Chemistry, 3e

Name _____ Date _____ Section _____

1. When 20.0 grams of an unknown compound is dissolved in 500. grams of benzene, the freezing point of the resulting solution is 3.77°C. The freezing point of pure benzene is 5.48°C and K_f for benzene is 5.12° C/m. What is the molecular weight of the unknown compound?

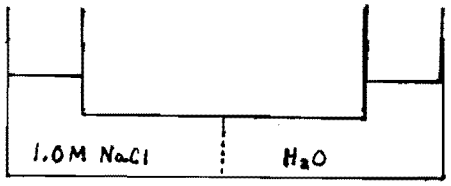
2. 8.00 g of a high molecular weight biological compound is dissolved in water to make 500. mL of solution. The resulting solution developed an osmotic pressure of 22.9 torr at 25°C. What is the molecular weight of the compound?

3. It is found that 3.90 g of benzene, C_6H_6, dissolved in 100.0 g of a solvent lowers the freezing point to 10.0°C. The pure solvent freezes at 25.0°C. The molal freezing point depression constant of the solvent is

4. The freezing point of a 1.00 m solution of NaCl in water is expected to be different then -3.72°C. Explain this rational. (K_f of H_2O = 1.86 C°/m)

5. What mass of urea $(NH_2)_2CO$, must be dissolved in 150.0 grams of water to give a solution with a freezing point of -3.00°C. (K_f of water is 1.86C kg/mol) note: Urea is a nonelectrolyte and will not dissociate.

6. Consider the following:



What would happen to the level of liquid in the two arms if the semipermeable membrane was permeable to:

a. water only
b. water, Na^+, and Cl^-

7. A 0.279m solution of $CaCl_2$ causes a freezing point depression of 1.330 C° in water. Calculate the apparent value of the van't Hoff factor. (K_f of water is 1.86 C° kg/mol.)

8. Calculate the osmotic pressure at 25°C of an aqueous solution of 1.00g/L of protein (MW=9.00 x 10^4).

9. The balanced equation for the reaction of bromate ion with bromide in acidic solution is given by:

$$BrO_3^- + 5Br^- + 6H^+ \rightarrow 3Br_2 + 3H_2O$$

At a particular instant in time, the value of $-\Delta [Br^-]/\Delta t$ is 2.0×10^{-3} mol/L s. What is the value of $\Delta [Br_2]/\Delta t$ in the same units?

10. The reaction

$$H_2SeO_3(aq) + 6I^-(aq) + 4H^+(aq) \rightarrow 2I_3^-(aq) + 3H_2O(l) + Se(s)$$

was studied at 0°C by the method of initial rates:

$[H_2SeO_3]_o$	$[H^+]_o$	$[I^-]_o$	Rate (mol/L s)
1.0×10^{-4}	2.0×10^{-2}	2.0×10^{-2}	1.66×10^{-7}
2.0×10^{-4}	2.0×10^{-2}	2.0×10^{-2}	3.33×10^{-7}
3.0×10^{-4}	2.0×10^{-2}	2.0×10^{-2}	4.99×10^{-7}
1.0×10^{-4}	4.0×10^{-2}	2.0×10^{-2}	6.66×10^{-7}
1.0×10^{-4}	1.0×10^{-2}	2.0×10^{-2}	0.42×10^{-7}
1.0×10^{-4}	2.0×10^{-2}	4.0×10^{-2}	13.4×10^{-7}
1.0×10^{-4}	1.0×10^{-2}	4.0×10^{-2}	3.36×10^{-7}

What is the rate law for this reaction?

11. A general reaction written as 2A + 2B ---> C + 2D is studied and yields the following rate law.

$$\text{Rate} = k [A]^2 [B]$$

What is the order of this reaction with respect to:
1. [A] 2. [B] 3. overall

12. The rate expression for a particular reaction is rate = $k [A][B]^2$. If the initial concentration of B is increased from 0.1 M to 0.3 M, by how much will the initial rate be increased?

13. The decomposition of $HI_{(g)}$ by the catalyst gold at 150 C is zero order with respect to HI. The rate defined below is constant at 1.20×10^{-4} mol/L s.

$$2HI_{(g)} \longrightarrow H_{2(g)} + I_{2(g)}$$

$$\text{Rate} = -\frac{\Delta[HI]}{\Delta t} = k = 1.20 \times 10^{-4} \text{ mol/L s}$$

a. If an experiment has an initial HI concentration of 0.250 mol/L, what is the concentration of HI after 25 minutes?
b. How long will it take for all of the HI to decompose?

14. The rate law and rate constant for the hypothetical reaction A + B --> C are given bellow.

$$\text{rate} = k [A]^2 [B]$$

$k = 1.8 \times 10^2 \quad L^2/mol^2 s$

If a rate of 2.88 mol/L s is needed and the concentration of B is 1.5 M. Determine the concentration of A needed?

15. The average rate of disappearance of ozone in the reaction $2O_3(g) \longrightarrow 3O_2(g)$ is found to be 9.0×10^{-3} atm/sec over a certain interval of time. What is the rate of appearance of O_2 during this interval?

16. Use the the following graphical data related to the following reaction to answer the questions below.

$$2N_2O_{5(aq)} \longrightarrow 4NO_{2(aq)} + O_{2(g)}$$

a. determine the average rate of N_2O_5 being consumed in this reaction between 400. and 1600. seconds.
b. What is the instaneous rate of consumption of N_2O_5 at 1300. seconds?