1. Given the following reaction: (Balance the equation first!)

\[ C_3H_8 + O_2 \rightarrow CO_2 + H_2O \]

a) If you start with 14.8 g of \( C_3H_8 \) and 3.44 g of \( O_2 \), determine the limiting reagent

b) determine the number of moles of carbon dioxide produced

c) determine the number of grams of \( H_2O \) produced

d) determine the number of grams of excess reagent left

2. Given the following equation:

\[ Al_2(SO_3)_3 + 6 NaOH \rightarrow 3 Na_2SO_3 + 2 Al(OH)_3 \]

a) If 10.0 g of \( Al_2(SO_3)_3 \) is reacted with 10.0 g of \( NaOH \), determine the limiting reagent

b) Determine the number of moles of \( Al(OH)_3 \) produced

c) Determine the number of grams of \( Na_2SO_3 \) produced

d) Determine the number of grams of excess reagent left over in the reaction

3. Given the following equation:

\[ Al_2O_3 + Fe \rightarrow Fe_3O_4 + Al \]

a) If 25.4 g of \( Al_2O_3 \) is reacted with 10.2 g of \( Fe \), determine the limiting reagent

b) Determine the number of moles of \( Al \) produced

c) Determine the number of grams of \( Fe_3O_4 \) produced

d) Determine the number of grams of excess reagent left over in the reaction
1. Consider the reaction
   \[ \text{I}_2\text{O}_5(g) + 5 \text{CO}(g) \rightarrow 5 \text{CO}_2(g) + \text{I}_2(g) \]
   a) 80.0 grams of iodine(V) oxide, \( \text{I}_2\text{O}_5 \), reacts with 28.0 grams of carbon monoxide, \( \text{CO} \).
   Determine the mass of iodine \( \text{I}_2 \), which could be produced?
   b) If, in the above situation, only 0.160 moles of iodine, \( \text{I}_2 \) was produced.
      i) what mass of iodine was produced?
      ii) what percentage yield of iodine was produced.

2. Zinc and sulphur react to form zinc sulphide according to the equation.
   \[ \text{Zn} + \text{S} \rightarrow \text{ZnS} \]
   If 25.0 g of zinc and 30.0 g of sulphur are mixed,
   a) Which chemical is the limiting reactant?
   b) How many grams of ZnS will be formed?
   c) How many grams of the excess reactant will remain after the reaction is over?

3. Which element is in excess when 3.00 grams of Mg is ignited in 2.20 grams of pure oxygen?
   What mass is in excess? What mass of MgO is formed?
   How many grams of \( \text{Al}_2\text{S}_3 \) are formed when 5.00 grams of Al is heated with 10.0 grams S?

4. When \( \text{MoO}_3 \) and Zn are heated together they react
   \[ 3 \text{Zn}(s) + 2 \text{MoO}_3(s) \rightarrow \text{Mo}_2\text{O}_3(s) + 3 \text{ZnO}(s) \]
   What mass of ZnO is formed when 20.0 grams of \( \text{MoO}_3 \) is reacted with 10.0 grams of Zn?

5. Silver nitrate, \( \text{AgNO}_3 \), reacts with ferric chloride, \( \text{FeCl}_3 \), to give silver chloride, \( \text{AgCl} \),
   and ferric nitrate, \( \text{Fe(NO}_3)_3 \). In a particular experiment, it was planned to mix a solution containing 25.0 g of \( \text{AgNO}_3 \) with another solution containing 45.0 grams of \( \text{FeCl}_3 \).
   a) Write the chemical equation for the reaction.
   b) Which reactant is the limiting reactant?
   c) What is the maximum number of moles of \( \text{AgCl} \) that could be obtained from this mixture?
   d) What is the maximum number of grams of \( \text{AgCl} \) that could be obtained?
   e) How many grams of the reactant in excess will remain after the reaction is over?

6. Solid calcium carbonate, \( \text{CaCO}_3 \), is able to remove sulphur dioxide from waste gases by the reaction (balanced as written):
   \[ \text{CaCO}_3 + \text{SO}_2 + \text{other reactants} \rightarrow \text{CaSO}_3 + \text{other products} \]
   In a particular experiment, 255 g of \( \text{CaCO}_3 \) was exposed to 135 g of \( \text{SO}_2 \) in the presence of an excess amount of the other chemicals required for the reaction.
   a) What is the theoretical yield of \( \text{CaSO}_3 \)?
   b) If only 198 g of \( \text{CaSO}_3 \) was isolated from the products, what was the percentage yield of \( \text{CaSO}_3 \) in this experiment?
1. Balanced equation:

\[ C_3H_8 + 5 O_2 \rightarrow 3 CO_2 + 4 H_2O \]

a) O_2
b) 0.065 mol CO_2
c) 1.56 g H_2O
d) 13.86 g C_3H_8

2a) Al_2(SO_3)_3
b) 0.068 mol Al(OH)_3
c) 12.85 g Na_2SO_3
d) 1.84 g NaOH

3. Balanced equation:

\[ 4 Al_2O_3 + 9 Fe \rightarrow 3 Fe_3O_4 + 8 Al \]

a) Fe
b) 0.16 mol Al
c) 14.12 g Fe_3O_4
d) 17.13 g Al_2O_3
1. Consider the reaction
   \[ \text{I}_2\text{O}_5 (g) + 5 \text{CO} (g) \rightarrow 5 \text{CO}_2 (g) + \text{I}_2 (g) \]
   a) 80.0 grams of iodine(V) oxide, \( \text{I}_2\text{O}_5 \), reacts with 28.0 grams of carbon monoxide, \( \text{CO} \). \( \text{CO} \) is limiting
   Determine the mass of iodine \( \text{I}_2 \), which could be produced? 50.7 g
   b) If, in the above situation, only 0.160 mol of iodine, \( \text{I}_2 \) was produced.
      i) what mass of iodine was produced? 40.6 g
      ii) what percentage yield of iodine was produced. 80.1%

2. Zinc and sulphur react to form zinc sulphide according to the equation.
   \[ \text{Zn} + \text{S} \rightarrow \text{ZnS} \]
   If 25.0 g of zinc and 30.0 g of sulphur are mixed,
   a) Which chemical is the limiting reactant? \( \text{Zn} \)
   b) How many grams of \( \text{ZnS} \) will be formed? 0.3803 mol = 37.1 g
   c) How many grams of the excess reactant will remain after the reaction is over? 17.7 g

3. Which element is in excess when 3.00 grams of Mg is ignited in 2.20 grams of pure oxygen? \( \text{O}_2 \)
   What mass is in excess? 0.226 g \( \text{O}_2 \) What mass of \( \text{MgO} \) is formed? 4.97 g \( \text{MgO} \)

4. How many grams of \( \text{Al}_2\text{S}_3 \) are formed when 5.00 grams of Al is heated with 10.0 grams \( \text{S} \)? \( \text{Al} \) is limiting, 13.9 g \( \text{Al}_2\text{S}_3 \)

5. When \( \text{MoO}_3 \) and \( \text{Zn} \) are heated together they react
   \[ 3 \text{Zn}(s) + 2 \text{MoO}_3(s) \rightarrow \text{Mo}_2\text{O}_3(s) + 3 \text{ZnO}(s) \]
   What mass of \( \text{ZnO} \) is formed when 20.0 grams of \( \text{MoO}_3 \) is reacted with 10.0 grams of \( \text{Zn} \)? \( \text{Zn} \) is limiting, 12.4 g of \( \text{ZnO} \) will be produced

6. Silver nitrate, \( \text{AgNO}_3 \), reacts with ferric chloride, \( \text{FeCl}_3 \), to give silver chloride, \( \text{AgCl} \), and ferric nitrate, \( \text{Fe(NO}_3)_3 \). In a particular experiment, it was planned to mix a solution containing 25.0 g of \( \text{AgNO}_3 \) with another solution containing 45.0 grams of \( \text{FeCl}_3 \).
   a) Write the chemical equation for the reaction. \( 3\text{AgNO}_3 + \text{FeCl}_3 \rightarrow 3\text{AgCl} + \text{Fe(NO}_3)_3 \)
   b) Which reactant is the limiting reactant? \( \text{AgNO}_3 \)
   c) What is the maximum number of moles of \( \text{AgCl} \) that could be obtained from this mixture? 0.147 mol
   d) What is the maximum number of grams of \( \text{AgCl} \) that could be obtained? 21.1 g
   e) How many grams of the reactant in excess will remain after the reaction is over? 37.1 g ferric chloride

7. Solid calcium carbonate, \( \text{CaCO}_3 \), is able to remove sulphur dioxide from waste gases by the reaction:
   \[ \text{CaCO}_3 + \text{SO}_2 + \text{other reactants} \rightarrow \text{CaSO}_3 + \text{other products} \]
   In a particular experiment, 255 g of \( \text{CaCO}_3 \) was exposed to 135 g of \( \text{SO}_2 \) (limiting) in the presence of an excess amount of the other chemicals required for the reaction.
   a) What is the theoretical yield of \( \text{CaSO}_3 \)? 253 g \( \text{CaSO}_3 \)
   b) If only 198 g of \( \text{CaSO}_3 \) was isolated from the products, what was the percentage yield of \( \text{CaSO}_3 \) in this experiment? 78.3%