The Sciences (Double Award)

2.1.4 Isotopes and relative atomic mass

In all atoms of the same element, the number of protons and electrons is always the same. However, some elements can have more than one atom type. These different atoms have different numbers of neutrons. These different atoms of the same element are called isotopes.

Isotopes have:

- the same atomic number / the same number of protons
- different mass numbers / different numbers of neutrons.

Example:

Chlorine has two isotopes, chlorine-35 and chlorine-37.

Chlorine-35	Chlorine-37
$^{35}_{17}\mathrm{Cl}$	$^{37}_{17}\mathrm{Cl}$
Atomic number is 17.	Atomic number is 17.
Mass number is 35.	Mass number is 37.
This atom of chlorine has: • 17 protons • 17 electrons • 35 – 17 = 18 neutrons.	This atom of chlorine has: • 17 protons • 17 electrons • 37 - 17 = 20 neutrons.

The relative atomic mass, Ar, of an element is the average mass of the atoms of that element, based on the natural mix of its isotopes. To calculate the relative atomic mass, Ar, of an element, the masses and abundances of its isotopes are put into the following formula (this will be given in an exam).

$$A_r = \frac{(\%\ of\ isotype \times mass) + (\%\ of\ isotype \times mass)}{100}$$

Please note: The relative abundance of an isotope simply means how much of each isotope there is compared to the total amount of the element.

For example, in any given sample of chlorine, 25% is chlorine-37 and the rest is chlorine-35. Calculate the relative atomic mass, A_r, of chlorine.

$$A_r = \frac{(37 \times 25) + (35 \times 75)}{100} = 35.5$$

This is why the relative atomic mass of chlorine is shown as 35.5 on the periodic table.