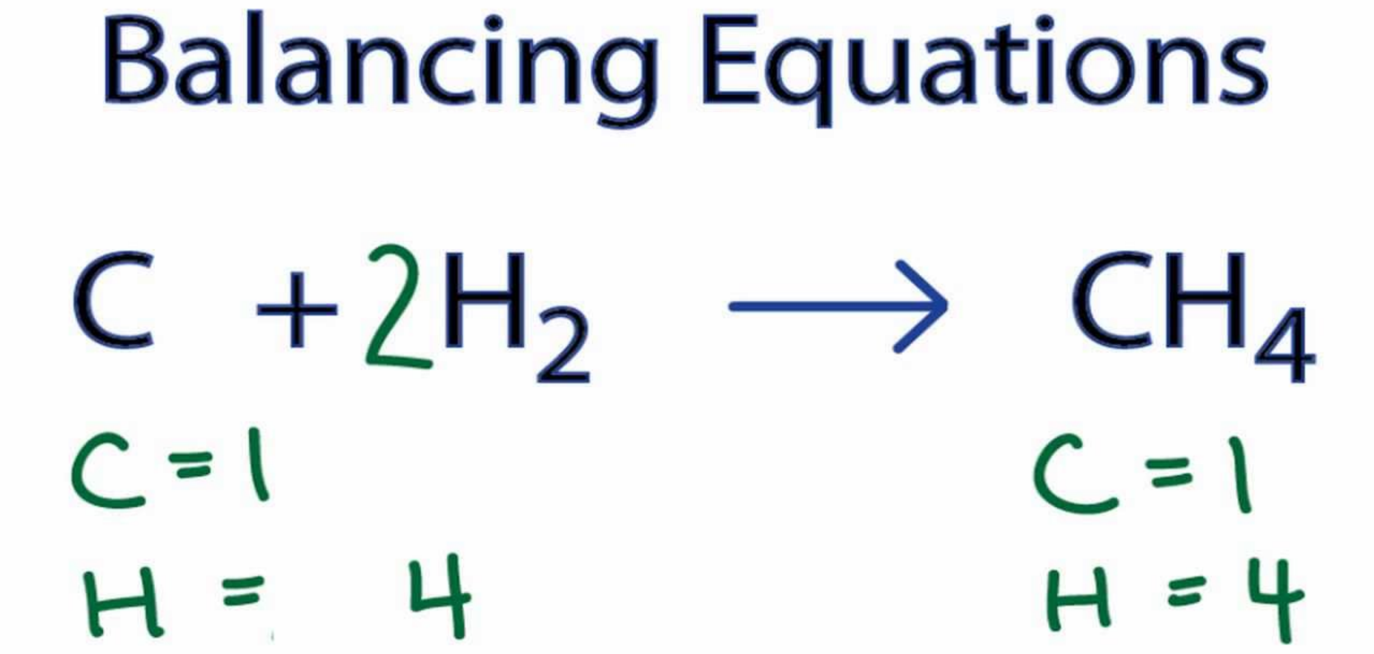
3. Reacting Masses

1.25

Balancing equations



1.26

Calculate relative formula mass (Mr) from relative atomic mass (Ar)

1.27

Mol is the unit for the amount of substance

Mol = mass (g)/Ar

1.28

Understand carrying out calculations involving amount of substance, relative atomic mass (Ar) and relative formula mass (Mr)

$$\% \text{ element} = \frac{\text{r.a.m. of element x number of atoms}}{\text{r.f.m of compound}} \times 100$$

Calculate reacting masses using experimental data and chemical equations

If you have 48 grams of magnesium, what mass of oxygen will react with this?

magnesium + oxygen → magnesium oxide
$2Mg + O_2 \rightarrow 2MgO$

- The balanced equation shows the ratio of **Mg : O_2** is **2 : 1**
- The relative atomic mass of **Mg = 24** and the relative formula mass of **O_2 = 32**.
- Combining these two sets of information gives the ratio of reacting masses.
  Mg : O_2 = (2 x 24) : (1 x 32) = 48 g : 32 g

So, 48 g of magnesium will react with 32 g of oxygen.

If you have 48 grams of magnesium, what mass of magnesium oxide will be produced?

magnesium + oxygen → magnesium oxide
$2Mg + O_2 \rightarrow 2MgO$

- The balanced equation shows the ratio of **Mg : MgO** is **2:2**
- The relative atomic mass of **Mg = 24** and the relative formula mass of **MgO = 24 + 16 = 40**.
- Combining these two sets of information gives the ratio of reacting masses.
  Mg : MgO = (2 x 24) : (2 x 40) = 48 g : 80 g

So, 48 g of magnesium will produce 80 g of magnesium oxide

If you have 480 grams of magnesium, what mass of magnesium oxide will be produced?

magnesium + oxygen → magnesium oxide

$$2Mg + O_2 \rightarrow 2MgO$$

- From previous calculations, the ratio of reacting masse for **Mg : MgO = (2 x 24) : (2 x 40) = 48 g : 80 g**.
- Starting with 480 g of magnesium, means you have to work out the scale factor for the ratio of reacting mass **scale factor = 480 g ÷ 48 g = 10**
- Applying this scale factor to the amount of magnesium oxide in the ratio of reacting masses gives the answer **mass of MgO to be produced = 80 g x 10 = 800g**

- **Step 1**. Write down the balanced symbol equation.
- **Step 2**. Write down the relative atomic/formula masses of the reactants and products.
- **Step 3**. Use the balanced equation to write down the ratios of reactants and products.
- **Step 4.** Convert to ratio of reacting masses.
- **Step 5**. Calculate the scale factor and apply this to the ratio of reacting masses.

If 28 g of iron reacts with copper sulphate solution, what mass of copper will be made?

- **Step 1**. Write down the balanced symbol equation.

$$Fe + CuSO_4 \rightarrow Cu + FeSO_4$$

- **Step 2**. Write down the relative atomic/formula masses.

  Fe = 56 **Cu = 64**

- **Step 3**. Write down the ratio of reactants and products.

  Fe : Cu = 1 : 1

- **Step 4.** Convert to ratio of reacting masses.

  Fe : Cu = 1 : 1 = 56 g : 64 g

- **Step 5**. Calculate the scale factor and apply this to the ratio of reacting masses.

  scale factor = 38 g / 56 g = 0.5

  mass of Cu made = 64 g x 0.5 = 32 g

1.30

percentage yield = actual yield / theoretical yield x 100

1.31

Formulae of simple compounds can be obtained experimentally, including metal oxides, water and salts containing water or crystallization

1.32

Empirical Formula - formula that shows the ratio of elements present in the compound, but not the actual numbers of atoms found in the molecule

Molecular Formula - shows the number of atoms of different elements

1.33

Calculate empirical and molecular formulae from experimental data

1.34

Carry out calculations involving amount of substance, volume and concentration (in mol/dm^3) of solution

$$\text{concentration} = \frac{\text{mass dissolved (g)}}{\text{volume of solution (dm}^3\text{)}}$$

1.36

Determine the formula of a metal oxide by combustion or by reduction

Rf values (Chromatography)	$\frac{Distance\ traveled\ by\ Compound\ (Solute)}{Distance\ traveled\ by\ Liquid\ (Solvent)}$
Relative Atomic Mass	$\frac{\sum(Isotope\ abundance\ \times\ Isotope\ mass\ number)}{\sum Isotope\ Abundance}$
Moles	$\frac{Mass}{Molar\ Mass}$ $Concentration\ \left(\frac{mol}{dm^3}\right) \times\ Volume\ (dm^3)$
Percentage Mass	$\frac{(Mr\ of\ Element)}{(Total\ Mr)} \times\ 100(\%)$
Percentage Yield	$\%\ Yield = \frac{Actual\ Yield}{Theoretical\ Yield} \times\ 100(\%)$
Concentration	$Cocentration\ \left(\frac{mol}{dm^3}\right) = \frac{\#\ of\ mol\ (mol)}{volume\ (dm^3)}$
Volume (cm^3)	$Volume\ (dm^3)\ \times\ 1000$