CHM 1220-Dang **Chapter 18 – Reading Questions** **Name**

1. What is a spontaneous process? Give a real life example.

2. Why can't we say that a spontaneous reaction is a fast reaction? Do you think a catalyst make a nonspontaneous reaction become spontaneous?

3. Write the 2nd law and 3rd of Thermodynamics.

4. The change in entropy of the universe can be expressed as:

   $\Delta S_{univ} = \Delta S_{syst} +$ ________

5. Circle the correct response below showing how ΔS_{surr} must change in order to maintain $\Delta S_{univ} > 0$ for the following:
   – A process that emits heat into the surroundings (q_{rev} is negative) (*increases/decreases*) the entropy of the surroundings.
   – A process that absorbs heat from the surroundings (q_{rev} is positive) (*increases/decreases*) the entropy of the surroundings.

6. We can calculate ΔS^o_{sys} using the equation:

   $\Delta S^o_{sys} =$

7. Write a balanced equation for the combustion of C_2H_6. Then use the values in Table 16.2 to calculate the standard state entropy change for this reaction. (All reactants and products should be gases.)

8. The change in Gibbs Free Energy can be used to predict whether a reaction is spontaneous. Based on the following equation, we can determine the effect of ΔH, ΔS and T on spontaneity:

$\Delta G° =$

A decrease in Gibbs free energy ($\Delta G < 0$) indicates a process is _________________________________.

9. Work through Example 16.9. Then, for the following reactions, describe the changes in entropy and specify the temperature conditions required for spontaneity. No calculation is required.

	ΔH	ΔS sign	Temperature Condition for Spontaneity
A(g) → A(s)	-120 kJ		
B (g) → 2C (g)	-25 kJ		
2X (g) → 3 Z(g)	-65 kJ		

10. How is the value of ΔG^o for a reaction related the equilibrium constant for the reaction? What does a negative ΔG^o for the reaction imply about K for the reaction?

11. We can calculate the free energy changes for reactions under non-standard conditions using the following equation:

$\Delta G_{rxn} =$

where Q represents the ______________________

12. Based on how you labeled the arrows, indicate on the graph the regions where: Q > K, Q < K and Q = K. G reactants Reaction progress products $\Delta G^o{}_{rxn} = 0$