Topic 3 AQA Chemistry- Quantitative Chemistry-

- Triple Science Content only in purple
- Triple Science and Higher Content Only in blue

Conservation of mass

● Law of conservation of mass:

In a **chemical reaction**, **no atoms are lost or gained** — they are simply rearranged.
➢ Therefore, **the total mass of reactants = total mass of products**.

Example:
Hydrogen + Oxygen → Water
$2H_2 + O_2 \rightarrow 2H_2O$
Mass before = Mass after.

- This happens because chemical reactions are **closed systems** — nothing escapes or enters.

Balanced Chemical Equations

- **Balanced equations** show that the number of atoms of each element is the same on both sides.

- You **cannot change subscripts**, only **add numbers in front** to balance the equation.

Example:
Unbalanced: $H_2 + O_2 \rightarrow H_2O$
Balanced: $2H_2 + O_2 \rightarrow 2H_2O$

Each side has 4 H atoms and 2 O atoms.

Relative formula mass

● In a balanced chemical equation:
sum of Mr of reactants = sum of Mr of products

- **Relative atomic mass (Ar):** The average mass of one atom of an element compared with 1/12 the mass of a carbon-12 atom.

- **Relative formula mass (Mr)**: The **sum of all Ar values** in the formula.

✅ **Example:**
Na_2CO_3 → (2 × 23) + 12 + (3 × 16) = **106**

- **No units** for Mr — it's a ratio, not a measurement.

Mass changes when a reactant or product is a gas

•Sometimes, the **mass appears to change** during a reaction — but it's due to **gases entering or leaving** the system.

Apparent Increase in Mass

If a **gas from the air** (like oxygen) reacts to form part of the product, the **mass increases**.
Example:
Magnesium + Oxygen → Magnesium Oxide
(Magnesium reacts with oxygen from the air — product weighs more.)

Apparent Decrease in Mass

If a **gas is produced and escapes**, the **mass decreases**.
Example:
Calcium Carbonate → Calcium Oxide + Carbon Dioxide
(CO_2 escapes — mass seems to go down.)

In reality: Mass is always conserved if all reactants and products are accounted for.

Chemical measurements

• Whenever a measurement is made there is always some *uncertainty* about the result obtained

- Therefore, be prepared to make estimations of uncertainty

Higher Tier Only from here-

Moles

- Chemical amounts are measured in moles. The symbol is mol.

▪ Moles = Mass / Mr

● The number of atoms, molecules or ions in a mole of a given substance is the Avogadro constant:6.02x10^23permole.

Amounts of substances in equations

Amount Of Substance - Youtube Video

Using moles to balance equations

● Balancing numbers in a symbol equation can be calculated from the masses of reactants and products

Limiting reactants

GCSE Quantitative Chemistry - Amount of substance in volumes (Limiting Reactants)

Percentage yield

Percentage yield = Amount of product produced / Maximum amount of product possible x 100

● It is not always possible to obtain the calculated amount of a product for 3 reasons:
- Reaction may not go to completion because it is reversible
- Some of the product may be lost when it is separated from the reaction mixture
- Some of the reactants may react in ways different to the expected reaction

Example:

If the theoretical yield of copper is **10 g** and the actual yield is **8 g**,

Percentage yield= 8/10×100=80%

Atom economy

- A measure of the amount of starting materials that end up as useful products
- Important for sustainable development and for economic reasons to use reactions with high atom economy

• Possible reasons why a particular reaction pathway is chosen/not chosen: atom economy, yield, rate, equilibrium position and usefulness of by-products

Using concentrations of solutions in mol/dm3

Video: https://youtu.be/lgMdv9dTQeo

Use of amount of substance in relation to volumes of gases

GCSE Quantitative Chemistry - Amount of substance in volumes