The Mole

One mole of a substance is the formula mass in grams (GFM).

Mass = number of moles x GFM

### **Worked example**

**Find the mass of 2.5 moles of methane.**

**Step 1 Write the formula for methane CH4**

**Step 2 Work out the formula mass of methane = (1 x 12) + (4 x 1) = 16**

**Step 3 Use triangle mass = no. of moles x GFM**

**= 2.5 x 16**

**= 40 g**

**Concentration**

**Concentration of a solution is measured in moles per litre.**

**n = number of moles**

**C = concentration (mol/l)**

# V = volume in litres

# Worked Example

**Calculate the concentration of a solution containing 4 moles in a volume of 2500 cm3.**

**Step 1 Using the triangle C = n**

**V (l)**

**Step 2 Use values from the question**

**remembering to change the**

**volume to litres if necessary C = 4 = 1.6 mol /l**

**2.5**

**Concentration, Moles and Mass**

### We can use the two relationships on the previous pages (mole and concentration) together.

**Worked Example**

**Calculate the mass required to prepare 250 cm3 of a 2 mol/l solution of sodium hydroxide (NaOH).**

**Step 1 Calculate the number of moles of sodium hydroxide**

n = C x V(l) = 2 x 0.25 = 0.5 mol

**Step 2 Calculate the mass of sodium hydroxide**

Mass = moles x GFM = 0.5 x 40 = 20 g

# Calculations from Equations

A balanced equation tells us the number of moles of each substance involved in the reaction.

For example

Mg + 2 HCl MgCl2 + H­2

means that one mole of magnesium reacts with 2 moles of hydrochloric acid to produce one mole of magnesium chloride and one mole of hydrogen gas.

# Worked Example

**Calculate the mass of hydrogen produced when 1.2 g of magnesium reacts with excess hydrochloric acid.**

**Step 1 Write a balance equation – tick the substances in the question (or score out the ones that are not!)**

**Step 2 Write the number of moles of substances mentioned in question**

**Step 3 Change moles to grams**

**Step 4 Use figures from question**

**Step 5 Cross multiply to get answer**

Mg + 2 HCl MgCl2 + H­2

**1 mole 1 mole**

**24 g 2 g**

**1.2 g 1.2 x 2**

**24**

**= 0.1 g**

# Titrations

# Worked Example

**Calculate the volume of sodium hydroxide, concentration 0.5 mol/l, required to neutralise 24.5 cm3 of sulphuric acid, concentration 0.25 mol/l.**

**2NaOH + H2SO4 🡪 Na2SO4 + 2H2O**

**Step 1 Write a balance equation**

**Step 2 Write the number of moles of substances mentioned in question (reactants)**

**Step 3 Use n = c\*v to work out number of moles of known**

**Step 4 Cross multiply to get number of moles of unknown**

**Step 5 use v=n/c to calculate volume (in this case)**

**2NaOH + H2SO4**

**2mol 1 mol**

**N = c\*v**

**=0.25\*0.0245**

**= 6.125\*10^-3**

# 2\*6.125\*10^-3mol = 6.125\*10^-3 mol

**v = n/c**

**= 0.01225/0.5**

**=0.0245 l**