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Force on charges and currents, galvanometer

Formulas and units, JEE Main. Status: Reviewed on 2026-11-20.

Result	Formula	Units or note
Lorentz force	F = q (E + v x B) Valid when: any charge q with velocity v in electric field E and magnetic field B	N
Radius in a perpendicular field	r = m v/(q B) = sqrt(2 m K)/(q B) Valid when: v perpendicular to uniform B; K is kinetic energy; non-relativistic	m
Period (cyclotron)	T = 2 pi m/(q B) Valid when: charge in uniform B; independent of speed; non-relativistic	s
Helix	pitch = 2 pi m v cos(theta)/(q B) Valid when: v at angle theta to uniform B; pitch = v_parallel x period	m
Velocity selector	v = E/B Valid when: E, B and v mutually perpendicular; charge moves undeflected	m/s
Force on a wire	F = I L B sin(theta) Valid when: straight wire in uniform B; theta is angle between wire and B	N
Parallel wires	F/L = mu0 I1 I2/(2 pi d) Valid when: two long parallel wires distance d apart; same direction attract	N/m
Torque on a loop	tau = N I A B sin(theta) Valid when: planar loop of N turns in uniform B; theta is angle between normal and B	N m (theta from normal to B)
Galvanometer deflection	theta = N B A I/k Valid when: radial field coil; deflection proportional to current; k is torsion constant	rad
Shunt and series resistance	S = Ig G/(I - Ig); R = V/Ig - G Valid when: ammeter shunt in parallel with G; voltmeter series resistor; Ig is full-scale current	ohm

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/physics/magnetic-effects-of-current-and-magnetism/force-on-charges-and-curre

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