Physics Formula Sheet

Chapter by chapter, topic by topic. Written by the PadhoNa team for quick revision.

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CHAPTER 21

Magnetic Effects of Current

Biot–Savart and Ampère's laws

BIOT–SAVART

$$d\vec{B} = \frac{\mu_0}{4\pi}\frac{I\,d\vec{l}\times\hat{r}}{r^2}$$

STRAIGHT WIRE

$$B = \frac{\mu_0 I}{4\pi d}(\sin\theta_1 + \sin\theta_2); \qquad \text{infinite: } \frac{\mu_0 I}{2\pi d}$$

CIRCULAR LOOP

$$B_{\text{centre}} = \frac{\mu_0 I}{2R}; \qquad B_{\text{axis}} = \frac{\mu_0 I R^2}{2(R^2+x^2)^{3/2}}; \qquad \text{arc } \frac{\mu_0 I\theta}{4\pi R}$$

AMPÈRE

$$\oint \vec{B}\cdot d\vec{l} = \mu_0 I_{\text{enc}}; \qquad \text{solenoid } B = \mu_0 n I; \qquad \text{toroid } B = \frac{\mu_0 N I}{2\pi r}$$

Force on charges and currents

LORENTZ FORCE

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

CIRCULAR PATH

$$r = \frac{mv}{qB}, \qquad T = \frac{2\pi m}{qB}, \qquad \text{pitch} = v\cos\theta\, T$$

WIRE

$$\vec{F} = I\vec{l}\times\vec{B}; \qquad \text{parallel wires } \frac{F}{L} = \frac{\mu_0 I_1 I_2}{2\pi d}$$

CYCLOTRON FREQUENCY

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

Torque on a loop and galvanometer

$$\vec{M} = NI\vec{A}, \qquad \vec{\tau} = \vec{M} \times \vec{B}, \qquad U = -\vec{M} \cdot \vec{B}$$

MOVING COIL GALVANOMETER

$$NIAB = k\phi \;\Rightarrow \text{current sensitivity } \frac{\phi}{I} = \frac{NAB}{k}$$

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