Name: _____

Chemistry 30
Unit 1: Energy Changes in Chemical Reactions
Assignment 5: Sections 3-2 to 3-3

1. For each of the following pairs, circle the situation which favors a spontaneous reaction:

      a)   endothermic reaction   or   exothermic reaction

      b)   negative value of $\Delta H°$ or   positive value of $\Delta H°$

      c)   negative value of $\Delta S°$ or   positive value of $\Delta S°$

      d)   increasing entropy   or   decreasing entropy

      e)   positive value of $\Delta G°$ or   negative value of $\Delta G°$

2. Describe the circumstances where:

    a) $\Delta H_f° = 0$ _____

    b) $S = 0$ _____

    c) $\Delta G_f° = 0$ _____

    d) $\Delta G = 0$ _____

3. Which one of the following shows and increase in entropy:

    a) dissolving sugar in a cup of hot tea.

    b) arranging a pack of playing cards into suits.

    c) building a sand castle on the beach.

4. Using values of $\Delta G_f°$ from the table provided below, calculate $\Delta G°$ for the following reaction **and** tell whether or not the reaction will occur spontaneously. Show your work clearly. Use the formula $\Delta G = \Sigma \Delta G_{products} - \Sigma \Delta G_{reactants}$
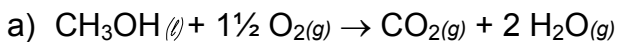
   $C_2H_{6(g)} + 2Cl_{2(g)} \rightarrow C_2H_4Cl_{2\ (g)} + 2\ HCl_{(g)}$
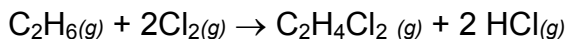
Substance	$\Delta G_f°$ (kJ/mol)
$C_2H_{6(g)}$	-32.9
$Cl_{2(g)}$	0.0
$C_2H_4Cl_{2(g)}$	-80.3
$HCl_{(g)}$	-95.2

   Is the reaction spontaneous?

5. Calculate $\Delta G°$ using the formula $\Delta G = \Delta H - T\Delta S$

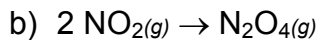   Also, for each question, tell whether or not the reaction will be spontaneous.

   Values for ΔH and ΔS are given. All reactions take place at 25°C (298 K). Remember to convert ΔS values to kJ.

   a) $CH_3OH_{(l)} + 1\frac{1}{2}\ O_{2(g)} \rightarrow CO_{2(g)} + 2\ H_2O_{(g)}$

   ΔH = -638.4 kJ ΔS = 156.9 J / K

b) $2 \text{ NO}_{2(g)} \rightarrow \text{N}_2\text{O}_{4(g)}$

$\Delta H = -57.2 \text{ kJ}$ $\Delta S = -175.9 \text{ J / K}$

6. Calculate $\Delta G°$ for the following reaction using values of $\Delta G_f°$ obtained from the Table of Thermochemical Data. Will the reaction be spontaneous?

Use the formula $\Delta G = \Sigma \Delta G_{products} - \Sigma \Delta G_{reactants}$

$3 \text{ Fe}_2\text{O}_{3(s)} \rightarrow 2 \text{ Fe}_3\text{O}_{4(s)} + \frac{1}{2} \text{ O}_{2(g)}$

7. For a certain spontaneous reaction, the change in enthalpy ($\Delta H°$) is -92.0 kJ and $\Delta G° = -50.2 \text{ kJ}$ at 25°C. Calculate ΔS.