South Pasadena • AP Chemistry

Name _____

Period ___ Date ___/___/___

13 • IMF's, Liquids and Solids

STUDY QUESTIONS

1. Describe the interparticle forces at work in the following:
   a. within a water molecule H_2O
   b. in a crystal of the salt NaCl
   c. in a solution of potassium nitrate KNO_3
   d. in diamond
   e. in a fiber of nylon
   f. in liquid butane
   g. between water molecules in ice
   h. between the two strands in the double helix of DNA
   i. in paraffin wax
   j. between the molecules of carbon dioxide CO_2 in dry ice
   k. between the molecules of HCl in liquid HCl
   l. in tungsten metal
   m. in a solution of perchloric acid

2. Which one of the following pairs of molecules would you expect to have the higher melting point?
   a. Cl_2 or Br_2
   b. C_4H_{10} or C_5H_{12}
   c. NH_3 or PH_3
   d. Na or Mg
   e. BeO or KCl
   f. ICl or Br_2

3. Which states or types of matter would be characterized by each of the following statements?
   a. High individual molecular speeds.
   b. A melting point spread over a wide temperature range.
   c. A regular repeating array of structural units.
   d. Molecules move with respect to one another but are held together in a condensed state.
   e. Molecules close together but having sufficiently high kinetic energies to overcome the intermolecular forces.
   f. Valence electrons delocalized over huge arrays of atoms.
   g. Totally random molecular order with comparatively great distances between individual molecules.
   h. A three-dimensional network of covalent bonds.

4. Acetone and chloroform form an unusually strong intermolecular bond. Why is this? Draw a picture of how the molecules attract each other.

5. a. How much heat is required to melt 15 grams of ice at 0°C?
   b. How much heat is released when 100 grams of steam condenses at 100°C?
   c. If a system of ice and water has a mass of 12 grams, and it is converted completely to water at 0.0°C by supplying 1.33 kJ of heat, how much water was initially present?

   Heat of fusion of ice = 333 J/g Heat of vaporization of water = 2250 J/g

Ignore Questions 6 – 10. They are not part of the AP curriculum.

11. Examine the data in Table 13.4 on page 601 of the text. Convert the boiling points from °C to K, and then divide the enthalpy of vaporization by the boiling point in K. Order the results and see if you can detect any correlation between the magnitude of the results and the intermolecular forces of attraction. (Copy your *ordered* list below.)

Substance	**BP (in °C)**	**BP (in K)**	**ΔH_{vap}/BP(in K)**	**IMF**

Compare the boiling points in K with the magnitude of the van der Waals constants listed in Table 12.3 on page 572 of the text. The easiest way to detect any correlation between the two is to plot the value of "a" against the boiling point. Does the existence of some correlation between the two quantities surprise you? The values are listed below with those for some additional substance: (Notice that water is not included!)