

Module 2: Foundations in Chemistry

2.1 Atoms and Reactions

2.1.1 Atomic Structure and Isotopes

Subatomic Particles:

	relative mass	relative charge
Proton	1	+1
neutron	1	0
electron	1/2000	-1

The nucleus contains protons and neutrons - it has a positive charge

A cloud of negatively charged electrons surrounds the nucleus.

Atomic (proton) number: the number of protons. This defines the element.

Mass number:- the number of protons + neutrons

Number of neutrons = Mass no - Atomic no.

Atoms are neutral so they have the same number of protons and electrons

Ions have a charge - the number of protons and electrons is not the same. A 2+ charge means two more protons than electrons.

Isotopes are atoms of the same element with different numbers of neutrons and different masses (different mass number).

They have the same atomic no (they are the same element).

They have the same number of protons but a different number of neutrons.

In all other respects they are identical. Isotopes have the same chemical properties.

Relative Masses

Relative Atomic Mass, A_r The weighted mean mass of an atom of an element compared with one-twelfth of the mass of an atom of carbon-12.

Calculation of relative atomic mass from relative abundances

e.g. A sample of silicon contains 92% of silicon 28, 5% of silicon 29 and 3% of silicon 30. Calculate the relative atomic mass of the silicon sample.

$$92/100 \times 28 + 5/100 \times 29 + 3/100 \times 30 = 28.11$$

Module 2: Foundations in Chemistry

2.1 Atoms and Reactions

If a **mass spectrum** is given, % composition may be read off the vertical axis and the calculation completed as above.

Relative isotopic mass is the mass of an atom of an isotope compared with one-twelfth of the mass of an atom of carbon-12. It is not an average.

Relative molecular mass, M_r of a compound is the weighted mean mass of a molecule compared with one-twelfth of the mass of an atom of carbon-12.
It is the sum of the relative atomic masses of the atoms in the molecule.

Relative formula mass, M_r is used for ionic compounds. It is the weighted mean mass of a formula unit compared with one-twelfth of the mass of an atom of carbon-12.
It is the sum of the relative atomic masses of the atoms in the formula.