Name _____   **AP Chemistry**

Chapter 11 HW 3: Due 3/7/19 Complete both free response questions. One will be graded. Show all work. Box and clearly label all final answers for question 1. Write the answers to question 2 on the line with the correct unit.

1. The formula and the molecular weight of an unknown hydrocarbon compound are to be determined by elemental analysis and the freezing-point depression method.
(a) The hydrocarbon is found to contain 93.46 percent carbon and 6.54 percent hydrogen. Calculate the empirical formula of the unknown hydrocarbon.
(b) A solution is prepared by dissolving 2.53 grams of p-dichlorobenzene (molecular weight 147.0) in 25.86 grams of naphthalene (molecular weight 128.2). Calculate the molality of the p-dichlorobenzene solution.
(c) The freezing point of pure naphthalene is determined to be 80.2°C. The solution prepared in (b) is found to have an initial freezing point of 75.7°C. Calculate the molal freezing-point depression constant of naphthalene.
(d) A solution of 2.42 grams of the unknown hydrocarbon dissolved in 26.7 grams of naphthalene is found to freeze initially at 76.2°C. Calculate the apparent molecular weight of the unknown hydrocarbon on the basis of the freezing-point depression experiment above.
(e) What is the molecular formula of the unknown hydrocarbon?

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2. Many years ago on a Friday at 2:45 PM at Herndon High School while working late and avoiding my responsibilities at home I prepared a solution (it didn't solve any problems but did create a bunch of questions –see some of them below). I added 21.47 grams of NaCl to 330.00 mL of water. There was no change in volume. The temperature of the solution was 20.0˚C. I did not cover the solution and man it started evaporating. The density of water at 20.0˚C is 0.99823g/mL. The vapor pressure of water at 20.0˚C is 17.5 mm Hg. The molal boiling point elevation constant of water is 0.51 ˚C kg/mol. The molal freezing point depression constant of water is 1.86˚C kg/mol. Write the answer to each question on the line after the question. **Attach all work on a separate sheet of paper. If there is no work you will not receive any credit.**

     a.   Calculate the molarity of the initial solution. _____

     b.   Calculate the mole fraction of sodium chloride in the initial solution. _____

     c.   Calculate the mass percent of sodium chloride in the initial solution. _____

     d.   Calculate the molality of the initial solution. _____

     e.   Calculate the density of the initial solution. _____

     f.   Calculate the vapor pressure of the initial solution. _____

     g.   Calculate the boiling point of the initial solution. _____

     h.   Calculate the freezing point of the initial solution. _____

     i.   Calculate the osmotic pressure of the initial solution at 20.0˚C. _____ _____

     j.   When I returned on Monday I reweighed the sample at 8:15 AM. The new mass was 322.31 grams. Calculate the

         number of water molecules that evaporated over the weekend. _____

     k.   Calculate the average number of water molecules that evaporated per second. _____

     l.   Calculate the molality of the solution on Monday morning at 8:15 AM. _____