

AQA C1a Atomic Structure TRIPLE CHEMISTRY

Atoms, elements and compounds

atom	smallest part of an element that can exist
molecule	two or more atoms, bonded together
element	only one type of atom. Shown on the periodic table.
compound	two or more <u>elements</u> , bonded together

Compounds are formed from elements in chemical reactions. We can show reactions with word or symbol equations.
reactants → products

Structure of the atom

Atoms are very small. They have a radius of about 0.1 nanometres. The nucleus is much smaller than the whole atom - about 10 000 times smaller.

Atoms are made of protons, neutrons and electrons.

The atomic number tells us the number of protons.

Atoms have the same number of protons and electrons – they are neutral overall.

The mass number is the sum of the protons and neutrons.

Particle	Charge	Relative Mass
Proton	+1	1
Neutron	0	1
Electron	-1	0

Atoms of the same element have the same number of protons.

Atoms of the same element can have a different number of neutrons.

These are called isotopes. They have the same chemical properties because they still have the same number of electrons.

Mixtures

Two or more elements or compounds, not chemically combined together. They can be separated by techniques such as:

- filtration
- distillation
- chromatography
- crystallisation

You need to be able to describe, explain and carry out each of these by your GCSE exams.

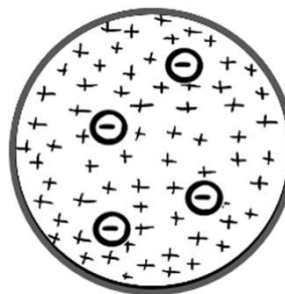
Development of the model of the atom

Over time, new evidence has helped our model of the atom to develop.

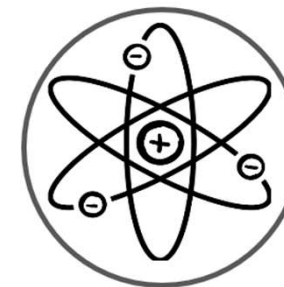
John Dalton thought atoms were tiny spheres that could not be divided.

JJ Thomson discovered the electron and created the “plum pudding” model of the atom. This is a ball of positive charge with negative electrons in it.

Rutherford did an experiment. He fired positive “alpha particles” at thin gold atoms. He expected them all to go straight through. He was surprised to find that although most went straight through, some were reflected, and some were deflected through wide angles. This was evidence for a small, positive, dense nucleus. It showed that most of the atom was empty space.



Plum pudding model



Nuclear model

Later, Chadwick discovered the neutron, and Bohr realised that electrons must orbit the nucleus in specific energy levels or shells.

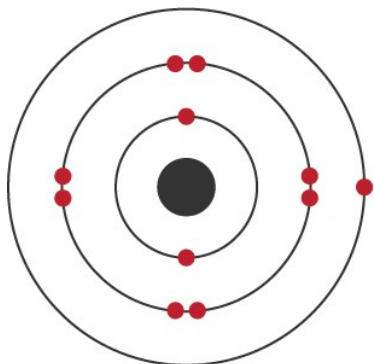
Electronic structure

Electrons fill energy levels (shells) from low levels to the outer levels.

The first shell can fit a maximum of 2 electrons, with each other shell having a maximum of 8.

This rule is true for the first 20 elements, but after that we have to remember that the group number = number of electrons in outer shell.

We can show electrons as dots or crosses. For example, sodium (11 electrons) can be written as 2,8,1 or drawn as:



Relative atomic mass

The relative atomic mass of an element is the average mass of the atoms of an element, taking into account the abundance (amount) of each isotope.

To find the relative atomic mass, multiply the abundance of each isotope by the mass number of each isotope, and add them up. Then, divide by the total abundance.

For example, chlorine is 75% chlorine-35, and 25% chlorine-37:

$$A_r = \frac{\text{total mass of atoms}}{\text{total number of atoms}} = \frac{(75 \times 35) + (25 \times 37)}{(75 + 25)}$$

$$A_r = \frac{2625 + 925}{100} = \frac{3550}{100}$$

$$A_r = 35.5 \text{ (to 1 decimal place)}$$