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?

\[
\text{Calcium chloride } + \text{ phosphoric acid } \rightarrow \text{ calcium phosphate } + \text{ hydrochloric acid}
\]

\[
3\text{CaCl}_2 + 2\text{H}_3\text{PO}_4 \rightarrow \text{Ca}_3(\text{PO}_4)_2 + 6\text{HCl}
\]

\[
2.50\text{L CaCl}_2 \times \frac{0.250\text{L CaCl}_2}{1\text{mol}} \times \frac{1\text{mol Ca}_3(\text{PO}_4)_2}{3\text{mol CaCl}_2} \times \frac{310.0\text{g Ca}_3(\text{PO}_4)_2}{1\text{mol}} = 64.6\text{g Ca}_3(\text{PO}_4)_2
\]

Answer ____________________

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

\[
14\text{HNO}_3 + 3\text{Cu}_2\text{O} \rightarrow 6\text{Cu(NO}_3)_2 + 2\text{NO} + 7\text{H}_2\text{O}
\]

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

Answer _________________________

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

\[
2\text{HNO}_3(\text{aq}) + \text{Ba(OH)}_2(\text{aq}) \rightarrow 2\text{H}_2\text{O}(\text{s}) + \text{Ba(NO}_3)_2(\text{aq}) \quad (\text{BALANCED})
\]

Find the Molarity of the nitric acid solution

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

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

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

\[
3\text{Fe} + 4\text{H}_2\text{O} \rightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2
\]

\[
40.0\text{ g} \quad 16.0\text{g}
\]

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

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

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.

a. Write and balance the equation

\[
2\text{AgNO}_2 + \text{Na}_2\text{S} \rightarrow \text{Ag}_2\text{S} + 2\text{NaNO}_2
\]

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

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

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

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

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?

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

Excess Na₂S = 35.5g - 8.97g = 26.5g Na₂S

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

\[ 2\text{AgNO}_3 + \text{MgCl}_2 \rightarrow (\text{Mg(NO}_3)_2) + 2\text{AgCl(aq)} \]

\[ 0.01000\text{ L MgCl}_2 \times \frac{10.0\text{mol MgCl}_2}{1\text{ L}} \times \frac{2\text{mol AgCl}}{1\text{mol MgCl}_2} = 0.200\text{ mol AgCl} \]

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

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

Answer _________________________

7] Aluminum reacts with oxygen to form aluminum oxide:

\[ 4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3 \]

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?

\[ 75.0\text{g Al} \times \frac{1\text{mol Al}}{27.0\text{g}} \times \frac{2\text{mol Al}_2\text{O}_3}{4\text{mol Al}} = 1.39\text{ mol Al}_2\text{O}_3 \]

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

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

% Yield = \[ \frac{75.0\text{g}}{141.8\text{g}} \times (100) = 52.9\% \]

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?

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

Answer _________________________

b. How many grams of Cu must you use to produce 5.00 x 10¹³mg CuO?

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

Answer _________________________