General Chemistry I
Dr. M. J. Wieder
Examination #6

Name _____

(4) 1. An aqueous solution that contains 1.0 g of ephedrine in 20.0 ml of solution is _____% ephedrine (mass-volume).

a) 0.05 b) 0.50 c) 5.0 d) 20.0 e) 50.0

(4) 2. A solution that contains 4.00 g of KCl in 36.0 g of water is _____% KCl (mass-mass).

a) 11.1 b) 10.0 c) 9.00 d) 1.11 e) 0.111

(4) 3. A solution contains 78.0 g of $(NH_4)_2SO_4$ (Molar mass = 132.066 g/mol) per 100.0 g H_2O. What is the **molality** of the solution?

a) 5.91m b) 4.78m c) 1.69m d) 0.78m e) 0.59m

(4) 4. What mass, in grams, of Na_3PO_4 (Molar mass = 164.0 g/mol) is needed to prepare 100.0 ml of a 2.5M Na_3PO_4 solution?

a) 4.1 b) 8.2 c) 16.4 d) 41.0 e) 82.0

(4) 5. At 25°C, the vapor pressure of pure n-hexane is 151.4 torr and that of n-heptane is 45.62 torr. What is the **vapor pressure of a solution**, at 25°C, that contains only n-hexane and n-heptane in which the mole fraction of n-hexane is 0.600?

a) 103 torr b) 109 torr c) 152 torr d) 170 torr e) 197 torr

(4) 6. An aqueous solution contains 64.0 g of C_2H_5OH in 122.0 g of solution. What is the **mole fraction of C_2H_5OH** in solution?

a) 0.698 b) 0.432 c) 0.302 d) 0.205 e) 0.178

(4) 7. A solution has an osmotic pressure of 323.14 torr at 25°C. What is the **molarity** of the solution?

a) 0.0904M b) 0.0759M c) 0.0339M d) 0.0174M e) 0.0151M

(4) 8. To what final volume would 450 ml of an aqueous 0.30M KOH solution need to be diluted to obtain a 0.075M KOH solution?

a) 800 ml b) 1000 ml c) 1200 ml d) 1500 ml e) 1800 ml

(4) 9. Predict the freezing point of a solution that is prepared by dissolving 6.0 g $MgCl_2$ (Molar mass = 95.211 g/mol) in 100.0 g H_2O. Assume 100% dissociation. K_f for H_2O is 1.86°C/m.

a) 5.3°C b) 3.5°C c) -0.51°C d) -3.5°C e) -5.3°C

(4) 10. When 3.2 grams of a compound (Molar mass = 96.0 g/mol) was dissolved in 50.0 g of H_2O, the resulting solution froze at -1.50°C. K_f for H_2O is 1.86°C/m. What is the **van't Hoff factor** for the solution?

a) 1.21 b) 1.35 c) 1.50 d) 1.83 e) 2.00

(4) 11. When solute-solvent attractive forces are comparable to solute-solute and solvent-solvent attractive forces, one is likely to experience (negative, positive, no) deviation from Raoult's law.

(4) 12. If, at a fixed temperature, 750.0 ml of solvent can dissolve a maximum of 65.0 g of solute, then mixing 42.0 g of solute in 500.0 ml of solvent will result in a(n) _____ solution.

a) supersaturated b) saturated c) unsaturated

d) the molar mass of the solute is needed to answer the question

(4) 13. 45.80 g of Na_2SO_4 (Molar mass = 142.066 g/mol) are used to prepare a 0.452M Na_2SO_4 aqueous solution. The total volume of the aqueous solution will be:

a) 798 ml b) 713 ml c) 684 ml d) 657 ml e) 639 ml

(4) 14. An aqueous sucrose, $C_{12}H_{22}O_{11}$ (Molar mass = 342 g/mol), solution boils at 100.72°C. K_b = 0.51 kg°C/mol for water. What is the % mass-mass of sucrose in the solution?

a) 48.2% b) 43.4% c) 39.8% d) 35.3% e) 32.6%

(4) 15. If a 4.004 g sample of biopolymer dissolved in 1.0 liter of water at 27°C produces an osmotic pressure of 15.0 torr, the molar mass of the polymer is approximately:

a) 1,250 g/mol b) 2,500 g/mol c) 5,000 g/mol

d) 12,500 g/mol e) 25,000 g/mol

(4) 16. If a **nondissociating, non-ionizing, and nonvolatile solute** is dissolved in a solvent at a fixed temperature:

a) the solvent molecules will experience an increase in kinetic energy.
b) the solvent molecules will experience an decrease in kinetic energy.
c) the solution will have a boiling point lower than that of the pure solvent.
d) the solution will have a melting point lower than that of the pure solvent.
e) the vapor pressure above the solution will increase relative to that of the pure solvent (at the same temperature).

(4) 17. Which one of the following concentration units is temperature dependent?

a) molality b) mass-volume % c) mole% d) mass-mass %

e) None of the above concentration units is temperature dependent

(4) 18. What will be the **final concentration of NO_3^{-1}** when 50.0 ml of 0.241M KNO_3 is mixed with 100.0 ml of 0.618M $Al(NO_3)_3$? Assume volumes are additive.

a) 1.31M b) 1.01M c) 0.943M d) 0.756M e) 0.508M

(4) 19. A solution contains 38.8 g of $C_{15}H_{30}$, a nonvolatile solute, in 400.0 g of benzene, C_6H_6. The vapor pressure of pure benzene at 25°C is 95.03 torr. What is the vapor pressure of the $C_{15}H_{30}$ / benzene solution at 25°C?

a) 93.0 torr b) 92.9 torr c) 92.2 torr d) 91.7 torr e) 90.1 torr

(12) 20. Compare Solution A, a 0.30m aqueous KCl solution, to Solution B, a 0.40m aqueous KCl solution with respect to the following:

i. The solution with the higher melting point is _____.

ii. The solution with the higher boiling point is _____.

iii. The solution with the higher vapor pressure at a given temperature is _____.

(6) 21. At 25°C, the vapor pressure of a benzene/toluene solution is 45.06 torr. At 25°C, the vapor pressure of pure benzene is 95.03 torr and that of toluene is 28.40 torr. What is the partial pressure of **toluene** in the vapor above the solution? Show all work in the space provided below.

22. A solution was prepared by dissolving 0.1200 g of an unknown nonelectrolyte in 10.00 g of benzene. The resulting solution freezes at 4.99°C. The freezing point for benzene is 5.48°C, and its K_f is 4.90°C/m.

(4) a) Determine the molar mass of the unknown compound. Show all work in the space provided below.

(2) b) If the empirical formula of the unknown compound is C_2H_2N, what is its **molecular** formula?