Checklist for Exam 5

Chapter 9 (Thermochemistry)

❑ I understand basic concepts related to entropy as a driving force. I know entropy is a measure of disorder within a system. I know everything has an absolute entropy at temperatures above 0 K. Absolute entropies are all positive values.

❑ I can predict the sign of ΔS for any reaction by comparing the number of moles of gaseous products and reactants as well as for phase changes. I can calculate ΔS for any reaction from a Table of Standard Entropies. The question I ask myself in order to predict ΔS is, "Is there more disorder in the system?" An answer of Yes means $\Delta S > 0$ and the process is entropy-favored.

❑ I know how of ΔH and of ΔS work together (or against each other) using the Gibbs-Helmholtz equation, of $\Delta G = \Delta H - T\Delta S$. Positive ΔG values are non-spontaneous and negative ΔG values are spontaneous. The question I ask myself in order to predict ΔG is, "Can it happen?" or "Does this happen?" An answer of Yes means $\Delta G < 0$ and the process is spontaneous.

Chapter 10 (Gases)

❑ I can convert between different units of pressure.
❑ I know how to determine the pressure of a gas using an open-end manometer.
❑ I can perform "Type I" calculations in which I use the ideal gas law, $PV = nRT$. Given three variables, I can calculate the fourth. I know I must make all units agree with the units on R.
❑ I can substitute $n = m/MM$ into the ideal gas equation to give: $PV = mRT/MM$. I can rearrange this equation to solve for MM. Since density, $d = m/V$, I can rearrange the equation to give $P = dRT/MM$. I can do further rearrangements to solve for density or molar mass.
❑ I can do "Type II" calculations in which there is a change afoot. Here I use the $P_iV_i/n_iT_i = P_fV_f/n_fT_f$ equation. It helps to set up a table as shown to organize the information.

	i	f
P		
V		
n		
T		

❑ I can make similar substitutions to the above equation ($n = m/MM$ and possibly $d = m/V$) if I need to in order to solve a particular problem.
❑ I can perform stoichiometric calculations relating the mass of a reactant to the mass, moles, and volume or pressure of a gaseous product.
❑ I can solve problems involving partial pressures. I know that the ideal gas law can be applied to total pressures given total moles or partial pressures, say of component A, given moles of component A. That is:

$$P_{tot}V = n_{tot}RT$$

$$P_AV = n_ART$$

❑ I know that partial pressures add together to give total pressure: $P_{tot} = P_A + P_B + P_C + \ldots$
❑ I know the definition of mole fraction, $X_A = n_A/n_{tot}$ and that the sum of all of the mole fractions equals 1. Given moles of the various components, I can calculate mole fraction.
❑ I know how to use the mole fraction and the total pressure to calculate the partial pressure of a particular component. Specifically, $P_A = X_AP_{tot}$
❑ I can use Graham's law to calculate the relative rates of effusion of two different gases. I can modify the Graham's law equation to work for distances and times as well as for speeds.

Chapter 10 (Solids and Liquids)

The first seven items (in blue) are a review of intermolecular forces which are important to understanding phase changes.

- I can use Lewis dots and the ABE formula in order to predict if a molecule is polar — has a molecular dipole moment — or not.
- I can label the δ^+ and δ^- end of a molecule.
- Knowing that a molecule is polar is enough to conclude that molecules are held together by dipole-dipole intermolecular forces.
- "Hydrogen bonding" occurs when hydrogen is covalently bonded to N, O, or F. The hydrogen bond is the intermolecular force between such a bond and another N, O, or F on a neighboring molecule. For example, the H-bond is represented by the dashed line:

$$H—F------H—F$$

- London dispersion forces (LDF) are another important type of intermolecular force. LDF are somewhat proportional to MM and so molecules with large MM have large LDF and these can be considerable. Thus, every substance has LDF forces.
- I know that intermolecular forces explain why and when solids melt and liquids boil, for example. In order to boil a liquid, enough energy has to be added to overcome all of the intermolecular forces.
- I can predict the sign for ΔH for phase changes. If one has to add energy, the process is endothermic, $\Delta H > 0$. If heat is given off, the process is exothermic, $\Delta H < 0$.
- I can use ΔH values in order to calculate q, the heat transferred and I know that q is an extensive property. I can use the units to do these q calculations. For example, given ΔH_{vap} which has units of kJ/mol, I can calculate q by multiplying ΔH_{vap} by the number of moles. Or, given the specific heat (units J/g deg), I multiply by mass and ΔT, and so on.
- I can answer questions about heating (or cooling) curves where $q_{tot} = q_I + q_{II} + q_{III} + q_{IV} + q_V$. I can calculate each of the q values and add them up. I know that usually not all q values will be needed. I practiced this calculation with Question 3 on worksheet for Chapter 11 Day 1. In addition to molar heat capacities used in this example, I know that for q_I, q_{II} and q_V, specific heats in J/g deg would also work – just make sure the units work out.
- I can answer questions about vapor pressure diagrams and can use the Clausius-Clapyron equation (provided), to plug in four variables to calculate a value for the fifth. I know to use units, so that ΔH_{vap} will be in the same units as R, in terms of J or kJ.
- I can answer questions about phase diagrams, condensable and permanent gases, triple points, critical temperature, etc.
- I can identify simple unit cells (cubic, body-centered, and face-centered.) I know how these relate to metals and I know the four important positions: corners, center, edge-centers and face-centers.
- I know how many net atoms are wholly contained within each of the cubic unit cells.
- I know where atom contact takes place for each of the cubic unit cells and can show how the radius, r, relates to the edge length, e.
- I know how to use the density of a solid and its unit cell dimensions to calculate the atomic radius and visa versa.
- I know that for ionic compounds, the big ions, usually the anions, often arrange themselves in the same patterns as metals do (simple, body-centered and face-centered unit cells) with the smaller ions going in some of the other positions such as edge-centers, and so on.
- I know that the formula of an ionic salt is represented by the relative number of ions within each unit cell because a bulk material is simply just a large number of unit cells.
- I can classify solids as ionic, molecular, covalent network, or metallic, and I can give the major forces of attraction of each.
- I can answer questions about bonding in metals and network covalents.