
CBSE Class-12 Physics Quick Revision Notes
Chapter-04: Moving Charges and Magnetism

- **Force on a Straight Conductor:**

Force F on a straight conductor of length l and carrying a steady current I placed in a uniform external magnetic field B ,

$$\vec{F} = I\vec{l} \times \vec{B}$$

- **Lorentz Force:**

Force on a charge q moving with velocity v in the presence of magnetic and electric fields B and E .

$$\vec{F} = q(\vec{v} \times \vec{B} + \vec{E})$$

- **Magnetic Force:**

The magnetic force $\vec{F}_B = q(\vec{v} \times \vec{B})$ is normal to \vec{V} and work done by it is zero.

- **Cyclotron:**

A charge q executes a circular orbit in a plane normal with frequency called the cyclotron frequency given by,

$$\nu_c = \frac{qB}{2\pi m}$$

This cyclotron frequency is independent of the particle's speed and radius.

- **Biot – Savart Law:**

It asserts that the magnetic field $d\vec{B}$ due to an element $d\vec{l}$ carrying a steady current I at a point P at a distance r from the current element is,

$$d\vec{B} = \frac{\mu_0}{4\pi} I \frac{d\vec{l} \times \vec{r}}{r^3}$$

- **Magnetic Field due to Circular Coil:**

Magnetic field due to circular coil of radius R carrying a current I at an axial distance X from the centre is

$$B = \frac{\mu_0 I R^2}{2(X^2 + R^2)^{3/2}}$$

At the centre of the coil,

$$B = \frac{\mu_0 I}{2R}$$

- **Ampere's Circuital Law:**

For an open surface S bounded by a loop C , then the Ampere's law states that

$$\oint_C \vec{B} \cdot d\vec{l} = \mu_0 I$$

where I refers to the current passing through S .

- If B is directed along the tangent to every point on the perimeter then
-

$$BL = \mu_0 I_e$$

Where I_e is the net current enclosed by the closed circuit.

- **Magnetic Field:**

Magnetic field at a distance R from a long, straight wire carrying a current I is given by,

$$B = \frac{\mu_0 I}{2R}$$

The field lines are circles concentric with the wire.

- **Magnetic field B inside a long Solenoid carrying a current I :**

$$B = \mu_0 nI$$

Where n is the number of turns per unit length.

- For a toroid,

$$B = \frac{\mu_0 NI}{2\pi r}$$

Where N is the total numbers of turns and r is the average radius.

- **Magnetic Moment of a Planar Loop:**

Magnetic moment m of a planar loop carrying a current I , having N closely wound turns, and an area A , is

$$\vec{m} = NI \vec{A}$$

- **Direction of \vec{m} is given by the Right - Hand Thumb Rule:**

Curl and palm of your right hand along the loop with the fingers pointing in the direction of the current, the thumb sticking out gives the direction of

$$\vec{m}(\text{and } \vec{A})$$

- **Loop placed in a Uniform Magnetic Field:**

a) When this loop is placed in a uniform magnetic field B ,

Then, the force F on it is, $F = 0$

And the torque on it is, $\vec{\tau} = \vec{m} \times \vec{B}$

In a moving coil galvanometer, this torque is balanced by a counter torque due to a spring, yielding,

$$k\phi = NI AB$$

where ϕ is the equilibrium deflection and k the torsion constant of the spring.

- **Magnetic Moment in an Electron:**

An electron moving around the central nucleus has a magnetic moment μ_l , given by

$$\mu_l = \frac{e}{2m} l$$

where l is the magnitude of the angular momentum of the circulating electron about the central nucleus.

- **Bohr Magnetron:**

The smallest value of μ_l is called the Bohr magneton μ_B

$$\mu_B = 9.27 \times 10^{-24} \text{ J/T}$$
