

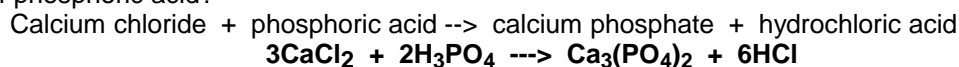
Solution Stoichiometry

CHEMISTRY 110

Name _____

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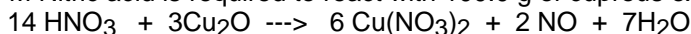
1] How many grams of calcium phosphate can be produced from the reaction of 2.50 L of 0.250 M Calcium chloride with an excess of phosphoric acid?



$$2.50\text{L CaCl}_2 \times \frac{0.250\text{L CaCl}_2}{1\text{mol}} \times \frac{1\text{mol Ca}_3(\text{PO}_4)_2}{3\text{mol CaCl}_2} \times \frac{310.0\text{g Ca}_3(\text{PO}_4)_2}{1\text{mol}} =$$

Answer _____ **64.6g Ca₃(PO₄)₂**

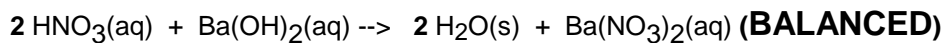
2] How many milliliters of 1.50 M Nitric acid is required to react with 100.0 g of cuprous oxide



$$100.0\text{g Cu}_2\text{O} \times \frac{1\text{mol Cu}_2\text{O}}{143.1\text{g}} \times \frac{14\text{mol HNO}_3}{3\text{mol Cu}_2\text{O}} \times \frac{1000\text{ml HNO}_3}{1.50\text{mol HNO}_3} = 2.18 \times 10^3\text{ml HNO}_3$$

Answer _____

3] 60.5 mL of HNO₃ are required to react with 25.0 mL of a 1.00 M Barium hydroxide solution:



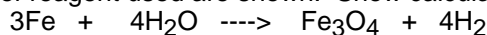
Find the **Molarity** of the nitric acid solution

$$25.0\text{ml Ba}(\text{OH})_2 \times \frac{1\text{L}}{10^3\text{ml}} \times \frac{1.00\text{mol Ba}(\text{OH})_2}{1\text{L}} \times \frac{2\text{mol HNO}_3}{1\text{mol Ba}(\text{OH})_2} = 0.0500\text{mol HNO}_3$$

$$M_{\text{HNO}_3} = \frac{0.0500\text{ mol HNO}_3}{0.0605\text{ L soln}} = 0.826\text{ M}$$

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



40.0 g 16.0g

$$40.0\text{g Fe} \times \frac{1\text{mol Fe}}{55.8\text{g}} \times \frac{1\text{mol Fe}_3\text{O}_4}{3\text{mol Fe}} = 0.239\text{ mol Fe}_3\text{O}_4$$

$$16.0\text{g H}_2\text{O} \times \frac{1\text{mol H}_2\text{O}}{18.0\text{g}} \times \frac{1\text{mol Fe}_3\text{O}_4}{4\text{mol H}_2\text{O}} = 0.222\text{ mol Fe}_3\text{O}_4 \text{ <==== amount made}$$

The limiting reactant is H₂O 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.



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

$$35.5\text{g AgNO}_2 \times \frac{1\text{mol AgNO}_2}{153.9\text{g}} \times \frac{1\text{mol Ag}_2\text{S}}{2\text{mol AgNO}_2} = 0.115\text{ mol Ag}_2\text{S} \text{ <==== amount made}$$

$$35.5\text{g Na}_2\text{S} \times \frac{1\text{mol Na}_2\text{S}}{78.0\text{g}} \times \frac{1\text{mol Ag}_2\text{S}}{1\text{mol Na}_2\text{S}} = 0.455\text{ mol Ag}_2\text{S}$$

$$0.115\text{ mol Ag}_2\text{S} \times \frac{247.8\text{g Ag}_2\text{S}}{1\text{mol}} = 28.5\text{g Ag}_2\text{S}$$

Answer _____

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

Answer 0 g **The AgNO₂ is the limiting reactant**

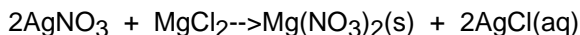
d. How many grams of sodium sulfide will remain at the end of the reaction?

$$0.115 \text{ mol Ag}_2\text{S} \times \frac{1 \text{ mol Na}_2\text{S}}{1 \text{ mol Ag}_2\text{S}} \times \frac{78.0 \text{ g Na}_2\text{S}}{1 \text{ mol}} = 8.97 \text{ g Na}_2\text{S used}$$

$$\text{Excess Na}_2\text{S} = 35.5 \text{ g} - 8.97 \text{ g} = 26.5 \text{ g Na}_2\text{S}$$

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



$$0.01000 \text{ L MgCl}_2 \times \frac{10.0 \text{ mol MgCl}_2}{1 \text{ L}} \times \frac{2 \text{ mol AgCl}}{1 \text{ mol MgCl}_2} = 0.200 \text{ mol AgCl} \leftarrow \text{amount made}$$

$$0.1000 \text{ L AgNO}_3 \times \frac{2.20 \text{ mol AgNO}_3}{1 \text{ L}} \times \frac{2 \text{ mol AgCl}}{2 \text{ mol AgNO}_3} = 0.220 \text{ mol AgCl}$$

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

Answer _____

7] Aluminum reacts with oxygen to form aluminum oxide: **4Al + 3O₂ → 2Al₂O₃ (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?

$$75.0 \text{ g Al} \times \frac{1 \text{ mol Al}}{27.0 \text{ g}} \times \frac{2 \text{ mol Al}_2\text{O}_3}{4 \text{ mol Al}} = 1.39 \text{ mol Al}_2\text{O}_3 \leftarrow \text{amount made}$$

$$200.0 \text{ g O}_2 \times \frac{1 \text{ mol O}_2}{32.0 \text{ g}} \times \frac{2 \text{ mol Al}_2\text{O}_3}{3 \text{ mol O}_2} = 4.17 \text{ mol Al}_2\text{O}_3$$

$$1.39 \text{ mol Al}_2\text{O}_3 \times \frac{102.0 \text{ g Al}_2\text{O}_3}{1 \text{ mol}} = 141.8 \text{ g Al}_2\text{O}_3$$

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

Answer _____

8] . According to the following reaction:..... **2 Cu(s) + O₂(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?

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

Answer _____

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

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

Answer _____