Thermo II HW

Worksheet Key

1) Do the following processes produce an increase or a decrease in entropy?

a. $H_2O(l) \rightarrow H_2O(g)$ **Increase** – liquid to gas

b. $N(g) + O(g) \rightarrow NO(g)$ **Decrease** – fewer moles

c. $N_2(g) + 3\ H_2(g) \rightarrow 2\ NH_3(g)$ **Decrease** – fewer moles

d. $C_8H_{18(g)} + 25\ O_{2(g)} \rightarrow 16\ CO_{2(g)} + 18\ H_2O_{(g)}$ **Increase** – more moles

e. $CaO(s) + CO_2(g) \rightarrow CaCO_3(s)$ **Decrease** – fewer moles a gas to solid

f. $MgCl_2(s) + H_2O(l) \rightarrow MgO(s) + 2\ HCl(g)$ **Increase** – more moles ar two moles of gas on the products side.

2) Find the entropy change, ΔS°, for the following reactions using the S° values i the appendix of your textbook.

a. $2\ H_2O(l) \rightarrow 2\ H_2(g) + O_2(g)$ $\Delta H^\circ = +572$ kJ

$$\Delta S^\circ_{rxn} = \sum S^\circ_{products} - \sum S^\circ_{reactants}$$

$$\Delta S^\circ_{rxn} = [2(S^\circ\ H_{2(g)}) + (S^\circ\ O_{2(g)})] - [2(S^\circ\ H_2O_{(l)})]$$

$$\Delta S^\circ_{rxn} = [2(131\ J/K) + (205\ J/K)] - [2(69.9\ J/K)]$$

$$\Delta S^\circ_{rxn} = +327\ J/molK$$

#2

Three out of the four answers correct. Identify which one is not.

a. +327 J/mol*K

b. -1087.4 J/mol*K

c. -89 J/mol*K

d. -387 J/mol*K

#3

While the reactants are the same, notice the difference in the products.

Use this as part of your explanation.

#4

Three out of the four answers are correct. Identify which one is not.

a. 475 kJ/mol
b. -2972.8 kJ/mol
c. -1379 kJ/mol
d. 1432 kJ/mol

Be sure to identify if they are spontaneous or non-spontaneous

#5

When something “becomes spontaneous” G changes from positive to negative. Therefore, we can set G=0 and solve for temperature

$G = H - TS$

$0 = H - TS$

$H = TS$

(Get H and S from #2)

Answer 1750 K or 1477 C

#6

There are two forces that determine whether a system is spontaneous—enthalpy and entropy.

If one is not favored, the other must be to produce a spontaneous reaction.

Think about this as you construct your response.

#7

In the notes, we discussion dissolved of an ionic solid.

#8

Textbook required

a. -632 kJ/mol
b. Look at the states of matter, then at the number of particles to decide if S is positive or negative.
c. Based on the sign you assigned to S (b) and the sign on G, you should be able to predict the sign on H (use the chart).

#9

Textbook required.

a. +890.7 kJ/mol
b. Look at the states of matter as well as the number of particles to determine the sign on S.

#10

a. Look at the states of matter as well as the number of particles to determine the sign on S.

c. Use the chart that we constructed to aid your response.

#11

a. Look at the states of matter as well as the number of particles to determine the sign on S.

c. Use the chart that we constructed to aid your response.

#12

Use G = H – TS to solve for S. Watch your units

150 J/molK

Remember that two forces can drive a reaction, the one that is FAVORABLE will be the driving force.

--Exothermic is favored (Enthalpy)

--Increase in disorder is favored (Entropy)

For c, use your values for H and S and the chart we constructed.

#13

Use G = H – TS to solve for H. Watch your units.

192 kJ/mol

#14

Use G = H – TS to solve for H. Watch your units.

-65 kJ/mol

Remember that two forces can drive a reaction, the one that is FAVORABLE will be the driving force.

--Exothermic is favored (Enthalpy)

--Increase in disorder is favored (Entropy)

For c, use your values for H and S and the chart we constructed.

#15

Use G = H – TS to solve for S. Watch your units.

194 J/molK

#16

Magnitude? This means to predict whether you think that the change in entropy is a large positive, large negative, small positive, small negative, or number close to zero.