Chapter 4
MOVING CHARGES AND MAGNETISM

Assignment-1
MCQ

Q1. Two parallel conductors carrying 'i' current in the same direction what will be the force being experienced by each conductor (r = distance between the conductors)

(a) Repulsion and $\frac{\mu 02i}{4\pi r}$ (b) Repulsion and $\frac{\mu 0i}{4\pi 2r}$

(c) Attraction and $\frac{\mu 0i^2}{2\pi r}$ (d) Attraction and $\frac{\mu 0i}{4\pi 2r}$

Q2. The magnetic field at a point midway between two parallel long wires carrying currents in the same direction is $10\mu T$. If the direction of the smallest current among them is reversed, the field becomes $30\mu T$. The ratio of the larger to the smaller current in them is

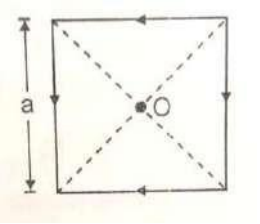
(a) 3 : 1 (b) 2 : 1 (c) 4 : 1 (d) 3 : 2

Q3. An electric current is flowing through a circular coil of radius R. The ratio of the magnetic field at the centre of the coil and that at a distance $2\sqrt{2R}$ from the centre of the coil and on its axis is

(a) $2\sqrt{2}$ (b) 27 (c) 36 (d) 8

Q4. A square coil of side a carries a current l. The magnetic field at the centre of the coil is

(a) $\frac{\mu 0l}{a\pi}$ (b) $\frac{\sqrt{2}\mu_0 l}{a\pi}$ (c) $\frac{\mu_0 l}{\sqrt{2}a\pi}$ (d) $\frac{2\sqrt{2}\mu_0 l}{a\pi}$



Q5. A current loop in a magnetic field

(a) Can be in equilibrium in one orientation

(b) Can be in equilibrium in two orientations, both the equilibrium states are unstable

(c) Can be in equilibrium in two orientations, one stable while the other is unstable

(d) Experiences a torque whether the field is uniform or non – uniform in all orientations

Q6. Force on a current carrying conductor in a magnetic field is

(a) BIL tan Θ (b) BI / Lsin Θ (c) BILsin Θ (d) BILcos Θ

Q7. A current carrying loop is placed in a uniform magnetic field. The torque acting on it does not depend upon

(a) Area of loop (b) Value of current (c) Magnetic field (d) None of these

Q8. What is the magnitude of magnetic force per unit length on a wire carrying a current of 4 amperes and making an angle of 30º with the direction of magnetic field of 2T?

(a)2 N/m (b) 3 N /m (c) 4 N/m (d) 5 N/m

Q9. We can convert moving coil galvanometer into voltmeter by:

(a)Introducing resistance of large value in parallel.

(b)Introducing resistance of small value in series

(c)Introducing resistance of large value in series.

(d)Introducing resistance of small value in parallel

1 MARK QUESTIONS

Q10. In a certain region of space, electric field E " and magnetic field B " are perpendicular to each other. An electron enters in the region perpendicular to the directions of both B E and " " and moves undeflected. Find the velocity of the electron.

Q11. Two identical charged particles moving with same speed enter a region of uniform magnetic field. If one of these enters normal to the field direction and the other enters along a direction at 30º with the field. What would be the ratio of their angular frequencies?

Q12. An α particle and a proton are moving in the plane of the paper in a region where there is a uniform magnetic field $\vec{B}$ directed normal to the plane of the paper. If the two particle have equal linear momenta, what will be the ratio of the radii of their trajectories in the field?

Q13. A beam of protons projected along +x-axis experiences a force due to a magnetic field along –y-axis. What is the direction of the magnetic field?

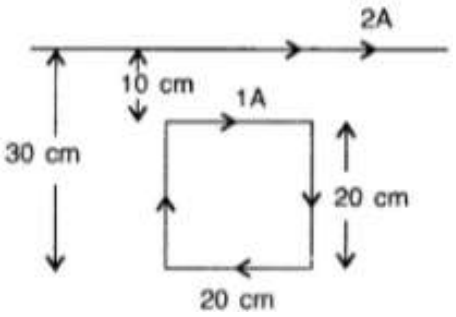
2 MARKS QUESTIONS

Q14. Can we decrease the range of an ammeter?

Q15. An electron and proton, moving parallel to each other in the same direction with equal momenta, enter into a uniform magnetic field which is at right angle to their velocities. Trace the trajectories in the magnetic field.

Q16.An ammeter of resistance 0.6 Ω can measure current up to 1.0 A. Calculate (i) The shunt resistance required to enable the ammeter to measure current up to 5.0 A (ii) The combined resistance of the ammeter and the shunt. (Delhi 2013)

Q17. A square loop of side 20 cm carrying current of 1 A is kept near an infinite long straight wire carrying current of 2A in the same plane as shown in the figure. Calculate the magnitude and direction of the net force exerted on the loop due to the current carrying conductor.

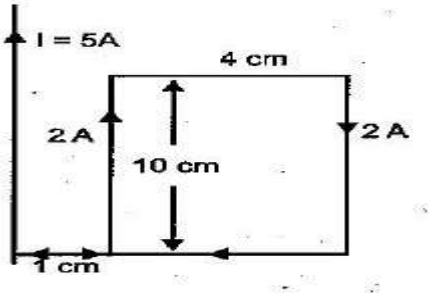


3-MARKS QUESTIONS

Q18. (a) Write the expression for the magnetic force acting on a charged particle moving with velocity v in the presence of magnetic field B.
(b)A neutron, an electron and an alpha particle moving with equal velocities, enter a uniform magnetic field going into the plane of the paper as shown. Trace their paths in the field and justify your answer.

5- MARKS QUESTIONS

Q19. A rectangular loop of wire as shown in the figure of size 4cm x 10cm carries a steady current of 2A A straight long wire carrying 5A current is kept near the loop as shown fig. If the loop and the wire are coplanar find (a) Write an expression for torque. (b)The torque acting on the loop and (c) the magnitude and direction of the loop due to the current carrying wire



Assertion-Reason

Select the correct answer to these questions from the codes (a), (b), (c) and (d) are as given below

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false and R is also false.

Q20. **Assertion** The poles of magnet cannot be separated by breaking into two pieces.

Reason The magnetic dipole moment will be reduced to half when broken into two equal pieces.

Q21. **Assertion** When a bar magnet is kept in an external uniform magnetic field, it starts oscillating.

Reason A restoring torque acts on the dipole when kept in the magnetic field.

Q22. **Assertion** Two parallel wires carrying currents in the opposite direction, attract each other.

Reason Parallel currents repel and antiparallel currents attract.

Q23. **Assertion** Gauss's theorem is not applicable in magnetism.

Reason Magnetic monopoles do not exist.

Q24. **Assertion** Magnetic field produced by a current carrying solenoid is independent of its length and cross-sectional area.

Reason There is a uniform magnetic field inside the solenoid.

Q25. **Assertion** If a charged particle is projected in a region, where B is perpendicular to velocity of projection, then the net force acting on the particle is independent of its mass.

Reason The particle is performing rectilinear motion.

Q26. **Assertion** When a charged particle moves in a region of magnetic field such that its velocity is at some acute angle with the direction of field, its trajectory is a helix.

Reason Perpendicular component of velocity causes a rotating centripetal force and the parallel component of velocity does not produce any force.

Q27. **Assertion** For a current carrying wire loop of N turns, placed in a region of a uniform magnetic field B, the torque acting on it is given by m x B.

Reason Whenever the magnetic moment m is perpendicular to B, then torque on the loop will be zero.

Q28**. Assertion** The current sensitivity of a galvanometer is the deflection of current per unit current passing through the coil.

Reason The galvanometer can be used as a detector to check if a current is flowing in the circuit.

Q29. **Assertion** Magnetic field lines always form closed loops.

Reason Moving charges or currents produce a magnetic field.

Case study based question

Q30. **Magnetic moment**

The directional property of magnets was also known since ancient times. A thin long piece of a magnet, when suspended freely, pointed in the north-south direction. Magnetic field is responsible for the most notable property of a magnet. It is a force that pulls on other ferromagnetic materials, such as iron, steel, nickel, cobalt, etc., and attracts or repels other magnets. Magnet's magnetic moment is a vector that characterises the magnet's overall magnetic properties. It is also called magnetic dipole moment and usually denoted by **m.**

For a bar magnet, the direction of the magnetic moment points from the magnet's south to north-pole and the magnitude relates to how strong and how far apart these poles are.

1. In a uniform magnetic field the net magnetic force on the dipole

(a) Is always zero

(b) Depends on the orientation of the dipole

(c) Can never be zero

(d) Depends on the strength of the dipole

2. Torque acting on a magnetic dipole in uniform magnetic field at an acute angle is

(a) Zero (b) Nonzero (c) Equal to force (d) None of these

3. The magnetic dipole moment of a circular coil current carrying I and area Ais

(a) IA (b) NIA (c) $\mu_0 nI$ (d) nIAB

4. Which of the following cannot behave as a magnetic dipole

(a) Electron revolving around nucleus (b) Current loop

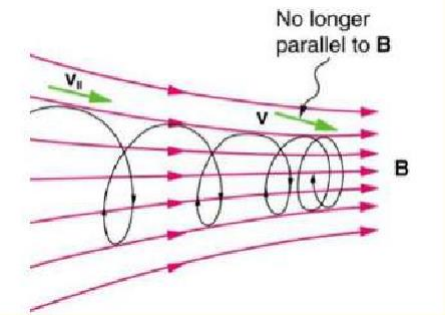
(c) Diamagnetic materials (d) All of them

5. The ultimate individual unit in any magnet is a

(a) south-pole (b) north-pole (c) Quadrupole (d) Dipole

Q 31. FORCE ON A CHARGE IN ELECTRIC AND MAGNETIC FIELD

A point charge q (moving with a velocity v and located at r at a given time (t) in the presence of both the electric field E and magnetic field B. The force on an electric charge q due to both of them can be written as $F = q [E + v \times B] = F_{el} + F_{mag}$ .It is called the 'Lorentz force'.



1. If the charge q is moving under a field, the force acting on the charge depends on the magnitude of field as well as the velocity of the charge particle, what kind of field is the chargemoving in?

(a) Electric field (b) Magnetic field

(c) Both electric and magnetic field perpendicular to each other (d) None of these

2. The magnetic force acting on the charge ‘q’ placed in a magnetic field will vanish if

(a) if v is small (b) If v is perpendicular to B (c) If v is parallel to B

(d) None of these

3. If an electron of charge -e is moving along + X direction and magnetic field is along + Z direction, then the magnetic force acting on the electron will be along

(a) + X axis (b) - X axis (c) - Y axis (d) + Y axis

4. The vectors which are perpendicular to each other in the relation for magnetic force acting on a charge particle are

(a) F and v (b) F and B (c) v and B (d) All of these

5. A particle moves in a region having a uniform magnetic field and a parallel, uniform electricfield. At some instant, the velocity of the particle is perpendicular to the field direction. The path of the particle will be

(a) A straight line (b) A circle (c) A helix with uniform pitch (d) A helix withnon-uniform pitch