

Elements, Mixtures and Compounds

Rule 1 - If two identical elements combine then the name doesn't change

Rule 2 - When two elements join the end is usually _____ide.

Rule 3 - When three or more elements combine and one of them is oxygen the ending is _____ate

An element is just a pure substance, for example oxygen (O₂)

A compound is a material that is made up of more than one type of atom chemically bonded together, for example Carbon Dioxide (CO₂)

A mixture contains two or more different types of compounds or elements that are not chemically bonded together

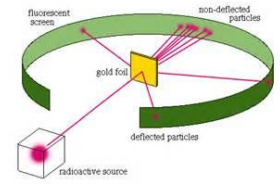


Atomic Structure

1. In 1901 JJ Thompson suggested the **plum pudding model** - this was an **atom** that the atom is a ball of positive charge with negative electrons embedded in it.

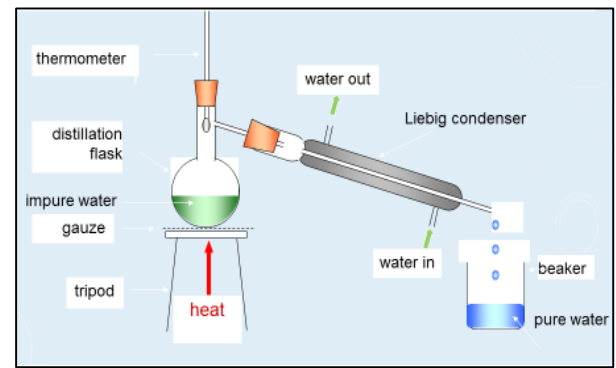


2. In 1909 Rutherford changed the accepted model using his alpha scattering experiment. The results from the alpha particle scattering experiment led to the conclusion that the mass of an atom was concentrated at the centre (nucleus) and that the nucleus was charged. This nuclear model replaced the plum pudding model.



3. Niels Bohr adapted the nuclear model by suggesting that electrons orbit the nucleus at specific distances.
4. 20 years later, James Chadwick provided the evidence to show the existence of neutrons within the nucleus.

Distillation



Distillation can be used to separate liquids from a mixture, if they have different boiling points. Distillation is the process in which evaporation of a liquid is followed by condensation

The Atom

Mass Number → 12
Atomic Number → 6

Name of particle	Relative charge	Relative mass
Proton	+1	1
Neutron	0	1
Electron	-1	Very small

Atoms are very small, having a radius of about 0.1 nm (1 × 10⁻¹⁰ m).

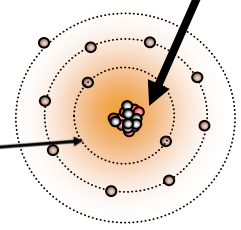
The radius of a nucleus is less than 1/10 000 of that of the atom (about 1 × 10⁻¹⁴ m).

The Nucleus
a dense core of protons and neutrons containing nearly all the mass of the atom

The mass number tells us the number of protons + neutrons.

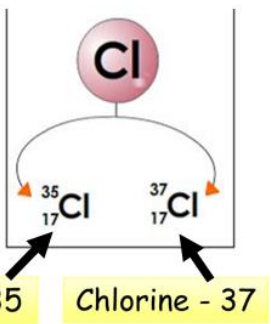
The number of protons in an atom is known as its atomic number, this is also the number of electrons

'Shells' of electrons
electrons are really very very tiny so the atom is mostly empty space.



Relative Atomic Mass

RAM is the average mass of all the stable isotopes of that element and includes the relative abundance.



Element	Relative mass of isotope	Relative abundance
Chlorine	35	3
	37	1

$$\text{R.A.M.} = \frac{(35 \times 3) + (37 \times 1)}{3 + 1} = 35.5$$

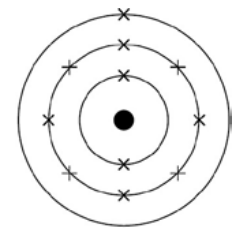
Electronic Structure

The electrons in an atom occupy the lowest available energy levels (innermost available shells).

The electronic structure of an atom can be represented by numbers or by a diagram.

Up to two electrons can occupy the lowest energy level, up to eight in the second energy level and up to eight in the third energy level.

For example, the electronic structure of sodium is 2,8,1.



Development of the Periodic Table



Newlands



Mendeleev



Before the discovery of protons, neutrons and electrons, scientists attempted to classify the elements by arranging them in order of their atomic weights.

The early periodic tables were incomplete and some elements were placed in inappropriate groups if the strict order of atomic weights was followed.

Mendeleev overcame some of the problems by leaving gaps for elements that he thought had not been discovered and in some places changed the order based on atomic weights.

Elements with properties predicted by Mendeleev were discovered and filled the gaps. Knowledge of isotopes made it possible to explain why the order based on atomic weights was not always correct.

Transition Metals (Triple Only)

The transition elements are metals with similar properties. Their properties are different from those found in Group 1. Lots of transition metals are used as catalysts.

Properties of transition metals:

- High melting + boiling point
- Form positive ions
- Good electrical conductors
- High thermal conductivity
- Malleable
- Form colored compounds

Copper Good conductor of heat and electricity	Iron Alloys are very strong	Manganese Resistant to corrosion
Cobalt Strong when alloyed with other metals	Chromium Can speed up reactions (Catalyst)	Nickel Alloys are resistant to corrosion

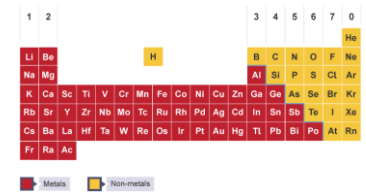
Metals and non-metals

Elements that react to form positive ions are metals. Elements that do not form positive ions are non-metals.

The formation of ions can be worked out using the Periodic Table:

- Group 1 elements form 1+ ions, group 2 elements form 2+ ions and group 3 elements form 3+ ions.
- Group 5 elements form 3- ions, group 6 elements form 2- ions and group 7 elements form 1- ions.
- Group 0 do not form ions due to having a stable structure/full outer shell.

The majority of elements are metals. Metals are found to the left and towards the bottom of the periodic table. Non-metals are found towards the right and top of the periodic table.



Group 0

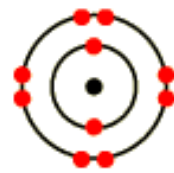
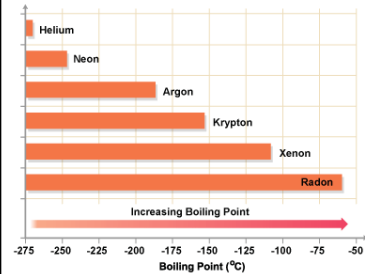
The elements in Group 0 of the periodic table are called the noble gases.

They are unreactive and do not easily form molecules because their atoms have stable arrangements of electrons.

The noble gases have eight electrons in their outer shell, except for helium, which has only two electrons.

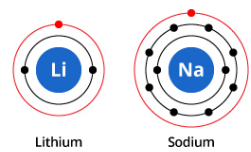
The boiling points of the noble gases increase with increasing relative atomic mass (down the group).

- He
- Ne
- Ar
- Kr
- Xe
- Rn



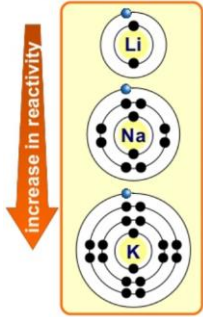
Group 1

The elements in Group 1 of the periodic table are known as the alkali metals and have characteristic properties because of the single electron in their outer shell.



How does electron structure affect reactivity?

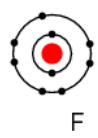
The reactivity of alkali metals **increases** going down the group. What is the reason for this?



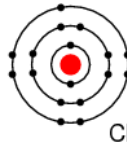
- The atoms of each element get larger going down the group.
- This means that the outer shell electron gets further away from the nucleus and is shielded by more electron shells.
- The further an electron is from the positive nucleus, the easier it can be lost in reactions.
- This is why the reactivity of the alkali metals increases going down group 1.

Group 7

The elements in Group 7 of the periodic table are known as the halogens and have similar reactions because they all have seven electrons in their outer shell.



The halogens are non-metals and consist of molecules made of pairs of atoms.



In Group 7, the further down the group an element is the higher its relative molecular mass, melting point and boiling point.

In Group 7, the reactivity of the elements decreases going down the group.

A more reactive halogen can displace a less reactive halogen from an aqueous solution of its salt.

Displaced is just a chemist's word for pushed out.

