1							
Formula	Form	Mol. wt.	$\Delta_f H^\circ$	$\Delta_f G^\circ$	S°	Cp	V°
		g mol ⁻¹	kJm	ol ⁻¹	J mol-	1 K-1	cm³ mol-1
Fluorine							
F ₂ HF HF F-	g g aq 18.9984	37.9968 20.0064 20.0064 -332.63	0 -271.1 -320.08 -278.79	0 -273.2 -296.82 -13.8	202.78 173.779 88.7 -106.7	31.30 29.133 — —	
Hydroger	 1 						
H ₂ H ⁺ OH ⁻ H ₂ O H ₂ O	g aq aq l	2.0160 1.0080 17.0074 18.0154 18.0154	0 0 -229.994 -285.830 -241.818	0 0 -157.244 -237.129 -228.572	130.684 0 -10.75 69.91 188.825	28.824 0 -148.5 75.291 33.577	24465.6 0 18.068 24465.6
Iodine	1						
I ₂ I ⁻ HI IO ₃ IO ₄	s aq aq aq aq	253.8088 126.9044 127.9124 174.9026 190.9020	0 -55.19 -55.19 -221.3 -155.5	0 -51.57 -51.57 -128.0 -58.5	111.3 111.3 111.3 118.4 222.0	54.438 -142.3 	
Iron	1						
Fe Fe ²⁺ Fe ³⁺ Fe _{0.947} O Fe ₂ O ₃ Fe ₃ O ₄ FeO(OH) Fe(OH) ₂ Fe(OH) ₃ FeS FeS ₂ FeCO ₃ Fe ₂ SiO ₄	s aq aq wüstite hematite magnetite goethite s troilite pyrite siderite fayalite	55.8470 55.8470 68.8865 159.6922 231.5386 88.8538 89.8618 106.8692 87.9110 119.9750 115.8564 203.7776	0 -89.1 -48.5 -266.27 -824.2 -1118.4 -559.0 -823.0 -100.0 -178.2 -740.57 -1479.9	0 -78.90 -4.7 -245.12 -742.2 -1015.4 (-487.02) -486.5 -696.5 -100.4 -166.9 -666.67 -1379.0	27.28 -137.7 -315.9 57.49 87.40 146.4 (60.25) 88. 106.7 60.29 52.93 92.9 145.2	25.10 — 48.12 103.85 143.43 — 50.54 62.17 82.13 132.88	
Lead	1						
Pb Pb ²⁺ PbO PbO	s aq yellow red	207.1900 207.1900 223.1894 223.1894	-1.7 -217.32	0 -24.43 -187.89 -188.93	64.81 10.5 68.70 66.5	26.44 — 45.77 45.81	

PbF2	Formula	Form	Mol. wt.	$\Delta_f H^{\circ}$	$\Delta_f G^\circ$	S°	Cp	V°
PbCl2			g mol ⁻¹	kJm	ol ⁻¹	J mol	-1 K-1	cm ³ mol ⁻¹
PNCl12	PhF ₂	c	245 1868	l -664 0	-6171 l	110.5	_	ı
PbS	_							
PSO ₄ anglesite 267.1994 -699.1 -625.5 131.0 87.40 PbCO ₃ cerussite 267.1994 -699.1 -625.5 131.0 87.40 PbCO ₃ s 283.2742 -1145.70 -1062.10 109.6 90.04 PbCO ₃ s 283.268 -24.3120 0 0 0 32.68 24.89 periclase 40.3114 -601.70 -569.43 26.94 37.15 pbcutie 58.3268 -924.54 -833.51 63.18 77.03 sellaite 62.3088 -1123.4 -1070.2 57.24 61.59 sellaite 62.3088 -1123.4 -1070.2 57.24 61.59 sellaite 62.3088 -1123.4 -1070.2 57.24 61.59 magnesite 84.3214 -1095.8 -1012.1 65.7 75.52 pbc. 46.0 -341.8 50.33 45.56 magnesite 84.3214 -1095.8 -1012.1 65.7 75.52 pbc. 46.0 -346.0 -341.8 50.33 45.56 magnesite 100.3962 -1549.00 -1462.09 67.74 81.38 pbc. 46.0 p	-						49.50	
PCCO3 Cerussite 267.1994 -699.1 -625.5 131.0 87.40 PbSiO3 S 283.2742 -1145.70 -1062.10 109.6 90.04		-		l				
Posto S	-	_						İ
Mg s 24.3120 0 0 32.68 24.89 Mg²+ aq 24.3120 -466.85 -454.8 -138.1 - MgOH)2 periclase 40.3114 -601.70 -569.43 26.94 37.15 MgCO3 brucite 58.3268 -924.54 -833.51 63.18 77.03 MgF2 sellaite 62.3088 -1123.4 -1070.2 57.24 61.59 MgCO3 magnesite 84.3214 -1095.8 -1012.1 65.7 75.52 28.1 MgCO3 magnesite 84.3214 -1095.8 -1012.1 65.7 75.52 28.1 MgCO3 magnesite 103.36676 - -1726.1 - - - Mg2SiO4 forsterite 140.7076 -2174.0 -2055.1 95.14 118.49 Mmaganese S 54.9380 0 0 32.01 26.32 MnO4 aq 54.9380 -220.75 -228.1 -73.6 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>•</td>								•
Mg2+ MgO aq 24.3120 periclase -466.85 40.3114 40.3114 40.7076 -466.85 50.70 50.2088 -454.8 601.70 50.694 -138.1 37.15 37.	Magnesium		,	•				
Mg²+ aq 24.3120 -466.85 -454.8 -138.1 — MgO periclase 40.3114 -601.70 -569.43 26.94 37.15 Mg(OH)2 brucite 58.3268 -924.54 -833.51 63.18 77.03 MgF2 sellaite 62.3088 -1123.4 -1070.2 57.24 61.59 MgCO3 magnesite 84.3214 -1095.8 -1012.1 65.7 75.52 28. MgCO3·3H ₂ O magnesite 84.3214 -1095.8 -1012.1 65.7 75.52 28. MgCO3·3H ₂ O mesquehonite 138.3676 — -1726.1 — — MgCO3·3H ₂ O denstatite 100.3962 -1549.00 -1462.09 67.74 81.38 Mg2SiO3 forsterite 140.7076 -2174.0 -2055.1 95.14 118.49 Manganese Mn s 54.9380 0 0 32.01 26.32 28. MnO4 an 18.9380	Ma	e	24 3120	lο	0	32.68	24.89	ı
MgO periclase brucite 40,3114 brucite -601.70 brucite -569.43 cross and provided brucite 37.15 brucite 58.3268 brucite -924.54 brucite -833.51 brucite 63.18 cross and provided brucite 77.03 cross and provided brucite 65.3760 cross and provided brucite 37.15 cross and provided brucite 77.03 cross and provided brucite 37.15 cross and p	M-2+	·						1
Mg(OH) ₂ brucite 58.3268 -924.54 -833.51 63.18 77.03 MgF ₂ sellaite 62.3088 -1123.4 -1070.2 57.24 61.59 MgCO ₃ magnesite 84.3214 -1095.8 -1012.1 65.7 75.52 28. MgCO ₃ · 3H ₂ O magnesite 84.3214 -1095.8 -1012.1 65.7 75.52 28. MgSiO ₃ magnesite 100.3962 -1549.00 -1462.09 67.74 81.38 Mg2SiO ₄ forsterite 140.7076 -2174.0 -2055.1 95.14 118.49 Manganese Mn s 54.9380 -220.75 -228.1 -73.6 50. MnO ² aq 118.9356 -541.4 -447.2 191.2 -82.0 MnO ₄ aq 118.9356 -541.4 -447.2 191.2 -82.0 MnO ₄ manganosite 70.9374 -835.22 -362.90 59.71 -45.44 Mn ₂ O ₃ s 157.87				1			2715	:
MgF₂ sellalte 62.3088 -1123.4 -1070.2 57.24 61.59 MgS s 56.3760 -346.0 -341.8 50.33 45.56 MgCO₃ magnesite 84.3214 -1095.8 -1012.1 65.7 75.52 28. MgCO₃ · 3H₂O mesquehonite 138.3676 — -1726.1 — — — MgSiO₃ enstatite 100.3962 -1549.00 -1462.09 67.74 81.38 Mg2SiO₃ deptatite 140.7076 -2174.0 -2055.1 95.14 118.49 Mag2SiO₃ deptatite 140.7076 -2174.0 -2055.1 95.14 118.49 Mag2SiO₃ deptatite 140.7076 -2174.0 -2055.1 95.14 118.49 Mn24* aq 54.9380 -220.75 -228.1 -73.6 50. 20.0 MnO₃ aq 118.9356 -541.4 -447.2 191.2 -82.0 Mn30₄ manganosite 70.9374 -3	_	1 -		E .				
MgS s 56.3760 magnesite 346.0 magnesite 341.8 magnesite 50.33 magnesite 45.56 magnesite 34.3214 magnesite 1095.8 magnesite 1012.1 magnesite 65.7 magnesite 75.52 magnesite 28. magnesite 100.3962 magnesite 1549.00 magnesite 140.7076 magnesite 140.7076 magnesite 140.7076 magnesite 1549.00 magnesite 140.7076 magnesite <t< td=""><td>_</td><td></td><td></td><td>1</td><td></td><td></td><td></td><td></td></t<>	_			1				
MgCO₃ magnesite nesquehonite 84.3214 nesquehonite 138.3676 nestatite 100.3962 nestatite 124.00 nestatite 100.3962 nestat	-	i e		l				1
MgCO ₃ · 3H ₂ O nesquehonite enstatite 138.3676 enstatite — — — — — — — — — — — — — — — — — — —	MgS	S	56.3760	1				
MgSiO3 mg2SiO4 enstatite forsterite 100.3962 labeled forsterite -1549.00 labeled forsterite -1462.09 labeled forsterite 67.74 labeled forsterite 81.38 labeled forsterite Manganese Mn s 54.9380 labeled forsterite 0 0 32.01 labeled forsterite 26.32 labeled forsterite Mn s 54.9380 labeled forsterite 0 0 32.01 labeled forsterite 26.32 labeled forsterite Mn s 54.9380 labeled forsterite -220.75 labeled forsterite -228.1 labeled forsterite -73.6 labeled forsterite 50. labeled forsterite MnO manganosite forsterite 70.9374 labeled forsterite -385.22 labeled forsterite -362.90 labeled forsterite 59.71 labeled forsterite 59.71 labeled forsterite 45.44 labeled forsterite 447.2 labeled forsterite 191.2 labeled forsterite 52.0 labeled forsterite 59.0 labeled forsterite 59.71 labeled forsterite 45.44 labeled forsterite 59.0 labeled forsterite	MgCO ₃	magnesite	84.3214	-1095.8	-1012.1	65.7	75.52	28.018
Mg₂SiO₄ forsterite 140.7076 −2174.0 −2055.1 95.14 118.49 Manganese Mn s \$4.9380 0 0 32.01 26.32 MnO⁴ aq \$54.9380 −220.75 −228.1 −73.6 50. MnO⁴ aq \$118.9356 −541.4 −447.2 191.2 -82.0 MnO manganosite 70.9374 −385.22 −362.90 59.71 45.44 Mn₃O₄ hausmannite 228.8116 −1387.8 −1283.2 155.6 139.66 Mn₂O₃ s 157.8742 −959.0 −881.1 110.5 107.65 MnO₂ pyrolusite 86.9368 −520.03 −465.14 53.05 54.14 Mn(OH)₂ alabandite 87.0020 −214.2 −218.4 78.2 49.96 MnCO₃ rhodochrosite 114.9474 −894.1 −816.7 85.8 81.50 MnsiO₃ rhodoite 131.0222 −1320.9 −1240.5	$MgCO_3 \cdot 3H_2O$	nesquehonite	138.3676	-	-1726.1	_		
Mg ₂ SiO ₄ forsterite 140.7076 −2174.0 −2055.1 95.14 118.49 Manganese Mn s 54.9380 0 0 32.01 26.32 MnO aq 54.9380 −220.75 −228.1 −73.6 50. MnO ₄ aq 118.9356 −541.4 −447.2 191.2 −82.0 MnO manganosite 70.9374 −385.22 −362.90 59.71 45.44 Mn ₃ O ₄ hausmannite 228.8116 −1387.8 −1283.2 155.6 139.66 Mn ₂ O ₃ s 157.8742 −959.0 −881.1 110.5 107.65 MnO ₂ pyrolusite 86.9368 −520.03 −465.14 53.05 54.14 Mn(OH) ₂ alabandite 87.0020 −214.2 −218.4 78.2 49.96 MnCO ₃ rhodochrosite 114.9474 −894.1 −816.7 85.8 81.50 MnSiO ₃ rhodonite 131.0222 −1320.9 −1240.5		enstatite	100.3962	-1549.00	-1462.09	67.74	81.38	1
Mn		1	140.7076	-2174.0	-2055.1	95.14	118.49	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Manganese	1						
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Mn	s	54.9380	I 0	0	32.01	26.32	
$\begin{array}{c} MnO_4^- \\ MnO \\ MnO \\ MnO \\ Mno \\ Mn \\ O \\ Mno \\ O \\ Mno \\ O \\ Mn_3 \\ O_4 \\ A \\ hausmannite \\ 228.8116 \\ 157.8742 \\ -959.0 \\ -959.0 \\ -881.1 \\ 110.5 \\ 10.7.65 \\ 110.5 \\ 10.7.65 \\ NnO_2 \\ Mn \\ OO_2 \\ pyrolusite \\ amorphous \\ 86.9368 \\ -520.03 \\ -465.14 \\ 53.05 \\ 54.14 \\ Mn(OH)_2 \\ amorphous \\ 88.9528 \\ -695.4 \\ -695.4 \\ -615.0 \\ -99.2 \\ \\ MnS \\ alabandite \\ 87.0020 \\ rhodochrosite \\ 114.9474 \\ -894.1 \\ -816.7 \\ -816.7 \\ 85.8 \\ 81.50 \\ MnSiO_3 \\ nno_2 \\ ino \\ Mn_2SiO_4 \\ 120.5900 \\ 131.0222 \\ -1320.9 \\ -1730.5 \\ -1632.1 \\ 163.2 \\ 129.87 \\ Mercury \\ \\ Mercury \\ \\ Mercury \\ \\ Mercury \\ \\ Mg \\ g \\ g \\ 200.5900 \\ g \\ 200.5900 \\ 0 \\ 171.1 \\ 164.4 \\ -32.2 \\ \\ Hg_2^2^+ \\ aq \\ q \\ 200.5900 \\ 171.1 \\ 164.4 \\ -32.2 \\ \\ Hg_2^2^+ \\ aq \\ q \\ 200.5900 \\ 171.1 \\ 164.4 \\ -32.2 \\ \\ Hg_2^2^- \\ aq \\ q \\ 264.7180 \\ \\ \\ 1.9 \\ \\ \\ \\ Hg_2^2 \\ \\ aq \\ \\ 342.4020 \\ \\ -554.0 \\ \\ -265.22 \\ \\ 210.745 \\ $	Mn ²⁺	ao	54.9380	-220.75	-228.1	-73.6	50.	1
MnO manganosite 70.9374 -385.22 -362.90 59.71 45.44 Mn ₃ O ₄ hausmannite 228.8116 -1387.8 -1283.2 155.6 139.66 Mn ₂ O ₃ s 157.8742 -959.0 -881.1 110.5 107.65 MnO ₂ pyrolusite 86.9368 -520.03 -465.14 53.05 54.14 Mn(OH) ₂ amorphous 88.9528 -695.4 -615.0 99.2 — MnS alabandite 87.0020 -214.2 -218.4 78.2 49.96 MnCO ₃ rhodochrosite 114.9474 -894.1 -816.7 85.8 81.50 MnSiO ₃ rhodonite 131.0222 -1320.9 -1240.5 89.1 86.44 Mn ₂ SiO ₄ tephroite 201.9596 -1730.5 -1632.1 163.2 129.87 Mercury Hg l 200.5900 0 0 76.02 27.983 Hg.44 174.96 20.786 Hg.44 <td< td=""><td></td><td>-</td><td></td><td>-541.4</td><td>-447.2</td><td>191.2</td><td>-82.0</td><td></td></td<>		-		-541.4	-447.2	191.2	-82.0	
Mn ₃ O ₄ hausmannite 228.8116 -1387.8 -1283.2 155.6 139.66 Mn ₂ O ₃ s 157.8742 -959.0 -881.1 110.5 107.65 MnO ₂ pyrolusite 86.9368 -520.03 -465.14 53.05 54.14 Mn(OH) ₂ amorphous 88.9528 -695.4 -615.0 99.2 — MnS alabandite 87.0020 -214.2 -218.4 78.2 49.96 MnCO ₃ rhodochrosite 114.9474 -894.1 -816.7 85.8 81.50 MnSiO ₃ rhodonite 131.0222 -1320.9 -1240.5 89.1 86.44 Mn ₂ SiO ₄ tephroite 201.9596 -1730.5 -1632.1 163.2 129.87 Mercury Hg g 200.5900 61.317 31.820 174.96 20.786 Hg ²⁺ aq 200.5900 171.1 164.4 -32.2 — HgS ²⁺ aq 401.1800 172.4				1			45.44	
Mn2O3 s 157.8742 −959.0 −881.1 110.5 107.65 MnO2 pyrolusite 86.9368 −520.03 −465.14 53.05 54.14 Mn(OH)2 amorphous 88.9528 −695.4 −615.0 99.2 − MnS alabandite 87.0020 −214.2 −218.0 99.2 − MnCO3 rhodochrosite 114.9474 −894.1 −816.7 78.2 49.96 MnSiO3 rhodonite 131.0222 −1320.9 −1240.5 89.1 86.44 Mn₂SiO4 tephroite 201.9596 −1730.5 −1632.1 163.2 129.87 Mercury Hg g 200.5900 61.317 31.820 174.96 20.786 Hg2+ aq 200.5900 171.1 164.4 −32.2 − Hg2 ²⁺ aq 401.1800 172.4 153.52 84.5 − Hg2C ¹ / ₂ aq 264.7180 − 41.9 −						ŀ	139.66	
MnO2		T .						
Mn(OH)2 amorphous alabandite 88.9528 alabandite -695.4 alabandite -615.0 alabandite 99.2 alabandite -78.2 alabandite 49.96 alabandite -214.2 alabandite -218.4 alabandite 78.2 alabandite 49.96 alabandite -214.2 alabandite -218.4 alabandite 78.2 alabandite 49.96 alabandite -214.2 alabandite -218.4 alabandite 78.2 alabandite 49.96 alabandite -214.0 alaba						1		
MnS alabandite rhodochrosite 87.0020 rhodochrosite -214.2 rhodochrosite -218.4 rhodochrosite 78.2 rhodochrosite 49.96 rhodochrosite MnSiO ₃ rhodonite rhodonite tephroite 131.0222 rhodochrosite -1320.9 rhodosite 89.1 rhodosite 86.44 rhodosite Mn ₂ SiO ₄ tephroite 201.9596 rhodosite -1730.5 rhodosite 163.2 rhodosite 129.87 Mercury Mercury Hg l 200.5900 rhodosite 0 rhodochrosite 76.02 rhodosite 27.983 rhodosite Hg g 200.5900 rhodochrosite 61.317 rhodosite 31.820 rhodosite 174.96 rhodosite 20.786 rhodochrosite Hg ²⁺ hg ²⁺ aq 401.1800 rhodochrosite 172.4 rhodochrosite 153.52 rhodochrosite 84.5 rhodochrosite				i		1	_	
MnCO3 rhodochrosite 114.9474 -894.1 -816.7 85.8 81.50 MnSiO3 rhodonite 131.0222 -1320.9 -1240.5 89.1 86.44 Mn2SiO4 tephroite 201.9596 -1730.5 -1632.1 163.2 129.87 Mercury Hg l 200.5900 0 0 76.02 27.983 Hg g 200.5900 61.317 31.820 174.96 20.786 Hg²+ aq 200.5900 171.1 164.4 -32.2 - Hg2²+ aq 401.1800 172.4 153.52 84.5 - Hg5²- aq 264.7180 - 41.9 - - Hg20²- aq 342.4020 -554.0 -446.8 293. - Hg2cl₂- s 472.0860 -265.22 -210.745 192.5 - Hg0 s, red 216.5894 -90.83 -58.539 70.29 44.06				1		I	49.96	i
MnSiO ₃ rhodonite tephroite 131.0222 -1320.9 -1240.5 89.1 86.44 lead Mn ₂ SiO ₄ tephroite 201.9596 -1730.5 -1632.1 163.2 129.87 Mercury Hg l 200.5900 0 0 76.02 27.983 1820 174.96 20.786 20.786 174.96 <						1		1
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Mercury Hg 1 200.5900 0 0 76.02 27.983 Hg g 200.5900 61.317 31.820 174.96 20.786 Hg ²⁺ aq 200.5900 171.1 164.4 -32.2 - Hg ²⁺ aq 401.1800 172.4 153.52 84.5 - HgS ²⁻ aq 264.7180 - 41.9 - - HgCl ¹ ₄ - aq 342.4020 -554.0 -446.8 293. - Hg2Cl ₂ s 472.0860 -265.22 -210.745 192.5 - HgO s, red 216.5894 -90.83 -58.539 70.29 44.06 HgO s, yellow 216.5894 -90.46 -58.409 71.1 - HgS cinnabar 232.6540 -58.2 -50.6 82.4 48.41	-			1		1		
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$\begin{array}{c ccccccccccccccccccccccccccccccccccc$,	200 5000	1.0	0	1 76.00	27.002	ı
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$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Hg ²⁺	aq		1				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Hg ₂ ²⁺	aq	401.1800	172.4		1		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		aq	264.7180	-	41.9		_	1
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		aq	342.4020	-554.0	-446.8	293.	_	
HgO s, red 216.5894 -90.83 -58.539 70.29 44.06 HgO s, yellow 216.5894 -90.46 -58.409 71.1 - HgS cinnabar 232.6540 -58.2 -50.6 82.4 48.41		, -				192.5	_	
HgO s, yellow 216.5894 -90.46 -58.409 71.1 - HgS cinnabar 232.6540 -58.2 -50.6 82.4 48.41				1		1	44.06	
HgS cinnabar 232.6540 -58.2 -50.6 82.4 48.41				1			_	
1180		1		I			48.41	
HgS metacinnabar 232.6540 -53.6 -47.7 88.3	•					1		

1							- V°
Formula	Form	Mol. wt.	$\Delta_f H^\circ$	$\Delta_f G^\circ$	S° Jmol-	C _p	cm ³ mol ⁻¹
		g mol ⁻¹	kJm	01-1	J moi	· K .	CIII- IIIOI
-							
Aluminum							
Al	s	26.9815	0	0 1	28.33	24.35	
Al ³⁺	aq	26.9815	-531.	-485.	-321.7	_	-45.3
Al(OH) ²⁺	aq	20.5015	-767.0	-693.7	_	_	
Al(OH)	aq		-1010.7	-901.4			
$Al(OH)_3^2(aq)$	aq		-1250.4	-1100.7	_	_	
Al(OH) ₄	aq	95.0111	-1490.0	-1307.0	102.9	_	45.60
Al ₂ O ₃	α, corundum	101.9612	-1675.7	-1582.3	50.92	79.04	25.575
Al_2O_3 $Al_2O_3 \cdot H_2O$	boehmite	119.9766	-1980.7	-1831.7	96.86	131.25	39.07
$Al_2O_3 \cdot H_2O$ $Al_2O_3 \cdot H_2O$	diaspore	119.9766	-1998.91	-1841.78	70.67	106.19	35.52
$Al_2O_3 \cdot H_2O$ $Al_2O_3 \cdot 3H_2O$	gibbsite	156.0074	-2586.67	-2310.21	136.90	183.47	63.912
Al ₂ O ₃ · 3H ₂ O Al ₂ O ₃ · 3H ₂ O	bayerite	156.0074	-2576.5	_	-		1
$Al(OH)_3$	amorphous	78.0037	-1276.		_	_	
Al ₂ SiO ₅	andalusite	162.0460	-2590.27	-2442.66	93.22	122.72	51.53
Al ₂ SiO ₅	kvanite	162.0460	-2594.29	-2443.88	83.81	121.71	44.09
Al ₂ SiO ₅ Al ₂ SiO ₅	sillimanite	162.0460	-2587.76	-2440.99	96.11	124.52	49.90
Al ₂ Si ₂ O ₇ · 2H ₂ O	kaolinite	258.1616	-4119.6	-3799.7	205.0	246.14	99.52
Al ₂ Si ₂ O ₇ · 2H ₂ O	halloysite	258.1616	-4101.2	-3780.5	203.3	246.27	99.30
$Al_2Si_2O_7 \cdot 2H_2O$	dickite	258.1616	-4118.3	-3795.9	197.1	239.49	99.30
Al ₆ Si ₂ O ₁₃	mullite	426.0532	-6816.2	-6432.7	255.	326.10	-
Al ₂ Si ₄ O ₁₀ (OH) ₂	pyrophyllite	360.3158	-5642.04	-5268.14	239.41	294.34	126.6
A125140 [0 (011)2	p,rop,		1		•		
Barium	1						
						20.07	
Ba	S	137.3400	0	0	62.8	28.07	-12.9
Ba ²⁺	aq	137.3400	-537.64	-560.77	9.6	47.70	-12.9
BaO	S	153.3394	-553.5	-525.1	70.42	47.78	
BaO_2	S	169.3388	-634.3	_	1 00 20	66.9	
BaF_2	S	175.3368	-1207.1	-1156.8	96.36	71.21 49.37	
BaS	S	169.4040	-460.	-456.	78.2 132.2	101.75	52.10
BaSO ₄	barite	233.4016	-1473.2	-1362.2	112.1	85.35	45.81
$BaCO_3$	witherite	197.3494	-1216.3	-1137.6	1	90.00	45.61
BaSiO ₃	S	213.4242	-1623.60	-1540.21	109.6	90.00	1
Calcium	1						
Ca	s	40.0800	10	0	41.42	25.31	1
Ca Ca ²⁺	aq	40.0800	-542.83	-553.58	-53.1		-18.4
CaO	s aq	56.0794	-635.09	-604.03	39.75	42.80	
Ca(OH)₂	portlandite	74.0948	-986.09	-898.49	83.39	87.49	
CaF ₂	fluorite	78.0768	-1219.6	-1167.3	68.87	67.03	24.542
Car ₂ CaS	S	72.1440	-482.4	-477.4	56.5	47.40	
	anhydrite	136.1416		-1321.79	106.7	99.66	45.94
CaSO ₄	amiyane	155.1110	1 - 10 1.71				•

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Formula	Form	Mol. wt.	$\Delta_f H^\circ$	$\Delta_f G^\circ$	S°	Сp	V°
		g mol ⁻¹	, kJ m	ol ⁻¹	J mol-	1 K~1	cm³ mol-1
CaSO ₄ · 2H ₂ O	gypsum	172.1724	-2022.63	-1797.28	194.1	186.02	
$Ca_3(PO_4)_2$	β ,whitlockite	310.1828	-4120.8	-3884.7	236.0	227.82	
$Ca_3(PO_4)_2$	α	310.1828	-4109.9	-3875.5	240.91	231.58	
CaCO ₃	calcite	100.0894	-1206.92	-1128.79	92.9	81.88	36.934
CaCO ₃	aragonite	100.0894	-1207.13	-1127.75	88.7	81.25	34.150
CaSiO ₃	wollastonite	116.1642	-1634.94	-1549.66	81.92	85.27	39.93
CaSiO₃	pseudowollastonite	116.1642	-1628.4	-1544.7	87.36	86.48	
CaAl ₂ SiO ₆	Ca-Al pyroxene	218.1254	-3298.2	-3122.0	141.4	165.7	
CaAl ₂ Si ₂ O ₈	anorthite	278.2102	-4227.9	-4002.3	199.28	211.42	100.79
CaTiO ₃	perovskite	135.9782	-1660.6	-1575.2	93.64	97.65	
CaTiSiO ₅	sphene	196.0630	-2603.3	-2461.8	129.20	138.95	
CaMg(CO ₃) ₂	dolomite	184.4108	-2326.3	-2163.4	155.18	157.53	64.365
CaMgSi ₂ O ₆	diopside	216.5604	-3206.2	-3032.0	142.93	166.52	66.090
	- -	,				,	
Carbon							
С	graphite	12.0112	0	0 1	5.740	8.527	5.298
č	diamond	12.0112	1.895	2.900	2.377	6.113	3.417
CO ₃ ² -	aq	60.0094	-677.149	-527.81	-56.9		-6.1
HCO ₃	aq	61.0174	-691.99	-586.77	91.2	_	24.2
CO	g	28.0106	-110.525	-137.168	197.674	29.142	24465.6
CO₂	g	44.0100	-393.509	-394.359	213.74	37.11	24465.6
CO ₂	aq	44.0100	-413.80	-385.98	117.6	37.11 —	32.8
H ₂ CO ₃	aq	62.0254	-679.339	-623.109	283.65		32.0
CH ₄	-	16.0432	-74.81	-50.72	186.264	35.309	24465.6
C ₂ H ₆	g g	30.0704	-84.68	-32.82	229.60	52.63	24465.6
CN	g	26.0179	437.6	407.5	202.6	29.16	24403.0
CN-	aq	26.0179	150.6	172.4	94.1	29.10	
HCN		27.0259	135.1	124.7	201.78	35.86	
HCN	g aq	27.0259	107.1	119.7	124.7	33.60	
nen	aq	27.0239	107.1	115.7	124.7	_	
Chlorine							
Cl ₂	g	70.9060	0	0	233.066	33.907	24465.6
ci-	aq	35.4530	-167.159	-131.228	56.5	-136.4	17.3
HCl	aq	36.4610	-167.159	-131.228	56.5	-136.4	17.3
HCI	g	36.4610	-92.307	-95.299	186.908	29.12	24465.6
1101	5	30.4010	32.307	33.233	100.300	23.12	24403.0
Copper							
Cu	s	63.5400	0	0	33.15	24.435]
Cu+	aq	63.5400	71.67	49.98	40.6	_	
Cu ²⁺	aq	63.5400	64.77	65.49	-99.6		
CuO	tenorite	79.5394	-157.3	-129.7	42.63	42.30	
Cu₂O	cuprite	143.0794	-168.6	-146.0	93.14	63.64	
CuS	covellite	96.6040	-53.1	-53.6	66.5	47.82	
Cu ₂ S	chalcocite	159.1440	79.5	-86.2	120.9	76.32	

APPENDIX B. STANDARD STATE PROPERTIES

Formula	Form	Mol. wt. g mol ⁻¹	Δ _f H° kJ m	$\Delta_f G^{\circ}$	J mol-	Cp	V° cm³ mol⁻¹
		g titot	KJIII		J [1101	Λ	сы шог
Molybdenum	1						
Мо	s	95.9400	0	0	28.66	24.06	1
MoO ₃	s	127.9388	-745.09	-667.97	77.74	74.98	
MoS ₂	molybdenite	160.0680	-235.1	-225.9	62.59	63.55	
Nickel	1						
Ni	s	58.7100	0	0	29.87	26.07	
Ni ²⁺	aq	58.7100	-54.0	-45.6	-128.9	_	
NiO	bunsenite	74.7094	-239.7	-211.7	37.99	44.31	
NiS	s	90.7740	-82.0	-79.5	52.97	47.11	
Nitrogen	1						
N ₂	g	28.0134	0	0	191.61	29.125	1
NO	g	30.0061	90.25	86.55	210.761	29.844	
NO ₂	g	46.0055	33.18	51.31	240.06	37.20	
N ₂ O	g	44.0128	82.05	104.2	219.85	38.45	
N ₂ O ₄	Ī	92.0110	-19.50	97.54	209.2	142.7	
N ₂ O ₄	g	92.0110	9.16	97.89	304.29	77.28	
N ₂ O ₅	s	108.0104	-43.1	113.9	178.2	143.1	1
N_2O_5	g	108.0104	11.3	115.1	355.7	84.5	
NH ₃	g	17.0307	-46.11	-16.45	192.45	35.06	
NO ₃	aq	62.0049	-205.0	-108.74	146.45	-86.6	
NH ₄ ⁺	aq	18.0837	-132.51	-79.31	113.4	79.9	
NH ₄ OH	aq	35.0461	-366.12	-263.63	181.21	_	
Oxygen	1						
O ₂	g	31.9988	0	0	205.138	29.355	
O ₂	aq	31.9988	-11.7	16.4	110.9	_	
OH-	aq	17.0074	-229.994	-157.244	-10.75	-148.5	
H ₂ O	1	18.0154	-285.830	-237.129	69.91	75.291	18.068
H ₂ O	g	18.0154	-241.818	-228.572	188.825	33.577	24465.6
Potassium	1						
K	s	39.1020	0	0	64.18	29.58	
K+	aq	39.1020	-252.38	-283.27	102.5	21.8	9.0
KCl	sylvite	74.5550	-436.747	-409.14	82.59	51.30	
KAlSi ₃ O ₈	sanidine	278.3367	-3959.7	-3739.9	232.88	204.51	
KAlSi ₃ O ₈	microcline	278.3367	-3968.1	-3742.9	214.22	202.38	108.741
KAlSiO ₄	kaliophilite	158.1671	-2121.3	-2005.3	133.1	119.79	
KAlSi ₂ O ₆	leucite	218.2519	-3034.2	-2871.4	200.08	164.14	
KAl ₃ Si ₃ O ₁₀ OH ₂	muscovite	398.3133	-5984.4	-5608.4	306.3	_	14.087

	1						
Formula	Form	Mol. wt.	$\Delta_f H^\circ$	$\Delta_f G^\circ$	S°.	C:	V°
		g mol ⁻¹	kJ r	kJ mol ⁻¹		S° C° J mol ⁻¹ K ⁻¹	
6111					<u> </u>		cm ³ mol ⁻¹
Silicon	1						
Si	S	28.0860	0	0	18.83	20.00	1
SiO ₂	α-quartz	60.0848	-910.94	-856.64	41.84	44.43	22.688
SiO ₂	α-cristobalite	60.0848	-909.48	-855.43	42.68	44.18	
SiO ₂	α-tridymite	60.0848	-909.06	-855.26	43.5	44.60	25.740
SiO ₂	coesite	60.0848	-906.31	-851.62	40.376	43.51	20.641
SiO ₂	amorphous	60.0848	-903.49	-850.70	46.9	44.4	
SiO ₂	aq	60.0848	-877.699	-833.411	75.312	318.40	16.1
H ₄ SiO ₄	aq		-1449.359	-1307.669	215.132	468.98	10.1
HSiO ₃	aq		-1125.583	-1013.783	41.84	-137.24	9.5
Silver	1				1		0.0
Ag	s	107.8700	l 0				
Ag+	aq	107.8700	1	0	42.55	25.351	
Ag ₂ O	s s	231.7394	105.579	77.107	72.68	21.8	
AgCl	cerargyrite	143.3230	-31.05	-11.20	121.3	65.86	
Ag ₂ S	acanthite	247.8040	-127.068	-109.789	96.2	50.79	
Ag ₂ S	argentite	247.8040	-32.59	-40.67	144.01	76.53	
11623	argentite	247.8040	-29.41	-39.46	150.6		
Sodium	I						
Na	s	22.9898	l 0	0	51.21	28.24	
Na+	aq	22.9898	-240.12	-261.905	59.0	46.4	1.0
NaCl	halite	58.4428	-411.153	-384.138	72.13	50.50	-1.2
Na ₂ SiO ₃	s	122.0638	-1554.90	-1462.80	113.85		27.015
NaAlSiO ₄	nepheline	142.0549	-2092.8	-1978.1	124.3	_	F4.16
NaAlSi ₃ O ₈	low albite	262.2245	-3935.1	-3711.5	207.40	205.10	54.16 100.07
NaAlSi ₂ O ₆	jadeite	202.1397	-3030.9	-2852.1	133.5	203.10	60.40
Sulfur			,		100.0	. 1	00.40
S	orthorhombic	22.0040		_			
S ² -	•	32.0640	0	0	31.80	22.64	
HS-	aq	32.0640	33.1	85.8	-14.6		
SO ₄ ² -	aq	33.0720	-17.6	12.08	62.8		
HSO ₄	aq	96.0616	-909.27	-744.53	20.1	-293.	
	aq	32.0640	-33.1	-85.8	-14.6	[
S ₂	g	64.1280	128.37	79.30	228.18	32.47	
H ₂ S	g	34.0800	-20.63	-33.56	205.79	34.23	
H ₂ S	aq	34.0800	-39.7	-27.83	121.	_	
SO ₂	g	64.0628	-296.830	-300.194	248.22	39.87	
SO ₃	g	80.0622	-395.72	-371.06	256.76	50.67	

$\frac{C_p^{\circ}}{\operatorname{J} \operatorname{mol}^{-1} \operatorname{K}^{-1}}$ $\Delta_f G^\circ$ kJ mol $^{-1}$ Formula Form Mol. wt. $\Delta_f H^\circ$ $cm^3 \, mol^{-1}$ g mol⁻¹ Titanium 30.63 25.02 47.9000 0 Ti 50.0 39.96 63.8994 -519.7-495.0TiO 49.92 55.48 79.8988 -939.7-884.5anatase TiO₂ 79.8988 -941.8brookite TiO₂ 55.02 50.33 79.8988 -944.7-889.5 TiO_2 rutile Uranium 50.21 27.665 238.0290 | 0 0 U 63.60 270.0278 -1031.7 77.03 uraninite -1084.9UO₂ -1223.896.11 81.67 286.0272 -1145.9 orthorhombic UO_3 238.0290 -489.1-475.4192. [J3+ aq -531.0410. 238.0290 -591.2U4+ aq -953.5-97.5 UO_{2}^{2+} 270.0278 -1019.6 aq Zinc 0 41.63 25.40 65.3700 0 Zn -147.06-112.146. Zn^{2+} 65.3700 -155.89aq -318.3043.64 40.25 81.3694 -348.28zincite ZnO wurtzite 97.4340 -192.63ZnS -201.29 57.7 46.0 -205.9897.4340 ZnS sphalerite 79.71 smith sonite125.3794 -812.78-731.52 82.4 ZnCO₃ 123.34 -1636.74-1523.16 131.4 222.8236 willemite Zn₂SiO₄

Part 2. Organic Substances

N.B.: columns for $\Delta_f G^\circ$ and $\Delta_f H^\circ$ are reversed from Part 1, and $\Delta_f G^\circ$ and $\Delta_f H^\circ$ are in J rather than kJ.

Data from Shock and Helgeson, Geochimica et Cosmochimica Acta, v. 54, pp. 915-945, 1990.

Formula	Form	Name	$\Delta_f G^\circ$	$\Delta_f H^\circ$	S°	C_p°	V°
		g mol ⁻¹	Jm	ol-1	S° Jmol-	1 K-1	cm ³ mol ⁻¹
n-Alkanes							
CH₄	aq	methane	-34451	-87906	87.82	277.4	37.30
CH ₄	g	methane	-50720	-74810	186.26	35.31	24465.6
C ₂ H ₆	aq	ethane	-16259	-103136	112.17	369.4	51.20
C ₃ H ₈	aq	propane	-8213	-127570	141.00	462.8	67.00
C ₄ H ₁₀	aq	n-butane	151	-151586	167.44	560.2	82.80
C ₅ H ₁₂	aq	n-pentane	8912	-173887	198.74	640.2	98.60
C ₆ H ₁₄	aq	n-hexane	18493	-198322	221.33	733.0	114.40
C ₇ H ₁₆	aq	n-heptane	27070	-221543	251.04	821.7	130.20
C ₈ H ₁₈	aq	n-octane	35899	-248571	266.94	910.4	146.00
C01110			1		•		1
1-Alkenes	I						
2.2014	1						
C ₂ H ₄	aq	ethylene	81379	35857	120.08	261.5	45.50
C ₃ H ₆	aq	1-propene	74935	-1213	153.55	350.2	61.30
C ₄ H ₈	aq	1-butene	84977	-23577	181.59	438.9	77.10
C ₅ H ₁₀	aq	1-pentene	94014	-46861	209.62	527.6	92.90
C ₆ H ₁₂	aq	1-hexene	101964	-71233	237.65	616.3	108.70
C ₇ H ₁₄	aq	1-heptene	110667	-94851	265.68	705.0	124.50
C ₈ H ₁₆	aq	1-octene	120164	-117654	293.72	793.7	140.30
C81110	"4	2 000000			1		,
Alkylbenze	enes						
· mt, ibuil	1						
C_6H_6	aq	benzene	133888	51170	148.53	361.1	83.50
Call CIL.	ag	toluene	126608	13724	183.68	430.1	97 71