483	0.000
Pb	8.205e-09				
Pb(OH)2	4.535e-09	4.535e-09	-8.343	-8.343	0.000
PbOH+	3.436e-09	3.409e-09	-8.464	-8.467	-0.003

Pb(OH)3-	1.795e-10	1.781e-10	-9.746	-9.749	-0.003
Pb+2	5.276e-11	5.113e-11	-10.278	-10.291	-0.014
Pb(OH)4-2	1.443e-12	1.398e-12	-11.841	-11.854	-0.014
Pb2OH+3	4.188e-18	3.902e-18	-17.378	-17.409	-0.031
Pb3(OH)4+2	3.749e-18	3.633e-18	-17.426	-17.440	-0.014
Zn	1.469e-07				
Zn(OH)2	1.429e-07	1.429e-07	-6.845	-6.845	0.000
Zn(OH)3-	1.557e-09	1.545e-09	-8.808	-8.811	-0.003
ZnOH+	1.406e-09	1.395e-09	-8.852	-8.855	-0.003
Zn+2	9.991e-10	9.684e-10	-9.000	-9.014	-0.014
Zn(OH)4-2	8.642e-13	8.375e-13	-12.063	-12.077	-0.014

## -----Saturation indices-----

Phase	SI	log IAP	log KT	
Birnessite	13.33	-77.17	-90.50	MnO2
Bixbyite	21.09	-196.23	-217.32	Mn2O3
Bunsenite	-2.13	11.06	13.19	NiO
Hausmannite	20.58	-315.30	-335.88	Mn3O4
Litharge	-4.45	8.78	13.23	PbO
Manganite	10.71	-98.12	-108.83	MnOOH
Massicot	-4.65	8.78	13.43	PbO
Minium	-8.66	68.22	76.88	Pb3O4
Ni(OH)2	1.20	11.06	9.86	Ni(OH)2
Nsutite	13.91	-77.17	-91.09	MnO2
O2(g)	-3.49	83.78	87.27	O2
Pb(OH)2(C)	0.19	8.78	8.58	Pb(OH)2
Pb2O(OH)2	-8.65	17.55	26.20	Pb2O(OH)2
Pb2O3	-1.60	59.44	61.04	Pb2O3
PbMetal	-37.37	-33.11	4.26	Pb
PbO:0.3H2O	-4.20	8.78	12.98	PbO:0.33H2O
Plattnerite	-0.83	50.66	51.49	PbO2
Pyrocroite	-1.55	-119.06	-117.51	Mn(OH)2
Pyrolusite	14.65	-77.17	-91.83	MnO2
Zincite	-1.76	10.05	11.82	ZnO
Zn(OH)2(A)	-2.40	10.05	12.45	Zn(OH)2
Zn(OH)2(B)	-1.70	10.05	11.75	Zn(OH)2
Zn(OH)2(C)	-2.15	10.05	12.20	Zn(OH)2
Zn(OH)2(E)	-1.45	10.05	11.50	Zn(OH)2
Zn(OH)2(G)	-1.66	10.05	11.71	Zn(OH)2
ZnMetal	-58.73	-31.83	26.90	Zn
ZnO(Active)	-1.26	10.05	11.31	ZnO

-----  
End of simulation.  
-----

-----  
Reading input data for simulation 2.  
-----

-----  
End of run.  
-----

No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a November 2012  
SOLUTION 1  
pH 7.63 charge  
temp 12.9  
pe 8.15  
units mg/L  
Pb 0.0017  
Mn 1.784 as Mn+2  
Ni 0.0014  
Zn 0.0096  
END

-----  
TITLE  
-----

BH301a November 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Mn	3.247e-05	3.247e-05
Ni	2.385e-08	2.385e-08
Pb	8.205e-09	8.205e-09
Zn	1.469e-07	1.469e-07

## -----Description of solution-----

pH = 10.192    Charge balance  
 pe = 8.150  
 Activity of water = 1.000  
 Ionic strength = 8.951e-05  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 6.530e-05  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.900  
 Electrical balance (eq) = 1.429e-19  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = 0.00  
 Iterations = 5  
 Total H = 1.110125e+02  
 Total O = 5.550628e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	6.098e-05	6.033e-05	-4.215	-4.219	-0.005
H+	6.491e-11	6.423e-11	-10.188	-10.192	-0.005
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
H(0)	3.319e-40				
H2	1.659e-40	1.660e-40	-39.780	-39.780	0.000
Mn(2)	3.247e-05				
Mn+2	2.852e-05	2.732e-05	-4.545	-4.563	-0.019
MnOH+	3.954e-06	3.912e-06	-5.403	-5.408	-0.005
Mn(OH)3-	1.652e-09	1.634e-09	-8.782	-8.787	-0.005
Mn(3)	8.311e-22				
Mn+3	8.311e-22	7.555e-22	-21.080	-21.122	-0.041
Mn(6)	3.177e-14				
MnO4-2	3.177e-14	3.043e-14	-13.498	-13.517	-0.019
Mn(7)	2.687e-16				
MnO4-	2.687e-16	2.658e-16	-15.571	-15.575	-0.005
Ni	2.385e-08				
Ni(OH)2	1.927e-08	1.927e-08	-7.715	-7.715	0.000
Ni(OH)3-	3.033e-09	3.001e-09	-8.518	-8.523	-0.005
Ni+2	8.299e-10	7.950e-10	-9.081	-9.100	-0.019
NiOH+	7.116e-10	7.040e-10	-9.148	-9.152	-0.005
O(0)	2.576e-17				
O2	1.288e-17	1.288e-17	-16.890	-16.890	0.000
Pb	8.205e-09				
Pb(OH)2	6.056e-09	6.056e-09	-8.218	-8.218	0.000
Pb(OH)3-	1.094e-09	1.083e-09	-8.961	-8.966	-0.005



PbOH+	1.011e-09	9.998e-10	-8.995	-9.000	-0.005
Pb(OH)4-2	4.041e-11	3.870e-11	-10.394	-10.412	-0.019
Pb+2	3.438e-12	3.293e-12	-11.464	-11.482	-0.019
Pb3(OH)4+2	4.356e-19	4.173e-19	-18.361	-18.380	-0.019
Pb2OH+3	8.121e-20	7.372e-20	-19.090	-19.132	-0.042
Zn	1.469e-07				
Zn(OH)2	1.395e-07	1.395e-07	-6.855	-6.855	0.000
Zn(OH)3-	6.945e-09	6.871e-09	-8.158	-8.163	-0.005
ZnOH+	3.025e-10	2.992e-10	-9.519	-9.524	-0.005
Zn+2	4.761e-11	4.562e-11	-10.322	-10.341	-0.019
Zn(OH)4-2	1.770e-11	1.695e-11	-10.752	-10.771	-0.019

-----Saturation indices-----

Phase	SI	log IAP	log KT	
Birnessite	9.71	52.51	42.80	MnO2
Bixbyite	19.05	68.33	49.28	Mn2O3
Bunsenite	-1.91	11.28	13.19	NiO
Hausmannite	20.12	84.15	64.02	Mn3O4
Litharge	-4.33	8.90	13.23	PbO
Manganite	9.69	34.16	24.47	MnOOH
Massicot	-4.53	8.90	13.43	PbO
Minium	-13.48	63.39	76.88	Pb3O4
Ni(OH)2	1.43	11.28	9.86	Ni(OH)2
Nsutite	10.29	52.51	42.21	MnO2
O2(g)	-13.90	73.37	87.27	O2
Pb(OH)2(C)	0.32	8.90	8.58	Pb(OH)2
Pb2O(OH)2	-8.40	17.80	26.20	Pb2O(OH)2
Pb2O3	-6.55	54.49	61.04	Pb2O3
PbMetal	-32.04	-27.78	4.26	Pb
PbO:0.3H2O	-4.08	8.90	12.98	PbO:0.33H2O
Plattnerite	-5.91	45.59	51.49	PbO2
Pyrocroite	0.03	15.82	15.79	Mn(OH)2
Pyrolusite	11.03	52.51	41.47	MnO2
Zincite	-1.77	10.04	11.82	ZnO
Zn(OH)2(A)	-2.41	10.04	12.45	Zn(OH)2
Zn(OH)2(B)	-1.71	10.04	11.75	Zn(OH)2
Zn(OH)2(C)	-2.16	10.04	12.20	Zn(OH)2
Zn(OH)2(E)	-1.46	10.04	11.50	Zn(OH)2
Zn(OH)2(G)	-1.67	10.04	11.71	Zn(OH)2
ZnMetal	-53.54	-26.64	26.90	Zn
ZnO(Active)	-1.27	10.04	11.31	ZnO

-----  
End of simulation.  
-----

-----  
Reading input data for simulation 2.  
-----

-----  
End of run.  
-----

No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a November 2012  
SOLUTION 1  
    pH 7.63 charge  
    temp 12.9  
    pe 3.26  
    units mg/L  
    Pb 0.0017  
    Mn 1.784 as Mn+2  
    Ni 0.0014  
    Zn 0.0096  
END

-----  
TITLE  
-----

BH301a November 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Mn	3.247e-05	3.247e-05
Ni	2.385e-08	2.385e-08
Pb	8.205e-09	8.205e-09
Zn	1.469e-07	1.469e-07

## -----Description of solution-----

pH = 10.192    Charge balance  
 pe = 3.260  
 Activity of water = 1.000  
 Ionic strength = 8.951e-05  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 6.530e-05  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.900  
 Electrical balance (eq) = 1.216e-19  
 Percent error, 100\*(Cat-|An|)/(Cat+|An|) = 0.00  
 Iterations = 5  
 Total H = 1.110125e+02  
 Total O = 5.550628e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	6.098e-05	6.033e-05	-4.215	-4.219	-0.005
H+	6.491e-11	6.423e-11	-10.188	-10.192	-0.005
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
H(0)	2.000e-30				
H2	9.999e-31	1.000e-30	-30.000	-30.000	0.000
Mn(2)	3.247e-05				
Mn+2	2.852e-05	2.732e-05	-4.545	-4.563	-0.019
MnOH+	3.954e-06	3.912e-06	-5.403	-5.408	-0.005
Mn(OH)3-	1.652e-09	1.634e-09	-8.782	-8.787	-0.005
Mn(3)	1.071e-26				
Mn+3	1.071e-26	9.733e-27	-25.970	-26.012	-0.041
Mn(6)	8.749e-34				
MnO4-2	8.749e-34	8.382e-34	-33.058	-33.077	-0.019
Mn(7)	0.000e+00				
MnO4-	0.000e+00	0.000e+00	-40.021	-40.025	-0.005
Ni	2.385e-08				
Ni(OH)2	1.927e-08	1.927e-08	-7.715	-7.715	0.000
Ni(OH)3-	3.033e-09	3.001e-09	-8.518	-8.523	-0.005
Ni+2	8.299e-10	7.950e-10	-9.081	-9.100	-0.019
NiOH+	7.116e-10	7.040e-10	-9.148	-9.152	-0.005
O(0)	7.094e-37				
O2	3.547e-37	3.547e-37	-36.450	-36.450	0.000
Pb	8.205e-09				
Pb(OH)2	6.056e-09	6.056e-09	-8.218	-8.218	0.000
Pb(OH)3-	1.094e-09	1.083e-09	-8.961	-8.966	-0.005

PbOH+	1.011e-09	9.998e-10	-8.995	-9.000	-0.005
Pb(OH)4-2	4.041e-11	3.870e-11	-10.394	-10.412	-0.019
Pb+2	3.438e-12	3.293e-12	-11.464	-11.482	-0.019
Pb3(OH)4+2	4.356e-19	4.173e-19	-18.361	-18.380	-0.019
Pb2OH+3	8.121e-20	7.372e-20	-19.090	-19.132	-0.042
Zn	1.469e-07				
Zn(OH)2	1.395e-07	1.395e-07	-6.855	-6.855	0.000
Zn(OH)3-	6.945e-09	6.871e-09	-8.158	-8.163	-0.005
ZnOH+	3.025e-10	2.992e-10	-9.519	-9.524	-0.005
Zn+2	4.761e-11	4.562e-11	-10.322	-10.341	-0.019
Zn(OH)4-2	1.770e-11	1.695e-11	-10.752	-10.771	-0.019

-----Saturation indices-----

Phase	SI	log IAP	log KT	
Birnessite	-0.07	42.73	42.80	MnO2
Bixbyite	9.27	58.55	49.28	Mn2O3
Bunsenite	-1.91	11.28	13.19	NiO
Hausmannite	10.34	74.37	64.02	Mn3O4
Litharge	-4.33	8.90	13.23	PbO
Manganite	4.80	29.27	24.47	MnOOH
Massicot	-4.53	8.90	13.43	PbO
Minium	-23.26	53.61	76.88	Pb3O4
Ni(OH)2	1.43	11.28	9.86	Ni(OH)2
Nsutite	0.51	42.73	42.21	MnO2
O2(g)	-33.46	53.81	87.27	O2
Pb(OH)2(C)	0.32	8.90	8.58	Pb(OH)2
Pb2O(OH)2	-8.40	17.80	26.20	Pb2O(OH)2
Pb2O3	-16.33	44.71	61.04	Pb2O3
PbMetal	-22.26	-18.00	4.26	Pb
PbO:0.3H2O	-4.08	8.90	12.98	PbO:0.33H2O
Plattnerite	-15.69	35.81	51.49	PbO2
Pyrocroite	0.03	15.82	15.79	Mn(OH)2
Pyrolusite	1.25	42.73	41.47	MnO2
Zincite	-1.77	10.04	11.82	ZnO
Zn(OH)2(A)	-2.41	10.04	12.45	Zn(OH)2
Zn(OH)2(B)	-1.71	10.04	11.75	Zn(OH)2
Zn(OH)2(C)	-2.16	10.04	12.20	Zn(OH)2
Zn(OH)2(E)	-1.46	10.04	11.50	Zn(OH)2
Zn(OH)2(G)	-1.67	10.04	11.71	Zn(OH)2
ZnMetal	-43.76	-16.86	26.90	Zn
ZnO(Active)	-1.27	10.04	11.31	ZnO

-----  
End of simulation.  
-----

-----  
Reading input data for simulation 2.  
-----

-----  
End of run.  
-----

No memory leaks

Database file: minteq.dat

-----  
Reading data base.  
-----

SOLUTION\_MASTER\_SPECIES  
SOLUTION\_SPECIES  
SOLUTION\_SPECIES  
PHASES  
SURFACE\_MASTER\_SPECIES  
SURFACE\_SPECIES  
END

-----  
Reading input data for simulation 1.  
-----

TITLE BH301a November 2012  
SOLUTION 1  
pH 7.63 charge  
temp 12.9  
pe 1.63  
units mg/L  
Pb 0.0017  
Mn 1.784 as Mn+2  
Ni 0.0014  
Zn 0.0096  
END

-----  
TITLE  
-----

BH301a November 2012

-----  
Beginning of initial solution calculations.  
-----

Initial solution 1.

-----Solution composition-----

Elements	Molality	Moles
Mn	3.247e-05	3.247e-05
Ni	2.385e-08	2.385e-08
Pb	8.205e-09	8.205e-09
Zn	1.469e-07	1.469e-07

## -----Description of solution-----

pH = 10.192    Charge balance  
 pe = 1.630  
 Activity of water = 1.000  
 Ionic strength = 8.951e-05  
 Mass of water (kg) = 1.000e+00  
 Total alkalinity (eq/kg) = 6.530e-05  
 Total carbon (mol/kg) = 0.000e+00  
 Total CO2 (mol/kg) = 0.000e+00  
 Temperature (deg C) = 12.900  
 Electrical balance (eq) = 1.216e-19  
 Percent error,  $100 \cdot (\text{Cat} - |\text{An}|) / (\text{Cat} + |\text{An}|)$  = 0.00  
 Iterations = 5  
 Total H = 1.110125e+02  
 Total O = 5.550628e+01

## -----Distribution of species-----

Species	Molality	Log Activity	Log Molality	Log Activity	Gamma
OH-	6.098e-05	6.033e-05	-4.215	-4.219	-0.005
H+	6.491e-11	6.423e-11	-10.188	-10.192	-0.005
H2O	5.551e+01	1.000e+00	-0.000	-0.000	0.000
H(0)	3.639e-27				
H2	1.820e-27	1.820e-27	-26.740	-26.740	0.000
Mn(2)	3.247e-05				
Mn+2	2.852e-05	2.732e-05	-4.545	-4.563	-0.019
MnOH+	3.954e-06	3.912e-06	-5.403	-5.408	-0.005
Mn(OH)3-	1.652e-09	1.634e-09	-8.782	-8.787	-0.005
Mn(3)	2.510e-28				
Mn+3	2.510e-28	2.282e-28	-27.600	-27.642	-0.041
Mn(6)	2.642e-40				
MnO4-2	2.642e-40	2.531e-40	-39.578	-39.597	-0.019
Mn(7)	0.000e+00				
MnO4-	0.000e+00	0.000e+00	-48.171	-48.175	-0.005
Ni	2.385e-08				
Ni(OH)2	1.927e-08	1.927e-08	-7.715	-7.715	0.000
Ni(OH)3-	3.033e-09	3.001e-09	-8.518	-8.523	-0.005
Ni+2	8.299e-10	7.950e-10	-9.081	-9.100	-0.019
NiOH+	7.116e-10	7.040e-10	-9.148	-9.152	-0.005
O(0)	0.000e+00				
O2	0.000e+00	0.000e+00	-42.970	-42.970	0.000
Pb	8.205e-09				
Pb(OH)2	6.056e-09	6.056e-09	-8.218	-8.218	0.000
Pb(OH)3-	1.094e-09	1.083e-09	-8.961	-8.966	-0.005



PbOH+	1.011e-09	9.998e-10	-8.995	-9.000	-0.005
Pb(OH)4-2	4.041e-11	3.870e-11	-10.394	-10.412	-0.019
Pb+2	3.438e-12	3.293e-12	-11.464	-11.482	-0.019
Pb3(OH)4+2	4.356e-19	4.173e-19	-18.361	-18.380	-0.019
Pb2OH+3	8.121e-20	7.372e-20	-19.090	-19.132	-0.042
Zn	1.469e-07				
Zn(OH)2	1.395e-07	1.395e-07	-6.855	-6.855	0.000
Zn(OH)3-	6.945e-09	6.871e-09	-8.158	-8.163	-0.005
ZnOH+	3.025e-10	2.992e-10	-9.519	-9.524	-0.005
Zn+2	4.761e-11	4.562e-11	-10.322	-10.341	-0.019
Zn(OH)4-2	1.770e-11	1.695e-11	-10.752	-10.771	-0.019

-----Saturation indices-----

Phase	SI	log IAP	log KT	
Birnessite	-3.33	39.47	42.80	MnO2
Bixbyite	6.01	55.29	49.28	Mn2O3
Bunsenite	-1.91	11.28	13.19	NiO
Hausmannite	7.08	71.11	64.02	Mn3O4
Litharge	-4.33	8.90	13.23	PbO
Manganite	3.17	27.64	24.47	MnOOH
Massicot	-4.53	8.90	13.43	PbO
Minium	-26.52	50.35	76.88	Pb3O4
Ni(OH)2	1.43	11.28	9.86	Ni(OH)2
Nsutite	-2.75	39.47	42.21	MnO2
O2(g)	-39.98	47.29	87.27	O2
Pb(OH)2(C)	0.32	8.90	8.58	Pb(OH)2
Pb2O(OH)2	-8.40	17.80	26.20	Pb2O(OH)2
Pb2O3	-19.59	41.45	61.04	Pb2O3
PbMetal	-19.00	-14.74	4.26	Pb
PbO:0.3H2O	-4.08	8.90	12.98	PbO:0.33H2O
Plattnerite	-18.95	32.55	51.49	PbO2
Pyrocroite	0.03	15.82	15.79	Mn(OH)2
Pyrolusite	-2.01	39.47	41.47	MnO2
Zincite	-1.77	10.04	11.82	ZnO
Zn(OH)2(A)	-2.41	10.04	12.45	Zn(OH)2
Zn(OH)2(B)	-1.71	10.04	11.75	Zn(OH)2
Zn(OH)2(C)	-2.16	10.04	12.20	Zn(OH)2
Zn(OH)2(E)	-1.46	10.04	11.50	Zn(OH)2
Zn(OH)2(G)	-1.67	10.04	11.71	Zn(OH)2
ZnMetal	-40.50	-13.60	26.90	Zn
ZnO(Active)	-1.27	10.04	11.31	ZnO

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End of simulation.  
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Reading input data for simulation 2.  
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End of run.  
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No memory leaks