

CLASS 12

PHYSICS

EXTRA QUESTIONS

Class 12 Physics Chapter 4 Moving Charges and Magnetism – Extra Questions with Answers

Moving charges generate their own magnetic fields and, in turn, feel a force from external ones -- the Lorentz force, Ampere's law, and circular motion in a field are all fair game in these Class 12 Physics Chapter 4 questions.

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How to Approach the HOTS Questions in This Chapter

HOTS questions here often combine a moving charge in both electric and magnetic fields (velocity-selector-type problems), or ask you to compare the field at different points around a current-carrying conductor — practice problems combining multiple field sources or crossed fields, not just single-source, single-point calculations.

Very Short Answer Questions (1 mark)

Q1. Write the formula for the Lorentz magnetic force.

Ans: $F = qv \times B$.

Q2. Write the radius of circular motion of a charged particle in a magnetic field.

Ans: $r = mv/(qB)$.

Q3. State Ampere's circuital law.

Ans: $\oint \mathbf{B} \cdot d\mathbf{l} = \mu_0 I_{\text{enclosed}}$.

Q4. What is the magnetic field at the center of a current loop of radius R carrying current I?

Ans: $B = \mu_0 I / 2R$.

Q5. Do like currents attract or repel?

Ans: Attract.

Short Answer Questions (2–3 marks)

Q6. Find the magnetic field at a distance 0.1m from a long straight wire carrying 5A current.

Ans: $B = \mu_0 I / 2\pi r = (4\pi \times 10^{-7})(5)/(2\pi \times 0.1) = 10^{-5} \text{ T}$.

Q7. A proton moves with velocity $2 \times 10^6 \text{ m/s}$ perpendicular to a field of 0.5T. Find the force.

Ans: $F = qvB = (1.6 \times 10^{-19})(2 \times 10^6)(0.5) = 1.6 \times 10^{-13} \text{ N}$.

Q8. Two parallel wires carry 3A and 4A separated by 0.2m. Find the force per unit length.

Ans: $F/l = \mu_0 I_1 I_2 / 2\pi d = (4\pi \times 10^{-7})(3)(4)/(2\pi \times 0.2) = 1.2 \times 10^{-5} \text{ N/m}$.

Higher-Order Thinking / Application Questions

Q9. A charged particle enters a region with perpendicular electric field $E = 2 \times 10^4 \text{ V/m}$ and magnetic field $B = 0.5 \text{ T}$ (velocity selector configuration) and passes through undeflected. It then enters a region with only the magnetic field $B = 0.5 \text{ T}$ and moves in a circle of radius 0.02m. Find the charge-to-mass ratio of the particle.

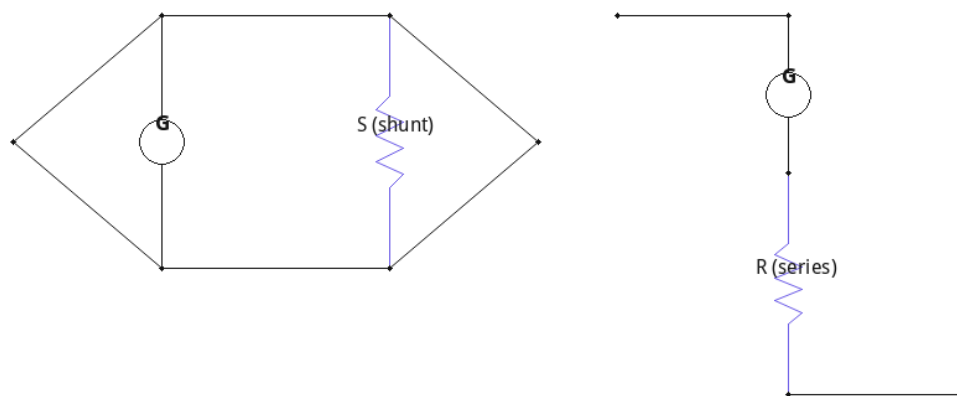
Ans: In the velocity selector, undeflected motion means the electric force balances the magnetic force: $qE = qvB$, so $v = E/B = (2 \times 10^4)/(0.5) = 4 \times 10^4 \text{ m/s}$. In the region with only the magnetic field, the particle moves in

a circle with radius $r = mv/(qB)$, so rearranging: $q/m = v/(rB) = (4 \times 10^4)/(0.02 \times 0.5) = (4 \times 10^4)/(0.01) = 4 \times 10^6 \text{ C/kg}$. This two-stage method (velocity selector to fix v , then circular motion to relate q/m) is exactly the technique used historically (e.g., by J.J. Thomson) to measure the charge-to-mass ratio of the electron.

Q10. A moving coil galvanometer has resistance 50Ω and gives full-scale deflection for a current of 5mA . Convert it into (a) an ammeter reading up to 5A , and (b) a voltmeter reading up to 10V , finding the required shunt/series resistance in each case.

Ans: (a) Ammeter conversion: We need a shunt S in parallel with the galvanometer so that most of the 5A current bypasses the galvanometer, with only $5\text{mA} = 0.005\text{A}$ flowing through it. The remaining current through the shunt is $I_s = 5 - 0.005 = 4.995\text{A}$. Since the galvanometer and shunt are in parallel, they have the same voltage: $I_g G = I_s S$, so $0.005 \times 50 = 4.995 \times S$, giving $S = 0.25/4.995 \approx 0.05\Omega$ (a very small shunt resistance).

(b) Voltmeter conversion: We need a series resistance R such that at full-scale deflection current $I_g = 0.005\text{A}$, the total voltage across (galvanometer + R) equals 10V . Using $V = I_g(G + R)$: $10 = 0.005(50 + R)$, so $50 + R = 10/0.005 = 2000$, giving $R = 2000 - 50 = 1950\Omega$ (a large series resistance). This illustrates the general principle: ammeters need a very small parallel shunt (low resistance, to divert most current), while voltmeters need a large series resistance (to limit current through the sensitive galvanometer while dropping most of the voltage across the added resistor).



Ammeter: G with small shunt S in parallel (left). Voltmeter: G with large series R (right).

Class 12 Physics Chapter 4 – Solutions and Notes

For complete step-by-step answers and a quick summary, check the [Class 12 Physics Chapter 4 Solutions](#) and [Class 12 Physics Chapter 4 Revision Notes](#).

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