CHEM 1423
Chapter 13
Homework Questions

TEXTBOOK HOMEWORK

13.43 Calculate the molarity of each aqueous solution:
(a) 78.0 mL of 0.240 M NaOH diluted to 0.250 L with water
(b) 38.5 mL of 1.2 M HNO3 diluted to 0.130 L with water

13.47 Calculate the molality of the following:
(a) A solution containing 85.4 g of glycine (NH_2CH_2COOH) dissolved in 1.270 kg of H_2O
(b) A solution containing 8.59 g of glycerol ($C_3H_8O_3$) in 77.0 g of ethanol (C_2H_5OH)

13.49 What is the molality of a solution consisting of 44.0 mL of benzene (C6H6; d = 0.877 g/mL) in 167 mL of hexane (C6H14; d = 0.660 g/mL)?

13.53 A solution contains 0.35 mol of isopropanol (C3H7OH) dissolved in 0.85 mol of water.
(a) What is the mole fraction of iso- propanol?
(b) The mass percent?
(c) The molality?

13.55 Calculate the molality, molarity, and mole fraction of NH3 in an 8.00 mass % aqueous solution (d = 0.9651 g/mL).

13.72 Calculate the vapor pressure of a solution of 34.0 g of glycerol (C3H8O3) in 500.0 g of water at 25 ^oC. The vapor pressure of water at 25 ^oC is 23.76 torr. (Assume ideal behavior.)

13.76 The boiling point of ethanol (C_2H_5OH) is 78.5 °C. What is the boiling point of a solution of 6.4 g of vanillin (M = 152.14 g/mol) in 50.0 g of ethanol (Kb of ethanol = 1.22 °C/m)?

13.80 Calculate the molality and van't Hoff factor (i) for the following aqueous solutions:
(a) 1.00 mass % NaCl, freezing point = -0.593 °C
(b) 0.500 mass % CH_3COOH, freezing point = -0.159 °C

SUPPLEMENTARY HOMEWORK

S1. The process of dissolving is favored if the _____ interactions are weaker than the

_____ interations.

a. solute-solvent; solute-solute and solvent-solvent
b. solvent-solvent; solute-solute and solute-solvent
c. solute-solute and solvent-solvent; solute-solvent
d. solute-solvent and solvent-solvent; solute-solute
e. solute-solute; solute-solvent and solvent-solvent

S2. Two liquids which mix together in all proportions are said to be _____; they mix because _____.

a. miscible; their intermolecular interactions are dissimilar
b. miscible; their intermolecular interactions are similar
c. miscible; their densities are dissimilar
d. immiscible; their intermolecular interactions are similar
e. immiscible; their intermolecular interactions are dissimilar

S3. The concentration unit one part per billion (one ppb) is equivalent to one of solute per _____ of solution.

a. mg; g
b. μg; g
c. mg; kg
d. μg; kg
e. ng; kg

S4. If 750 mL of a certain solution contains 50.0 g Na_2SO_4, the sodium ion concentration, $[Na^+]$, is

a. 0.264 M
b. 0.315 M
c. 0.469 M
d. 0.560 M
e. 0.939 M

S5. The freezing points of the following aqueous solutions, from highest to lowest, are: 0.25 m glucose, $C_6H_{12}O_6$ 0.15 m $CaCl_2$ 0.20 m NH_4NO_3

a. $C_6H_{12}O_6 > NH_4NO_3 > CaCl_2$
b. $C_6H_{12}O_6 > CaCl_2 > NH_4NO_3$
c. $CaCl_2 > C_6H_{12}O_6 > NH_4NO_3$
d. $CaCl_2 > NH_4NO_3 > C_6H_{12}O_6$
e. $NH_4NO_3 > C_6H_{12}O_6 > CaCl_2$

S6. A sample of the strong electrolyte, potassium phosphate (K_3PO_4, M=212.3) is dissolved in 400 grams of water. The boiling point of the solution is 102.65 ^oC. How many grams of K_3PO_4 are contained in the mixture?

S7. The vapor pressure of liquid toluene, $C_6H_5CH_3(l)$ [M=92], is 94.0 torr at 40 ^oC. When 25.0 grams of an unknown non-volatile compound is dissolved in 184 grams of toluene at 40 ^oC, the vapor pressure of the mixture is 84.6 torr. Calculate the Molar Mass of the unknown compound, in g/mol.

S8. An aqueous solution of phosphoric acid, H_3PO_4, contains 285 g H_3PO_4 in 400 mL solution, and has a density of 1.35 g/mL. Calculate

(a) the weight % H_3PO_4 in this solution.

(b) the concentration in mol/L of this solution

S9. The solvent, toluene, has a normal boiling point of 110.6 ^{o}C and a boiling point elevation constant of 3.33 ^{o}C/m. When 12.0 grams of an unknown substance, X, is added to 240 grams of toluene, the boiling point is 111.9 ^{o}C. Calculate the Molar Mass of the unknown compound.