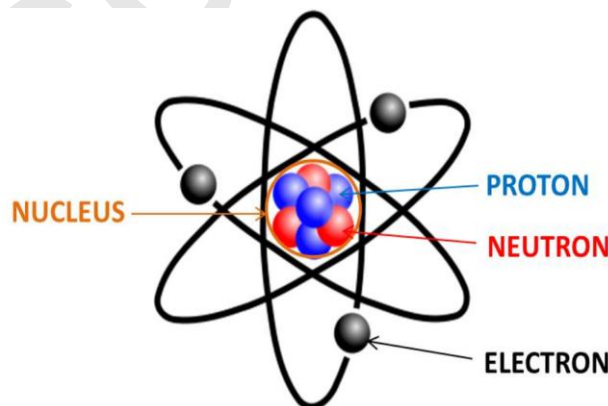
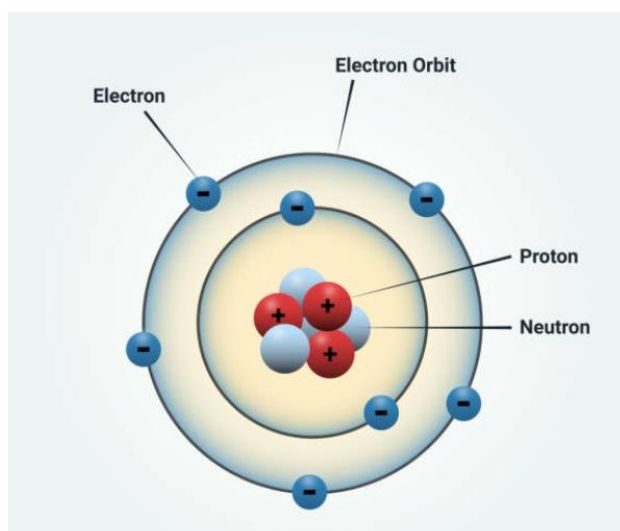


Chapter-1

Atomic structure

Fundamental Particles and Atomic Structure

- **The Atom:** Atoms are the smallest parts of an element that can participate in chemical change and contain only one type of particle. An atom consists of a **very small, dense nucleus** surrounded by **mostly empty space** where electrons are found in regions called shells.
- **The Nucleus:** Located at the center of the atom, the nucleus contains **nucleons**, which are categorized into two types: **protons** and **neutrons**. Nearly all the atom's mass is concentrated here.
- **Electrons:** These negatively charged particles move around the nucleus in **electron shells** (or energy levels).



Properties of Subatomic Particles

The three main subatomic particles differ in their relative mass and charge:

- **Protons:** Have a relative mass of 1 and a relative charge of **+1**.
- **Neutrons:** Have a relative mass of 1 and a relative charge of **0** (uncharged).
- **Electrons:** Have a very small relative mass (approximately 1/2000th of a proton) and a relative charge of **-1**.

In a **neutral atom**, the number of protons always equals the number of electrons, resulting in no overall charge.

Atomic and Mass Numbers

- **Atomic (Proton) Number (Z):** This is the number of protons in the nucleus. It is unique to each element and determines its identity (e.g., any atom with 11 protons is sodium).
- **Mass (Nucleon) Number (A):** This is the total number of protons and neutrons in the nucleus.
- **Calculations:** The number of neutrons in an atom can be calculated by subtracting the atomic number from the mass number ($A - Z$).

Subatomic particle	Relative mass	Relative charge	Actual charge
Proton	1	+1	$+1.6 \times 10^{-19}$ coulomb
Neutron	1	0	
Electron	$\frac{1}{1836}$	-1	-1.6×10^{-19} coulomb

Isotopes and Ions

- **Isotopes:** These are atoms of the same element that have the **same number of protons but different numbers of neutrons**. While they have the same chemical properties, they differ in physical properties such as mass and density.
- The chemical properties of an element are determined by its electronic configuration, and physical properties are determined by its mass. Isotopes of an element have **the same electronic configuration but different masses**.
- **Ions:** These are charged particles formed when atoms **gain or lose electrons**.
 - **Positive Ions (Cations):** Formed when an atom loses one or more electrons.
 - **Negative Ions (Anions):** Formed when an atom gains one or more electrons.

Behavior in Electric Fields

Scientific experiments fire beams of subatomic particles through electric fields to deduce their charges:

- **Proton beams** are deflected away from positive plates and toward negative ones because they are positively charged.

- **Electron beams** are deflected toward positive plates because they are negatively charged. Due to their much smaller mass, **electrons are deflected more easily than protons.**
- **Neutron beams** are not deflected, confirming they carry no charge.

