CHEM 102 PS-2
Chapter 12-Phyisical Properties of Solutions

1. The density of an aqueous solution containing 10% of ethanol (C_2H_5OH) by mass is 0.984 g/mL.

A) Calculate the molality of this solution.
B) Calculate its molarity.
C) What volume of the solution would contain 0.125 mol of ethanol?

2. The solubility of N_2 in blood at 37°C and a partial pressure of 0.8 atm is 5.6×10^{-4} mole/L. A deep-sea diver breathes compressed air with a partial pressure of N_2 equal to 4.8 atm. Assume that the total volume of blood in the body is 5.0 L. Calculate the amount of N_2 gas released (in liters at 37°C and 1.00 Atm) when the diver returns to the surface, where the partial pressure of N_2 is 0.80 atm.

3. An aqueous solution contains the amino acid glycine (NH_2CH_2COOH). Assuming that the acid does not ionize in water, calculate the molality of the solution if it freezes at -1.1 degrees Celsius.

4. A solution is prepared by condensing 4.00 L of a gas, measured at 27°c and 748 mm Hg pressure, into 58.0 g of benzene. Calculate the freezing point of this solution. [Kfp(benzene) = 5.12°c/m, Kbp(benzene) = 2.53°c/m] (the boiling point and freezing point of benzene are 80.1°c and 5.5°c, respectively).

7. A solution containing 0.8330 g of a polymer in 170.0 mL of an organic solvent was found to have an osmotic pressure of 5.20 mmHg at 25 ^oC. Determine the molar mass of the polymer.

8. Arrange the following aqueous solutions in order of decreasing freezing point and express your reasoning: 0.5 m HCl, 0.5 m glucose, 0.5 m acetic acid.

9. A 0.86 percent by mass solution of NaCl is called "physiological saline" because its osmotic pressure is equal to that of the solution in blood cells. Calculate the osmotic pressure of this solution at normal body temperature (37 ^oC). Note that the density of the saline solution is 1.005 g/mL.

10. A 9.50 % by mass solution of acetone (C_3H_6O) in water has a density of 0.9849 g/mL at 20^oC. What is the molarity of this solution? (acetone:58.08 g/mol)
A. 0.621 M
B. 1.61 M
C. 1.66 M
D. 1.71 M
E. 16.9 M

11. A solution is prepared by adding 40.3 g of $Mg(NO_3)_2$ to 127 g of water. Calculate the mole fraction and molality of magnesium nitrate in this solution. ($Mg(NO_3)_2$ =148.3 g/mol)
A. Mole fraction = 0.0371; molality = 2.14 m
B. Mole fraction = 0.0571; molality = 2.14 m
C. Mole fraction = 0.0371; molality = 1.14 m
D. Mole fraction = 0.0571; molality = 1.14 m

12. A solution is 35.0% by mass carbon tetrachloride (CCl_4) in benzene (C_6H_6) at 20ºC. The vapor pressure of pure benzene and pure carbon tetrachloride at this temperature is 74.61 mmHg and 91.32 mmHg, respectively. Calculate the vapor pressure of the solution at 20ºC: (CCl_4=153.08 g/mol , C_6H_6= 78.11 g/mol)
A. 58.1 mmHg
B. 78.2 mmHg
C. 80.5 mmHg
D. 82.9 mmHg
E. 83.0 mmHg

13. What is the molar mass of toluene if 0.85 g of toluene depresses the freezing point of 100 g of benzene by 0.47ºC? Kf of benzene is 5.12ºC/m.
A. 927 g/mol
B. 92.4 g/mol
C. 81.8 g/mol
D. 78.0 g/mol
E. 10.7 g/mol

14. A research chemist isolates a new compound with an empirical formula C3H3O2. Dissolving 2.51 g of the compound in 100. g of water produces a solution with a freezing point of –0.325 ºC. What is the molecular formula of the compound? (For water, Kf = 1.86ºC/m.)
A. $C_3H_3O_2$
B. $C_6H_6O_4$
C. $C_9H_9O_6$
D. $C_3H_{12}O_4$
E. None of the above