

ASSIGNMENT 7

CHEMISTRY 305

Due: 4:30 pm Monday 15 March 2010

1. While mole fraction is often the most convenient theoretical measure of composition, it is rarely the most convenient experimentally. The practical concentration units of most utility are: percent by weight (g of species i per 100 g of solution), mass concentration (g of i per unit volume of solution), molarity (moles of i per L of solution), and molality (moles of solute i per kg of solvent).
 - (a) Find expressions relating mole fraction to each of these other concentration measures.
 - (b) An aqueous solution of 69.0 g of ethanol per L of solution has a density of 0.9862 g cm^{-3} at 20°C . The density of pure water is 0.9982 g cm^{-3} at 20°C . Express the concentration of ethanol in this solution in each of these units..
2. At 100°C , the vapor pressures of hexane and octane are 2.416 atm and 0.466 atm. Solutions of these follows Raoult's law. One particular solution is mixed and held at 100°C and 5.00 atm, where it is all in the liquid phase. The pressure is slowly reduced and it is noted that the first gas bubble appears when the pressure has reached 1.00 atm. What was the solution's composition?
3. Salt, NaCl, is used effectively to lower water's freezing point and to keep streets and sidewalks clear of winter ice. Any salt would work: NaCl is relatively inexpensive. Likewise, CaCl_2 is readily available (and used in some commercial de-icing formulations for sidewalks) and has an advantage over NaCl of providing three solute particles per mole of compound rather than two. If NaCl costs x per kg, at what cost per kg does CaCl_2 become economically advantageous. The economic factor is degrees of freezing point depression per unit mass of salt.
4. Do question 6 on page 740 of your text.
5. Do question 8 on page 740 of your text.
6. Do question 10 on page 740 of your text.
7. Do question 12 on page 740 of your text.
8. Do question 14 on page 740 of your text.
9. Do question 20 on page 741 of your text.