Name_____ H Chem, Period_____

Colligative Properties

1. Define colligative property:

2. Why is salt added to icy roads. Explain thoroughly.

3. Recall that a liquid boils when its vapor pressure is equal to the surrounding pressure (If the liquid is in an open container, the surrounding pressure is the atmospheric pressure). Why does the boiling point go up when a solute is dissolved in water?

4. When pure water is heated, the temperature rises until it begins to boil and the temperature remains constant until all the water is evaporated. When a salt solution is heated, the temperature continues to rise even after it begins to boil. Why?

5. What is the Van't Hoff factor for the following:

   a. $C_{12}H_{22}O_{11}$ =

   b. $NaNO_3$ =

   c. $MgCl_2$ =

   d. $Al_2(SO_4)_3$ =

e. CO_2 =

6. Assuming they are all the same concentrations, which of the above aqueous solutions will have the highest boiling point and highest freezing point? (examples from above)

7. Will one mole of sugar have the same effect as 1 mol of table salt in lowering the freezing point of water? Explain.

8. Which of the following solutions has the lowest freezing point and the highest boiling point? Why?
   a. 0.100 *m* sucrose
   b. 0.050 *m* $CaCl_2$
   c. 0.050 *m* NaCl

9. The change in freezing point and boiling point can be determined using the following equations:

$$\Delta T_f = -iK_f m \quad \text{and} \quad \Delta T_b = iK_b m$$

K_f for water = 1.86 °C kg/mol and K_b for water = 0.512 °C kg/mol

   a. Calculate the freezing and boiling points for a 0.100 *m* aqueous solution of KCl

   b. Antifreeze is used in automobile radiators to keep the coolant from freezing and cracking the engine blocks, radiators, and coolant lines. The component of antifreeze is ethylene glycol, $C_2H_4(OH)_2C_2H_4(OH)_2$. What is the concentration of aqueous ethylene glycol in molality, if the freezing point dropped by 2.64 °C