

**What is an element?**

An element is a pure substance that made up of only type of atom. It can not be broken down chemically into anything simpler.

**Compounds & Mixtures** – Compounds contain 2 or more elements chemically combined together. They cannot be separated by physical processes (i.e. filtering, boiling etc). Mixtures can be separated because the substances in them are not chemically joined together. They are usually separated by filtering, crystallisation (see topic 4), distillation (see topic 7) and chromatography (see topic 8). Filtering is used to separate soluble substances (ones that dissolve) from insoluble substances (e.g. sand and water).

**The Periodic Table** - The table is called a periodic table because similar properties occur at regular intervals. Early scientists (e.g. Newlands and his law of octaves) arranged the elements in order of their atomic weights. However, it was Mendeleev who finally solved the puzzle...

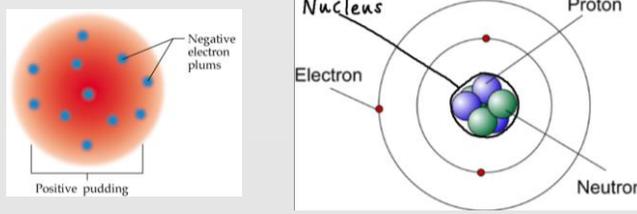
- Mendeleev overcame some of the problems by leaving gaps for elements that had not been discovered and in some places changed the order based on atomic weights (so they fitted into the groups with similar properties).
- The elements were later discovered and fitted in the gaps where Mendeleev had predicted.

Elements are now in order of atomic number (number of protons).  
**Group number** – tells us the number of electrons in the outer shell  
**Period number** – tells us the number of shells.

**Structure of the atom**

Atoms are very small, having a radius of about 0.1 nm (1 x 10<sup>-10</sup> m). The radius of a nucleus is less than 1/10 000 of that of the atom (about 1 x 10<sup>-14</sup> m).

In 1897 J J Thompson discovered the electron which led to **the plum-pudding model** of the atom. The plum pudding model suggested that the atom was a ball of positive charge with negative electrons embedded in it.



In 1909, Geiger and Marsden bombarded gold leaf with alpha particles and finding that some alpha particles (1 in 8000) bounced back suggested that most of the atom was empty space.

In 1911, Lord Rutherford suggested existence of a nucleus carrying most of the mass of the atom and carrying a positive charge. He came up with the **nuclear model** of the atom. Niels Bohr adapted this model with electrons orbiting a nucleus at fixed distances i.e. in electron shells (known as the **Bohr model**).

Finally neutrons were discovered in 1932 by James Chadwick. This discovery gave rise to the existence of isotopes.

**Isotopes**

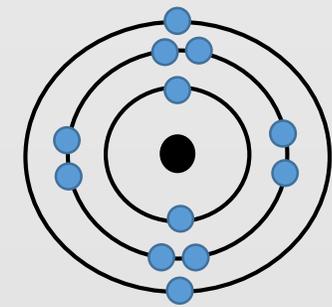
Isotopes are atoms with the same number of protons but a different number of neutrons.

e.g.

${}^7_3\text{Li}$	${}^8_3\text{Li}$
3 protons	3 protons
3 electrons	3 electrons
4 neutrons	5 neutrons

**Electronic Structure**

Electrons are found in shells (energy levels) that orbit the nucleus. Electrons fill the shells from the inner shell outwards.  
2 electrons can fit in the 1<sup>st</sup> shell  
8 electrons can fit in the 2<sup>nd</sup> shell  
8 electrons can fit in the 3<sup>rd</sup> shell  
So if an atom has 12 electrons, we can write it's electron arrangement as 2.8.2.  
We would draw it like so.....



We always fill the electrons top and bottom in the first shell, then fill top, right, bottom, left and then pair up again.

**Atomic Number & Mass Number**

Each element in the Periodic Table is given two numbers. The atomic number or proton number is (number of protons).

The mass number tells us the number of protons and neutrons added together (see table below).

In atoms the number of protons is equal to the number of electrons (hence why atoms have no overall electrical charge).

Name	Relative Mass	Relative Charge
Proton	1	+1
Neutron	1	0
Electron	0 (or very small)	-1

