

Topic 3 AQA Chemistry- Quantitative Chemistry-
- Triple Science Content only in purple
- Triple Science and Higher Content Only in blue

Conservation of mass

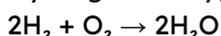
- Law of conservation of mass:

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



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: $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$

Balanced: $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$

Each side has 4 H atoms and 2 O atoms.

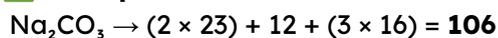
Relative formula mass

- 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:**



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

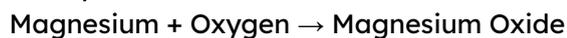
Mass changes when a reactant or product is a gas

- 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 reacts with oxygen from the air – product weighs more.)

☐ **Apparent Decrease in Mass**

If a **gas is produced and escapes**, the **mass decreases**.

Example:



(CO₂ 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: 6.02×10^{23} per mole.

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 = $8/10 \times 100 = 80\%$

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/lqMdv9dTQeo>

[Use of amount of substance in relation to volumes of gases](#)

- ▶ [GCSE Quantitative Chemistry - Amount of substance in volumes](#)