

The Atom

Atoms are the smallest particles. Each atom consists of a nucleus and a cloud of particles called electrons that whizz around the nucleus.

An element is a substance that contains only one kind of atom.

The periodic table is the “map/address book” for elements where each element is given a symbol (E.g. K for potassium). The group of elements that have similar properties are put in a numbered column. For example, if you know how one element in group 1 behaves, you can easily guess how the others in the same group will behave.

The rows are called periods. The zig-zag line separates metals from non-metals, with the non-metals on the right. So most elements are metals.

A compound contains atoms of different elements joined together where the atoms are chemically combined. For example carbon dioxide is a compound of carbon and oxygen (1 carbon and 2 oxygen molecules).

The symbol for compound is made from the symbols of the elements in it. So the formula for carbon dioxide is CO₂.

Isotopes and Radioactivity

You can identify an atom by the number of protons in it. For example, only sodium atoms have 11 protons.

Isotopes are atoms of the same element, with different numbers of neutrons.

Some isotopes are radioactive. That means its nucleus is unstable, sooner or later the atoms breaks down or decays, giving out radiation in the form of rays and tiny particles, as well as large amount of energy.

Like carbon-14, a number of other elements have radioisotopes that occur naturally and eventually decays. But the other two isotopes of carbon (like most natural isotopes) are non-radioactive.

You can know when radioisotopes decay by looking at their half life. Radiation affects humans as it may cause them radiation sickness but radiation also has some uses.

Uses of radiation:

1. Check for leaks in pipes (industry)

This is done by adding a radioisotope to the oil or gas. At a leak, the radiation is detected using an instrument. Radioisotopes used in this way are called tracers.

2. in cancer treatment (Medical)

Radioisotopes can cause cancer but yet also can cure it. Using radiotherapy the radioisotope will decay and give out rays that can kill cancer cells. These rays will be aimed exactly at the cancer cells.

3. To find the age of old remains

A tiny percentage of a living thing contains carbon-14 atoms. When living thing dies it no longer takes in new carbon atoms. But existing carbon-14 atom decay over time - we can measure the faint radiation from them.

How electrons are arranged

The electrons in an atom circle fast around the nucleus, at different levels from it. These energy levels are called electron shells. The further the shell is from the nucleus, the higher the energy level.

Each shell can hold a limited number of electrons.

First shell can hold up to 2 electrons

Second shell can hold up to 8 electrons

The third shell can also hold up to 8 electrons

Electronic configuration means the arrangement of electrons in an atom.

Example:

- Argon has the electronic configuration : 2,8,8
- Magnesium has the electronic configuration : 2,8,2

Important points:

- The shells fill in order, from lowest energy level to highest energy level
- All the elements in a group have the same number of electrons in their outer shells. These are called Valency electrons.
- The group number is the same number of outer shell electrons
- The period number shows how many shells there are.
- If an element possesses a full outer shell, the element become unreactive