

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

### Liquids and Concentration Review

1. Compare a polar water molecule with a less-polar molecule, such as formaldehyde,  $\text{CH}_2\text{O}$ . Both liquids are at room temperature and 1 atm.

- \_\_\_\_\_ a. Which liquid should have a higher surface boiling point?
- \_\_\_\_\_ b. Which is more volatile?
- \_\_\_\_\_ c. Which liquid has a higher surface tension?
- \_\_\_\_\_ d. Which diffuses more rapidly?
- \_\_\_\_\_ e. In which liquid is NaCl, an ionic crystal, likely to be more soluble?

2. The heat of fusion of ice is 6.009 kJ/mol.

a. How much heat is needed to melt 12.0 g of ice?

b. Determine the heat of fusion of ice in calories/gram.

3. Freon-11,  $\text{CCl}_3\text{F}$ , has been commonly used in air conditioners. Its heat of vaporization is 24.8 kJ/mol at its normal boiling point of  $24^\circ\text{C}$ . How much heat is removed from a room by an air conditioner that evaporates 1.00kg of Freon-11?

4. The heat of molar vaporization of methane,  $\text{CH}_4$ , is 8.19 kJ/mol; for water, it is 40.79 kJ/mol.

a. If  $2.0 \times 10^{23}$  molecules of liquid  $\text{CH}_4$  are made to boil, how much heat must be supplied?  
Show your work.

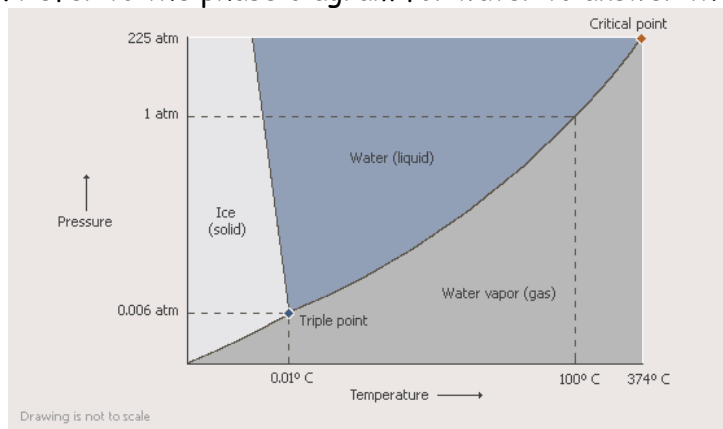
b. Based on the molar heat of vaporization data, which is more volatile,  $\text{CH}_4$  or  $\text{H}_2\text{O}$ ?

c. Which molecule is more polar,  $\text{CH}_4$  or  $\text{H}_2\text{O}$ ?

5. Methanol has a normal boiling point of  $65^{\circ}\text{C}$ . It is a liquid at conditions of 1 atm and  $25^{\circ}\text{C}$ . A small beaker filled with methanol is placed under a bell jar, and the air is then pumped out. It is observed that under a vacuum the methanol boils readily at  $25^{\circ}\text{C}$ .

Use the kinetic-molecular theory and the concept of equilibrium vapor pressure to account for the lowered boiling point of methanol under a vacuum.

6. Refer to the phase diagram for water to answer the following questions:



a. Which point represents the conditions under which all three phases coexists?

b. Based on the diagram, as the pressure on the water system is increased, the melting point of ice ----- (increases, decreases, or stays the same).

7. Describe the errors made by the following students in making molar solutions.

a. James needs a 0.600 M solution of KCL. He measures out 0.600 g of KCL and adds 1 L of water to the solid.

b. Mary needs a 0.02 M solution of  $\text{NaNO}_3$ . She calculates that she needs 2.00 g of  $\text{NaNO}_3$  for 0.02 mol. She puts this solid into a 1.00 L volumetric flask and fills the flask to the 1.00 L mark.

**PROBLEMS** Show all your work in the space provided.

8. What is the molarity of a solution made by dissolving 2.0 mol of solute in 6.0 L of solvent?

9.  $\text{CH}_3\text{OH}$  is soluble in water. What is the molality of a solution made by dissolving 8.0 g of  $\text{CH}_3\text{OH}$  in 250. g of water?

10. Marble chips effervesce when treated with acid. This reaction is represented by the following equation:



To produce a reaction, 25.0 mL of 4.0 M HCl is added to excess  $\text{CaCO}_3$ .

a. How many moles of HCl are consumed in this reaction?

b. How many liters of  $\text{CO}_2$  are produced at STP?

c. How many grams of  $\text{CaCO}_3$  are consumed?

11. 10.0 g of Iodine,  $\text{I}_2(\text{s})$ , dissolved in 1000. g of ethanol,  $\text{C}_2\text{H}_5\text{OH}$ .

a. How many grams of solvent are present in 1000. g of this solution?

b. 10.0g of  $\text{I}_2$  represent how many moles of solute?

c. What is the molality of this 1% solution?