Practice Exam 2

1. ***Balance*** the following chemical equations:

   a. 2 Na_2O_2 + 2 H_2O Ž 4 NaOH + 2 O_2

   b. 2 NaOH + Cl_2 Ž NaCl + NaClO + H_2O

2. 133.22 g of iron(III) acetate reacts with potassium sulfide to produce iron(III) sulfide and potassium acetate. Calculate the ***number of grams of iron(III) sulfide*** produced if there is a 96.10 % yield.

2 $Fe(C_2H_3O_2)_3$ + 3 K_2S Ž Fe_2S_3 + 6 $KC_2H_3O_2$

$$? \text{ g Fe}_2\text{S}_3 = 133.22 \text{ g Fe}\left(\text{C}_2\text{H}_3\text{O}_2\right)_3 \times \frac{1 \text{ mol Fe}\left(\text{C}_2\text{H}_3\text{O}_2\right)_3}{232.977 \text{ g Fe}\left(\text{C}_2\text{H}_3\text{O}_2\right)_3} \times \frac{1 \text{ mol Fe}_2\text{S}_3}{2 \text{ mol Fe}\left(\text{C}_2\text{H}_3\text{O}_2\right)_3} \times \frac{201.87 \text{ g Fe}_2\text{S}_3\text{, theor.}}{1 \text{ mol Fe}_2\text{S}_3}$$

$$\times \frac{96.10 \text{ g Fe}_2\text{S}_3\text{, act.}}{100.00 \text{ g Fe}_2\text{S}_3\text{, theor.}} = 57.11 \text{ g Fe}_2\text{S}_3\text{, act.}$$

3. Calculate the ***mass of carbon dioxide produced*** when 40.00 g of butanoic acid (C_2H_5COOH) reacts with 30.00 g of oxygen gas. The products are carbon dioxide and water.

2 C_2H_5COOH + 7 O_2 Ž 6 CO_2 + 6 H_2O

$$? \text{ g CO}_2 = 40.00 \text{ g C}_2\text{H}_5\text{COOH} \times \frac{1 \text{ mol C}_2\text{H}_5\text{COOH}}{74.079 \text{ g C}_2\text{H}_5\text{COOH}} \times \frac{6 \text{ mol CO}_2}{2 \text{ mol C}_2\text{H}_5\text{COOH}} \times \frac{44.010 \text{ g CO}_2}{1 \text{ mol CO}_2} = 71.29 \text{ g CO}_2$$

$$? \text{ g CO}_2 = 30.00 \text{ g O}_2 \times \frac{1 \text{ mol O}_2}{31.998 \text{ g O}_2} \times \frac{6 \text{ mol CO}_2}{7 \text{ mol O}_2} \times \frac{44.010 \text{ g CO}_2}{1 \text{ mol CO}_2} = 35.36 \text{ g CO}_2$$

35.36 g of carbon dioxide can be produced.

4. Calculate the ***%(m/m)of a sodium carbonate solution*** that is 1.26 M and has a density of 1.457 g/mL.

$$? \frac{\text{g Na}_2\text{CO}_3}{\text{100 g sol'n}} = \frac{\text{1.26 mol Na}_2\text{CO}_3}{\text{1 L sol'n}} \times \frac{10^{-3}\text{ L sol'n}}{\text{1 mL sol'n}} \times \frac{\text{1 mL sol'n}}{\text{1.457 g sol'n}} \times \frac{\text{105.988 g Na}_2\text{CO}_3}{\text{1 mol Na}_2\text{CO}_3} \times 100 = 9.17\ \%\left({}^{m}\!/_{m}\right)$$

5. 135.2 mL of a 0.436 M solution of gold(I) chloride reacts with an excess of an potassium permanganate solution. The balanced chemical equation is:

$8\ HNO_3 + 2\ KMnO_4 + 5\ AuCl$ Ž $2\ MnCl_2 + KNO_3 + 5\ Au(NO_3)_3 + 8\ H_2O + KCl$

Calculate the ***number of grams of the manganese(II) chloride*** produced.

$$?\ \text{g MnCl}_2 = \text{135.2 mL AuCl} \times \frac{\text{0.436 mol AuCl}}{\text{1000 mL AuCl sol'n}} \times \frac{\text{2 mol MnCl}_2}{\text{5 mol AuCl}} \times \frac{\text{125.84 g MnCl}_2}{\text{1 mol MnCl}_2} = \text{2.97 g MnCl}_2$$

6. What ***volume, in mL***, of a 12.45 M solution of hydrochloric acid is needed to make 500.0 mL of a 0.1032 M solution of hydrochloric acid?

$$M_1V_1 = M_2V_2$$

$$V_1 = \frac{M_1V_1}{M_2} = \frac{(0.1032\text{ M})(500.0\text{ mL})}{12.45\text{ M}} = 4.145\text{ mL}$$

7. What ***mass, in g***, of aluminum sulfate is needed to make 150.0 mL of a 3.42 M solution of aluminum sulfate?

$$?\ \text{g Al}_2(\text{SO}_4)_3 = \text{150.0 mL sol'n} \times \frac{\text{3.42 mol Al}_2(\text{SO}_4)_3}{\text{1000 mL sol'n}} \times \frac{\text{342.13 g Al}_2(\text{SO}_4)_3}{\text{1 mol Al}_2(\text{SO}_4)_3} = \text{176 g Al}_2(\text{SO}_4)_3$$