REVIEW QUESTIONS

Chapter 12

1. Commercial nitric acid has a density of 1.42 g/mL and is 16.0 M. Calculate the mass of percent of HNO_3 in this solution.

2. Ascorbic acid, vitamin C, is a water soluble vitamin. A solution containing 80.5 g of ascorbic acid, $C_6H_8O_6$, in 210 g of water has a density of 1.22 g/mL at 55°C. Calculate **(a)** the mass % , **(b)** the mole fraction, **(c)** the molarity and **(d)** the molality of ascorbic acid in this solution.

3. Calculate the mass of ethylene glycol, $C_2H_6O_2$, that must be added to 1.00 kg of ethanol, C_2H_5OH, to reduce its vapor pressure by 13.2 torr at 35°C. Vapor pressure of pure ethanol at 35°C is 100. torr.

4. Which of the following in each pair is likely to be the more soluble in water:

   a) $CH_3CH_2CH_2CH_2OH$ or CH_3CH_2OH

   b) CCl_4 or $CaCl_2$

   c) C_6H_6 or C_6H_5OH

5. The dissolution of NH_4NO_3 in water is an endothermic process. Describe the solution process in terms of three distinct components, and show how the sum of these can lead to a positive enthalpy change.

6. Calculate the vapor pressure of a solution prepared by adding 32.5 g of glycerin ($C_3H_8O_3$) to 140 g of water at 70°C. ($P°=234$ torr)

7. A mixture of styrene (C_8H_8, 38%) and ethylbenzene (C_8H_{10}, 62%) is separated by fractional distillation at 90°C. What is the composition of the vapor in equilibrium with this mixture at 90°C, given the vapor pressure of the two components: styrene, 134 mmHg and ethylbenzene, 182 mmHg.

8. A solution of antifreeze contains 25% by mass ethylene glycol ($C_2H_6O_2$) in water. Calculate the boiling point and freezing point for this solution.
(K_b=0.512 °C/m and K_f=1.86 °C/m)

9. Calculate the freezing point of an aqueous solution that boils at 102.5 °C.

10. The density of a 1.80 M solution of LiBr in acetonitrile (CH_3CN) is 0.826 g/mL. Calculate the concentration of this solution in (a) molality, (b) mole fraction of LiBr, and (c) mass percent of CH_3CN.

11. Calculate the vapor pressure of a solution prepared by adding
    a) 32.5 g of glycerin ($C_3H_8O_3$) to 140 g of water at 70°C. ($P°$=234 torr)

    b) 5.00 g of Na_2SO_4 to 92.0 g of water at 55°C. ($P°$=118 torr)

12. Arrange the following solutions in the order of increasing boiling point:

    0.040 m glycerol ($C_3H_8O_3$)
    0.025 m KBr
    0.010 m $CaCl_2$

13. A solution of an unknown nonvolatile, non-electrolyte compound was prepared by dissolving 0.250 g of the unknown in 40.0 g of CCl_4. The boiling point of the resultant solution was measured to be 0.357°C higher than the pure solvent. Calculate the molar mass of the unknown solute. (K_b= 5.02 °C/m)