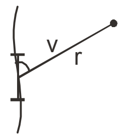
MAGNETIC EFFECT OF CURRENT & MAGNETIC FORCE ON CHARGE/CURRENT

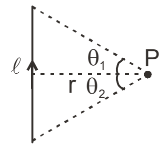
1. Magnetic field due to a moving point charge

$$\vec{B} = \frac{\mu_0}{4\pi} \cdot \frac{q(\vec{v} \times \vec{r})}{r^3}$$



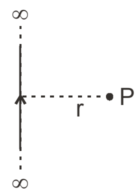
2. Biot-savart's Law

$$\overrightarrow{dB} = \frac{\mu_0 I}{4\pi} \cdot \left(\frac{\overrightarrow{d\ell} \times \vec{r}}{r^3} \right)$$



3. Magnetic field due to a straight wire

$$B = \frac{\mu_0}{4\pi} \frac{I}{r} (\sin \theta_1 + \sin \theta_2)$$

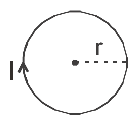


4. Magnetic field due to infinite straight wire

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

5. Magnetic field due to circular loop

(i) At centre

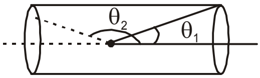


$$B = \frac{\mu_0 NI}{2r}$$

(ii) At Axis

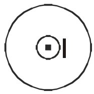
$$B = \frac{\mu_0}{2} \left(\frac{NIR^2}{(R^2 + x^2)^{3/2}} \right)$$

6. Magnetic field on the axis of the solenoid



$$B = \frac{\mu_0 nI}{2}\ (\cos\theta_1 - \cos\theta_2)$$

7. Ampere's Law

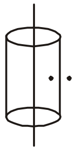


$$\oint \vec{B}.d\vec{\ell} = \mu_0 I$$

8. Magnetic field due to long cylinderical shell

$B = 0,\ r < R$

$= \frac{\mu_0}{2\pi}\frac{I}{r}, r \geq R$



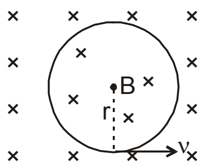
9. Magnetic force acting on a moving point charge

a. $\vec{F} = q(\vec{v} \times \vec{B})$

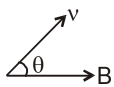
(i) $\vec{v} \perp \vec{B}$

$r = \frac{mv}{qB}$

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



(ii)



$r = \frac{mv\sin\theta}{qB}$

$T = \frac{2\pi m}{qB}$ Pitch $= \frac{2\pi mv\cos\theta}{qB}$

b. $\vec{F} = q\left[(\vec{v} \times \vec{B}) + \vec{E}\right]$

10. Magnetic force acting on a current carrying wire

$\vec{F} = I\left(\vec{\ell} \times \vec{B}\right)$

11. Magnetic Moment of a current carrying loop

$M = N \cdot I \cdot A$

12. Torque acting on a loop

$\vec{\tau} = \vec{M} \times \vec{B}$

13. Magnetic field due to a single pole

$$B = \frac{\mu_0}{4\pi} \cdot \frac{m}{r^2}$$

14. Magnetic field on the axis of magnet

$$B = \frac{\mu_0}{4\pi} \cdot \frac{2M}{r^3}$$

15. Magnetic field on the equatorial axis of the magnet

$$B = \frac{\mu_0}{4\pi} \cdot \frac{M}{r^3}$$

16. Magnetic field at point P due to magnet

$$B = \frac{\mu_0}{4\pi} \frac{M}{r^3} \sqrt{1 + 3\cos^2\theta}$$