EXAM-DAY · 90-MIN REVISION CARD

Moving Charges and Magnetism

Print this · Fold it · Carry to the exam-hall gate · Revise once · Then walk in.

FORMULAS & KEY RESULTS

- Magnetic force on charge: F = q v x B; |F| = qvB sin(theta)
- Lorentz force: F = q(E + v x B)
- Cyclotron radius: r = mv/(qB)
- Cyclotron frequency: f = qB/(2*pi*m); T = 2*pi*m/(qB)
- Cyclotron max KE: KE_max = q^2 B^2 R^2/(2m)
- Velocity selector: v = E/B (when qE = qvB)
- Force on conductor: F = I L x B; |F| = BIL sin(theta)
- Force between parallel wires: F/L = mu_0 I1 I2/(2*pi*d)
- Biot-Savart: dB = (mu_0/4*pi) I dL x r_hat / r^2
- B at centre of loop: B = mu_0 I/(2R)
- B on axis of loop: B = mu_0 I R^2/[2 (R^2 + x^2)^(3/2)]
- Ampere's law: closed integral of B.dL = mu_0 I_enc
- B inside solenoid: B = mu_0 n I (n = turns per metre)
- B inside toroid: B = mu_0 N I/(2*pi*r)
- Torque on loop: tau = N I A B sin(theta) = m x B
- Magnetic moment: m = N I A
- Ammeter shunt: S = I_g G/(I - I_g); Voltmeter: R = V/I_g - G

TOP 5 PYQ PATTERNS

1 Biot-Savart + B on axis/centre of loop
3 marks · 88% of years
dB integral, symmetry kills perpendicular components; B=mu_0 I/2R at centre

2 Cyclotron radius + frequency
3 marks · 80% of years
qvB=mv^2/r => r=mv/qB; f=qB/2*pi*m independent of v

3 Force between parallel wires + define ampere
3 marks · 78% of years
F/L = mu_0 I1 I2/2*pi*d; 2e-7 N/m at 1 m

4 Torque on loop + galvanometer
3 marks · 75% of years
tau=NIAB sin(theta); radial field => sin=1; I proportional to phi

5 Galvanometer to ammeter/voltmeter
3 marks · 70% of years
Shunt S=I_g G/(I-I_g); series R=V/I_g - G

90-MIN REVISION FLOW

0-15 min
Force on a moving charge F = qv x B + Lorentz force. Memorise r = mv/qB and that B does no work.

15-35 min
Cyclotron — working, r = mv/qB, f = qB/2*pi*m, KE_max. Velocity selector v = E/B. 2 numericals.

35-55 min
Biot-Savart law: B at centre and on axis of a loop. Force on conductor F = BIL. 2 numericals.

55-70 min
Ampere's law: long wire, solenoid B = mu_0 n I, toroid. Force between parallel wires + ampere definition.

70-85 min
Torque tau = NIAB, magnetic moment m = NIA, galvanometer + conversion (shunt/series). 2 numericals.

85-90 min
Speed-revise the formula grid; flag any formula you hesitated on for tomorrow.

Confidence, not anxiety. You've practised this all year. Trust your steps. Don't change strategy on exam morning.
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