

A **chemical reaction** is a process where atoms are rearranged to make new substances with the atoms joined together in different ways.

### 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 symbol equation** to represent a reaction.



A balanced symbol equation shows:

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

### What happens during a chemical reaction?

If a chemical reaction is happening you might:

- 1 see flames or sparks
- 2 notice a smell
- 3 hear 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

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	<b>endothermic</b>	thermal decomposition
to the surroundings from the reaction mixture	increases	<b>exothermic</b>	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 ( $\text{H}_2\text{O}$ ) 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**.

#### Burning fuels

**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**.

Fossil fuels produce carbon dioxide and water when combusted. This release of carbon dioxide is harmful to the environment and a cause of climate change.

**Hydrogen** can also be combusted and used as a fuel.

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



#### Key terms

Make sure you can write definitions for these key terms.

balanced symbol equation

catalyst

chemical reaction

combustion

conservation of mass

decomposition

endothermic

exothermic

fossil fuel

fuel

non-renewable

oxidation

physical change

product

reactant

reversible

thermal decomposition

word equation