O P JINDAL SCHOOL, SAVITRINAGAR

CLASS TEST & PRACTICE

ANSWER KEY

CLASS XII PHYSICS TOPIC : MOVING CHARGES AND MAGNETISM

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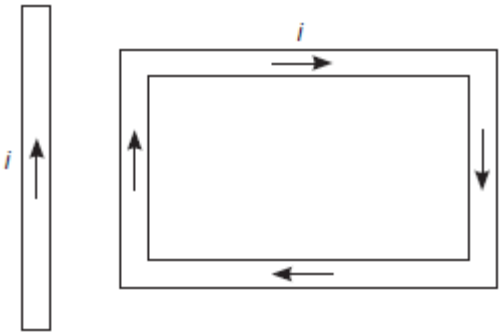
1 A rectangular loop carrying a current i is situated near a long straight wire such that the wire is parallel to the one of the sides of the loop and is in the plane of the loop. If a steady current I is established in wire as shown in figure, the loop will



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(a) rotate about an axis parallel to the wire.
(b) move away from the wire or towards right.
(c) move towards the wire.
(d) remain stationary.

ANS: (c)

2 A circular coil of radius 4 cm and of 20 turns carries a current of 3 amperes. It is placed in a magnetic field of intensity of 0.5 weber/m^2. The magnetic dipole moment of the coil is

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(a) 0.15 ampere–m^2 (b) 0.3 ampere–m^2
(c) 0.45 ampere–m^2 (d) 0.6 ampere–m^2

ANS: (b)

3 A cubical region of space is filled with some uniform electric and magnetic fields. An electron enters the cube across one of its faces with velocity v and a positron enters via opposite face with velocity –v. At this instant,

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(a) the electric forces on both the particles cause identical accelerations.
(b) the magnetic forces on both the particles cause equal accelerations.
(c) Only electron gains or looses energy.
(d) the motion of the centre of mass (CM) is determined by E alone.

ANS: (b)

4 Consider a wire carrying a steady current, I placed in a uniform magnetic field B perpendicular to its length. Consider the charges inside the wire. It is known that magnetic forces do not work. This implies that,

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(a) motion of charges inside the conductor is unaffected by B, since they do not absorb energy.
(b) Some charges inside the wire move to the surface as a result of B.
(c) if the wire moves under the influence of B, no work is done by the force.
(d) If the wire moves under the influence of B, no work is done by the electric force on the ions, assumed fixed within the wire.

ANS: (b)

5 Two identical current carrying coaxial loops, carry current I in an opposite sense. A simple amperian loop passes through both of them once. Calling the loop as C,

(a) $\oint_C B.dl = \pm 2\mu_0 I.$

(b) the value of $\oint_C B.dl$ is independent of sense of C.

(c) there may be a point on C where, B and dl are parallel.

(d) B vanishes everywhere on C.

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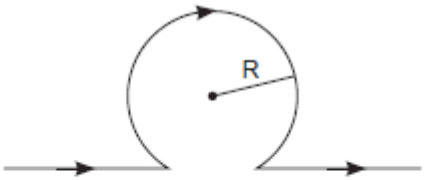
ANS: (b) Ampere's law gives another method to calculate the magnetic field due to a given current distribution. Applying the Ampere's circuital law, we have

Applying the Ampere's circuital law, we have

$\oint B.dl = i_0(I - I) = 0$ (because current is in opposite sense).

Also, there may be a point on C where B and dl are perpendicular and hence $\oint_C B.dl = 0$

6 The strength of magnetic field at the centre of circular coil is



(a) $\frac{\mu_0 I}{R}\left(1 - \frac{1}{\pi}\right)$ (b) $\frac{\mu_0 I}{\pi R}$

(c) $\frac{\mu_0 I}{2R}\left(1 - \frac{1}{\pi}\right)$ (d) $\frac{\mu_0 I}{2R}\left(1 + \frac{1}{\pi}\right)$

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ANS: (c) B = Field to circular portion – Field due to straight portion $= \left(\frac{\mu_0 I}{2R} - \frac{\mu_0 I}{2\pi R}\right) = \frac{\mu_0 I}{2R}\left(1 - \frac{1}{\pi}\right)$

7 If a charged particle moves through a magnetic field perpendicular to it

(a) both momentum and energy of particle change.

(b) momentum as well as energy are constant.

(c) energy is constant but momentum changes.

(d) momentum is constant but energy changes.

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ANS: (c) Since the direction of velocity of a particle varies so momentum changes but direction of magnetic force is always perpendicular to direction of charged particle. So no work is done, i.e. energy remains the same.

8 A current carrying closed loop of an irregular shape lying in more than one plane when placed in uniform magnetic field, the force acting on it

(a) will be more in the plane where its larger position is covered.

(b) is zero.

(c) is infinite.

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(d) may or may not be zero.

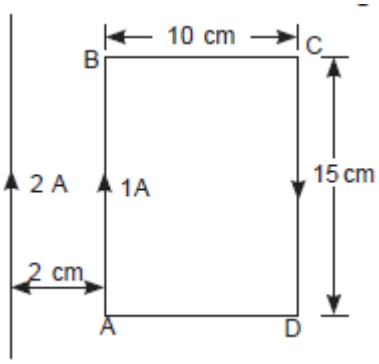
ANS: (b) A current carrying closed loop of any shape when placed in a uniform magnetic field does not experience any force.

9 The maximum current that can be measured by a galvanometer of resistance 40 Ω is 10 mA. It is converted into voltmeter that can read upto 50 V. The resistance to be connected in the series with the galvanometer is 1

(a) 2010 Ω (b) 4050 Ω

(c) 5040 Ω (d) 4960 Ω

ANS: $(d)\ R = \frac{V}{I_g} - G = \frac{50}{10 \times 10^{-3}} - 40 = 4960\ \Omega$

10 

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What is the net force on the rectangular coil? (a) 25 × 10^{-7} N towards wire.

(b) 25 × 10^{-7} N away from wire.

(c) 35 × 10^{-7} N towards wire.

(d) 35 × 10^{-7} N away from wire.

ANS: (a) Since force,

$F_{AB} = \frac{\mu_0 I_1 I_2}{2\pi r} l = 30 \times 10^{-7}$ N (attractive)

$F_{CD} = 5 \times 10^{-7}$ N (repulsive)

$F_{net} = F_{AB} - F_{CD} = 25 \times 10^{-7}$ N towards wire