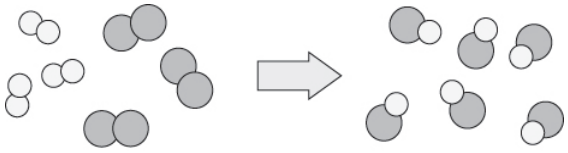
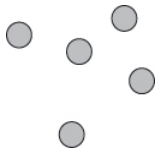
Dalton's atomic theory

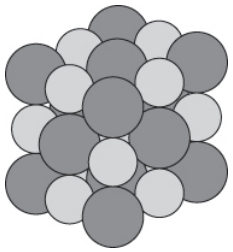
Dalton's theory stated that:

- All matter is made up of tiny particles called atoms.
- Atoms are indestructible, and cannot be created, or destroyed.
- The atoms in an element are all identical.
- In compounds, each atom of an element is always joined to a fixed number of atoms of the other elements.
- During chemical reactions, atoms rearrange, to make new substances. For example:





Atoms of an element



Atoms in a compound

Chemical reactions

Some signs of a chemical reaction include such as a colour change, a gas being produced, a solid forming in a solution and an increase/decrease in temperature.

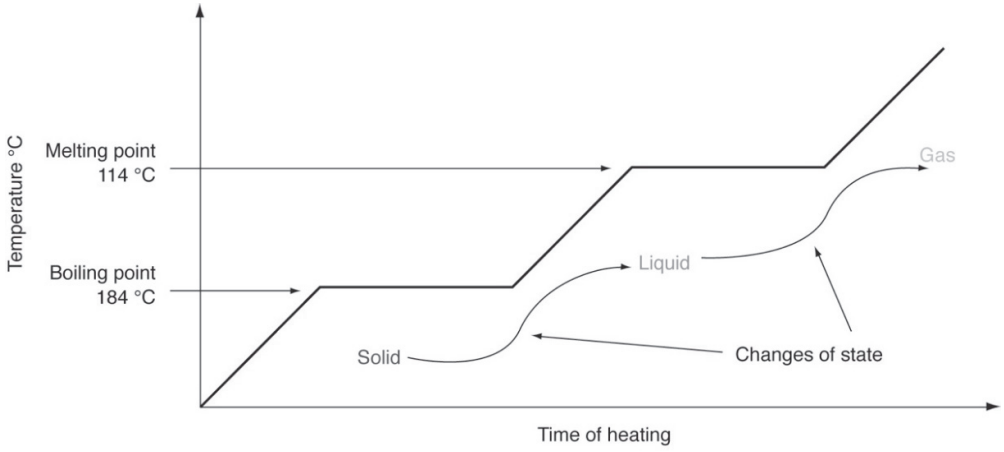
The **word equation** for the reaction in the diagram above is:

hydrogen + chlorine → hydrogen chloride
REACTANTS **PRODUCT**

No atoms are lost or gained so the mass of the reactants is equal to the mass of the products.

Changes of state

A change of state is a physical change. No atoms are lost or gained during a physical change and so the mass of the substance stays the same.



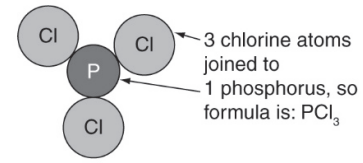
Elements and symbols

The **symbols** for the elements used today have been agreed by scientists in all countries. They are either a single or double letter. The first letter is always a capital letter.

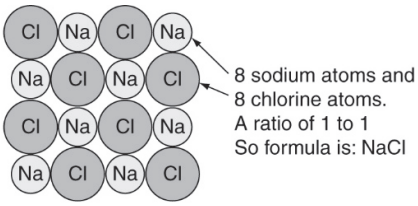
Examples:

nitrogen = **N** lithium = **Li**
sulfur = **S** copper = **Cu**
chlorine = **Cl** iron = **Fe**

Formulae



Phosphorus, chloride
PCl_3



Sodium chloride
NaCl

The **chemical formula** of a substance tells you the number of atoms of each element that are joined in its molecules, or the ratio of atoms of each element in the compound.

Metals and non-metals

The common **properties** of most **metals** are:

- high melting points (most are solids)
- strong, **malleable** and **ductile**
- shiny (when polished)
- good **conductors of heat and electricity**.

The common properties of most **non-metals** are:

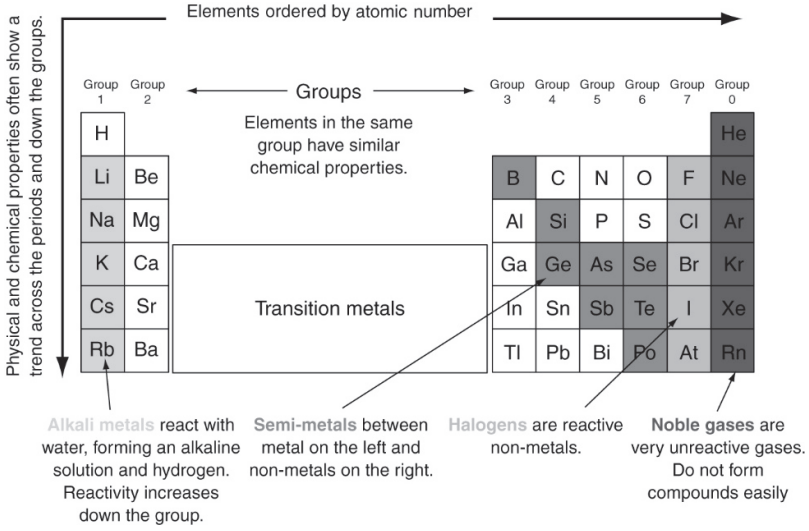
- low melting point
- **brittle** (when solid)
- not shiny
- poor conductors of heat and electricity.

The properties of a substance are what it looks like or what it does. There are two types:

- **chemical properties** (e.g. flammability, pH, reaction with acid)
- **physical properties** (e.g. melting point, boiling point, density).

Periodic table

Mendeleev originally ordered the elements in the **periodic table** by their masses. Today, the elements are in order of **atomic number** (the number of particles called **protons** in an atom). Elements with similar properties are in the same vertical **group**. The periodic table allows us to spot trends and patterns in these groups and across the rows (**periods**).



Metal and non-metal oxides

Many elements burn in air/oxygen to form oxides; e.g.:

- calcium + oxygen → calcium oxide
- carbon + oxygen → carbon dioxide
- metal oxides tend to form alkaline solutions.
- non-metal oxides tend to form acidic solutions.

Metal oxides are **bases** and react with acids in **neutralisation** reactions:

acid + base → salt + water

e.g. hydrochloric acid + magnesium oxide → magnesium chloride + water

sulfuric acid + copper oxide → copper sulfate + water