Chapter 13 problem review

Problem

1. A solution contains 85.0 g of $NaNO_3$, and has a volume of 750. mL. Find the molarity of the solution.
2. What is the molarity of a solution of sucrose, $C_{12}H_{22}O_{11}$, that contains 125 g of sucrose in 3.50 L of solution?
3. How many grams of NaOH are required to prepare 200. mL of a 0.450 M solution?
4. How many grams of $NaC_2H_3O_2$ are needed to prepare 350. mL of a 2.75 M solution?
5. How many ml of 0.500M Na_2SO_4 solution are needed to prepare 750. mL of a 0.375 M solution?
6. Iron(III) chloride can be produced by reacting Fe_2O_3 with a hydrochloric acid solution. How many milliliters of a 6.00 M HCl solution are needed to react with excess Fe_2O_3 to produce 16.5 g of $FeCl_3$?
7. How would you prepare 300 grams of a 20.0% by mass NaOH solution. How much NaOH and how much water would be needed?
8. How much water must be added to 42.0g of hydrochloric acid to make a .30 M solution? (The density of hydrochloric acid is 1.18 g/ml)
9. The freezing point for water is lowered to –0.620°C when 7.90 g of a nonvolatile molecular solute is dissolved in 575 g of water. Calculate the molar mass of the solute
10. How many milliliters of 3.0 M HF are needed to prepare 250 ml of 0.95 M solution?

Chpt 13 Problems Review

1. $M = \frac{\text{mol solute}}{\text{L soln}} = \frac{1.00 \text{ mol } NaNO_3}{0.750 \text{ L soln}} = 1.33 \text{ M } NaNO_3$

$85.0 \text{ g } NaNO_3 \left(\frac{1 \text{ mol } NaNO_3}{85.00 \text{ g}}\right) = 1.00 \text{ mol } NaNO_3$

2. $M = \frac{\text{mol solute}}{\text{L soln}} = \frac{0.365 \text{ mol}}{3.50 \text{ L soln.}} = 0.104 \text{ M } C_{12}H_{22}O_{11}$

$125 \text{ g } C_{12}H_{22}O_{11} \left(\frac{1 \text{ mol } C_{12}H_{22}O_{11}}{342.30 \text{ g}}\right) = 0.365 \text{ mol } C_{12}H_{22}O_{11}$

3. $200. \text{ ml soln.} \left(\frac{1.00 \text{ L soln.}}{1000 \text{ ml}}\right)\left(\frac{0.450 \text{ mol NaOH}}{1.00 \text{ L soln.}}\right)\left(\frac{40.00 \text{ g NaOH}}{1 \text{ mol NaOH}}\right) = 3.60 \text{ g NaOH}$

4. $350. \text{ ml soln.} \left(\frac{1.00 \text{ L soln.}}{1000 \text{ ml}}\right)\left(\frac{2.75 \text{ mol } NaC_2H_3O_2}{1.00 \text{ L soln.}}\right)\left(\frac{82.03 \text{ g}}{1 \text{ mol } NaC_2H_3O_2}\right) = 79.0 \text{ g } NaC_2H_3O_2$

5. $M_1V_1 = M_2V_2$

$V_1 = \frac{M_2V_2}{M_1} = \frac{(0.375 \text{ M } Na_2SO_4)(750. \text{ ml})}{(0.500 \text{ M } Na_2SO_4)} = 562 \text{ ml } 0.500 \text{ M } Na_2SO_4 + 188 \text{ ml } H_2O$

6. $Fe_2O_3 + 6HCl \rightarrow 2FeCl_3 + 3H_2O$

ml, 6.00 M; 16.5 g

$16.5 \text{ g } FeCl_3 \left(\frac{1 \text{ mol } FeCl_3}{162.2 \text{ g } FeCl_3}\right)\left(\frac{6 \text{ mol HCl}}{2 \text{ mol } FeCl_3}\right)\left(\frac{1.00 \text{ L soln.}}{6.00 \text{ mol HCl}}\right)\left(\frac{1000 \text{ ml soln}}{1.00 \text{ L soln}}\right) = 50.9 \text{ ml soln.}$

7. $\% = \frac{\text{g solute}}{\text{g soln}} \times 100$ $\quad 20.0\% \text{ NaOH} = \frac{\text{g NaOH}}{300 \text{ g soln.}} \times 100$

Yucky SF!

$60 \text{ g NaOH} + 240 \text{ g } H_2O$

$(60 \text{ g NaOH} + 800 \text{ g } H_2O)$

8. $42.0\text{g HCl}\left(\frac{1\text{mol HCl}}{36.46\text{g HCl}}\right)\left(\frac{1.0\text{L Soln.}}{0.30\text{mol HCl}}\right)\left(\frac{1000\text{ml Soln}}{1.0\text{L Soln}}\right)\left(\frac{1.18\text{g Soln}}{1.08\text{ml Soln}}\right) = 4530\text{g Soln}$

$4530\text{g Soln} - 42.0\text{g HCl} = 4490\text{g } H_2O$
$(+ 42.0\text{g HCl})$

9. $\Delta t_f = K_f m$

$\frac{-0.620^\circ C}{-1.86\frac{^\circ C}{m}} = m = 0.333\frac{\text{mol}}{\text{kg solvent}}$ $\quad MM = \frac{g}{mol} = \frac{7.90\text{g solute}}{0.191\text{mol}} = 41.4\frac{g}{mol}$

$\frac{0.333\text{ mol}}{\text{kg solvent}}(0.575\text{kg } H_2O) = 0.191\text{ mol solute}$

10. $M_1V_1 = M_2V_2$

$V_1 = \frac{M_2V_2}{M_1} = \frac{(0.95M\,HF)(250ml)}{(3.0M\,HF)} = 79\text{ml } 3.0M\,HF$
$(+ 171\text{ml } H_2O)$
$(170SF$