CHM 1046 Chapter 12 Homework

1. Review page 1 of the chapter notes. Provide complete and detailed definitions for the terms solution and solute. (1 pt)

2. Review pages 1 and 2 of the chapter notes. Provide complete and detailed definitions for the terms miscible (not miscibility), immiscible, and partially-miscible. Explain how partially-miscible fluids can form a mixture that is only one layer (and is single-phase). (1.5 pts)

3. Review Example 12.12 in the chapter 12 notes. Suppose 3.005 g of a nonvolatile solute is added to 20.02 g of water (the solvent), and the boiling point increases from 100.000 ^{O}C to 101.286 ^{O}C. Determine the ΔT_B, molality (mol/kg), moles, and molar mass (g/mol) for the solute. Use 0.512 ^{O}C-kg/mol for the k_b of water. Report each value using the correct number of significant digits. Refer to Example 1.02 and pages 3-4 in the chapter 1 notes for general chemistry 1 to understand significant figures. Also, include all applicable units and conversion factors. (1.5 pts)

4. Review Example 12.04. Suppose that 5.49 g of water (18.0 g/mole) are mixed with 9.32 g of ethanol (46.1 g/mole) in a solution. Find the number of moles and the mole fraction for each component. Use significant figures and include all units where applicable. (2 pts)

5. Review Example 12.09. Suppose that the mixture with the mole fraction values in problem 4 is at 15 ^{O}C, where the pure vapor pressures are 12.5 mmHg for water and 32.1 mmHg for ethanol. According to Raoult's Law, the vapor pressure of a component in a solution is equal to its pure vapor pressure times its mole fraction, that is $P_A = (P_A^o)\ (X_A)$. Use Raoult's law to determine the vapor pressure of each component in the solution. Then, add them together to find the total vapor pressure. Use significant figures. Show all equations and conversion factors. (1.5 pts)

6. Review Example 12.08. KCl is an ionic salt with a formula weight of 74.54 g/mole. A 1.417 M (mole/liter) KCl solution has a density of 1064.5 grams/liter at 20.0 ^{O}C. Use the Molarity and the formula weight to find the mass (g) of salt in one liter. Then, find the mass (g and kg) of water in one liter of the solution as the difference between the solution mass and the KCl mass. Include the kg conversion factor. Determine the molality (m), or moles of salt per kg of water, by dividing the moles of salt in one liter by the kg of water in one liter. Show all equations with all units and use proper significant figures. (1.5 pts)

7. Review Example 12.13 and page 8 of the chapter 12 notes. Suppose a 0.00126 M $CrBr_3$ solution at 15.0 ^{O}C is in contact with a semi-permeable osmosis membrane. Find "i" (the Van't Hoff factor) as the sum of the number of ions in the formula. Then, find the osmotic pressure in both atm and mmHg using $\Pi = iMRT$. Show all units and conversion factors. Include the units on the conversion factor equation. Use significant figures. Assume that "i" is an exact number which does not reduce the number of significant digits. (1 pt)