

A **chemical reaction** is a change in which atoms rearrange and join together differently to make new substances. **Physical changes** are changes that do not make new substances.

Equations

The substances that you start with in a reaction are called reactants, and the ones you finish with are the products.

We can represent a reaction with a **word equation**.

The reactants are on the left
The products are on the right
There is an \rightarrow from the reactants to the products



We can also use a **balanced formula equation** to represent a reaction.



A balanced formula equation shows:

- the formula of each substance in the reaction
- how the atoms are rearranged
- the relative number (ratio) of atoms of each substance.

If a chemical reaction is happening you might:

- 1 see flames or sparks
- 2 notice a smell
- 3 Here fizzing or a bang
- 4 feel the temperature of the reaction mixture going up or down

Speed of reactions

Some reactions are very fast but others can be very slow.

Adding a **catalyst** can speed up a reaction, for example, to make a product more quickly.

Different reactions require different catalysts.

A catalyst isn't used up in the reaction but helps the reaction along.

Chemical reactions are normally not **reversible**.

This means that you cannot turn the products back into reactants.

What happens during a reaction?

All chemical reactions involve an energy transfer to or from the surroundings:

Energy transfer	Temperature of surroundings	Type of reaction	Example
from the surroundings to the reaction mixture	decreases	endothermic	thermal decomposition
to the surroundings from the reaction mixture	increases	exothermic	combustion

Conservation of mass

In a reaction, atoms are not created or destroyed – they are just rearranged.

The total mass of the reactants is always equal to the total mass of the products.

This is called **conservation of mass**.

If the mass seems to increase, it is because atoms have been added from a gas.



If the mass seems to have decreased, it is because atoms have rearranged and formed a gas that has escaped.



Changes of state are not chemical reactions, but they are reversible. This is called a **physical change**.

This is because no new substances are made.

For example, Water, ice, and steam are all made of molecules of the same substance (H_2O) in different states, and the change from one state to another is reversible.

Types of reaction

Thermal decomposition reactions

A **decomposition** reaction is when a substance breaks down into simpler substances.

Most decomposition reactions need heat to happen – this is called **thermal decomposition**.

Oxidation is when substances react with oxygen.

Combustion is a type of oxidation reaction where a **fuel** reacts (burns) with oxygen this transfers energy by heating.

Petrol, diesel, and coal are all **fossil fuels** and take millions of years to form.

They cannot be replaced when used, and will eventually run out, so are called **non-renewable** (finite).

Fossil fuels produce carbon dioxide and water when combusted. Extra carbon dioxide released into the air can cause climate change.

Hydrogen can also be combusted and used as fuel.

This may be better than using fossil fuels because it only produces water as a product.



Key Words

Make sure you can write a definition for these key terms.

balanced formula equation catalyst chemical reaction combustion reaction conservation of mass decomposition endothermic change exothermic change fossil fuel fuel non-renewable
 oxidation reaction physical change product ratio reactants

