WKS
Colligative Property Calculations
(FP depression and BP elevation)

Name _____
Period _____

1) What is the formula for the concentration of a solution in *molal, m*? Why is molality sometimes used for solutions rather than molarity?

2) What is the concentration, in *m*, of a solution with 50.0 g of sucrose, $C_6H_{12}O_6$, dissolved in 250. g of H_2O?

3) How many grams of $CaCl_2$ are needed to make a 1.50 *m* solution with 500. g of H_2O? [Hint: set up the *molal* equation to find moles first.]

4) What does the van't Hoff factor, *i*, signify? What is *i* for $C_6H_{12}O_6$? NaCl? $CaCl_2$?

5) Write the mathematical expressions for boiling point elevation (ΔT_b) and freezing point depression (ΔT_f).

6) Calculate the freezing point of a solution containing 36.2 g hexane (C_6H_{14}) in 500.0 g CCl_4. The K_f for CCl_4 is 29.8 °C/*m* and the normal freezing point for CCl_4 is –23.0°C. Assume $i = 1$ for hexane.

7) What is the boiling point of a solution containing 63.9 g $SrBr_2$ in 100.0 g H_2O? $K_b = 0.512$ °C/*m* for water. [Hints: What is *i* for $SrBr_2$? What is the normal boiling point of H_2O?]

8) The molal boiling point constant for ethyl alcohol is 1.22°C/*m*. Its normal boiling point is 78.4°C.

a) What is the molality of a solution of alcohol and an unknown nonvolatile molecular solute ($i = 1$) that boils at 79.8°C?

b) If 264 g of ethyl alcohol was used, what is the number of moles of the solute?

c) Given that 14.2 g of the solute was used, hat is the molar mass of the solute?

9) A researcher places 53.2 g of an unknown molecular solute in 505 g naphthalene ($K_f = 6.80$°C/*m*). The nonelectrolyte lowers naphthalene's freezing point by 8.8°C. What is the molar mass of the unknown substance?

Answers: 2) *m* = 1.11 *m*; 3) m = 83.3 g $CaCl_2$; 6) $T_f = -48.0$°C; 7) $T_b = 103.98$°C; 8a) *m* = 1.15 *m*; 8b) mol = 0.303 mol; 8c) MM = 47 g/mol; 9) 1.29 *m* → 0.651 mol → MM = 82 g/mol