

Unit 2: Atoms and Elements

Atoms, Elements and Compounds

- The sub atomic particles in an atom are protons, neutrons, and electrons
- A proton has a charge of +1 and a relative mass of 1
- A neutron has no charge and a relative mass of 1
- An electron has a charge of -1 and a negligible mass of 0.0054
- Atoms are neutral because they have equal numbers of protons and neutrons
- The number of protons and neutrons in an atom is called the nucleon or atomic mass number
- Numbers arranged in order of their proton number in the periodic table

Elements, Compound and Mixtures

- Elements are substances made up of one type of atom
- A compound is a substance made up of two or more different types of atoms joined together
- A molecule is the same or different atoms joined together by covalent bonds
- A mixture contains two or more elements or compounds that are not chemically joined together. Mixtures do not have a fixed composition. The substances in a mixture can be separated by physical means.

Electronic Structure

- Electrons are arranged in shells or energy levels around the nucleus
- Electrons spin in orbits around the nucleus constantly
- The arrangement of electrons in shells is called electronic configuration
- The first shell contains a maximum of 2 electrons, the second, third and fourth shell hold a maximum of 8 electrons
- The electrons in the outer shell are called the valence or valency electrons
- The valence electrons are important to determine the chemical properties of elements
- Elements in the periodic table are grouped according to the number of valence electrons

Isotopes

- Atoms of the same element with the same number of protons but a different number of neutrons
- If an isotope is radioactive its nucleus is unstable and so it breaks down over a period of time (it decays). As it decays the nucleus gives out tiny particles or rays. We call these isotopes: radioisotopes. The radiation given out by radioisotopes can be harmful
- Although radioisotopes are harmful they are useful:
 - i. Medicinal purposes: treatment of cancer cells, thyroid glands, for locating tumors and sterilizing medical equipment
 - ii. Industrial-used to check for leaks in gas and oil pipelines and regulate the thickness of paper during manufacture

Metals and Non-metals

Physical properties

<u>Metals</u>	<u>Non-metals</u>
Have high densities (exceptions: Group I metals and gallium)	Have low densities
Have high melting and boiling points (exceptions: Group I metals and mercury)	Low melting and boiling points (exception: carbon and silicon)
Hard, cannot be scratched easily and strong (exceptions: Group I metals, mercury, gallium)	Soft, can be scratched easily (exception: diamond)
Good conductors of electricity	Do not conduct electricity (exception: graphite)
Good conductors of heat	Do not conduct heat (exception: graphite)
Malleable	Brittle
Ductile	Not ductile
Lustrous	Dull surface (exceptions: graphite and iodine)
Sonorous	Not sonorous

Chemical Properties

<u>Metals</u>	<u>Non-metals</u>
Metal oxides are basic	Non-metal oxides are acidic
Metals react with acids to give off hydrogen gas	Non-metals do not react with acids
When they react, metals form positive ions by losing electrons	When they react, non-metals form negative ions by gaining electrons (exception: hydrogen)