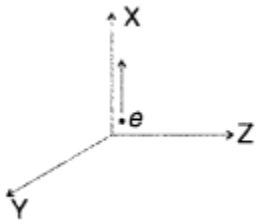
Physics

Board – CBSE | Class – 12th | Chapter – MOVING CHARGES AND MAGNETISM

Q.1. What is the direction of the force acting on a charged particle q, moving with a velocity $\vec{v}$ in a uniform magnetic field B?

Q.2. A beam of electrons projected along +x-axis, experiences a force due to a magnetic field along the +y-axis. What is the direction of the magnetic field?



Q.3. Depict the trajectory of a charged particle moving with velocity v as it enters a uniform magnetic field perpendicular to the direction of its motion.

Q.4. An Ammeter of resistance 0.6Ω can measure current upto 1.0 A. Calculate

(i) The shunt resistance required to enable the ammeter to measure current upto 5.0 A

(ii) The combined resistance of the ammeter and the shunt.

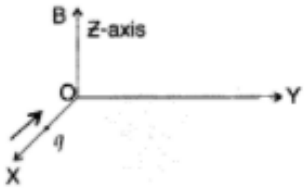
Q.5. Using the concept of force between two infinitely long parallel current carrying conductors, define one ampere of current.

Q.6. Write the underlying principle of a moving coil galvanometer.

Q.7. Using Ampere's circuital law, obtain an expression for the magnetic field along the axis of a current carrying solenoid of length l and having N number of turns.

Q.8. A charge 'q' moving B along the X -axis with a velocity v is subjected to a uniform magnetic field B acting along the Z-axis as it crosses the origin O.

(i) Trace its trajectory.



(ii) Does the charge gain kinetic energy as it enters the magnetic field? Justify your answer.

Q.9. Explain Biot-Savart law and write its applications.

Q.10. A circular coil of wire consisting of 100 turns, each of radius 8.0 cm carries a current of 0.40 A. What is the magnitude of the magnetic field **B** at the Centre of the coil?

Q.11. A long straight wire carries a current of 35 A. What is the magnitude of the field **B** at a point 20 cm from the wire?

Q.12. A 3.0 cm wire carrying a current of 10 A is placed inside a solenoid perpendicular to its axis. The magnetic field inside the solenoid is given to be 0.27 T. What is the magnetic force on the wire?

Q.13. Two long and parallel straight wires A and B carrying currents of 8.0 A and 5.0 A in the same direction are separated by a distance of 4.0 cm. Estimate the force on a 10 cm section of wire A.

Q.14. A closely wound solenoid 80 cm long has 5 layers of windings of 400 turns each. The diameter of the solenoid is 1.8 cm. If the current carried is 8.0 A, estimate the magnitude of **B** inside the solenoid near its Centre.

Q.15. Two moving coil meters, M_1 and M_2 have the following particulars:

$R_1 = 10\Omega, N_1 = 30, A_1 = 3.6 \times 10^{-3}\ m^2, B_1 = 0.25\ T$

$R_2 = 14\Omega, N_2 = 42, A_2 = 1.8 \times 10^{-3}\ m^2, B_2 = 0.50\ T$

(The spring constants are identical for the two meters).

Determine the ratio of (a) current sensitivity and (b) voltage sensitivity of M_2 and M_1.

Q.16. In a chamber, a uniform magnetic field of 6.5G($1G = 10^{-4}$ T) is maintained. An electron is shot into the field with a speed of 4.8×10^6 m s^{-1} normal to the field. Explain why the path of the electron is a circle. Determine the radius of the circular orbit.

($e = 1.6 \times 10^{-19}C, m_e = 9.1 \times 10^{-31}$ kg)

Q.17. Obtain the frequency of revolution of the electron in its circular orbit.
Does the answer depend on the speed of the electron? Explain.

Q.18. (a) A circular coil of 30 turns and radius 8.0 cm carrying a current of 6.0 A is suspended vertically in a uniform horizontal magnetic field of magnitude 1.0 T. The field lines make an angle of 60° with the normal of the coil. Calculate the magnitude of the counter torque that must be applied to prevent the coil from turning.
(b) Would your answer change, if the circular coil in (a) were replaced by a planar coil of some irregular shape that encloses the same area? (All other particulars are also unaltered.)

Q.19. Two concentric circular coils X and Y of radii 16 cm and 10 cm, respectively, lie in the same vertical plane containing the north to south direction. Coil X has 20 turns and carries a current of 16 A; coil Y has 25 turns and carries a current of 18 A. The sense of the current in X is anticlockwise, and clockwise in Y, for an observer looking at the coils

facing west. Give the magnitude and direction of the net magnetic field due to the coils at their Centre.

Q.20. For a circular coil of radius R and N turns carrying current I, the magnitude of the magnetic field at a point on its axis at a distance x from its centre is given by,

$$B = \frac{\mu_0 I R^2 N}{2(x^2+R^2)^{\frac{3}{2}}}$$

(a) Show that this reduces to the familiar result for field at the Centre of the coil.

(b) Consider two parallel co-axial circular coils of equal radius R, and number of turns N, carrying equal currents in the same direction, and separated by a distance R. Show that the field on the axis around the mid-point between the coils is uniform over a distance that is small as compared to R, and is given by, $B = 0.72 - \frac{\mu_0 BNI}{R}$, approximately.

[Such an arrangement to produce a nearly uniform magnetic field over a small region is known as Helmholtz coils.]

Q.21. A toroid has a core (non-ferromagnetic) of inner radius 25 cm and outer radius 26 cm, around which 3500 turns of a wire are wound. If the current in the wire is 11 A, what is the magnetic field (a) outside the toroid, (b) inside the core of the toroid, and (c) in the empty space surrounded by the toroid.

Q.22. Answer the following questions:

(a) A magnetic field that varies in magnitude from point to point but has a constant direction (east to west) is set up in a chamber. A charged particle enters the chamber and travels undeflected along a straight path with constant speed. What can you say about the initial velocity of the particle?

(b) A charged particle enters an environment of a strong and non-uniform magnetic field varying from point to point both in magnitude and direction, and comes out of it following a complicated trajectory. Would its final speed equal the initial speed if it suffered no collisions with the environment?

(c) An electron travelling west to east enters a chamber having a uniform electrostatic field in north to south direction. Specify the direction in which a uniform magnetic field should be set up to prevent the electron from deflecting from its straight-line path.

Q.23. An electron emitted by a heated cathode and accelerated through a potential difference of 2.0kV, enters a region with uniform magnetic field of 0.15 T. Determine the trajectory of the electron if the field (a) is transverse to its initial velocity, (b) makes an angle of 30° with the initial velocity.

Q.24. Write the expression for Lorentz magnetic force on a particle of charge 'q' moving with velocity $\vec{v}$ in a magnetic field $\vec{B}$. Show that no work is done by this force on the charged particle.

Q.25. Two identical circular loops, P and Q, each of radius r and carrying current I and 21 respectively are lying in parallel planes such that they have a common axis. The direction of current in both the loops is clockwise as seen from O which is equidistant from both the loops. Find the magnitude of the net magnetic field at point O.