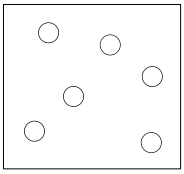
The Periodic Table & Chemical Reactions

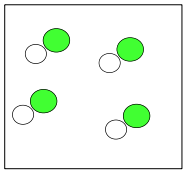
Elements & Compounds

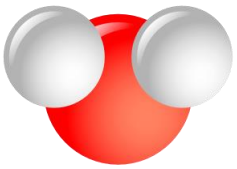
Elements are the simplest type of substance.
Compounds are made of **2 or more elements** joined together.

Substances are made up of **atoms**. Atoms are the smallest type of particle in substances.
Elements contain only **one type of atom**.



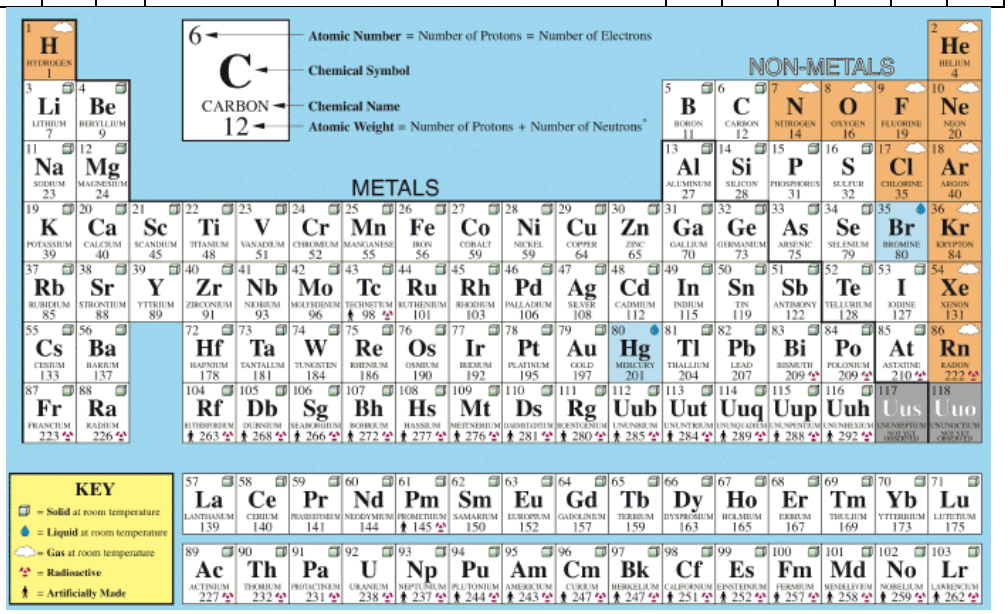
A **molecule** is made up of **2 or more atoms** joined together.





Elements can exist as solids, liquids or gases. Every element known to man is listed in the **Periodic Table**. This is split into **metals** and **non-metals**.

Group	1	2	Transition metals	3	4	5	6	7	8



Groups of the Periodic Table

The **rows** of elements are called **periods**.
The **columns** are called **groups**. Elements in the same group react in similar ways.

Group 1 metals all react with water and are called the **Alkali Metals**.
Group 2 metals are reactive with acid and are called the **Earth Metals**.
Group 7 elements are reactive and are known as the **Halogens**.
Group 8 elements are completely **unreactive** and are known as the **Noble Gases**.

Properties of Metals and Non-metals

Metals:

- Are shiny when polished.
- Can conduct electricity and heat.
- Are solids at room temperature (except mercury).

Non-metals:

- Can be solid, liquid or gas.
- Most have low melting points.
- Are poor conductors of electricity and heat.
- Solids are brittle.

Atomic Number, Names and Symbols

Every element has its own number, name and symbol. The number is called the **Atomic Number** and elements are listed in order of increasing atomic number.

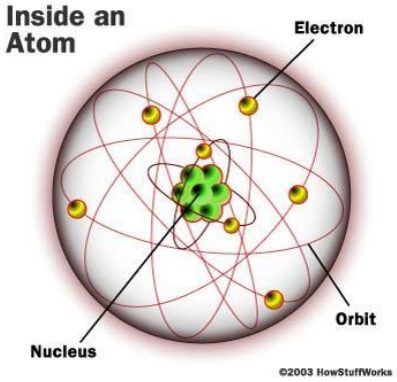
Every symbol has **one capital letter**. If a second letter is used it is a **small letter**.
The symbol usually comes from the name. For example, **Carbon** has the symbol **C**. **Calcium** has the symbol **Ca** to tell it apart from Carbon. **Magnesium** has the symbol **Mg**.

Some symbols do not seem to come from the name, eg. **Iron**'s symbol is **Fe**, **Lead**'s is **Pb**.
These have actually come from the **Latin** names of the elements.

Structure of the Atom

The atom is made up of 3 types of tiny particles:

- Protons
- Neutrons
- Electrons



the **Atomic Number** = the number of **protons**

If there is no charge on the atom:

the number of **protons** = the number of **electrons**

Particle (symbol)	Mass (a.m.u.)	Charge	Where it is found
Proton (p)	1	+1	nucleus
Neutron (n)	1	0	nucleus
Electron (e)	1/2000 = 0	-1	outside nucleus

Mass Number

The mass number = number of protons + number of neutrons

Chemical Change versus Physical Change

A chemical reaction occurs when a **new substance is formed**. This cannot be easily reversed.
Baking a cake, frying an egg or striking a match are examples of chemical reactions in everyday life.
A physical change can be easily reversed, such as changing states of matter.

Solid ⟷ Liquid ⟷ Gas

These changes are all reversible.

Dissolving a chemical is to make a solution is reversible as the solvent can be **evaporated** off. A **saturated** solution is one in which **no more solid can dissolve**.

Separating Mixtures

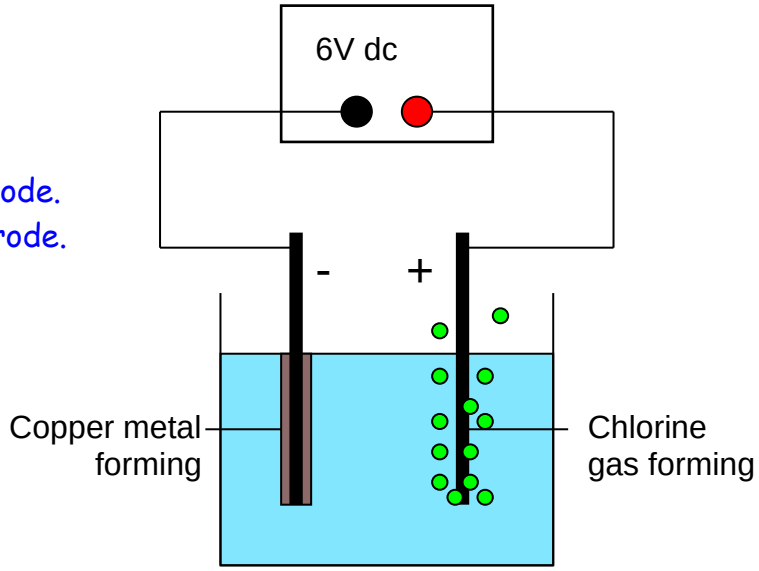
Mixtures can be easily separated as they are not chemically joined.
Iron can be separated from other elements using a **magnet**.
Soluble solids can be separated from liquids by **evaporation** of the liquid.
Insoluble solids can be separated from liquids by **filtration**.
Liquids can be separated by **distillation**.

Electrolysis

Electrolysis is the reaction which **breaks down a compound** into its elements using **electricity**.

Electrolysis of **copper chloride**:

Copper forms on the **negative** electrode.
Chlorine forms at the **positive** electrode.



Electrolysis of **water** produces **hydrogen** at the **negative** electrode and **oxygen** at the **positive** electrode. If collected these can be tested because:

- Hydrogen burns with a pop.
- Oxygen re-lights a **glowing** splint.

Writing Chemical Word Equations

We can write out any chemical reaction as a chemical word equation using just the **names** of the chemicals and some symbols.
The reactants go on the left and the products go on the right.

Reactants → Products

Examples:
Magnesium reacts with **hydrochloric acid** to produce **hydrogen** gas and the compound **magnesium chloride**.

magnesium + hydrochloric acid → magnesium chloride + hydrogen

Identifying Chemical Reactions

A **new substance** is always formed. The following are things to look out for to tell us a chemical reaction has occurred:

- Colour change
- Gas given off
- Temperature change (getting hotter or colder)
- Solid forming (from 2 liquids)

Reaction Rate

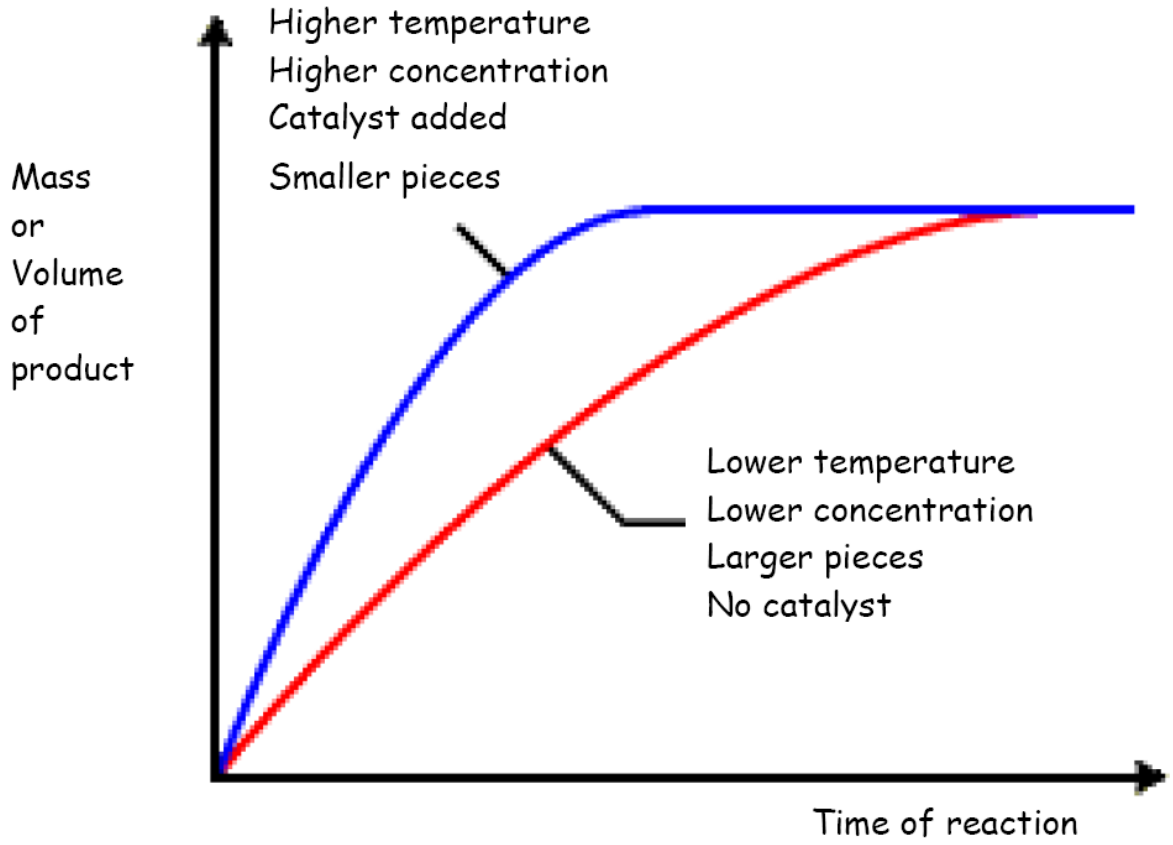
The **rate** is the **speed** of a reaction. This is always measured over time.

The rate of a chemical reaction can be **increased** by:

- Increasing the temperature
- Increasing the concentration
- Decreasing the particle size
- Adding a catalyst

A catalyst is **not used up** during a reaction, so it can be re-used.

Catalytic converters are fitted to cars to turn harmful gases produced by the car engine into harmless gases.



Enzymes

Enzymes are biological catalysts. An example is **amylase**, which is in our saliva. This breaks starch down into small sugar molecules which our body can use for energy.

How well an enzyme works depends on:

1. Temperature
2. pH

The temperature or pH at which an enzyme works best is called the optimum temperature or pH.

At too high a temperature or extreme pH, enzymes stop working completely. We say the enzyme has been denatured.