

## Topic 1 AQA Chemistry GCSE- Atomic structure and the periodic table.

- Triple Science Content only in purple
- Triple Science and Higher Content Only in blue

- **Atoms** are the smallest units of an element.
- **Chemical symbols** represent atoms of elements, for example, "O" stands for an atom of **oxygen**.

**Compounds** form when elements chemically bond through a reaction.

**Chemical reactions** always result in the creation of one or more new substances, and often involve a change in energy (like heat being released or absorbed).

Compounds are made up of **two or more elements** that are chemically combined.

These compounds are shown using **chemical formulas**, which use the symbols of the atoms they are made from e.g NaCl

Compounds can only be broken down into their original elements through another **chemical reaction**.

### Mixtures

A mixture-

**2 or more elements/compounds not chemically combined together.**

**Separating techniques to separate components in a mixture:**

**Filtration** : Liquid containing insoluble solid is filtered through filter paper. The Filter paper collects the solid

**Crystallisation:** Using evaporation to allow salt crystals to form. The evaporating basin is wide, which gives the liquid a large surface area for quicker evaporation

**Simple distillation:** Liquid containing soluble solid is boiled until the liquid evaporates and is then condensed in a condenser and retrieved.

**Fractional distillation:** Crude oil is heated and boiled. Evaporation moves up the fractionating column. Hydrocarbons with larger chains have higher boiling points, so are

collected near the bottom. Hydrocarbons with smaller chains have lower boiling points, so are collected near the top.

**Chromatography-** Soluble dye, move up the paper via the water and separate the different soluble substances in the dye.

### The development of the atom

Atoms were first theorised as tiny spheres.

Electrons were discovered which led to the plum-pudding model

**Alpha particle scattering experiment-** [▶ The Rutherford's Gold Foil Experiment Video](#)

Scattering experiment:

1	A beam of positively charged alpha particles fired at thin gold foil
2	Some alpha particles went straight through
3	Some of the alpha particles came out <b>at different angles</b> , and some came back
4	The <b>alpha particles</b> were being deflected because of a positive charge in the atom (the nucleus)

### Subatomic Particles (Protons, Electrons, Neutrons)

Atomic number: the number of **protons** in an atom of an element.

An atom has an **overall charge** of 0, therefore Number of protons = the number of electrons in an atom of an element.

E.g Na has an atomic number of 11. Therefore has 11 **protons**, and 11 **electrons**.

Atoms are **very small** and the mass of the atom is mainly in the nucleus (which contains the protons and neutrons)

The radius of an atom: **0.1 nm**

## Definitions

**Mass number:** number of the protons and neutrons in an atom

**Atomic number-** number of protons the atom has.

**Isotopes:** atoms of the same element with different number of neutrons (have same number of protons and electrons)

**Relative atomic mass:** The average mass, taking into account the isotopes of an element, relative to 1/12 of Carbon 12.

Mass of a Proton and Neutron- 1

For Electron **its 0**

## Structure of an atom based on Electrons, and Electron Shells - Electronic Structure

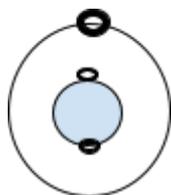
The centre of the atom is a **nucleus**, this contains **protons and neutrons**.

Atoms have **electron shells**. These electron shells have **electrons on them**.

**The Electronic structure of an atom** tells you how many electrons are in each shell

e.g for Lithium 2 electrons in shell 1 ( closest to nucleus), 1 in shell 2.

Electronic structure: 2,1



Lithium Cell (Yeah sorry for the bad drawing lol)

## The Periodic Table

### Early

The early periodic tables were not complete.

Some elements were placed in the wrong groups

## Modern

- Elements are arranged in order of **atomic number**

The Group Number - Shows how many **electrons** are in the outer shell of that electron.

(Elements in the same group have the same number of electrons in the outer shell, so have similar **chemical properties**.)

The Period Number- Shows how many **electron shells** the atom has.

- **Periodicity-similar properties occur at regular intervals.**

## Dmitri Mendeleev-

- Dmitri Ordered table via atomic mass
- He Left gaps for elements not yet discovered.

- Elements with properties predicted by Mendeleev were discovered and filled the gaps.

**Knowledge of isotopes made it possible to explain why order based on atomic weights was not always correct.**

- When electrons, protons and neutrons were discovered, elements were ordered in atomic number.

## Metals and non-metals

- Elements that form **positive ions** are metals - metals mainly form positive ions.
- Elements that form negative ions are non-metals - excluding Hydrogen

## Group 1 – Alkali metals

- They have 1 electron in outer shell
- Have low density
- They all react with oxygen to make oxides (hence are stored in oil to prevent rusting or oxidising)
- All react with chlorine to form a white precipitate.
- The reactivity of the elements increases going down the group:

Reaction with:	Oxygen	Water	Chlorine
Lithium	Red flame and white solid	Fizzes until it disappears	White powder
Sodium	Orange flame and white solid	Rapid fizzing	Bright yellow flame
Potassium	Lilac flame	Ignites with sparks	More vigorous than Sodium

They also react vigorously with water to make an alkaline solution.

### **Group 0 – Noble gases**

- Have full outer shell electrons (have 8 electrons in outer shell) except for helium which has 2.
- Therefore they are **unreactive**
- The boiling points of the noble gases increase as you go down the group

### **Group 7 – The halogens**

- Similar chemical properties as they all have 7 electrons in the outer shell.
  - Diatomic e.g exists as Cl<sub>2</sub> rather than just Cl (Chlorine)
  - They react with metals to form ionic compounds (metal halides) which the halide ion has a -1 charge.
  - they react with **nonmetals** to form **covalent compounds**
  - as you go **down the group** melting point and boiling point all increase
  - Reactivity decreases down the group due to there being more electron shells, therefore the outer shell is further away from the nucleus, so there is a weaker electrostatic attraction. Therefore it is harder to attract an electron as the outer shell is further away.
- more reactive halogen can displace a less reactive one in a reaction.

- E.g. Bromine will displace Iodine .
- Bromine + Potassium Iodide → Potassium Bromide + Iodine

## **Properties of Transition Metals**

### **Compared to group 1, the transition elements:**

- Are Harder
- Are Stronger
- Have Higher Densities
- Higher Melting Points
- Not that reactive

### **Typical properties**

- They have ions with different positive charges e.g +2,+3 etc.
- Form coloured compounds
- Are useful as catalysts.