

CH 223 Spring 2026:

Problem Set #1

Instructions

Step One:

- **Learn the material** for Problem Set #1 by **reading Chapter 12** of the textbook and/or by watching the videos found on the website (<https://mhchem.org/222video>)
- **Try the problems** for Problem Set #1 found on the next pages on your own first. Write your answers in the space provided or write your answers on separate paper (your choice.) Include your name on your problem set!

Step Two:

Watch the recitation video for Problem Set #1:

<http://mhchem.org/3/1>

Self correct *all* of the problems while viewing the video. Mark correct problems with a star (or other similar mark), and correct all incorrect problems (show the correct answer and the steps required to achieve it.)

Step Three:

Turn the Problem Set in at the beginning of recitation to the instructor on **Monday, April 6 (section L1) or Wednesday, April 8 (section L2.)** The graded problem set will be returned to you the following week during recitation.

Do *not* include this page to avoid a point penalty; your front page should be page II-1-3.

If you have any questions regarding this assignment, please email (mike.russell@mhcc.edu) the instructor! Good luck on this assignment!

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CH 223 Problem Set #1

Name:

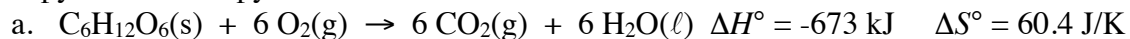
Complete the problem set on your own first using these sheets for your work or separate paper (your choice.) **Self correct your work (all problems!)** using the recitation video for this problem set, found here: <http://mhchem.org/3/1>

* *Covering: Chapter Twelve and Chapter Guide One*

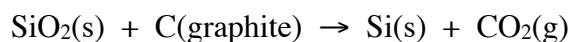
* *Important Tables and/or Constants: periodic table* found here: <http://mhchem.org/pertab>, **Table of Thermodynamic values** at the end of this problem set and here: <http://mhchem.org/thermo>

- Which substance has the higher entropy in each of the following pairs?
 - a sample of pure silicon (to be used in a computer chip) or a piece of silicon containing traces of other elements such as boron or phosphorus
 - $\text{O}_2(\text{g})$ at $0\text{ }^\circ\text{C}$ or $\text{O}_2(\text{g})$ at $-50\text{ }^\circ\text{C}$
 - $\text{I}_2(\text{s})$ or $\text{I}_2(\text{g})$, both at room temperature
 - $\text{C}_2\text{H}_4(\text{g})$ or $\text{N}_2(\text{g})$ (two substances with the same molar mass)
- Using a table of S° values, calculate the entropy change, ΔS° , for each of the following changes and comment on the sign of the change.
 - $\text{C}_2\text{H}_5\text{OH}(\ell) \rightarrow \text{C}_2\text{H}_5\text{OH}(\text{g})$
 - $\text{CCl}_4(\text{g}) \rightarrow \text{CCl}_4(\ell)$
- Calculate the standard molar **enthalpy** change of formation (ΔH_f°) for each of the following compounds from the elements at $25\text{ }^\circ\text{C}$. (Recall: 1 mol of products, reactants are elements in their standard states.)
 - $\text{H}_2\text{S}(\text{g})$ (*Note: sulfur is an octamer (S_8)*)
 - $\text{Li}_2\text{CO}_3(\text{s})$
- Calculate the standard molar **entropy** change of formation (ΔS_f°) for each of the following compounds from the elements at $25\text{ }^\circ\text{C}$. (Recall: 1 mol of products, reactants are elements in their standard states.)
 - $\text{H}_2\text{S}(\text{g})$ (*Note: sulfur is an octamer (S_8)*)
 - $\text{Li}_2\text{CO}_3(\text{s})$

5. Classify each of the reactions according to their spontaneity without calculating ΔG° . Are these reactions enthalpy and/or entropy driven?



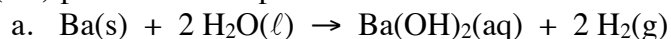
6. Use a Table to calculate ΔH° and ΔS° for the reaction of silicon(IV) oxide with carbon, then calculate ΔG° at 298 K.



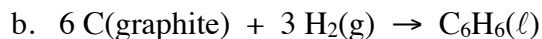
a. Is the reaction spontaneous at 298 K?

b. Is the reaction predicted to be spontaneous at higher temperatures?

7. Using values of ΔH_f° and S° , calculate $\Delta G^\circ_{\text{rxn}}$ for each of the following reactions. Which of these reactions is (are) predicted to be product-favored? Are the reactions enthalpy or entropy driven?



(Note: for $\text{Ba}(\text{OH})_2(\text{aq})$, $\Delta H^\circ = -1002.82 \text{ kJ/mol}$ and $S^\circ = 74.5 \text{ J K}^{-1} \text{ mol}^{-1}$)



8. Using values of ΔG°_f , calculate $\Delta G^\circ_{\text{rxn}}$ for each of the following reactions. Which are product-favored?
- $\text{HgS(s, red)} + \text{O}_2(\text{g}) \rightarrow \text{Hg}(\ell) + \text{SO}_2(\text{g})$
 - $2 \text{H}_2\text{S}(\text{g}) + 3 \text{O}_2(\text{g}) \rightarrow 2 \text{H}_2\text{O}(\text{g}) + 2 \text{SO}_2(\text{g})$
9. Estimate the temperature required to decompose $\text{CaSO}_4(\text{s})$ into $\text{CaO}(\text{s})$ and $\text{SO}_3(\text{g})$ using values of ΔH°_f and S° .
10. Predict the signs of the following thermodynamic quantities using the information provided.
- A solid dissolves in water - *predict the sign of ΔG*
 - A solid dissolves in water and the container feels warm - *predict the sign of ΔH*
 - A reaction occurs, and bubbles can be observed escaping from the beaker - *predict the sign of ΔS*
 - Ice forms on the base of a reaction flask - *predict the sign of ΔH*
 - Two chemicals are added together, but nothing happens - *predict the sign of ΔG*

Standard Thermodynamic Properties for Selected Substances

Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/K·mol)
aluminum			
Al(s)	0	0	28.3
Al(g)	324.4	285.7	164.54
Al ₂ O ₃ (s)	-1676	-1582	50.92
AlF ₃ (s)	-1510.4	-1425	66.5
AlCl ₃ (s)	-704.2	-628.8	110.67
AlCl ₃ ·6H ₂ O(s)	-2691.57	-2269.40	376.56
Al ₂ S ₃ (s)	-724.0	-492.4	116.9
Al ₂ (SO ₄) ₃ (s)	-3445.06	-3506.61	239.32
antimony			
Sb(s)	0	0	45.69
Sb(g)	262.34	222.17	180.16
Sb ₄ O ₆ (s)	-1440.55	-1268.17	220.92
SbCl ₃ (g)	-313.8	-301.2	337.80
SbCl ₅ (g)	-394.34	-334.29	401.94
Sb ₂ S ₃ (s)	-174.89	-173.64	182.00
SbCl ₃ (s)	-382.17	-323.72	184.10
SbOCl(s)	-374.0	-	-
arsenic			
As(s)	0	0	35.1
As(g)	302.5	261.0	174.21
As ₄ (g)	143.9	92.4	314
As ₄ O ₆ (s)	-1313.94	-1152.52	214.22
As ₂ O ₅ (s)	-924.87	-782.41	105.44
AsCl ₃ (g)	-261.50	-248.95	327.06
As ₂ S ₃ (s)	-169.03	-168.62	163.59
AsH ₃ (g)	66.44	68.93	222.78
H ₃ AsO ₄ (s)	-906.3	—	—
barium			
Ba(s)	0	0	62.5
Ba(g)	180	146	170.24
BaO(s)	-548.0	-520.3	72.1
BaCl ₂ (s)	-855.0	-806.7	123.7
BaSO ₄ (s)	-1473.2	-1362.3	132.2
beryllium			
Be(s)	0	0	9.50
Be(g)	324.3	286.6	136.27
BeO(s)	-609.4	-580.1	13.8
bismuth			
Bi(s)	0	0	56.74
Bi(g)	207.1	168.2	187.00
Bi ₂ O ₃ (s)	-573.88	-493.7	151.5
BiCl ₃ (s)	-379.07	-315.06	176.98
Bi ₂ S ₃ (s)	-143.1	-140.6	200.4
boron			
B(s)	0	0	5.86
B(g)	565.0	521.0	153.4
B ₂ O ₃ (s)	-1273.5	-1194.3	53.97
B ₂ H ₆ (g)	36.4	87.6	232.1
H ₃ BO ₃ (s)	-1094.33	-968.92	88.83
BF ₃ (g)	-1136.0	-1119.4	254.4
BCl ₃ (g)	-403.8	-388.7	290.1
B ₃ N ₃ H ₆ (l)	-540.99	-392.79	199.58

Standard Thermodynamic Properties for Selected Substances

Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/K•mol)
boron continued			
HBO ₂ (s)	-794.25	-723.41	37.66
bromine			
Br ₂ (l)	0	0	152.23
Br ₂ (g)	30.91	3.142	245.5
Br(g)	111.88	82.429	175.0
BrF ₃ (g)	-255.60	-229.45	292.42
HBr(g)	-36.3	-53.43	198.7
cadmium			
Cd(s)	0	0	51.76
Cd(g)	112.01	77.41	167.75
CdO(s)	-258.2	-228.4	54.8
CdCl ₂ (s)	-391.5	-343.9	115.3
CdSO ₄ (s)	-933.3	-822.7	123.0
CdS(s)	-161.9	-156.5	64.9
calcium			
Ca(s)	0	0	41.6
Ca(g)	178.2	144.3	154.88
CaO(s)	-634.9	-603.3	38.1
Ca(OH) ₂ (s)	-985.2	-897.5	83.4
CaSO ₄ (s)	-1434.5	-1322.0	106.5
CaSO ₄ ·2H ₂ O(s)	-2022.63	-1797.45	194.14
CaCO ₃ (s) (calcite)	-1220.0	-1081.4	110.0
CaSO ₃ ·H ₂ O(s)	-1752.68	-1555.19	184.10
carbon			
C(s) (graphite)	0	0	5.740
C(s) (diamond)	1.89	2.90	2.38
C(g)	716.681	671.2	158.1
CO(g)	-110.52	-137.15	197.7
CO ₂ (g)	-393.51	-394.36	213.8
CH ₄ (g)	-74.6	-50.5	186.3
CH ₃ OH(l)	-239.2	-166.6	126.8
CH ₃ OH(g)	-201.0	-162.3	239.9
CCl ₄ (l)	-128.2	-62.5	214.4
CCl ₄ (g)	-95.7	-58.2	309.7
CHCl ₃ (l)	-134.1	-73.7	201.7
CHCl ₃ (g)	-103.14	-70.34	295.71
CS ₂ (l)	89.70	65.27	151.34
CS ₂ (g)	116.9	66.8	238.0
C ₂ H ₂ (g)	227.4	209.2	200.9
C ₂ H ₄ (g)	52.4	68.4	219.3
C ₂ H ₆ (g)	-84.0	-32.0	229.2
CH ₃ CO ₂ H(l)	-484.3	-389.9	159.8
CH ₃ CO ₂ H(g)	-434.84	-376.69	282.50
C ₂ H ₅ OH(l)	-277.6	-174.8	160.7
C ₂ H ₅ OH(g)	-234.8	-167.9	281.6
C ₃ H ₈ (g)	-103.8	-23.4	270.3
C ₆ H ₆ (g)	82.927	129.66	269.2
C ₆ H ₆ (l)	49.1	124.50	173.4
CH ₂ Cl ₂ (l)	-124.2	-63.2	177.8
CH ₂ Cl ₂ (g)	-95.4	-65.90	270.2
CH ₃ Cl(g)	-81.9	-60.2	234.6

Standard Thermodynamic Properties for Selected Substances

Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/K•mol)
carbon continued			
$\text{C}_2\text{H}_5\text{Cl}(l)$	-136.52	-59.31	190.79
$\text{C}_2\text{H}_5\text{Cl}(g)$	-112.17	-60.39	276.00
$\text{C}_2\text{N}_2(g)$	308.98	297.36	241.90
$\text{HCN}(l)$	108.9	125.0	112.8
$\text{HCN}(g)$	135.5	124.7	201.8
chlorine			
$\text{Cl}_2(g)$	0	0	223.1
$\text{Cl}(g)$	121.3	105.70	165.2
$\text{ClF}(g)$	-54.48	-55.94	217.78
$\text{ClF}_3(g)$	-158.99	-118.83	281.50
$\text{Cl}_2\text{O}(g)$	80.3	97.9	266.2
$\text{Cl}_2\text{O}_7(l)$	238.1	—	—
$\text{Cl}_2\text{O}_7(g)$	272.0	—	—
$\text{HCl}(g)$	-92.307	-95.299	186.9
$\text{HClO}_4(l)$	-40.58	—	—
chromium			
$\text{Cr}(s)$	0	0	23.77
$\text{Cr}(g)$	396.6	351.8	174.50
$\text{Cr}_2\text{O}_3(s)$	-1139.7	-1058.1	81.2
$\text{CrO}_3(s)$	-589.5	—	—
$(\text{NH}_4)_2\text{Cr}_2\text{O}_7(s)$	-1806.7	—	—
cobalt			
$\text{Co}(s)$	0	0	30.0
$\text{CoO}(s)$	-237.9	-214.2	52.97
$\text{Co}_3\text{O}_4(s)$	-910.02	-794.98	114.22
$\text{Co}(\text{NO}_3)_2(s)$	-420.5	—	—
copper			
$\text{Cu}(s)$	0	0	33.15
$\text{Cu}(g)$	338.32	298.58	166.38
$\text{CuO}(s)$	-157.3	-129.7	42.63
$\text{Cu}_2\text{O}(s)$	-168.6	-146.0	93.14
$\text{CuS}(s)$	-53.1	-53.6	66.5
$\text{Cu}_2\text{S}(s)$	-79.5	-86.2	120.9
$\text{CuSO}_4(s)$	-771.36	-662.2	109.2
$\text{Cu}(\text{NO}_3)_2(s)$	-302.9	—	—
fluorine			
$\text{F}_2(g)$	0	0	202.8
$\text{F}(g)$	79.4	62.3	158.8
$\text{F}_2\text{O}(g)$	24.7	41.9	247.43
$\text{HF}(g)$	-273.3	-275.4	173.8
hydrogen			
$\text{H}_2(g)$	0	0	130.7
$\text{H}(g)$	217.97	203.26	114.7
$\text{H}_2\text{O}(l)$	-285.83	-237.1	70.0
$\text{H}_2\text{O}(g)$	-241.82	-228.59	188.8
$\text{H}_2\text{O}_2(l)$	-187.78	-120.35	109.6
$\text{H}_2\text{O}_2(g)$	-136.3	-105.6	232.7
$\text{HF}(g)$	-273.3	-275.4	173.8
$\text{HCl}(g)$	-92.307	-95.299	186.9
$\text{HBr}(g)$	-36.3	-53.43	198.7
$\text{HI}(g)$	26.48	1.70	206.59

Standard Thermodynamic Properties for Selected Substances

Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/K•mol)
hydrogen continued			
H ₂ S(g)	−20.6	−33.4	205.8
H ₂ Se(g)	29.7	15.9	219.0
iodine			
I ₂ (s)	0	0	116.14
I ₂ (g)	62.438	19.3	260.7
I(g)	106.84	70.2	180.8
IF(g)	95.65	−118.49	236.06
ICl(g)	17.78	−5.44	247.44
IBr(g)	40.84	3.72	258.66
IF ₇ (g)	−943.91	−818.39	346.44
HI(g)	26.48	1.70	206.59
iron			
Fe(s)	0	0	27.3
Fe(g)	416.3	370.7	180.5
Fe ₂ O ₃ (s)	−824.2	−742.2	87.40
Fe ₃ O ₄ (s)	−1118.4	−1015.4	146.4
Fe(CO) ₅ (l)	−774.04	−705.42	338.07
Fe(CO) ₅ (g)	−733.87	−697.26	445.18
FeCl ₂ (s)	−341.79	−302.30	117.95
FeCl ₃ (s)	−399.49	−334.00	142.3
FeO(s)	−272.0	−255.2	60.75
Fe(OH) ₂ (s)	−569.0	−486.5	88.
Fe(OH) ₃ (s)	−823.0	−696.5	106.7
FeS(s)	−100.0	−100.4	60.29
Fe ₃ C(s)	25.10	20.08	104.60
lead			
Pb(s)	0	0	64.81
Pb(g)	195.2	162.	175.4
PbO(s) (yellow)	−217.32	−187.89	68.70
PbO(s) (red)	−218.99	−188.93	66.5
Pb(OH) ₂ (s)	−515.9	—	—
PbS(s)	−100.4	−98.7	91.2
Pb(NO ₃) ₂ (s)	−451.9	—	—
PbO ₂ (s)	−277.4	−217.3	68.6
PbCl ₂ (s)	−359.4	−314.1	136.0
lithium			
Li(s)	0	0	29.1
Li(g)	159.3	126.6	138.8
LiH(s)	−90.5	−68.3	20.0
LiOH(s)	−487.5	−441.5	42.8
LiF(s)	−616.0	−587.5	35.7
Li ₂ CO ₃ (s)	−1216.04	−1132.19	90.17
manganese			
Mn(s)	0	0	32.0
Mn(g)	280.7	238.5	173.7
MnO(s)	−385.2	−362.9	59.71
MnO ₂ (s)	−520.03	−465.1	53.05
Mn ₂ O ₃ (s)	−958.97	−881.15	110.46
Mn ₃ O ₄ (s)	−1378.83	−1283.23	155.64
mercury			
Hg(l)	0	0	75.9

Standard Thermodynamic Properties for Selected Substances

Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/K•mol)
mercury continued			
Hg(g)	61.4	31.8	175.0
HgO(s) (red)	-90.83	-58.5	70.29
HgO(s) (yellow)	-90.46	-58.43	71.13
HgCl ₂ (s)	-224.3	-178.6	146.0
Hg ₂ Cl ₂ (s)	-265.4	-210.7	191.6
HgS(s) (red)	-58.16	-50.6	82.4
HgS(s) (black)	-53.56	-47.70	88.28
HgSO ₄ (s)	-707.51	-594.13	0.00
nitrogen			
N ₂ (g)	0	0	191.6
N(g)	472.704	455.5	153.3
NO(g)	90.25	87.6	210.8
NO ₂ (g)	33.2	51.30	240.1
N ₂ O(g)	81.6	103.7	220.0
N ₂ O ₃ (g)	83.72	139.41	312.17
N ₂ O ₄ (g)	11.1	99.8	304.4
N ₂ O ₅ (g)	11.3	115.1	355.7
NH ₃ (g)	-45.9	-16.5	192.8
N ₂ H ₄ (l)	50.63	149.43	121.21
N ₂ H ₄ (g)	95.4	159.4	238.5
NH ₄ NO ₃ (s)	-365.56	-183.87	151.08
NH ₄ Cl(s)	-314.43	-202.87	94.6
NH ₄ Br(s)	-270.8	-175.2	113.0
NH ₄ I(s)	-201.4	-112.5	117.0
NH ₄ NO ₂ (s)	-256.5	—	—
HNO ₃ (l)	-174.1	-80.7	155.6
HNO ₃ (g)	-133.9	-73.5	266.9
oxygen			
O ₂ (g)	0	0	205.2
O(g)	249.17	231.7	161.1
O ₃ (g)	142.7	163.2	238.9
phosphorus			
P ₄ (s)	0	0	164.4
P ₄ (g)	58.91	24.4	280.0
P(g)	314.64	278.25	163.19
PH ₃ (g)	5.4	13.5	210.2
PCl ₃ (g)	-287.0	-267.8	311.78
PCl ₅ (g)	-374.9	-305.0	364.4
P ₄ O ₆ (s)	-1640.1	—	—
P ₄ O ₁₀ (s)	-2984.0	-2697.0	228.86
HPO ₃ (s)	-948.5	—	—
H ₃ PO ₂ (s)	-604.6	—	—
H ₃ PO ₃ (s)	-964.4	—	—
H ₃ PO ₄ (s)	-1279.0	-1119.1	110.50
H ₃ PO ₄ (l)	-1266.9	-1124.3	110.5
H ₄ P ₂ O ₇ (s)	-2241.0	—	—
POCl ₃ (l)	-597.1	-520.8	222.5
POCl ₃ (g)	-558.5	-512.9	325.5
potassium			
K(s)	0	0	64.7
K(g)	89.0	60.5	160.3

Standard Thermodynamic Properties for Selected Substances

Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/K•mol)
potassium continued			
KF(s)	-576.27	-537.75	66.57
KCl(s)	-436.5	-408.5	82.6
silicon			
Si(s)	0	0	18.8
Si(g)	450.0	405.5	168.0
SiO ₂ (s)	-910.7	-856.3	41.5
SiH ₄ (g)	34.3	56.9	204.6
H ₂ SiO ₃ (s)	-1188.67	-1092.44	133.89
H ₄ SiO ₄ (s)	-1481.14	-1333.02	192.46
SiF ₄ (g)	-1615.0	-1572.8	282.8
SiCl ₄ (l)	-687.0	-619.8	239.7
SiCl ₄ (g)	-662.75	-622.58	330.62
SiC(s, beta cubic)	-73.22	-70.71	16.61
SiC(s, alpha hexagonal)	-71.55	-69.04	16.48
silver			
Ag(s)	0	0	42.55
Ag(g)	284.9	246.0	172.89
Ag ₂ O(s)	-31.05	-11.20	121.3
AgCl(s)	-127.0	-109.8	96.3
Ag ₂ S(s)	-32.6	-40.7	144.0
sodium			
Na(s)	0	0	51.3
Na(g)	107.5	77.0	153.7
Na ₂ O(s)	-414.2	-375.5	75.1
NaCl(s)	-411.2	-384.1	72.1
sulfur			
S ₈ (s) (rhombic)	0	0	256.8
S(g)	278.81	238.25	167.82
SO ₂ (g)	-296.83	-300.1	248.2
SO ₃ (g)	-395.72	-371.06	256.76
H ₂ S(g)	-20.6	-33.4	205.8
H ₂ SO ₄ (l)	-813.989	690.00	156.90
H ₂ S ₂ O ₇ (s)	-1273.6	—	—
SF ₄ (g)	-728.43	-684.84	291.12
SF ₆ (g)	-1220.5	-1116.5	291.5
SCl ₂ (l)	-50	—	—
SCl ₂ (g)	-19.7	—	—
S ₂ Cl ₂ (l)	-59.4	—	—
S ₂ Cl ₂ (g)	-19.50	-29.25	319.45
SOCl ₂ (g)	-212.55	-198.32	309.66
SOCl ₂ (l)	-245.6	—	—
SO ₂ Cl ₂ (l)	-394.1	—	—
SO ₂ Cl ₂ (g)	-354.80	-310.45	311.83
tin			
Sn(s)	0	0	51.2
Sn(g)	301.2	266.2	168.5
SnO(s)	-285.8	-256.9	56.5
SnO ₂ (s)	-577.6	-515.8	49.0
SnCl ₄ (l)	-511.3	-440.1	258.6
SnCl ₄ (g)	-471.5	-432.2	365.8

Standard Thermodynamic Properties for Selected Substances

Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/K•mol)
titanium			
Ti(s)	0	0	30.7
Ti(g)	473.0	428.4	180.3
TiO ₂ (s)	-944.0	-888.8	50.6
TiCl ₄ (l)	-804.2	-737.2	252.4
TiCl ₄ (g)	-763.2	-726.3	353.2
tungsten			
W(s)	0	0	32.6
W(g)	849.4	807.1	174.0
WO ₃ (s)	-842.9	-764.0	75.9
zinc			
Zn(s)	0	0	41.6
Zn(g)	130.73	95.14	160.98
ZnO(s)	-350.5	-320.5	43.7
ZnCl ₂ (s)	-415.1	-369.43	111.5
ZnS(s)	-206.0	-201.3	57.7
ZnSO ₄ (s)	-982.8	-871.5	110.5
ZnCO ₃ (s)	-812.78	-731.57	82.42
complexes			
<i>cis</i> -[Co(NH ₃) ₄ (NO ₂) ₂]NO ₃	-898.7	—	—
<i>trans</i> -[Co(NH ₃) ₄ (NO ₂) ₂]NO ₃	-896.2	—	—
NH ₄ [Co(NH ₃) ₂ (NO ₂) ₄]	-837.6	—	—
[Co(NH ₃) ₆][Co(NH ₃) ₂ (NO ₂) ₄] ₃	-2733.0	—	—
<i>cis</i> -[Co(NH ₃) ₄ Cl ₂]Cl	-874.9	—	—
<i>trans</i> -[Co(NH ₃) ₄ Cl ₂]Cl	-877.4	—	—
<i>cis</i> -[Co(en) ₂ (NO ₂) ₂]NO ₃	-689.5	—	—
<i>cis</i> -[Co(en) ₂ Cl ₂]Cl	-681.2	—	—
<i>trans</i> -[Co(en) ₂ Cl ₂]Cl	-677.4	—	—
[Co(en) ₃](ClO ₄) ₃	-762.7	—	—
[Co(en) ₃]Br ₂	-595.8	—	—
[Co(en) ₃]I ₂	-475.3	—	—
[Co(en) ₃]I ₃	-519.2	—	—
[Co(NH ₃) ₆](ClO ₄) ₃	-1034.7	-221.1	615
[Co(NH ₃) ₅ NO ₂](NO ₃) ₂	-1088.7	-412.9	331
[Co(NH ₃) ₆](NO ₃) ₃	-1282.0	-524.5	448
[Co(NH ₃) ₅ Cl]Cl ₂	-1017.1	-582.5	366.1
[Pt(NH ₃) ₄]Cl ₂	-725.5	—	—
[Ni(NH ₃) ₆]Cl ₂	-994.1	—	—
[Ni(NH ₃) ₆]Br ₂	-923.8	—	—
[Ni(NH ₃) ₆]I ₂	-808.3	—	—