IIT PHYSICS CENTRE

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Time :

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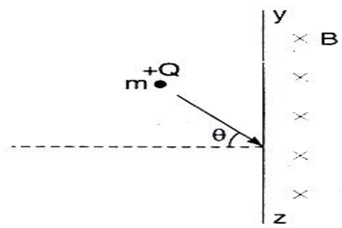
1. A particle with charge +Q and mass m enters a magnetic field of magnitude B, existing only on the right of the boundary YZ. The direction of the motion of the particle is perpendicular to the direction of B. Let $T = 2\pi \frac{m}{QB}$. The time spent by the particle in the field will be:



(A) $T\theta$ **(B)** $2T\theta$ **(C)** $T\left(\frac{\pi+2\theta}{2\pi}\right)$ **(D)** $T\left(\frac{\pi-2\theta}{2\pi}\right)$

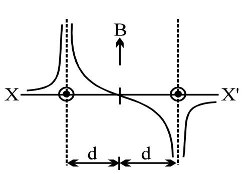
2. The current I flows through a square loop of a wire of side a. The magnetic induction at the centre of the loop is:

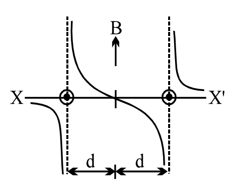
(A) $\frac{\sqrt{2}\mu_0 I}{\pi a}$ **(B)** $\frac{2\sqrt{2}\mu_0 I}{\pi a}$ **(C)** $\frac{\sqrt{2}\mu_0 I}{a}$ **(D)** $\frac{\sqrt{2}\pi\mu_0 I}{a}$

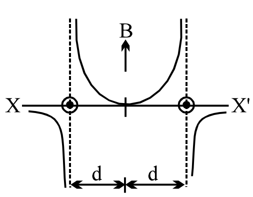
3. A charged particle of unit mass and unit charge moves with velocity of $\vec{v} = \left(8\hat{i} + 6\hat{j}\right) m/s$ in a magnetic field of $\vec{B} = 2\hat{k}T$. Choose the correct alternative(s):

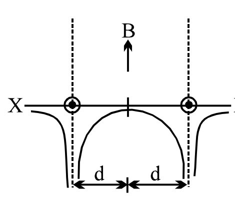
(A) The path of the particle be $x^2 + y^2 - 4x - 21 = 0$.
(B) The path of the particle may be $x^2 + y^2 = 25$.
(C) The path of the particle may be $y^2 + z^2 = 25$.
(D) The time period of the particle will be 3.14 s.

4. Two long parallel wires are at a distance 2d apart. They carry steady equal currents flowing out of the plane of the paper, as shown. The variation of the magnetic field B along the line XX' is given by

(A)


(B)


(C)


(D)


5. A charged particle is released from rest in a region of steady and uniform electric and magnetic fields which are parallel to each other. The particle will move in a

(A) straight line **(B)** circle
(C) helix **(D)** cycloid

6. A particle of mass m and charge q moves with a constant velocity v along the positive x direction. It enters a region containing a uniform magnetic field B directed along the negative z direction, extending from x = a to x = b. The minimum value of v required so that the particle can just enter the region x > b is

(A) $\frac{qbB}{m}$ **(B)** $\frac{q(b-a)B}{m}$

(C) $\frac{qaB}{m}$ **(D)** $\frac{q(b+a)B}{2m}$

7. A long straight wire along the z-axis carries a current I in the negative z direction. The magnetic vector field $\vec{B}$ at a point having coordinates (x, y) in the z = 0 plane is

(A) $\frac{\mu_0 I\left(y\hat{i} - x\hat{j}\right)}{2\pi\left(x^2+y^2\right)}$ **(B)** $\frac{\mu_0 I\left(x\hat{i} + y\hat{j}\right)}{2\pi\left(x^2+y^2\right)}$

(C) $\frac{\mu_0 I\left(x\hat{j} - y\hat{i}\right)}{2\pi\left(x^2+y^2\right)}$ **(D)** $\frac{\mu_0 I\left(x\hat{i} - y\hat{j}\right)}{2\pi\left(x^2+y^2\right)}$

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

(A) rotate about an axis parallel to the wire
(B) move away from the wire
(C) move towards the wire
(D) remain stationary