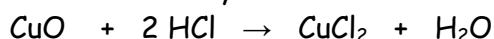# CHEMICAL CALCULATIONS

1.   Calculate the mass of copper(II) chloride which is produced when 39.75 g of copper(II) oxide reacts with excess hydrochloric acid.
$$CuO \ + \ 2\,HCl \ \rightarrow \ CuCl_2 \ + \ H_2O$$

   i)   Find the number of moles of copper(II) oxide present in 39.75g
   ii) How many moles of $CuCl_2$ will form when 39.75g of copper(II) oxide reacts?
   iii) Deduce the mass of copper(II) chloride which is formed to 3 significant figures.

2.   Calculate the mass of sodium nitrate which is formed when 2.65 g of sodium carbonate reacts with excess nitric acid solution.
$$Na_2CO_3 \ + \ 2\,HNO_3 \ \rightarrow \ 2\,NaNO_3 \ + \ H_2O \ + \ CO_2$$
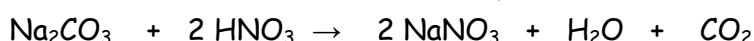
   i)   Find the number of moles of sodium carbonate present in 2.65 g
   ii) How many moles of sodium nitrate will be formed when 2.65 g of Na_2CO_3 reacts?
   iii) Deduce the mass of sodium nitrate which is formed.

3.   Calculate the mass of copper(II) hydroxide which is formed when 5.61 g of potassium hydroxide in a solution reacts with excess copper(II) sulphate solution
$$CuSO_4 \ + \ 2\,KOH \ \rightarrow \ Cu(OH)_2 \ + \ K_2SO_4$$
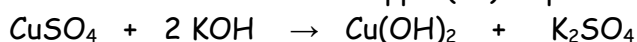
   i)   Find the number of moles of potassium hydroxide present in 5.61 g
   ii) How many moles of copper(II) hydroxide will be formed when 5.61 g of KOH reacts?
   iii) Deduce the mass of copper(II) hydroxide which is formed to 3 significant figures.

4.   Calculate the mass of oxygen which is needed to react with 5.75g of sodium to form sodium oxide.
$$4\,Na \ + \ O_2 \ \rightarrow \ 2\,Na_2O$$
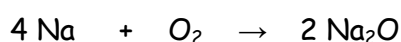
   i)   Find the number of moles of sodium atoms present in 5.75g of sodium.
   ii) How many moles of oxygen are needed to react with 5.75g of sodium?
   iii) Deduce the mass of oxygen which is needed to 3 significant figures.

5.   Calculate the mass of chromium(III) oxide which is needed to react with 10.8g of aluminium in the reaction shown below.
$$Cr_2O_3 \ + \ 2\,Al \ \rightarrow \ 2\,Cr \ + \ Al_2O_3$$
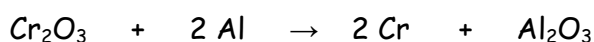
   i)   Find the number of moles of aluminium atoms present in 10.8g of aluminium.
   ii) How many moles of chromium(III) oxide are needed to react with 10.8g of aluminium?
   iii) Deduce the mass of chromium(III) oxide which is needed to 3 significant figures.

6.   Calculate the mass of sodium which reacts with excess water to make 0.7g of hydrogen.
$$2\,Na \ + \ 2\,H_2O \ \rightarrow \ 2\,NaOH \ + \ H_2$$
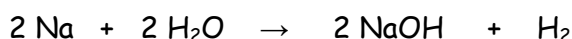
   i)   Find the number of moles of hydrogen molecules present in 0.7g of hydrogen.
   ii) How many moles of sodium are needed to produce 0.7g of hydrogen?
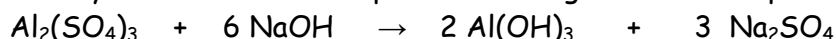   iii) Deduce the mass of sodium which is needed.

7. Calculate the mass of magnesium which reacts with excess phosphoric acid solution to make 53.685g of magnesium phosphate.

$$3\ Mg\ +\ 2\ H_3PO_4\ \rightarrow\ Mg_3(PO_4)_2\ +\ 3\ H_2$$
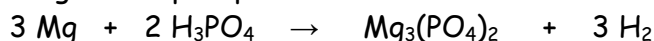
   i) Find the number of moles of magnesium phosphate present in 53.685g.
   ii) How many moles of magnesium are needed to produce 53.685g of magnesium phosphate?
   iii) Deduce the mass of magnesium which is needed to 3 significant figures.

8. Calculate the mass of chlorine which is needed to react with excess aluminium to make 2.67g of aluminium chloride.

$$2\ Al\ +\ 3\ Cl_2\ \rightarrow\ 2\ AlCl_3$$
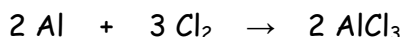
   i) Find the number of moles of aluminium chloride present in 2.67g of aluminium chloride.
   ii) How many moles of chlorine molecules are needed to produce 2.67g of $AlCl_3$?
   iii) Deduce the mass of chlorine which is needed.

9. Calculate the mass of aluminium sulphate present in a solution which reacts with excess sodium hydroxide solution to produce 7.105g of sodium sulphate.

$$Al_2(SO_4)_3\ +\ 6\ NaOH\ \rightarrow\ 2\ Al(OH)_3\ +\ 3\ Na_2SO_4$$

   i) Find the number of moles of sodium sulphate present in 7.105g of sodium sulphate.
   ii) How many moles of aluminium sulphate are needed to produce 7.105g of sodium sulphate?
   iii) Deduce the mass of aluminium sulphate which is needed to 3 significant figures.

10. Calculate the mass of aluminium which is needed to react with excess Fe_3O_4 to form 864.9g of iron.

$$8Al\ +\ 3\ Fe_3O_4\ \rightarrow\ 9\ Fe\ +\ 4\ Al_2O_3$$
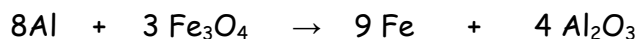
   i) Find the number of moles of iron present in 864.9g of iron.
   ii) How many moles of aluminium are needed to produce 864.9g of iron?
   iii) Deduce the mass of aluminium which is needed.