Stoichiometry Test Review

$2\ KClO_3 \rightarrow 2\ KCl + 3\ O_2$

1. How many moles of oxygen are made if 12.0 moles of potassium chlorate react?

$\frac{2\ mol\ KClO_3}{12\ mol} = \frac{3\ mol\ O_2}{x}$ $\boxed{18\ mol\ O_2}$

2. Copper(II) chloride reacts with sodium nitrate to produce copper(II) nitrate and sodium chloride. a) Write the balanced equation for the reaction.

$CuCl_2 + 2NaNO_3 \longrightarrow Cu(NO_3)_2 + 2NaCl$

b) If 20.0 g of copper(II) chloride react with 20.0 g of sodium nitrate, what mass of sodium chloride is formed? 134.45g 170.02g 116.9g

$CuCl_2$: $\frac{134.45}{20} = \frac{116.9}{x}$ $NaNO_3$: $\frac{170.02}{20} = \frac{116.9}{x}$ $\boxed{13.8g\ NaCl}$

17.4g NaCl

c) What is the limiting reactant? d) How many moles of copper(II) nitrate are formed?

$\boxed{LR = NaNO_3}$ $\frac{13.8g}{116.9g} = 0.12\ mol\ NaCl$ $\boxed{0.06\ mol\ Cu(NO_3)_2}$

$\frac{2\ mol\ NaCl}{0.12\ mol} = \frac{1\ mol\ Cu(NO_3)_2}{x}$

$2\ K + Cl_2 \rightarrow 2\ KCl$

3. How many grams of potassium chloride are produced from 2.50 g of potassium and excess chlorine? 149.1g 78.2g

$\frac{78.2g}{2.50g} = \frac{149.1g}{x}$ $\boxed{4.77g\ KCl}$

$2\ FePO_4 + 3\ Na_2SO_4 \rightarrow Fe_2(SO_4)_3 + 2\ Na_3PO_4$

4. a) If 25.0 g of iron(III) phosphate react with excess sodium sulfate, how many grams of iron(III) sulfate can be made? 301.8g

400.07g

$\frac{301.8g}{25.0g} = \frac{400.07g}{x}$ $\boxed{33.1g\ Fe_2(SO_4)_3}$

b) If 18.5 grams of iron(III) sulfate are actually produced in Q4A, what is the percent yield?

% Yield = $\left(\frac{experimental}{theoretical}\right) \times 100$

$\left(\frac{18.5g}{33.1g}\right) \times 100 = \boxed{55.9\%}$

426.21g

c) Now, a different trial of the reaction is done, starting with 15.0 grams of sodium sulfate and excess iron(III) phosphate. If that trial achieves a 65.0% yield, how many grams of sodium phosphate were made?

281.94g

0.65(9.92g) = 6.45g

$\frac{426.21}{15} = \frac{281.94}{x}$ 9.92g Na_2PO_4

$2\ NaClO_3 \rightarrow 2\ NaCl + 3\ O_2$

5. a) What volume of oxygen (L) is produced from 19.4 moles of sodium chlorate?

$\frac{2\ mol\ NaClO_3}{19.4\ mol} = \frac{3\ mol\ O_2}{x}$ 29.1 mol O_2

1 mol = 22.4 L so $\frac{29.1\ mol}{1\ mol} \frac{22.4\ L}{}$

651.84 L

b) How many molecules of oxygen are produced when 80.0 grams of sodium chloride are produced?

1 mol NaCl = 58.45g

$\frac{80.0g}{58.45g} \frac{1\ mol}{} = 1.37\ mol\ NaCl$

$\frac{2\ mol\ NaCl}{1.37\ mol\ NaCl} = \frac{3\ mol\ O_2}{x}$

2.05 mol O_2

$2.05(6.02 \times 10^{23}) = 1.23 \times 10^{24}$ molecules

$Cu + 2\ AgNO_3 \rightarrow Cu(NO_3)_2 + 2\ Ag$

6. a) How many moles of copper react with 3.50 moles of silver nitrate?

$\frac{2\ mol\ AgNO_3}{3.5\ mol} = \frac{1\ mol\ Cu}{x}$

1.75 mol Cu

b) If 89.5 grams of silver were produced, how many grams of copper reacted?

1 mol Ag = 107.87g

$\frac{89.5g}{107.87g} \frac{1\ mol}{} = 0.83\ mol\ Ag$

$\frac{2\ mol\ Ag}{0.83\ mol} = \frac{1\ mol\ Cu}{x}$ 0.41 mol Cu

0.41 mol (63.55g) = 26.1

7. If 284.7g of $Al(NO_3)_3$ react with 162.8g of CaO in a double replacement reaction, how much of the excess reactant remains?

$2\ Al(NO_3)_3 + 3CaO \rightarrow Al_2O_3 + 3Ca(NO_3)_2$

426.02g 168.24g 101.96g

$\frac{426.02}{284.7} = \frac{101.96}{x}$ 68.14g Al_2O_3 LR

$\frac{168.24}{162.8} = \frac{101.96}{x}$ ER = CaO 98.66g Al_2O_3

$\frac{101.96}{68.14} = \frac{168.24}{x}$ 112.44g

162.8 − 112.44 = 50.36g of CaO left

8. Assuming we start with 100 grams of calcium chlorate and 45 grams of iron (III) sulfate, how many grams of the excess are left over?

$3Ca(ClO_3)_2 + Fe_2(SO_4)_3 \rightarrow 3CaSO_4 + 2Fe(ClO_3)_3$

620.94 g 400.07 g 408.45 g

$\frac{620.94}{100} = \frac{408.45}{x}$ $Ca(ClO_3)_2$ ER

65.8 g $CaSO_4$

$\frac{400.07}{45} = \frac{408.45}{x}$ Fe_2SO_4 LR

45.9 g $CaSO_4$

$\frac{408.45}{45.9} = \frac{620.94}{x}$

69.8 g $Ca(ClO_3)_2$

100 − 69.8 = 30.2 g $Ca(ClO_3)_2$ left

9. The combustion of methane produces carbon dioxide and water. Assume that 2.0 mol of CH_4 burned in the presence of excess air. What is the percentage yield if the reaction produces 87.0 g of CO_2?

experimental

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

$\frac{1 \text{ mol } CH_4}{2 \text{ mol}} = \frac{1 \text{ mol } CO_2}{x}$

2 mol CO_2

1 mol CO_2 = 44.01 g

theoretical

$\frac{2 \text{ mol}}{1 \text{ mol}} \left| \frac{44.01 \text{ g}}{} \right. = 88.02 \text{ g } CO_2$ produced

$\left(\frac{87}{88.02}\right) \times 100 = 98.8\%$