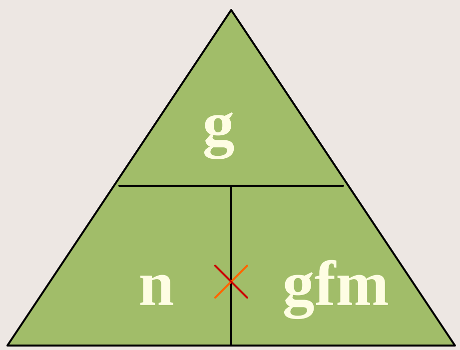
Calculations in Chemistry

- **To calculate the number of moles in a solid we use the following Mole Triangle**

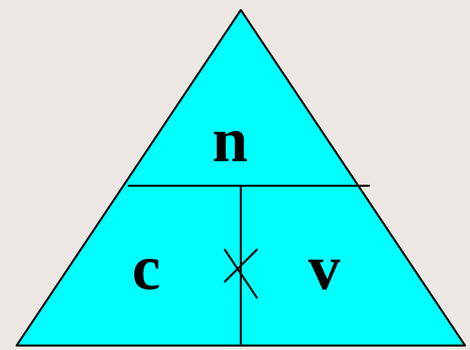


g = Mass in Grams

n= Number of moles

gfm=gram formula mass

To calculate the number of moles in a solution we use the following Mole Triangle



n = number of moles

c = concentatration (moles/litre)

v= volume in ***litres***

Examples using the Mole Triangle

- ***Calculate the no. of moles present in 0.4g of Na OH***

From previous slide : If we cover up the entity we require we see that

n = g/gfm   gfm of NaOH= 23+16+1= 40g

therefore   n=0.4/40 **=0.01moles**

Calculate the mass of 0.05 moles of Mg(Cl)$_2$

Again from previous slide we see that if we cover up the letter we want that we get

g= n × gfm   gfm = 24+2(35.5) =95g

therefore 0.05× 95=**4.75g**

Calculations contd.

- ***Calculate the no. of moles present in 50cm^3 of 0.05 molar HCl .***

From previous triangle we that if we cover the letter we want that

$n = c \times v/1000$ therefore $n = 0.05 \times 50/1000 =$ **0.00005moles**

Calculate the concentration if we have 0.1 moles dissolved in 100cm^3 of water

From previous triangle we see that

$c = n/v$ in litres

therefore $C = 0.1/100_{/1000}$ **= 0.01 moles/litre**

Empirical or Simplest formula

Example: A sample of a substance was found to contain 0.12g of Magnesium and 0.19g of Fluorine. Find the simplest Formula.

> *It doesn't matter if the original sample is in grams or percentages*

- ***Rules***
- **1. Write down all the symbols present.** → **Mg and F**
- **2. Calculate the no of moles of each element present.** → **n =g/gfm**

  0.12/24 = 0.005moles   **0.19/19 = 0.01moles**
- **3. Compare ratios(get the smallest number of moles and divide it into all the others.** → **0.005 : 0.01**

  1 : 2
- **4.Write down the formula.** → $Mg(F)_2$

Neutralisation Calculations

- **One way of Neutralising an Acid is to add an Alkali(for other methods see reactions of acids section).ie.**

Acid + Alkali → Salt + water

To do neutralisation calculations we use the following formula.

$$\underbrace{H^+ \times C_A \times V_A}_{\text{acid}} = \underbrace{OH^- \times C_B \times V_B}_{\text{alkali}}$$

acid ***alkali***

H^+ = no. of H^+ ions in acid

HCl = 1

H_2SO_4 = 2

H_3PO_4 = 3

C_A =Concentration of acid

C_B= Concentration of alkali

V_A = volume of acid

V_B =Volume of alkali

OH^- = no. of OH^- ions in alkali

NaOH = 1

$Ba(OH)_2$ = 2

$Al(OH)_3$ = 3

Neutralisation Calculations contd.

- Example: **What volume of 0.1M HCl is required to neutralise 100cm^3 of 0.5M NaOH.**

$$H^+ \times C_A \times V_A = OH^- \times C_B \times V_B$$

We require to find

$$1 \times 0.1 \times V_A = 1 \times 0.5 \times 100$$

$$V_A = 50/0.1 \qquad \underline{= 500cm3}$$

Example: **What concentration of 50cm^3 KOH is used to neutralise 100cm^3 of 0.05M H_2SO_4**

$$H^+ \times C_A \times V_A = OH^- \times C_B \times V_B$$

We require to find

$$2 \times 0.05 \times 100 = 1 \times C_B \times 50$$

$$C_B = 10/50 \qquad \underline{= 0.2M}$$

Calculations from Equations

- Example: **What mass of Hydrogen gas is produced when 0.12g of Magnesium is added to excess Hydrochloric Acid.**

We first require to write down the balanced equation

$$Mg_{(s)} + 2HCl_{(aq)} \longrightarrow Mg(Cl)_{2(aq)} + H_{2(g)}$$

To balance the equation we add a 2 in front of the HCl

From This we can see that:

1M → **1M + 1M**

24g → **2g**

1g → **2/24 =0.08**

therefore

0.12g → **0.08×0.12 = 0.0096g of H_2**