CH 222 Practice Problem Set #5

*This is a **practice problem set** and not the actual graded problem set that you will turn in for credit. Answers to each problem can be found at the end of this assignment.*

Covering: **Chapter Eleven** *and* **Chapter Guide Five**
Important Tables and/or Constants:"**Solution Calculations**" *(Handout)*

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1. Fill in the blanks in the table. All solutions are aqueous.

Compound	Molality	Weight Percent	Mole Fraction
NaI	0.15	_____	_____
C_2H_5OH	_____	5	_____
$C_{12}H_{22}O_{11}$	_____	_____	0.0027

2. Hydrochloric acid is sold as a concentrated aqueous solution. If the molarity of commercial HCl is 12.0 and its density is 1.18 g/cm^3, calculate the following:
   a. the molality of the solution
   b. the weight percent of HCl in the solution
3. The average lithium ion concentration in sea water is 0.18 ppm. What is the molality of Li^+ in sea water?
4. An unopened soda can has an aqueous CO_2 concentration of 0.0506 M at 25 °C. What is the pressure of CO_2 gas in the can? (k_H = 4.48 x 10^{-5} M/mm Hg)
5. Pure iodine (105 g) is dissolved in 325 g of CCl_4 at 65 °C. Given that the vapor pressure of CCl_4 at this temperature is 531 mm Hg, what is the vapor pressure of the CCl_4–I_2 solution at 65 °C? (Assume that I_2 does not contribute to the vapor pressure.)
6. What is the boiling point of a solution composed of 15.0 g of $CHCl_3$ (which boils at 61.70 °C) and 0.515 g of the nonvolatile solute acenaphthene, $C_{12}H_{10}$, a component of coal tar? (K_{bp} = 3.63 °C/m)
7. Assume a bottle of wine consists of an 11 weight percent solution of ethanol (C_2H_5OH) in water. If the bottle of wine is chilled to -20 °C, will the solution begin to freeze? (K_{fp} = 1.86 °C/m)
8. Anthracene, a hydrocarbon obtained from coal, has an empirical formula of C_7H_5. To find its molecular formula you dissolve 0.500 g in 30.0 g of benzene (K_{bp} = 2.53 °C/m). The boiling point of the pure benzene is 80.10 °C, whereas the solution has a boiling point of 80.34 °C. What is the molecular formula of anthracene?
9. Phenylcarbinol is used in nasal sprays as a preservative. A solution of 0.52 g of the compound in 25.0 g of water (K_{fp} = -1.86 °C/m) has a melting point of -0.36 °C. What is the molar mass of phenylcarbinol?
10. An aqueous solution containing 1.00 g of bovine insulin (a protein, not ionized) per liter has an osmotic pressure of 3.1 mm Hg at 25 °C. Calculate the molar mass of bovine insulin.

Answers to the Practice Problem Set:

1. *Answers*:

Compound	Molality	Weight percent	Mole fraction
NaI	0.15	2.2	0.0027
C_2H_5OH	1.1	5.0	0.020
$C_{12}H_{22}O_{11}$	0.15	4.9	0.0027

2. a. 16.2 *m* b. 37.1%
3. 2.6 x 10^{-5} *m*
4. 1130 mm Hg
5. 444 mm Hg
6. 62.51 ºC
7. Solution will freeze beginning at -5.0 ºC
8. $C_{14}H_{10}$
9. 110 g/mol
10. 6.0 x 10^3 g/mol