Solution Stoichiometry

Name_____
last first

CHEMISTRY 110

1] How many grams of calcium phosphate can be produced from the reaction of 2.50 L of 0.250 M Calcium chloride with and excess of phosphoric acid?

Calcium chloride + phosphoric acid --> calcium phosphate + hydrochloric acid

$$\mathbf{3CaCl_2 + 2H_3PO_4 \rightarrow Ca_3(PO_4)_2 + 6HCl}$$

$$\mathbf{2.50L\ CaCl_2\ X.\ \frac{0.250L\ CaCl_2}{1mol}\ X.\ \frac{1mol\ Ca_3(PO_4)_2}{3mol\ CaCl_2}\ X.\ \frac{310.0g\ Ca_3(PO_4)_2}{1mol} =}$$

Answer _____ **64.6g $Ca_3(PO_4)_2$**

2] How many milliliters of 1.50 M Nitric acid is required to react with 100.0 g of cuprous oxide

$$14\ HNO_3 + 3Cu_2O \rightarrow 6\ Cu(NO_3)_2 + 2\ NO + 7H_2O$$

$$\mathbf{\textit{100.0g\ Cu_2O\ X\ \frac{1mol\ Cu_2O}{143.1g}\ X\ \frac{14mol\ HNO_3}{3mol\ Cu_2O}\ X\ \frac{1000ml\ HNO_3}{1.50mol\ HNO_3} = 2.18 \times 10^3 ml\ HNO_3}}$$

Answer _____

3] 60.5 mL of HNO_3 are required to react with 25.0 mL of a 1.00 M Barium hydroxide solution:

$$\mathbf{2}\ HNO_3(aq) + Ba(OH)_2(aq) \rightarrow \mathbf{2}\ H_2O(s) + Ba(NO_3)_2(aq)$$ **(BALANCED)**

Find the **Molarity** of the nitric acid solution

$$\mathbf{25.0ml\ Ba(OH)_2\ X\ \frac{1L}{10^3 ml}\ X.\ \frac{1.00mol\ Ba(OH)_2}{1L}\ X\ \frac{2mol\ HNO_3}{1mol\ Ba(OH)_2} = 0.0500mol\ HNO_3}$$

$$\mathbf{M_{HNO_3} = \frac{0.0500\ mol\ HNO_3}{0.0605\ L\ soln} = 0.826\ M}$$

Answer _____

4] For the following equation determine which reactant is the limiting reactant and which reactant is in excess. The amounts of reagent used are shown. Show calculations to support your choices

$$3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$$

40.0 g 16.0g

$$\mathbf{40.0g\ Fe\ X\ \frac{1molFe}{55.8g}\ X\ \frac{1mol\ Fe_3O_4}{3molFe} = 0.239\ mol\ Fe_3O_4}$$

$$\mathbf{16.0g\ H_2O\ X\ \frac{1molH_2O}{18.0g}\ X\ \frac{1mol\ Fe_3O_4}{4mol\ H_2O} = 0.222\ mol\ Fe_3O_4}$$ <==== amount made

The limiting reactant is ____**H_2O**_____ The excess reactant is _____**Fe**_____

5] 35.5 g of silver nitrite is reacted with 35.5 grams of sodium sulfide which produces silver sulfide and sodium nitrite.

a. Write and balance the equation **$2AgNO_2 + Na_2S \rightarrow Ag_2S + 2NaNO_2$**

b.. Calculate the number of grams of silver sulfide produced.

$$\mathbf{35.5g\ AgNO_2\ X\ \frac{1mol\ AgNO_2}{153.9g}\ X\ \frac{1mol\ Ag_2S}{2mol\ AgNO_2} = 0.115\ mol\ Ag_2S}$$ <==== amount made

$$\mathbf{35.5g\ Na_2S\ X.\ \frac{1mol\ Na_2S}{78.0g}\ X\ \frac{1mol\ Ag_2S}{1mol\ Na_2S} = 0.455\ mol\ Ag_2S}$$

$$\mathbf{0.115\ mol\ mol\ Ag_2S\ X\ \frac{247.8g\ Ag_2S}{1mol} = 28.5g\ Ag_2S}$$

Answer _____

c. How many grams of silver nitrite will remain at the end of the reaction?

Answer _____**0 g**_____ **The $AgNO_2$ is the limiting reactant**

d. How many grams of sodium sulfide will remain at the end of the reaction?

$$\textbf{0.115 mol } Ag_2S \times \frac{\textbf{1mol } Na_2S}{\textbf{1 mol } Ag_2S} \times \frac{\textbf{78.0 g } Na_2S}{\textbf{1mol}} = \textbf{8.97g } Na_2S \textbf{ used}$$

Excess Na_2S = 35.5g - 8.97g = 26.5g Na_2S

Answer _____

6] Calculate the grams of silver chloride produced from 10.00 ml of 10.0M magnesium chloride with 100.0 ml of 2.20 M silver nitrate

$$2AgNO_3 + MgCl_2 \rightarrow Mg(NO_3)_2(s) + 2AgCl(aq)$$

$$\textbf{0.01000 L } MgCl_2 \times \frac{\textbf{10.0mol } MgCl_2}{\textbf{1 L}} \times \frac{\textbf{2mol AgCl}}{\textbf{1mol } MgCl_2} = \textbf{0.200 mol AgCl} \Leftarrow \text{==== amount made}$$

$$\textbf{0.1000 L } AgNO_3 \times \frac{\textbf{2.20mol } AgNO_3}{\textbf{1L}} \times \frac{\textbf{2mol AgCl}}{\textbf{2mol } AgNO_3} = \textbf{0.220 mol AgCl}$$

$$\textbf{0.200 mol AgCl} \times \frac{\textbf{143.3g AgCl}}{\textbf{1mol}} = \textbf{28.7g AgCl}$$

Answer _____

7] Aluminum reacts with oxygen to form aluminum oxide: **4**Al + **3**O_2 ---> **2**Al_2O_3 **(balanced)**

If 75.0g of Al and 200.0 g of oxygen are reacted, and 75.0 g of aluminum oxide is produced, what is the percent yield for the reaction?

$$\textbf{75.0g Al} \times \frac{\textbf{1mol Al}}{\textbf{27.0g}} \times \frac{\textbf{2mol } Al_2O_3}{\textbf{4mol Al}} = \textbf{1.39 mol } Al_2O_3 \Leftarrow \text{==== amount made}$$

$$\textbf{200.0 g } O_2 \times \frac{\textbf{1mol } O_2}{\textbf{32.0g}} \times \frac{\textbf{2mol } Al_2O_3}{\textbf{3mol } O_2} = \textbf{4.17 mol } Al_2O_3$$

$$\textbf{1.39 mol } Al_2O_3 \times \frac{\textbf{102.0g } Al_2O_3}{\textbf{1mol}} = \textbf{141.8 g } Al_2O_3$$

$$\textbf{\% Yield} = \frac{\textbf{75.0g}}{\textbf{141.8g}}\textbf{(100)} = \textbf{52.9\%}$$

Answer _____

8] . According to the following reaction:..... 2 Cu(s) + O_2(g) ----> + 2 CuO(s)

a. If the percentage yield is 96.7% how many grams of CuO will be produced from 13.4 g of Cu?

$$\textbf{13.4 g Cu} \times \frac{\textbf{1mol Cu}}{\textbf{63.5g}} \times \frac{\textbf{2mol CuO}}{\textbf{2mol Cu}} \times \frac{\textbf{79.5gCuO}}{\textbf{1mol}} \times \frac{\textbf{96.7g Actual}}{\textbf{100g Theo.}} = \textbf{16.2 g CuO}$$

Answer _____

b..How many grams of Cu must you use to produce 5.00 x 10^{13}mg CuO?

$$\textbf{5.00 x } 10^{13}\textbf{mg CuO} \times \frac{\textbf{10}^{-3}}{\textbf{1mg}} \times \frac{\textbf{1mol CuO}}{\textbf{79.5g}} \times \frac{\textbf{2mol Cu}}{\textbf{2mol CuO}} \times \frac{\textbf{63.5g Cu}}{\textbf{1mol}} \times \frac{\textbf{100g}}{\textbf{96.7g}} = \textbf{4.13 x } 10^{\textbf{10}}\textbf{g}$$

Answer _____