



PHYSICS

BOOKS - DC PANDEY PHYSICS (HINGLISH)

MAGNETICS

Solved Examples

1. A charged particle projected in a magnetic field

$$B = (3\hat{i} + 4\hat{j}) \times 10^{-2}T$$

The acceleration of the particle is found to be

$$a = (x\hat{i} + 2\hat{j}) \frac{m}{s^2}$$

find the value of x



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2. When a proton has a velocity $v = (2\hat{i} + 3\hat{j}) \times 10^6 \frac{m}{s}$, it experiences a force $F = - (1.28 \times 10^{-13}\hat{k})$. When its velocity is along the z -axis, it experiences a force along the x -axis. What is the magnetic field?

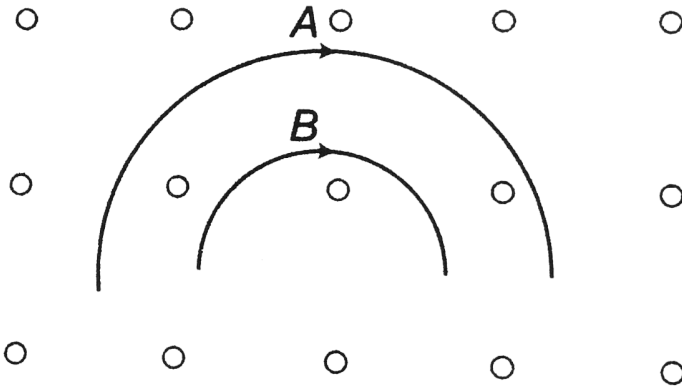
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3. A magnetic field of $(4.0 \times 10^{-3}\hat{k})T$ exerts a force $(4.0\hat{i} + 3.0\hat{j}) \times 10^{-10}N$ on a particle having a charge $10^{-9}C$ and moving in the $x - y$ plane. Find the velocity of the particle.

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4. Two particles A and B of masses m_A and m_B respectively and having the same charge are moving in a plane. A uniform magnetic field exists perpendicular to this plane. The speeds of the particles are v_A and v_B

respectively and the trajectories are as shown in the figure. Then,



- A. $m_A v_A < m_B v_B$
- B. $m_A v_A > m_B v_B$
- C. $m_A < m_B$ and $v_A < v_B$
- D. $m_A = m_B$ and $v_A = v_B$

Answer: B



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5. A proton, a deuteron and an α -particle having the same kinetic energy are moving in circular trajectories in a constant magnetic field. If r_p , r_d and

r_α denote respectively the radii of the trajectories of these particles then

A. $r_\alpha = r_p < r_d$

B. $r_\alpha > r_d > r_p$

C. $r_\alpha = r_d > r_p$

D. $r_p = r_d = r_\alpha$

Answer: A



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6. Two particles X and Y having equal charges, after being acceleration through the same potential difference, enter a region of uniform magnetic field and describe circular paths of radii R_1 and R_2 , respectively.

The ratio of the mass of X to that of Y is

A. $(R_1 / R_2)^{1/2}$

B. R_2 / R_1

C. $(R_1 / R_2)^2$

D. R_1 / R_2

Answer:



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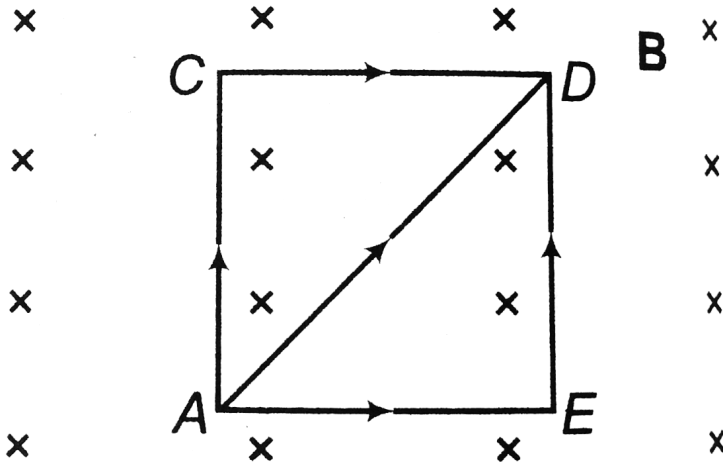
7. A horizontal rod $0.2m$ long is mounted on a balance and carries a current. At the location of the rod a uniform horizontal magnetic field has magnitude $0.067T$ and direction perpendicular to the rod. The magnetic force on the rod is measured by the balance and is found to be $0.13N$. What is the current?



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8. A square of side $2.0m$ is placed in a uniform magnetic field $B = 2.0T$ in a direction perpendicular to the plane of the square inwards. Equal current $i = 3.0A$ is flowing in the directions shown in figure. Find the

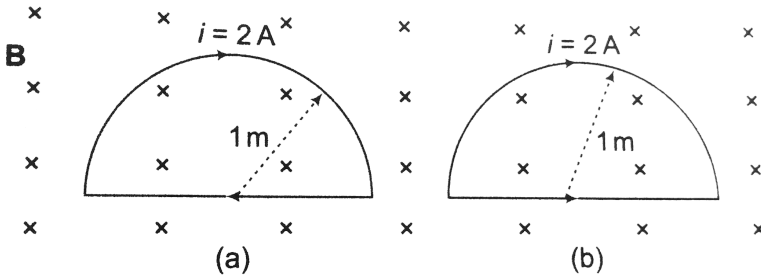
magnitude of magnetic force on the loop.



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9. In the figure shown a semicircular wire loop is placed in a uniform magnetic field $B = 1.0T$. The plane of the loop is perpendicular to the magnetic field. Current $i = 2A$ flows in the loop in the directions shown. Find the magnitude of the magnetic force in newton in both the cases a

and b . The radius of the loop is 1.0 m



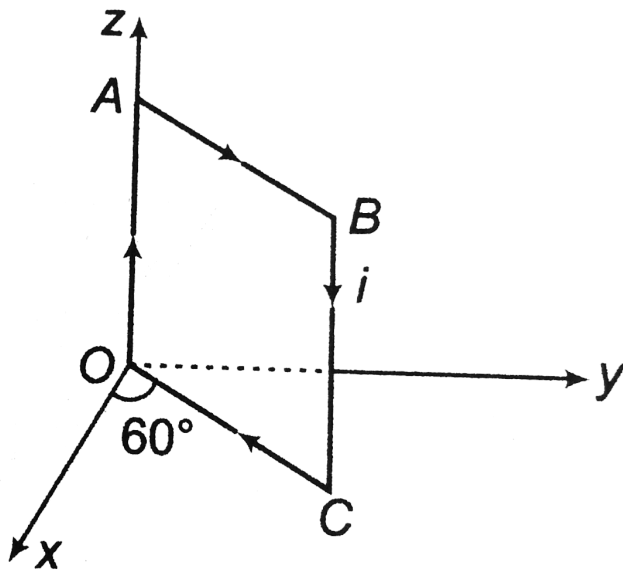
- A. $4N$
- B. $8N$
- C. $10N$
- D. $12N$

Answer: B



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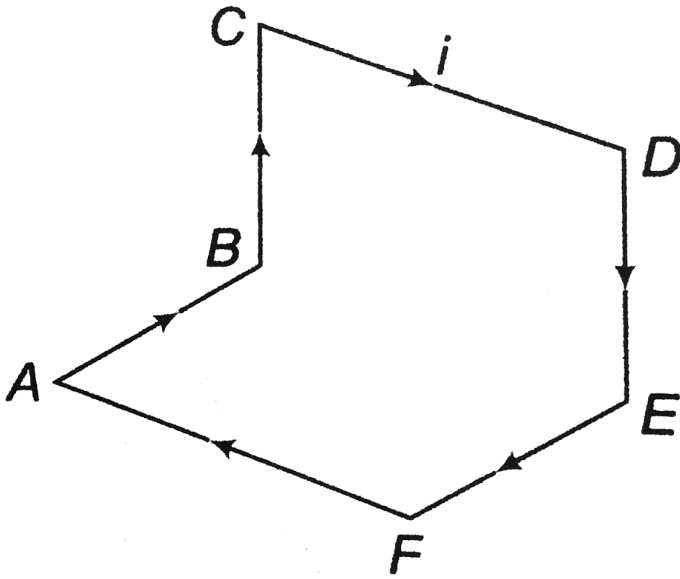
10. A square loop $OABCO$ of side of side l carries a current i . It is placed as shown in figure. Find the magnetic moment of loop.



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11. Find the magnitude of magnetic moment of the current carrying loop $ABCDEF A$. Each side of the loop is 10cm long and current in the loop

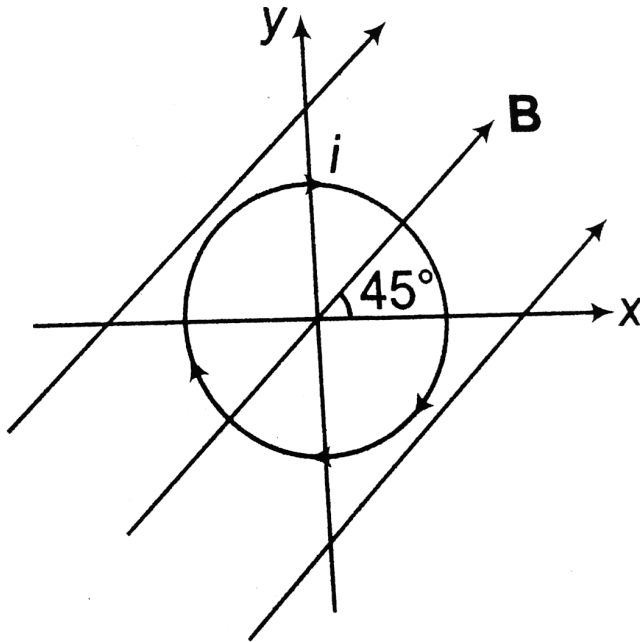
is $i = 2.0A$



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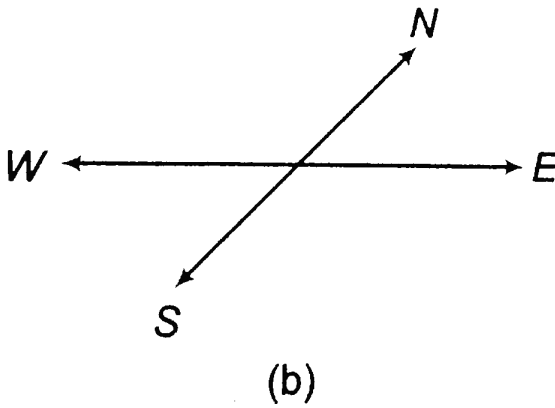
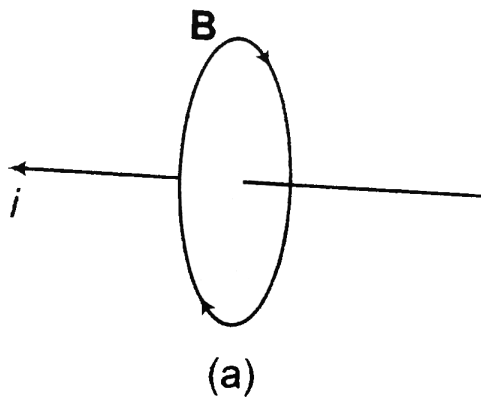
12. A circular loop of radius $R = 20$ cm is placed in a uniform magnetic field $B = 2T$ in xy -plane as shown in figure. The loop carries a current $i = 1.0A$ in the direction shown in figure. Find the magnitude of torque

acting on the loop.



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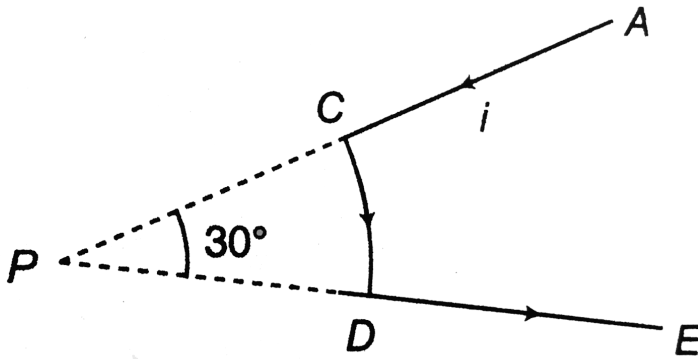
13. In a high tension wire electric current runs from east to west. Find the direction of magnetic field at points above and below the wire.



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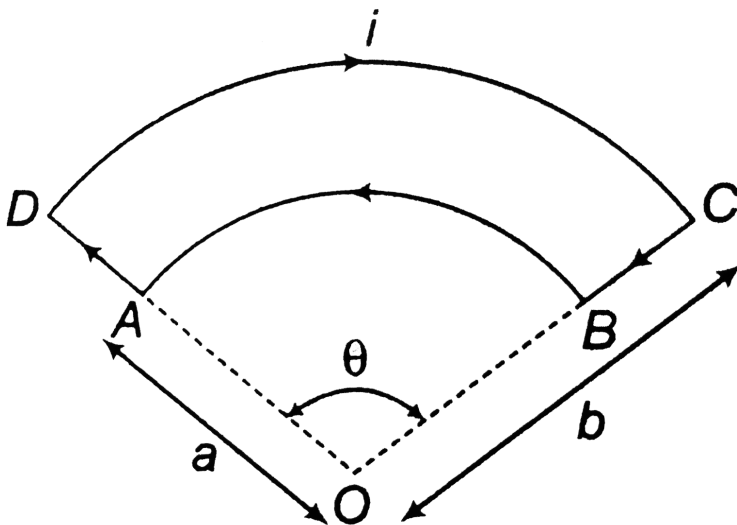
14. A current path shaped as shown in figure produces a magnetic field at P , the centre of the arc. If the arc subtends an angle of 30° and the radius of the arc is $0.6m$, what are the magnitude and direction of the

field produced at P if the current is 3.0A .



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15. Figure shows a current loop having two circular arcs joined by two lines. Find the magnitude field B at the centre O .





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16. The magnetic field B due to a current carrying circular loop of radius 12cm at its centre is $0.5 \times 10^{-4}\text{T}$. Find the magnetic field due to this loop at a point on the axis at a distance of 5.0cm from the centre.



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17. A closed curve encircles several conductors. The line integral $\int B \cdot dI$ around this curve is $3.83 \times 10^{-7}\text{T} \cdot \text{m}$

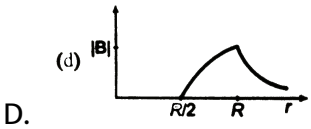
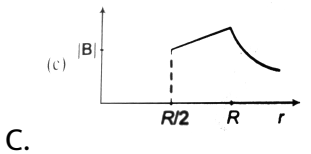
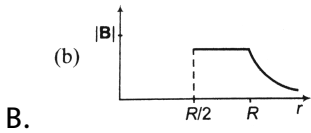
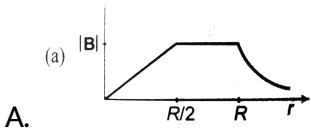
- What is the net current in the conductors?
- If you were to integrate around the curve in the opposite direction, what would be the value of the line integral?



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18. An infinitely long hollow conducting cylinder with inner radius $\frac{r}{2}$ and outer radius R carries a uniform current density along its length. The

magnitude of the magnetic field, $|\vec{B}|$ as a function of the radial distance r from the axis is best represented by



Answer: D



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19. A device called a toroid (figure) is often used to create an almost uniform magnetic field in some enclosed area. The device consists of a conducting wire wrapped around a ring (a torus) made of a non

conducting material. For a toroid having N closely spaced turns of wire, calculate the magnetic field in the region occupied by the torus, a distance r from the centre.



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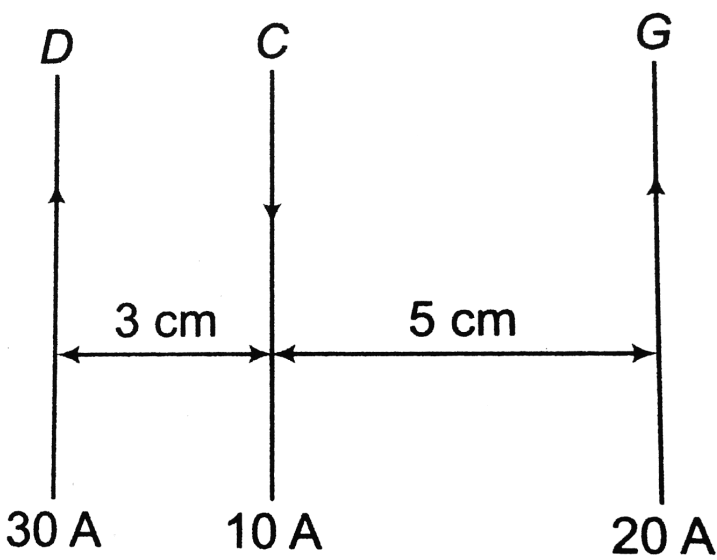
20. Two long parallel wires are separated by a distance of 2.50cm . The force per unit length that each wire exerts on the other is $4.00 \times 10^{-5} \frac{N}{m}$, and the wires repel each other. The current in one wire is 0.600A .

- What is the current in the second wire ?
- Are the two currents in the same direction or in opposite direction?



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21. Consider three long straight parallel wire as shown in figure. Find the force experienced by a 25cm length of wire C .



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22. Calculate the magnetic induction (or magnetic field) at a point 1A away from a proton, measured along its axis of spin. The magnetic moment of the proton is $1.4 \times 10^{-26} \text{ A} - \text{m}^2$

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23. A bar magnet of magnetic moment $2.0 \text{ A} - \text{m}^2$ is free to rotate about a vertical axis through its centre. The magnet is released from rest from

the east west position. Find the kinetic energy of the magnet as it takes the north south position. The horizontal component of the earth's magnetic field as $B = 25\mu T$. Earth's magnetic field is from south to north.

A. $40\mu J$

B. $50\mu J$

C. $60\mu J$

D. $70\mu J$

Answer: B

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24. In the magnetic meridian of a certain place, the horizontal component of earth's magnetic field is $0.26G$ and the dip angle is 60° . Find

Vertical component of earth's magnetic field

b. the net magnetic field at this place

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25. A magnet suspended at 30° with magnetic meridian makes an angle of 45° with the horizontal. What shall be the actual value of the angle of dip?



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26. A short bar magnet is placed with its north pole point in north. The neutral point is 10cm away from the centre of the magnet. If $H = 0.4\text{G}$, calculate the magnetic moment of the magnet.



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27. A magnetic needle performs 20 oscillations per minute in a horizontal plane. If the angle of dip be 30° , then how many oscillation per minute will this needle perform in vertical, north south plane and in vertical east - west plane?



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28. A rectangular coil of area $5.0 \times 10^{-4} m^2$ and 60 turns is pivoted about one of its vertical sides. The coil is in a radial horizontal magnetic field of $9 \times 10^{-3} T$. What is the torsional constant of the spring connected to the coil if a current of $0.20 mA$ produces an angular deflection of 18° ?

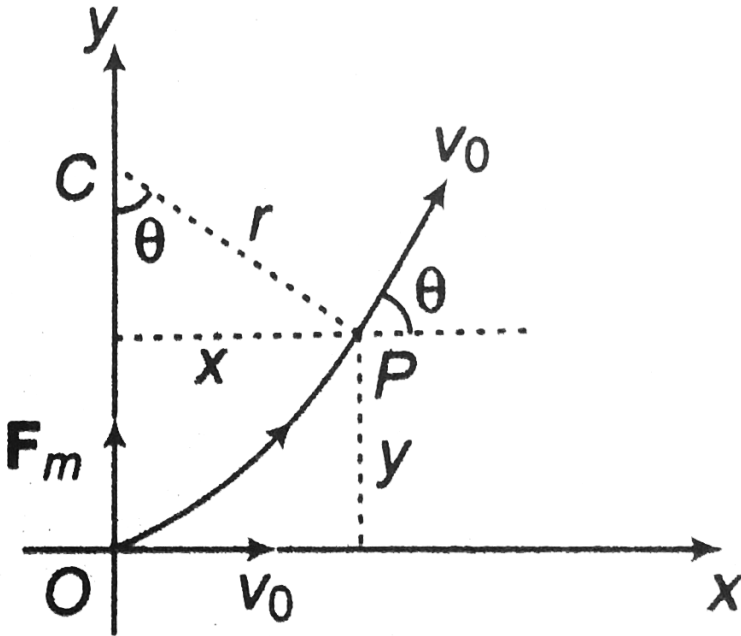
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29. The region between $x = 0$ and $x = L$ is filled with uniform steady magnetic field $B_0 \hat{k}$. A particle of mass m , positive charge q and velocity $v_0 \hat{i}$ travels along x -axis and enters the region of the magnetic field. Neglect the gravity throughout the question.

- Find the value of l if the particle emerges from the region of magnetic field with its final velocity at an angle 30° to its initial velocity.
- Find the final velocity of the particle and the time spent by it in the magnetic field, if the magnetic field now extends upto $2.1L$.

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30. A particle of specific charge α enters a uniform magnetic field $B = -B_0\hat{k}$ with velocity $v = v_0\hat{i}$ from the origin. Find the time dependence of velocity and position of the particle.



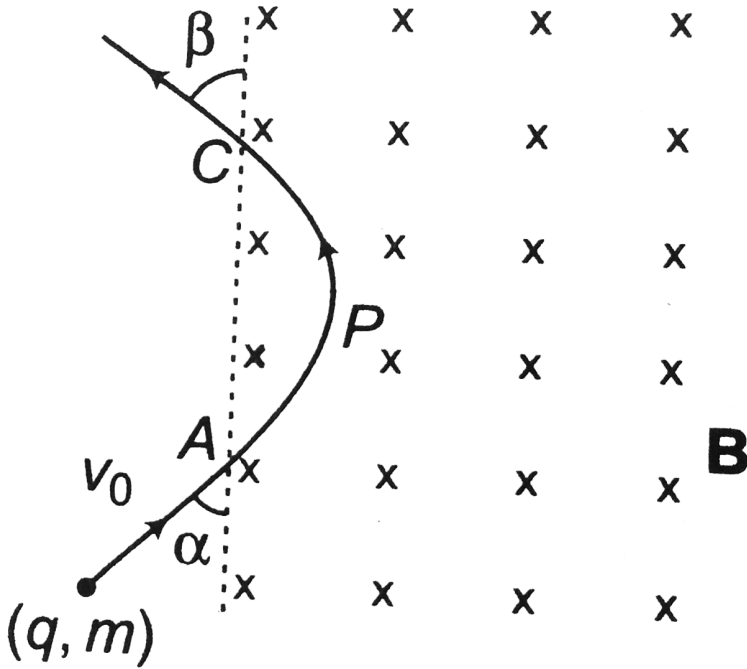
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31. A particle of specific charge α is projected from origin with velocity $v = v_0\hat{i} - v_0\hat{k}$ in a uniform magnetic field $B = -B_0\hat{k}$. Find time dependence of velocity and position of the particle.



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32. A charged particle (q, m) enters uniform magnetic field B at angle α shown in figure with speed v_0 . Find

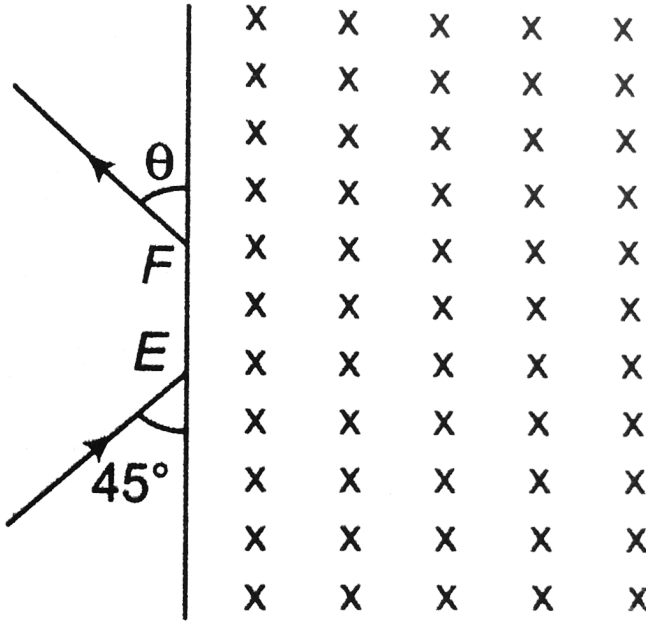


- The angle β at which it leaves the magnetic field
- time spent by the particle in magnetic field and
- the distance C .



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33. A particle of mass $m = 1.6 \times 10^{-27}$ kg and charge $q = 1.6 \times 10^{-19}$ C enters a region of uniform magnetic field of strength $1T$ along the direction shown in figure. The speed of the particle is 10^7 m/s

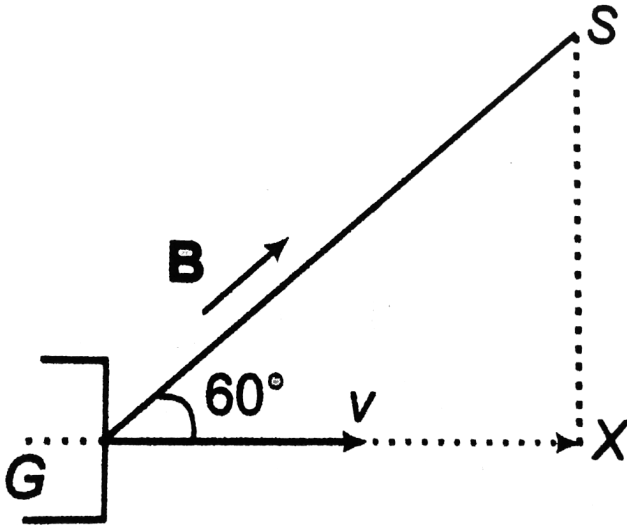


- The magnetic field is directed along the inward normal to the plane of the paper. The particle leaves the region of the field at the point F . Find the distance EF and the angle θ .
- If the direction of the field is along the outward normal to the plane of the paper find the time spent by the particle in the region of the magnetic field after entering it at E .



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34. An electron gun G emits electrons of energy $2keV$ travelling in the positive x-direction. The electrons are required to hit the spot S where $GS = 0.1m$, and the line GS makes an angle of 60° with the x-axis as shown in figure. A uniform magnetic field B parallel to GS exists in the region outside the electron gun.



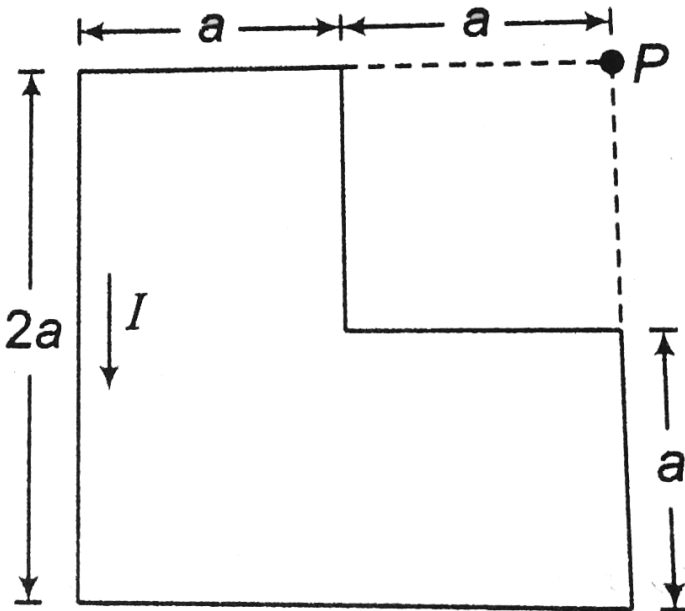
find the minimum value of B needed to make the electrons hit S .

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35. A wire shaped to a regular hexagon of side 2cm carries a current of 2A . Find the magnetic field at the centre of the hexagon.

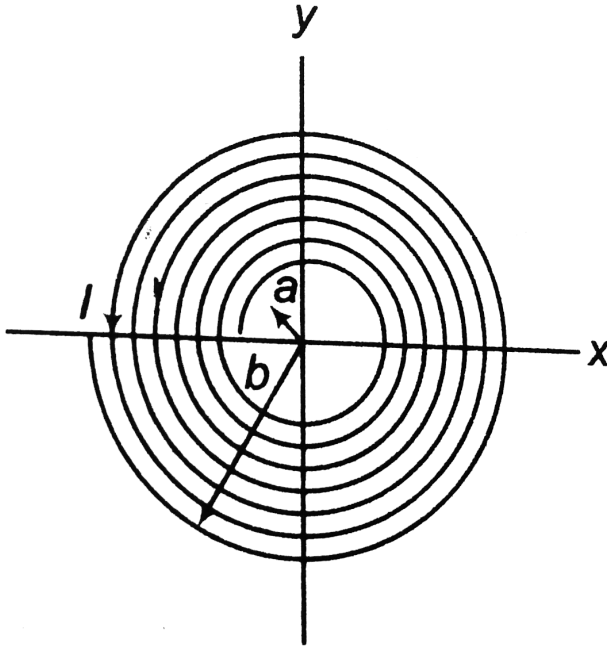
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36. Find the magnetic field B at the point P in figure



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37. A long insulated copper wire is closely wound as a spiral of N turns. The spiral has inner radius a and outer radius b . The spiral lies in the xy -plane and a steady current I flows through the wire. The z -component of the magnetic field at the centre of the spiral is



- A. $\frac{\mu_0 NI}{2(b-a)} \ln\left(\frac{b}{a}\right)$
- B. $\frac{\mu_0 NI}{2(b-a)} \ln\left(\frac{b+a}{b-a}\right)$
- C. $\frac{\mu_0 NI}{2b} \ln\left(\frac{b}{a}\right)$
- D. $\frac{\mu_0 NI}{2b} \left(\frac{b+a}{b-a}\right)$

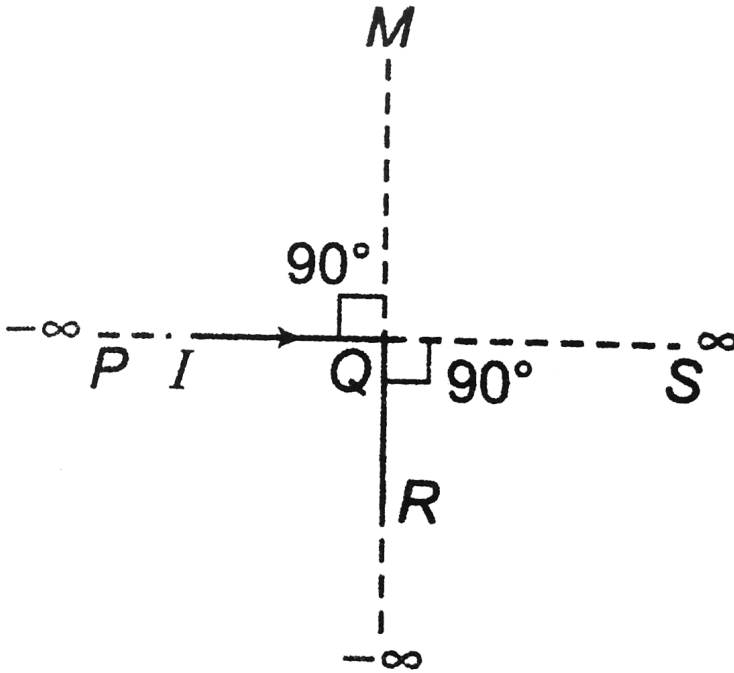
Answer: A



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38. An infinitely long conductor PQR is bent to form a right angle as shown in figure. A current I flows through PQR . The magnetic field due to this current at the point M is H_1 . Now, another infinitely long straight conductor QS is connected at Q , so that current is $\frac{I}{2}$ in QR as well as in QS , the current in PQ remaining unchanged. The magnetic field at M is

now H_2 . The ratio $\frac{H_1}{H_2}$ is given by`



A. $\frac{1}{2}$

B. 1

C. $\frac{2}{3}$

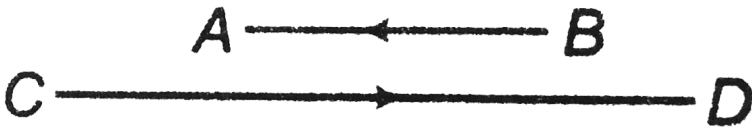
D. 2

Answer:



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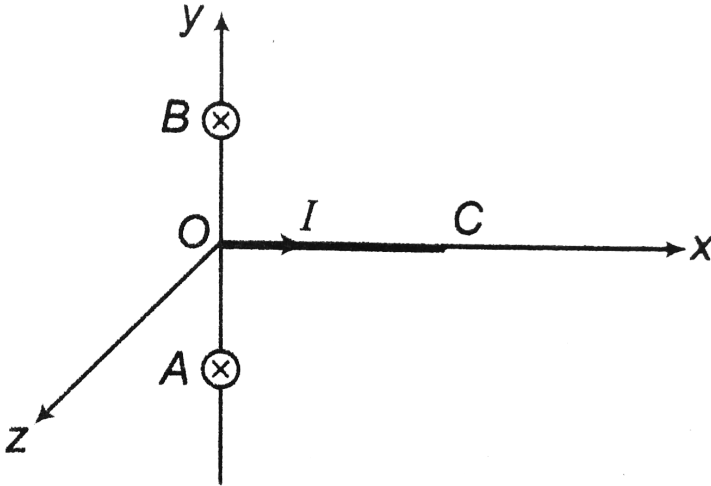
39. A long horizontal wire AB , which is free to move in a vertical plane and carries a steady current of $20A$, is in equilibrium at a height of $0.01m$ over another parallel long wire CD which is fixed in a horizontal plane and carries a steady current of $30A$, as shown in figure. Show that when AB is slightly depressed it executes simple harmonic motion. Find the period of oscillations.



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40. A straight segment OC (of length L) of a circuit carrying a current I is placed along the x -axis. Two infinitely long straight wire A and B each extending from $z = -\infty \rightarrow +\infty$ are fixed at $y = -a$ and $y = +a$ respectively as show in the figure. If the wires A and B each carry a

current I into the plane of the paper, obtain the expression for the force acting on the segment OC . What will be the force on OC if the current in the wire B is reversed?



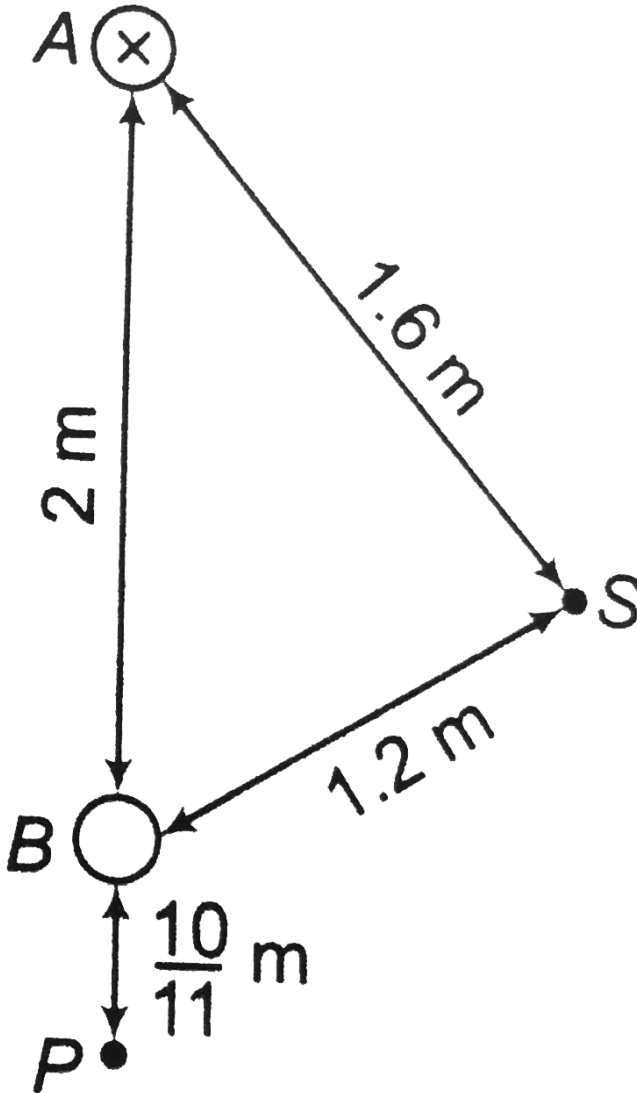
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41. Two long straight parallel wires are $2m$ apart, perpendicular to the plane of the paper. The wire A carries a current of $9.6A$, directed into the plane of the paper. The wire B carries a current such that the magnetic field of induction at the point P , at a distance of $\frac{10}{11}$ m from the wire B , is zero. find

a. the magnitude and direction of the current in B .

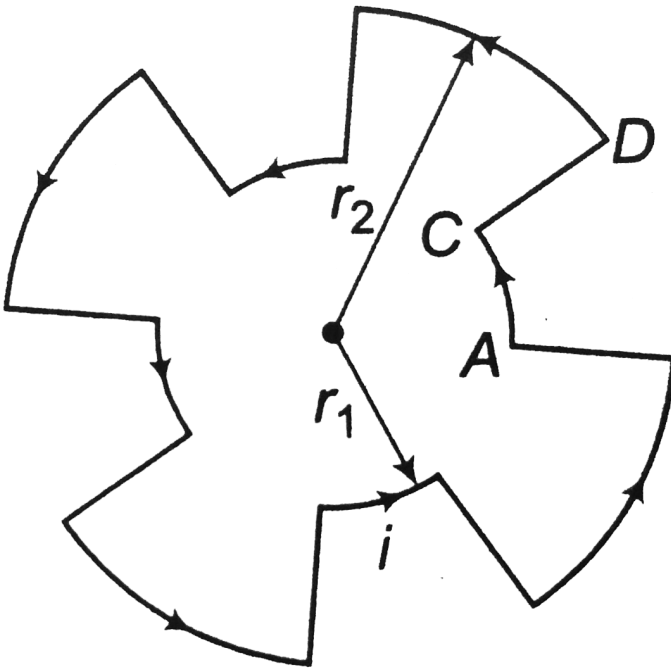
b. the magnitude of the magnetic field of induction of the point S .

c. the force per unit length on the wire B .



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42. A current of $10A$ flows around a closed path in a circuit which is in the horizontal plane as shown in the figure. The circuit consists of eight alternating arcs of radii $r_1 = 0.08m$ and $r_2 = 0.12m$. Each subtends the same angle at the centre.



- Find the magnetic field produced by this circuit at the centre.
- An infinitely long straight wire carrying a current of $10A$ is passing through the centre of the above circuit vertically with the direction of the

current being into the page of the circuit. what is the force acting on the wire at the centre due to the current in the circuit? What is the force acting on the arc AC and the straight segment CD due to the current at the centre?



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43. Consider the motion of a positive point charge in a region where there are simultaneous uniform electric and magnetic field $E = E_0 \hat{j}$ and $B = B_0 \hat{j}$. At time $t = 0$, this charge has velocity v in the xy -plane making an angle θ with the x -axis. Which of the following option(s) is (are) correct for time $t > 0$?

If $\theta = 0^\circ$ the charge moves in a circular path in the xy -plane.

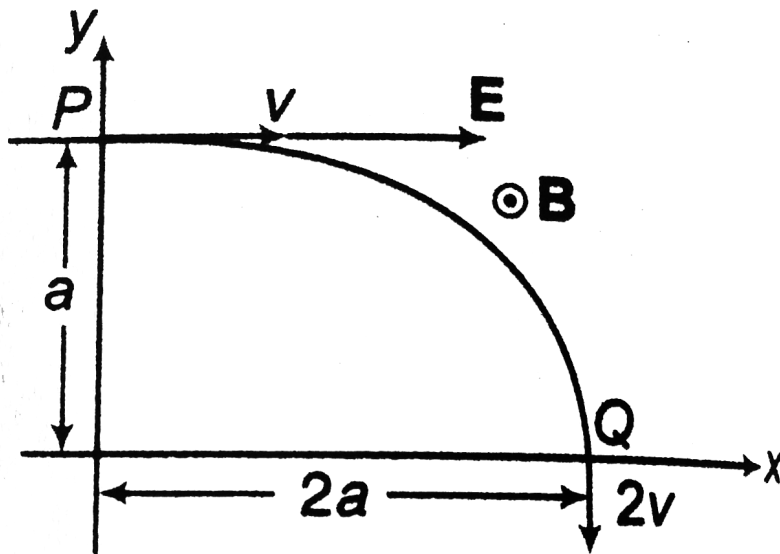
b. If $\theta = 0^\circ$ the charge undergoes helical motion with constant pitch along the y -axis.

c. If $\theta = 10^\circ$ the charge undergoes helical motion with its pitch increasing with time along the y -axis.

d. If $\theta = 90^\circ$ the charge undergoes linear but accelerated motion along the y -axis.



44. A particle of charge $+q$ and mass m moving under the influence of a uniform electric field $E\hat{i}$ and uniform magnetic field $B\hat{k}$ follows trajectory from P to Q as shown in figure. The velocities at P and Q are $v\hat{i}$ and $-2\hat{j}$. Which of the following statement(s) is/are correct?



a. $E = \frac{3}{4} \left[\frac{mv^2}{qa} \right]$

b. Rate of work done by the electric field at P is $\frac{3}{4} \left[\frac{mv^3}{a} \right]$

c. Rate of work done by the electric field at P is zero.

d. Rate of work done by both the field at Q is zero.



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45. A proton moving with a constant velocity passes through a region of space without any changing its velocity. If E and B represent the electric and magnetic fields, respectively. Then, this region of space may have

A. $E = 0, B = 0$

B. $E = 0, B \neq 0$

C. $E \neq 0, B = 0$

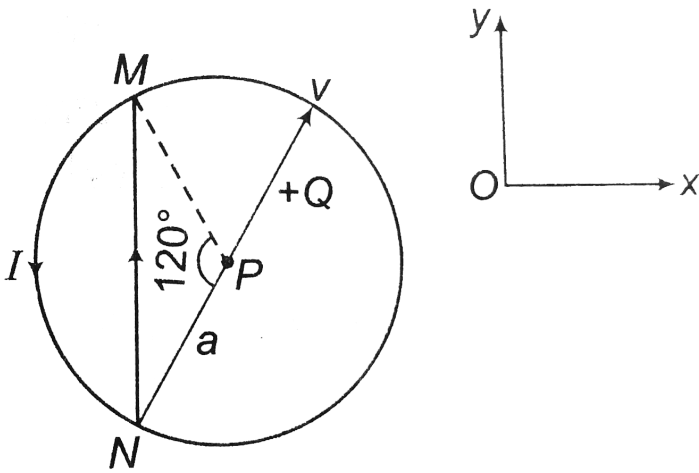
D. $E \neq 0, B \neq 0$

Answer: D



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46. A wire loop carrying a current I is placed in the xy -plane as shown in figure

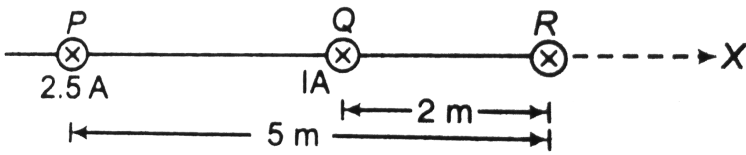


a. If a particle charge $+Q$ and mass m is placed at the centre P and given a velocity v along NP (see figure), find its instantaneous acceleration.

If an external uniform magnetic induction field $B = B\hat{i}$ is applied, find the force and the torque acting on the loop due to this field.

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47. Two long parallel wires carrying currents $2.5A$ and I (ampere) in the same direction (directed into the plane of the paper) are held at P and Q , respectively such that they are perpendicular to the plane of paper. The points P and Q are located at distance of $5m$ and $2m$ respectively from a collinear point R (see figure).



a. An electron moving with a velocity of 4×10^5 m/s along the positive x-direction experiences a force of magnitude 3.2×10^{-20} N at the point R.

Find the value of I .

b. Find all the positions at which a third long parallel wire carrying a current of magnitude $2.5A$ may be placed, so that the magnetic induction at R is zero.

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48. When $E \uparrow \uparrow B$ and particle velocity is perpendicular to both of these fields.

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49. When $E \perp B$ and the particle is released at rest from origin.

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50. A cyclotron's oscillator frequency is 10MHz . What should be the operating magnetic field for accelerating protons? If the radius of its dees is 60cm , what is the kinetic energy (in MeV) of the proton beam produced by the acceleration?

$$(e = 1.60 \times 10^{-19}\text{C}, m_p = 1.67 \times 10^{-27}\text{kg}, 1\text{MeV} = 1.6 \times 10^{-13}\text{J})$$



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51. A charged particle carrying charge $q = 1\mu\text{C}$ moves in uniform magnetic field with velocity $v_1 = 10^6\text{m/s}$ at angle 45° with x -axis in the xy -plane and experiences a force $F_1 = 5\sqrt{2}\text{mN}$ along the negative z -axis.

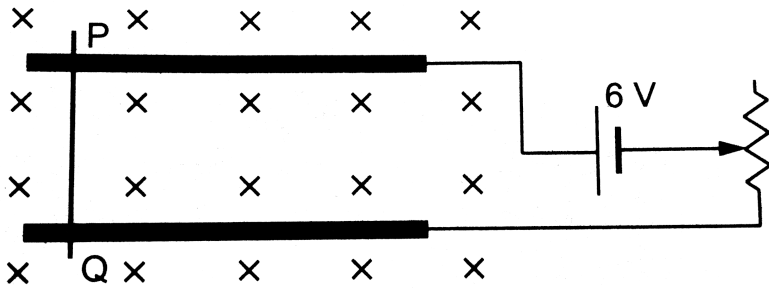
When the same particle moves with velocity $v_2 = 10^6\text{m/s}$ along the z -axis it experiences a force F_2 in y -direction. Find

- the magnitude and direction of the magnetic field
- the magnitude of the force F_2 .



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52. A metal wire PQ of mass 10g lies at rest on two horizontal metal rails separated by 4.90 cm. A vertically downward magnetic field of magnitude 0.800 T exists in the space. The resistance of the circuit is slowly decreased and it is found that when the resistance goes below 20.0Ω , the wire PQ starts sliding on the rails. Find the coefficient of friction.



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53. What is the value of B that can be set up at the equator to permit a proton of speed 10^7 m/s to circulate around the earth?

$$[R = 6.4 \times 10^6 \text{ m}, m_p = 1.67 \times 10^{-27} \text{ kg}]$$

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54. Deuteron in a cyclotron describes a circle of radius 32.0cm . Just before emerging from the D 's. The frequency of the applied alternating voltage is 10MHz . Find

- the magnetic flux density (i.e. the magnetic field).
- the energy and speed of the deuteron upon emergence.



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55. In the Bohr model of the hydrogen atom, the electron circulates around the nucleus in a path of radius $5 \times 10^{-11}\text{m}$ at a frequency of $6.8 \times 10^{15}\text{Hz}$.

- What value of magnetic field is set up at the centre of the orbit?
- What is the equivalent magnetic dipole moment?



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56. A flat dielectric disc of radius R carries an excess charge on its surface. The surface charge density σ . The disc rotates about an axis

perpendicular to its lane passing through the centre with angular velocity ω . Find the torque on the disc if it is placed in a uniform magnetic field B directed perpendicular to the rotation axis.

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57. Three infinitely long thin wires, each carrying current i in the same direction, are in the xy -plane of a gravity-free space. The central wire is along the y -axis while the other two are along $x = \pm d$

i) Find the locus of the points for which the magnetic field B is zero.

ii) If the central wire is displaced along the z -direction by a small amount and released, show that it will execute simple harmonic motion. If the linear mass density of the wires is λ , find the frequency of oscillation.

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58. Uniform electric and magnetic fields with strength E and B are directed along the x -axis. A particle with specific charge $\frac{q}{m}$ leaves the origin in the direction of x -axis with an initial velocity v_0 . Find

- a. the y-coordinate of the particle when it crosses the y-axis for nth time.
- b. the angle α between the particle's velocity vector and the y-axis for nth time



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59. A current is passing through a cylindrical conductor with a hole (or cavity) inside it. Show that the magnetic field inside the hole is uniform and find its magnitude and direction.



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60. A particle of charge q and mass m is projected from the origin with velocity $v = v_0 \hat{i}$ in a non uniform magnetic field $B = -B_0 x \hat{k}$. Here v_0 and B_0 are positive constants of proper dimensions. Find the maximum positive x coordinate of the particle during its motion.



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Exercise

1. Write the dimensions of $\frac{E}{B}$. Here, E is the electric field and B the magnetic field.



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2. In the relation $F = q(V \times B)$, which pairs are always perpendicular to each other.



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3. If a beam of electrons travels in a straight line in a certain region. Can we say there is no magnetic field?



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4. A charge $q = 4\mu\text{C}$ has an instantaneous velocity $v = (2\hat{i} - 3\hat{j} + \hat{k}) \times 10^6 \frac{\text{m}}{\text{s}}$ in a uniform magnetic field $B = (2\hat{i} + 5\hat{j} - 3\hat{k}) \times 10^{-2}\text{T}$. What is the force on the charge?

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5. A particle initially moving towards south in a vertically downward magnetic field is deflected toward the east. What is the sign of the charge on the particle?

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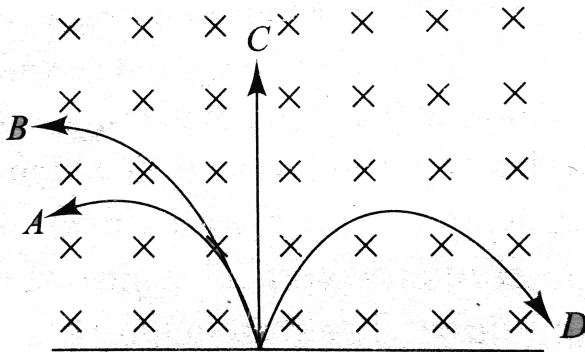
6. An electron experiences a magnetic force of magnitude $4.60 \times 10^{-15}\text{N}$, when moving at an angle of 60° with respect to a magnetic field of magnitude $3.50 \times 10^{-3}\text{T}$. Find the speed of the electron.

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7. He^{2+} ion travels at right angles to a magnetic field of $0.80T$ with a velocity of $10^5 \frac{m}{s}$. Find the magnitude of the magnetic force on the ion.

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8. A neutron, a proton, an electron and an alpha particle enter a region of constant magnetic field with equal velocities. The magnetic field is along the inward normal to the plane of the paper. The tracks of the particles are labelled in Fig. The electron follow track..... and the alpha particle follow track.....



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9. An electron and a proton are moving with the same kinetic energy along the same direction, When they pass through a uniform magnetic field perpendicular to the direction of their motion, they describe circular path of the same radius. Is this statement true or false?

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10. A charged particle enters a region of uniform magnetic field at an angle of 85° to the magnetic line of force. The path of the particle is a circle. Is this statement true or false?

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11. Can a charged particle be accelerated by a magnetic field. Can its speed be increased?

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12. An electron beam projected along positive x-axis deflects along the positive y-axis. If this deflection is caused by a magnetic field, what is the direction of the field?



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13. An electron and a proton are projected with same velocity perpendicular to a magnetic field.

(a) Which particle will describe the smaller circle?

(b) Which particle will have greater frequency?



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14. An electron is accelerated through a PD of $100V$ and then enters a region where it is moving perpendicular to a magnetic field $B = 0.2T$. Find the radius of the circular path. Repeat this problem for a proton.



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15. A wire of length l carries a current along the x -axis. A magnetic field $B = B_0(\hat{j} + \hat{k})$ exists in the space. Find the magnitude of the magnetic force acting on the wire.



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16. A wire along the x -axis carries a current of $3.50A$ in the negative direction. Calculate the force (expressed in term of unit vectors) on a $1.00cm$ section of the wire exerted by these magnetic fields.

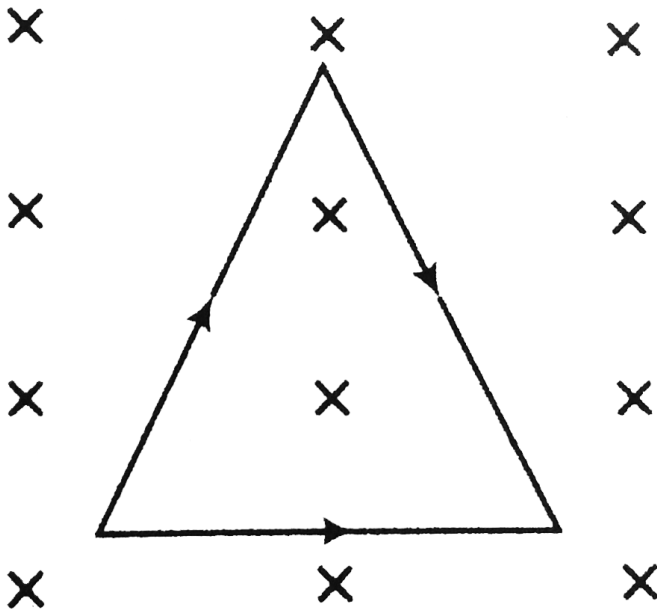
a. $B = - (0.65T)\hat{j}$ b. $B = +(0.56T)\hat{k}$ c. $B = - (0.31T)\hat{j}$

d. $B = 0.33T \hat{i} - (0.28T)\hat{k}$ e. $B = + (0.74T)\hat{j} - 0(0.36T)\hat{k}$



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17. Find net force on the equilateral loop of side m carrying a current of $2A$ kept in a uniform magnetic field of $2T$ as shown in figure.



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18. A charge q is uniformly distributed on a non-conducting disc of radius R . It is rotated with an angular speed ω about an axis passing through the centre of mass of the disc and perpendicular to its plane. Find the magnetic moment of the disc.

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19. A circular loop of wire having a radius of 8.0cm carries a current of 0.20A . A vector of unit length and parallel to the dipole moment \mathbf{W} of the loop is given by $0.60\hat{i} - 0.80\hat{j}$. If the loop is located in a uniform magnetic field given by $\mathbf{B} = (0.25\text{T})\hat{i} + (0.30\text{T})\hat{k}$ find,

(a) the torque on the loop and

(b) the magnetic potential energy of the loop.

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20. A length L of wire carries a current i . Show that if the wire is formed into a circular coil, then the maximum torque in a given magnetic field is developed when the coil has one turn only, and that maximum torque has the magnitude $\tau = L^2 i \frac{B}{4} \pi$

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21. A coil with magnetic moment $1.45\text{A} \cdot \text{m}^2$ is oriented initially with its magnetic moment antiparallel to a uniform 0.835T magnetic field. What

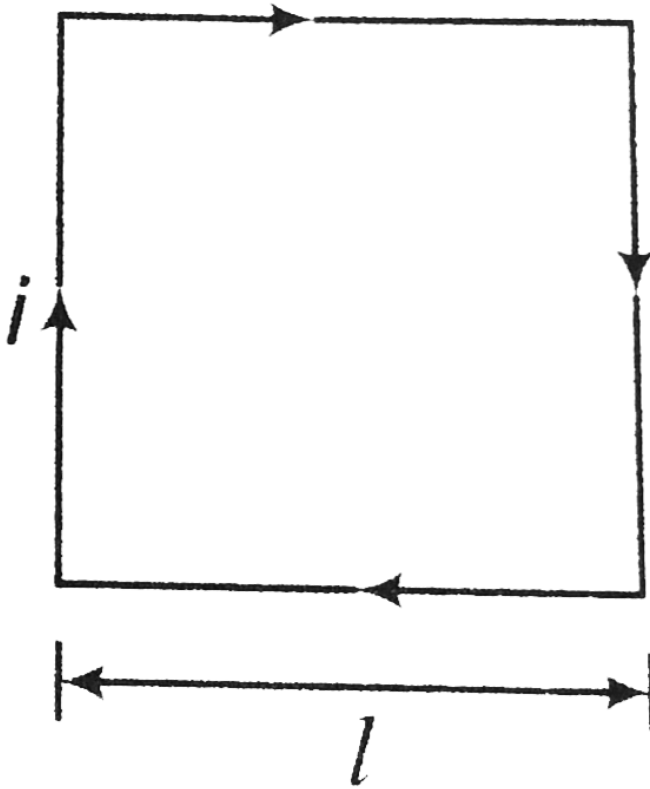
is the change in potential energy of the coil when it is rotated 180° so that its magnetic moment is parallel to the field?

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22. a. A conductor in the shape of a square of edge length $l = 0.4m$ carries a current $i = 10.0A$. Calculate the magnitude and direction of magnetic field at the centre of the square.

b. If this conductor is formed into a single circular turn and carries the

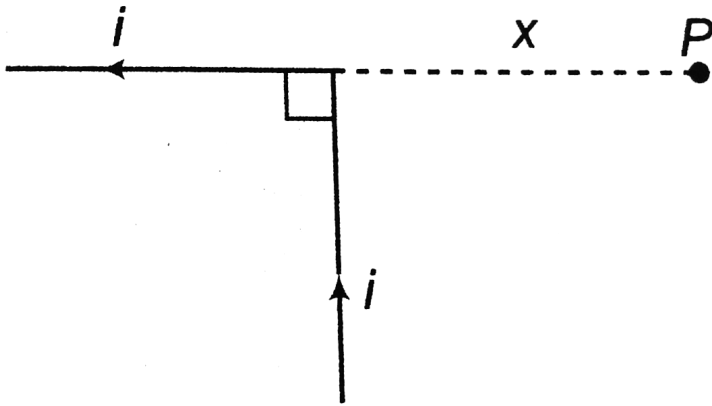
same current. what is the value of the magnetic field at the centre.



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23. Determine the magnetic field at point P located a distance x from the corner of an infinitely long 2. Wire bent at right angle as shown in figure.

The wire carries a steady current i .

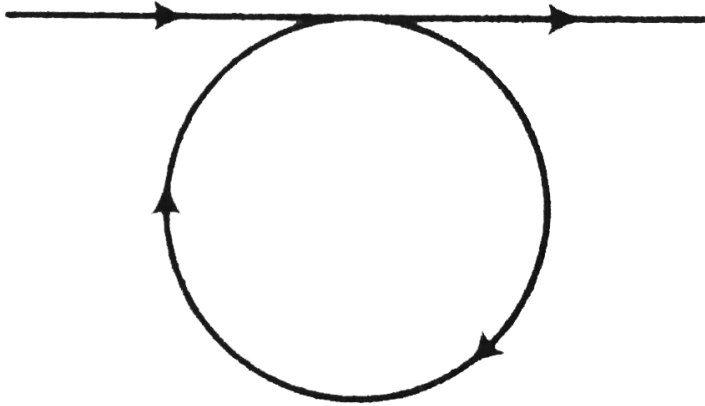


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24. A conductor consists of a circular loop of radius $R = 10\text{cm}$ and two straight, long sections as shown in figure. The wire lies in the plane of the paper and carries a current of $i = 7.00\text{A}$. Determine the magnitude and

direction of the magnetic field at the centre of the loop.

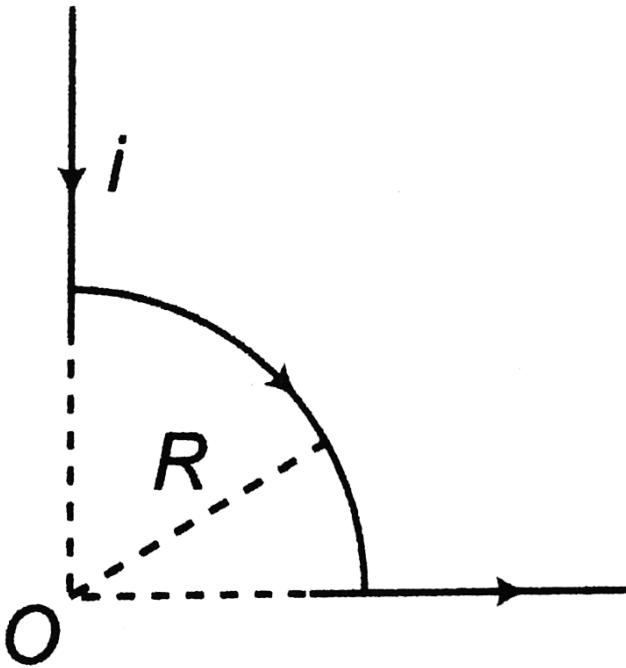
$$i = 7.0 \text{ A}$$



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25. The segment of wire shown in figure carries a current of $i = 5.0 \text{ A}$ where the radius of the circular arc is $R = 3.0 \text{ cm}$. Determine the

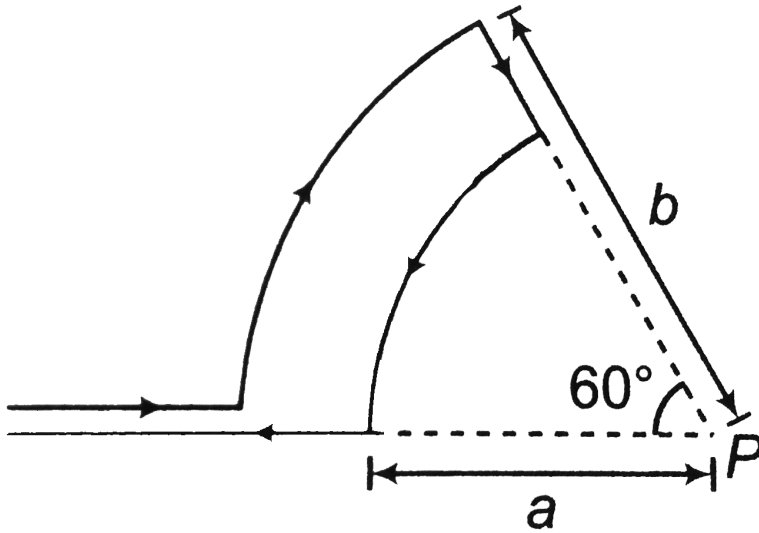
magnitude and direction of the magnetic field at the origin.



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26. Consider the current carrying loop shown in figure formed of radial lines and segments of circles whose centres are at point P . Find the

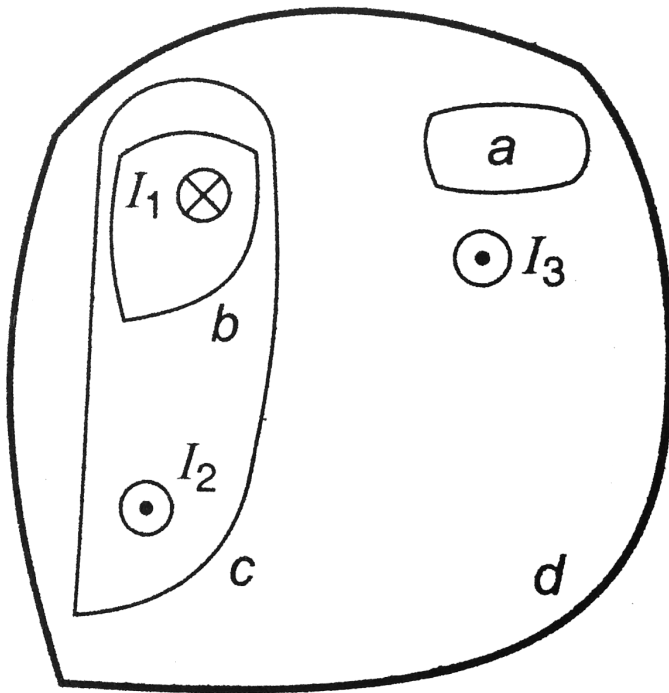
magnitude and direction of B at point P .



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27. Figure shows, in cross-section, several conductors that carry currents through the plane of the figure. The currents have the magnitudes $i_1 = 4.0A$, $I_2 = 6.0A$, and $I_3 = 2.0 A$, in the directions shown. Four paths labelled a to d, are shown. What is the line integral $\int B \cdot dI$ for each path? Each integral involves going around the path in the counter-

clockwise direction.



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28. A current I flows along the length of an infinitely long, straight, thin-walled pipe. Then,

(a) the magnetic field at all points inside the pipe is the same, but not zero

(b) the magnetic field at any point inside the pipe is zero

(c) the magnetic field is zero only on the axis of the pipe

(d) the magnetic field is different at different points inside the pipe



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29. A coil of a moving Coil galvanometer twists through 90° when a current of one microampere is passed through it. If the area of the coil is $10^{-4}m^2$ and it has 100 turns, calculate the magnetic field of the magnet of the galvanometer. Given, $k = 10^{-8}N - m /degree$.



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30. A galvanometer coil $5cm \times 2cm$ with 200 turns is suspended vertically in a field of $5 \times 10^{-2}T$. The suspension fibre needs a torque of $0.125 \times 10^{-7}N - m$ to twist it through one radian. Calculate the strength of the current required to be maintained in the coil if we require a deflection of 6° .



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31. Assertion : Path of a charged particle in uniform magnetic field cannot be a parabola.

Reason : For parabolic path acceleration should be constant.

- A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
- B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion
- C. If Assertion is true, but the Reason is false.
- D. If Assertion is false but the Reason is true.

Answer: C



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32. Assertion : A beam of protons is moving towards east in vertically upward magnetic field. Then, this beam will deflect towards south.

Reason : A constant magnetic force will act on the proton beam.

- A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
- B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion
- C. If Assertion is true, but the Reason is false.
- D. If Assertion is false but the Reason is true.

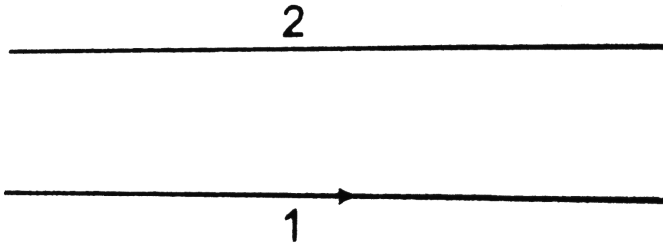
Answer: C



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33. Assertion : Current in wire-1 is in the direction as shown in figure. The bottom wire is fixed. To keep the upper wire stationary, current in it should be in opposite direction.

Reason : Under the above condition, equilibrium of upper wire is stable.



- A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
- B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion
- C. If Assertion is true, but the Reason is false.
- D. If Assertion is false but the Reason is true.

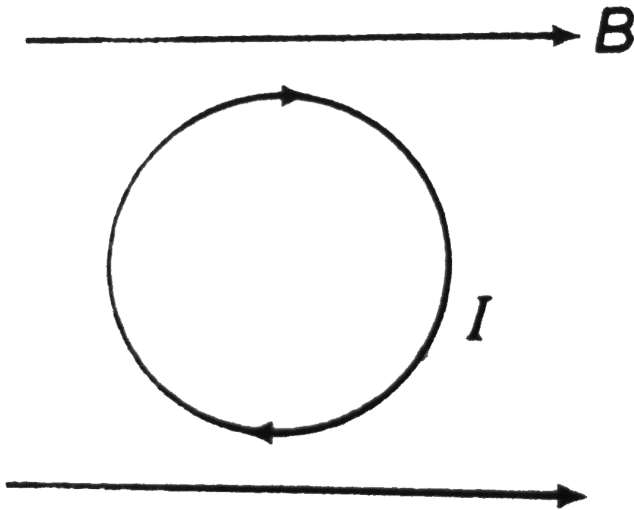
Answer: B



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34. Assertion : A current carrying loop is placed in uniform magnetic field as shown in figure. Torque in the loop in this case is zero.

Reason : Magnetic moment vector of the loop is perpendicular to paper inwards.



- A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
- B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion
- C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

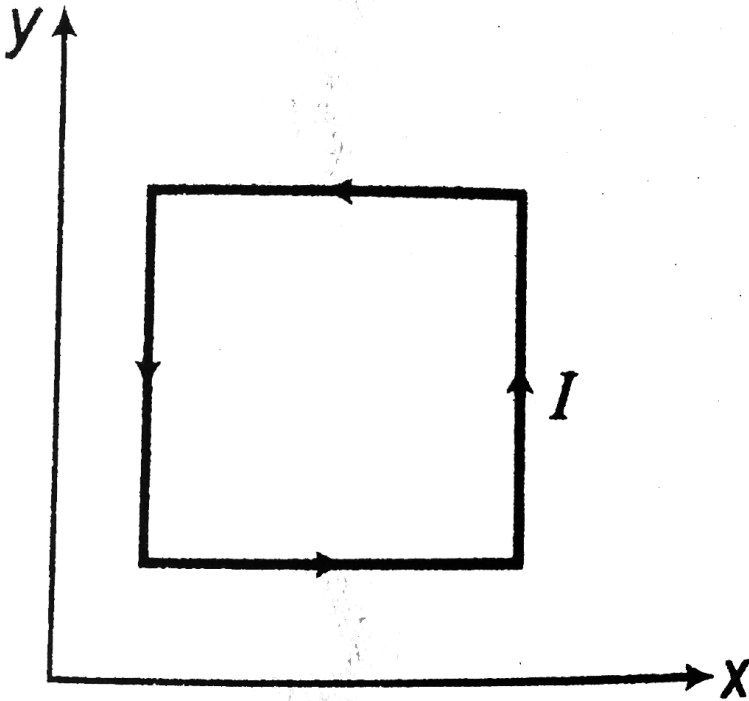
Answer: D



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35. Assertion : Force on current carrying loop shown in figure in Y magnetic field, $B = (B_0x)\hat{k}$ is along positive x -axis. Here, B_0 is a positive constant.

Reason : A torque will also act on the loop. brgt



- A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
- B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion
- C. If Assertion is true, but the Reason is false.
- D. If Assertion is false but the Reason is true.

Answer: C



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36. Assertion : An electron and a proton are accelerated by same potential difference and then enter in uniform transverse magnetic field.

The radii of the two will be different.

Reason : Charges on them are different.

- A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
- B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion
- C. If Assertion is true, but the Reason is false.
- D. If Assertion is false but the Reason is true.

Answer: B



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37. A charged particle moves along positive y-axis with constant velocity in uniform electric and magnetic fields. If magnetic field is acting along positive x-axis, then, electric field should act along positive z-axis.

Reason: To keep the charged particle undeviated the relation $E = B \times v$ must hold good.

- A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
- B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion
- C. If Assertion is true, but the Reason is false.
- D. If Assertion is false but the Reason is true.

Answer: A



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38. Assertion: Power of a magnetic force on a charged particle is always zero.

Reason: Power of electric force on charged particle cannot be zero.

A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion

C. If Assertion is true, but the Reason is false.

D. If Assertion is false but the Reason is true.

Answer: C

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39. Assertion : If a charged particle enters from outside at right angles in uniform magnetic field. The maximum time spent in magnetic field may be

$$\frac{\pi m}{Bq}$$

Reason: It can complete only semi circle in the magnetic field.

- A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
- B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion
- C. If Assertion is true, but the Reason is false.
- D. If Assertion is false but the Reason is true.

Answer: A



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40. Assertion: A charged particle enters in a magnetic field $B = B_0 \hat{i}$ with velocity $v = v_0 \hat{i} + v_0 \hat{j}$, then minimum speed of charged particle may be v_0 .

Reason: A variable acceleration particle may be v_0 .

- A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
- B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion
- C. If Assertion is true, but the Reason is false.
- D. If Assertion is false but the Reason is true.

Answer: D

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41. Assertion: A charged particle is moving in a circle with constant speed in uniform magnetic field. If we increase the speed of particle to twice, its acceleration will become four times.

Reason: In circular path of radius R with constant speed v , acceleration is given by $\frac{v^2}{R}$

- A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
- B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion
- C. If Assertion is true, but the Reason is false.
- D. If Assertion is false but the Reason is true.

Answer: D



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42. The universal property among all substance is

- A. diamagnetism
- B. paramagnetilsm
- C. ferromagnetism
- D. non magnetism

Answer: A



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43. A charged particle moves in a circular path in a uniform magnetic field.

If its speed is reduced, then its time period will

A. increase

B. decrease

C. remain same

D. none of these

Answer: C



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44. A straight wire of diameter 0.5mm carrying a current 2A is replaced

by another wire of diameter 1mm carrying the same current. The

strength of magnetic field at a distance $2m$ away from the centre is

- A. half of the previous value
- B. twice of the previous value
- C. unchanged
- D. quarter of its previous value

Answer: C



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45. The path of a charged particle moving in a uniform steady magnetic field cannot be a

- A. straight line
- B. circle
- C. parabolas
- D. none of these

Answer: C



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46. The *SI* unit of magnetic permeability is

A. $Wbm^{-2}A^{-1}$

B. $Wbm^{-1}A$

C. $Wbm^{-1}A^{-1}$

D. $WbmA^{-1}$

Answer: C



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47. Identify the correct statement about the magnetic field lines.

A. These start always from closed loops

B. These lines always form closed loops

C. Both a and b are correct

D. Both a and b are wrong

Answer: B



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48. Identify the correct statement related to the direction of magnetic moment of a planar loop.

A. It is always perpendicular to the plane of the loop

B. It depends on the direction of current

C. It is obtained by right hand screw rule

D. All of the above

Answer: D



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49. A non planar closed loop of arbitrary shape carryign a current I is placed in uniform magnetic field. The force acting on the loop

- A. is zero only for one orientation of loop in magnetic field
- B. is zero for two symmetrically located positions of loop in magnetic field
- C. is zero for all orientations
- D. is never zero

Answer: C



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50. The magnetic dipole moment of current loop is independent of

- A. number of turns
- B. area of loop

C. current in the loop

D. magnetic field in which it is lying

Answer: D



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51. The acceleration of an electron at a certain moment in a magnetic field

$B = 2\hat{i} + 3\hat{j} + 4\hat{k}$ is $a = x\hat{i} + \hat{j} - \hat{k}$. The value of x is

A. 0.5

B. 1

C. 2.5

D. 1.5

Answer: A



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52. A closed loop carrying a current I lies in the xz -plane. The loop will experience a force if it is placed in a region occupied by uniform magnetic field along

- A. x -axis
- B. y -axis
- C. z -axis
- D. none of these

Answer: D



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53. A stream of protons and α -particle of equal momenta enter a uniform magnetic field perpendicularly. The radii of their orbits are in the ratio

- A. 1 : 1
- B. 1 : 2
- C. 2 : 1

D. 4: 1

Answer: C



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54. As loop of magnetic moment M is placed in the orientation of unstable equilibrium position in a uniform magnetic field B . The external work done in rotating it through an angle θ is

A. $-MB(1 - \cos \theta)$

B. $-Mb \cos \theta$

C. $Mb \cos \theta$

D. $MB(1 - \cos \theta)$

Answer: A



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55. A current of $50A$ is placed through a straight wire of length $6cm$ then the magnetic induction at a point $5cm$ from the either end of the wire is ($1gauss = 10^{-4}T$)

- A. $2.5gauss$
- B. $1.25gauss$
- C. $1.5gauss$
- D. $3.0gauss$

Answer: C



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56. The magnetic field due to a current carrying circular loop of radius $3m$ at as point on the axis at a distance of $4m$ from the centre is $54\mu T$. What will be its value at the centre of the loop/

- A. $250\mu T$
- B. $150\mu T$

C. $125\mu T$

D. $75\mu T$

Answer: A



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57. A conductor ab of arbitrary shape carries current I flowing from b to a . The length vector ab is oriented from a to b . The force F experienced by this conductor in a uniform magnetic field B is

A. $F = -I(ab \times B)$

B. $F = I(b \times ab)$

C. $F = I(ba \times B)$

D. All of the above

Answer: D



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58. When an electron is accelerated through a potential difference V , it experience a force F through a uniform transverse magnetic field. If the potential difference is increased to $2V$, the force experienced by the electron in the same magnetic field is

A. $2F$

B. $2\sqrt{2}F$

C. $\sqrt{2}F$

D. $4F$

Answer: C



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59. Two long straight wires, each carrying a current I in opposite directions are separated by a distance R . The magnetic induction at a point midway between the wires is

A. zero

B. $\frac{\mu_0 I}{\pi R}$

C. $\frac{2\mu_0 I}{\pi R}$

D. $\frac{\mu_0 I}{4\pi R}$

Answer: C



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60. The magnetic field at a distance x on the axis of a circular coil of radius R is $\frac{1}{8}$ th of that at the centre. The value of x is

A. $\frac{R}{\sqrt{3}}$

B. $\frac{2R}{\sqrt{3}}$

C. $R\sqrt{3}$

D. $R\sqrt{2}$

Answer: C

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61. Electric field and magnetic field in a region of space is given by $E = E_0 \hat{j}$ and $B = B_0 \hat{j}$. A particle of specific charge α is released from origin with velocity $v = v_0 \hat{i}$. Then path of particle

- A. is a circle
- B. is a helix with uniform pitch
- C. is a helix with non uniform pitch
- D. is cycloid

Answer: C

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62. An electron having kinetic energy K is moving in a circular orbit of radius R perpendicular to a uniform magnetic induction. If kinetic energy is doubled and magnetic induction tripled, the radius will become

A. $\frac{2R}{3}$

B. $\frac{\sqrt{2}}{3}R$

C. $\sqrt{\frac{2}{3}}R$

D. $\frac{2}{\sqrt{3}}R$

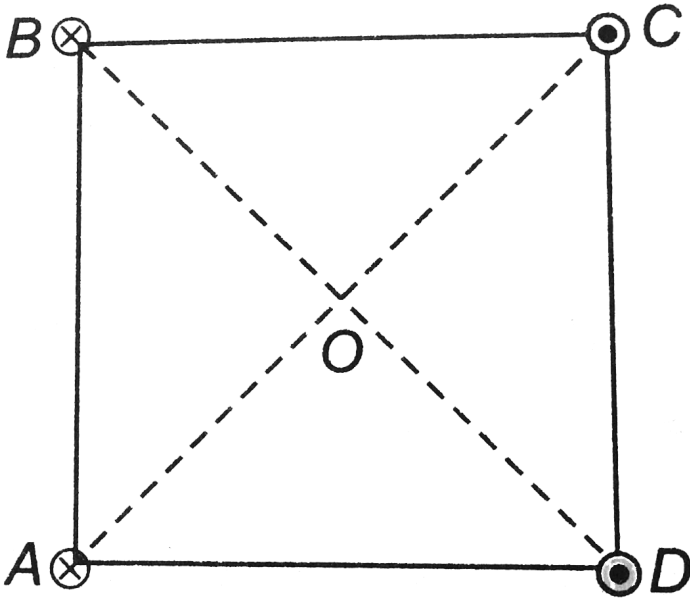
Answer: B



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63. Four long straight wires are located at the corners of a square $ABCD$. All the wires carry equal currents. Current in the wires A and B are inwards and in C and D are outwards. The magnetic field at the

centre O is along



A. AD

B. CB

C. AB

D. CD

Answer: D



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64. A charged particle of mass m and charge q is accelerated through a potential differences of V volts. It enters of uniform magnetic field B which is directed perpendicular to the direction of motion of the particle. The particle will move on a circular path of radius

A. $\left(\frac{\sqrt{Vm}}{2qB^2} \right)$

B. $\frac{2Vm}{qB^2}$

C. $\sqrt{\frac{2Vm}{q}} \left(\frac{1}{B} \right)$

D. $\sqrt{\frac{Vm}{q}} \left(\frac{q}{B} \right)$

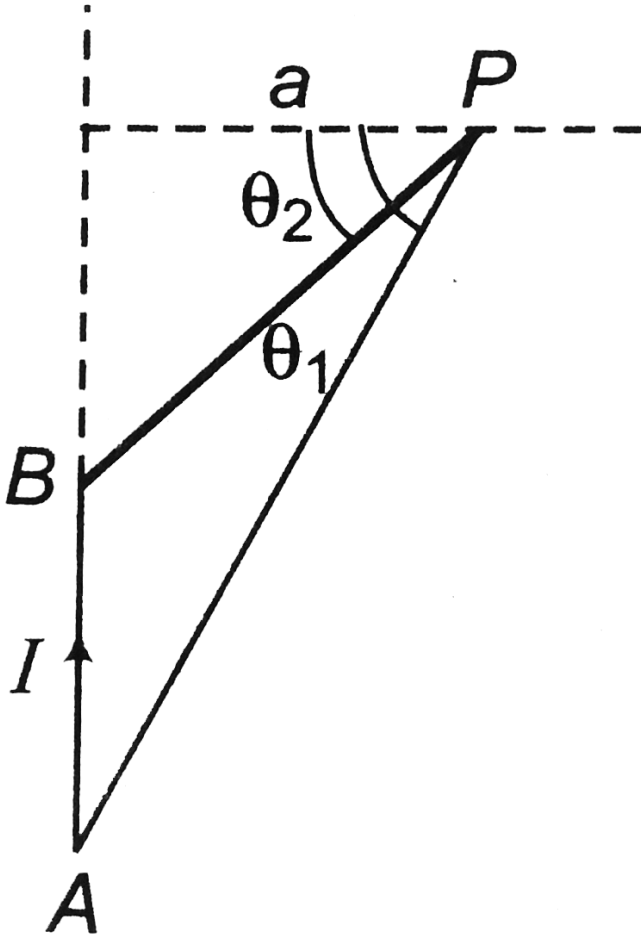
Answer: C



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65. The straight wire AB carries a current I . The ends of the wire subtend angles θ_1 and θ_2 at the point P as shown in figure. The magnetic field at

the point P is



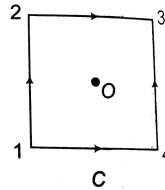
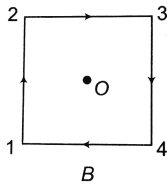
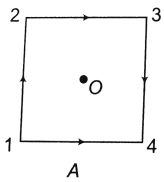
- A. $\frac{\mu_0 I}{4\pi a} (\sin \theta_1 - \sin \theta_2)$
- B. $\frac{\mu_0 I}{4\pi a} (\sin \theta_1 + \sin \theta_2)$
- C. $\frac{\mu_0 I}{4\pi a} (\cos \theta_1 - \cos \theta_2)$
- D. $\frac{\mu_0 I}{4\pi a} (\cos \theta_1 - \cos \theta_2)$

Answer: A



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66. The figure shows three identical current carrying square loops A , B and C . Identify the correct statement related to magnetic field B at the centre O of the square loop. Current in each wire is I .



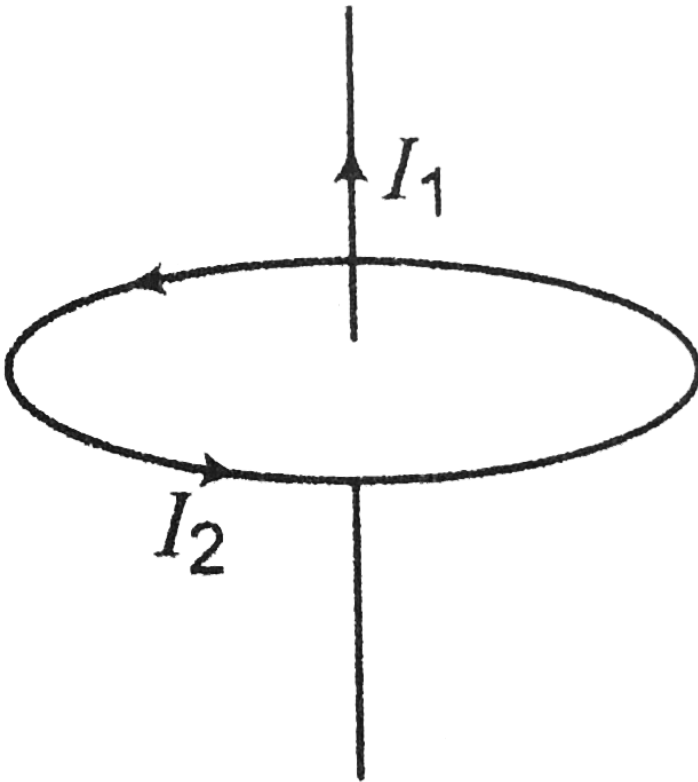
- A. B is zero in all cases
- B. B is zero only in case of C
- C. B is non zero in all cases
- D. B is non zero only in case of B

Answer: B



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67. The figure shows a long straight wire carrying a current I_1 along the axis of a circular ring carrying a current I_2 . Identify the correct statement.



A. Straight wire attracts the ring

B. Straight wire attracts a small element of the ring

C. Straight wire does not attract any small element of the ring

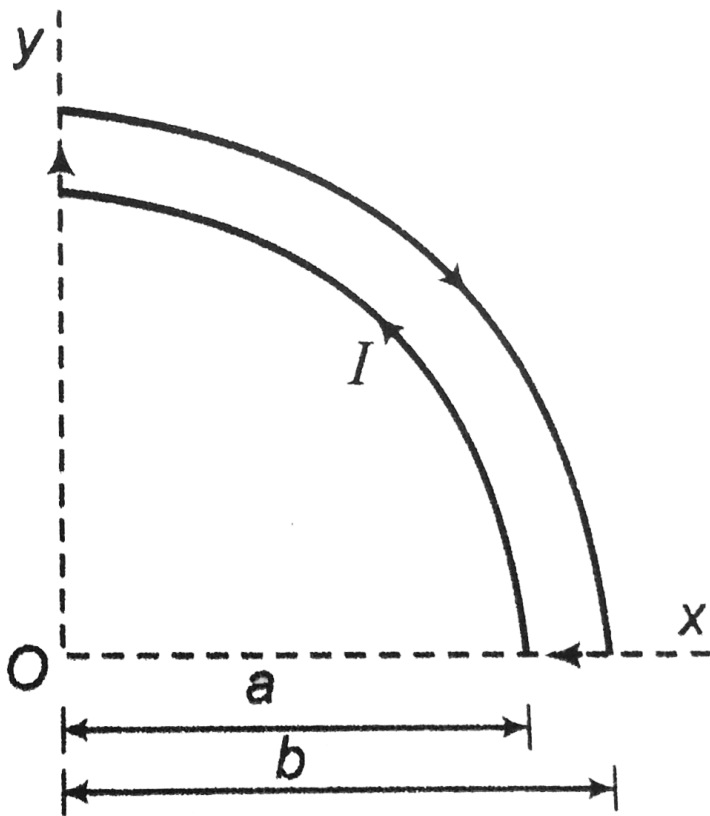
D. none of these

Answer: C



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68. The figure shows a wire frame in xy -plane carrying current I . The magnetic field at the point O is



- A. $\frac{\mu_0}{8} \left[\frac{1}{a} - \frac{1}{b} \right] \hat{k}$
- B. $\frac{\mu_0 I}{8} \left[\frac{1}{b} - \frac{1}{a} \right] \hat{k}$
- C. $\frac{\mu_0 I}{4} \left[\frac{1}{a} - \frac{1}{b} \right] \hat{k}$
- D. $\frac{\mu_0 I}{4} \left[\frac{1}{b} - \frac{1}{a} \right] \hat{k}$

Answer: A



69. An electron moving in a circular orbit of radius R with frequency f .

The magnetic field at the centre of the orbit is

A. $\frac{\mu_0 e f}{2\pi R}$

B. $\frac{\mu_0 e f}{2R}$

C. $\frac{\mu e f^2}{2R}$

D. zero

Answer: B

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70. A square loop of side a carries a current I . The magnetic field at the center of the loop is

A. $\frac{2\mu_0 I \sqrt{2}}{\pi a}$

B. $\frac{\mu_0 I \sqrt{2}}{\pi a}$

C. $\frac{4\mu_0 I \sqrt{2}}{\pi a}$

D. $\frac{\mu_0 I}{\pi a}$

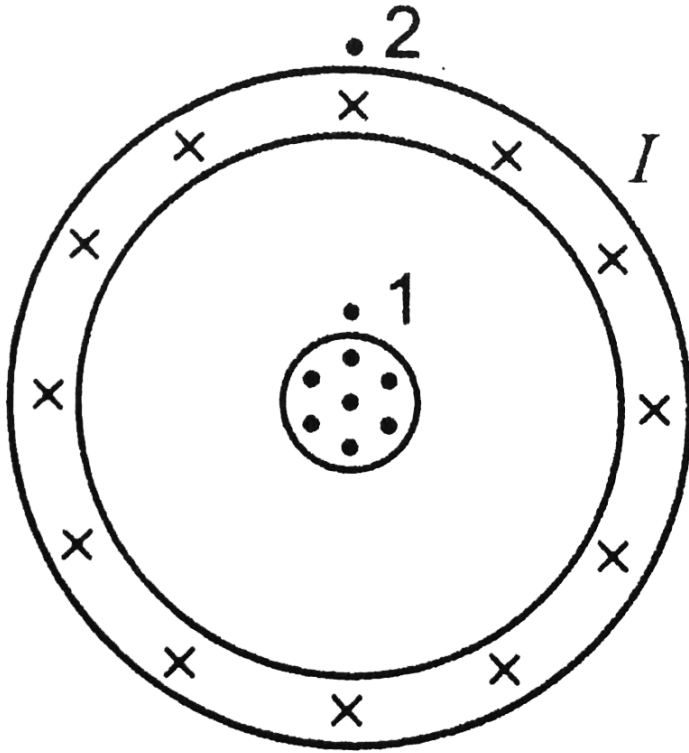
Answer: A



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71. The figure shows the cross section of two long coaxial tubes carrying equal current I in opposite directions. If B_1 and B_2 are magnetic fields

at point 1 and 2 as shown in figure then



A. $B_1 \neq 0, B_2 = 0$

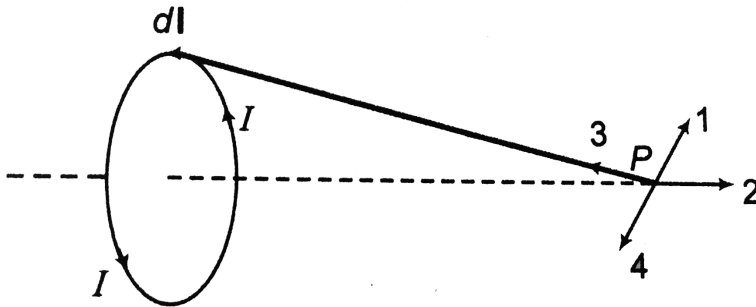
B. $B_1 = 0, B_2 = 0$

C. $B_1 \neq 0, B_2 \neq 0$

D. $B_1 = 0, B_2 \neq 0$

Answer: A

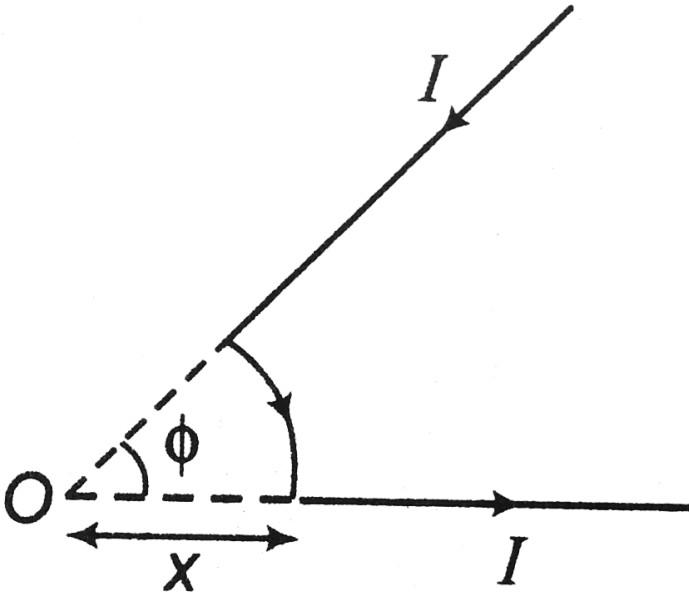
72. The figure shows a point P on the axis of a circular loop carrying current I . The correct direction of magnetic field vector at P due to dI is respectively by



- A. 1
- B. 2
- C. 3
- D. 4

Answer: A

73. In the figure, the curved part represents arc of a circle of radius x . If it carries a current I then the magnetic field at the point O is



- A. $\frac{\mu_0 I \phi}{2\pi x}$
- B. $\frac{\mu_0 I \phi}{4\pi x}$
- C. $\frac{\mu_0 I \phi}{2x}$
- D. $\frac{\mu_0 I \phi}{4x}$

Answer: B

74. A cylindrical long wire of radius R carries a current I uniformly distributed over the cross sectional area of the wire. The magnetic field at a distance x from the surface inside the wire is

A. $\frac{\mu_0 I}{2\pi(R - x)}$

B. $\frac{\mu_0 I}{2\pi x}$

C. $\frac{\mu_0 I}{2\pi(R + x)}$

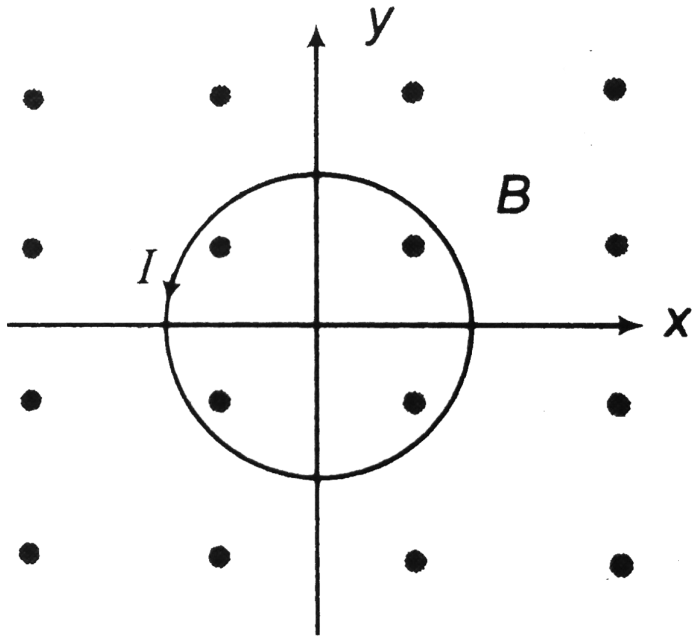
D. none of these

Answer: D

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75. A circular loop carrying a current I is placed in the xy -plane as shown in figure. A uniform magnetic field B is oriented along the positive z -axis.

The loop tends to



- A. expand
- B. contract
- C. rotate about x-axis
- D. rotate about y-axis

Answer: A

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76. An electron has velocity $v = \left(2.0 \times 10^6 \frac{m}{s}\right)\hat{i} + \left(3.0 \times 10^6 \frac{m}{s}\right)\hat{j}$.

Magnetic field present in the region is $B = (0.030T)\hat{i} - (0.15T)\hat{j}$.

(a) Find the force on electron.

(b) Repeat your calculation for a proton having the same velocity.

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77. An electron moves through a uniform magnetic field given by

$B = B_x\hat{i} + (3B_x)\hat{j}$. At a particular instant, the electron has the velocity

$v = (2.0\hat{i} + 4.0\hat{j})$ m/s and the magnetic force acting on it is

$(6.4 \times 10^{-19} N)\hat{k}$ Find B_x .

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78. A particle with charge $7.80\mu C$ is moving with velocity

$v = -\left(3.80 \times 10^3 \frac{m}{s}\right)\hat{j}$. The magnetic force on the particle is

measured to be $F = + (7.60 \times 10^{-3} N)\hat{i} - (5.20 \times 10^{-3} N)\hat{k}$

(a) Calculate the components of the magnetic field you can find from this

information.

(b) Are the components of the magnetic field that are not determined by the measurement of the force? Explain.

(c) Calculate the scalar product $B \cdot F$. What is the angle between B and F ?



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79. Each of the lettered points at the corners of the cube as shown in Fig.

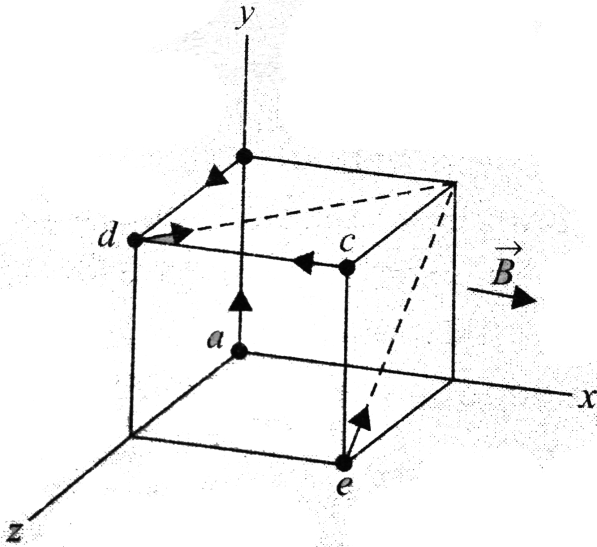
1.60 represents a positive charge q moving with a velocity of magnitude v

in the direction indicated. The region in the figure is in a uniform

magnetic field \vec{B} , parallel to the x -axis and directed toward right. Copy

the figure, find the magnitude and direction of the force on each charge

and show the force in your diagram.



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80. An electron in the beam of a TV picture tube is accelerated by a potential difference of 2.00 kV . Then, it passes through region of transverse magnetic field, where it moves in a circular arc with radius 0.180 m . at is the magnitude of the field?

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81. A deuteron (the nucleus of an isotope of hydrogen) has a mass of 3.34×10^{-27} kg and a charge of $+e$. The deuteron travels in a circular path with a radius of 6.96mm in a magnetic field with magnitude $2.50T$.

(a) Find the speed of the deuteron.

(b) Find the time required for it to make half of a revolution.

(c) Through what potential difference would the deuteron have to be accelerated to acquire this speed?



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82. A neutral particle is at rest in a uniform magnetic field B . At time $t = 0$ it decays into two charged particles, each of mass m .

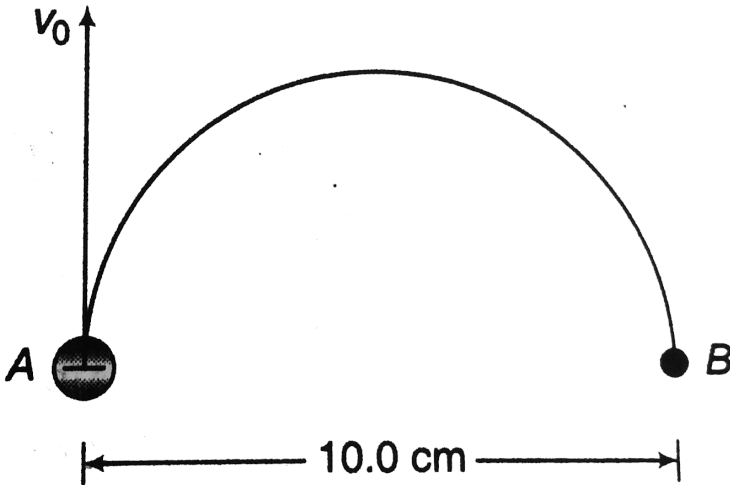
(a) If the charge of one of the particles is $+q$, what is the charge of the other?

(b) The two particles move off in separate paths, both of them lie in the plane perpendicular to B . At a later time, the particles collide. Express the time from decay until collision in terms of m , B and q .



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83. An electron at point A in figure has a speed $v_0 = 1.41 \times 10^6 \frac{m}{s}$. Find



- (a) the magnitude and direction of the magnetic field that will cause the electron to follow the semicircular path from A to B ,
- (b) the time required for the electron to move from A to B .



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84. A proton of charge e and mass m enters a uniform magnetic field $B = B\hat{i}$ with an initial velocity $v = v_x\hat{i} + v_y\hat{j}$. Find an expression in unit vector notation for its velocity at time t .



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85. A proton moves at a constant velocity of $50\frac{m}{s}$ along the x-axis, in uniform electric and magnetic fields. The magnetic field is $B = (2.0mT)\hat{j}$. What is the electric field?



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86. A particle having mass m and charge q is released from the origin in a region in which electric field and magnetic field are given by $B = -B_0\hat{j}$ and $E = E_0\hat{k}$.

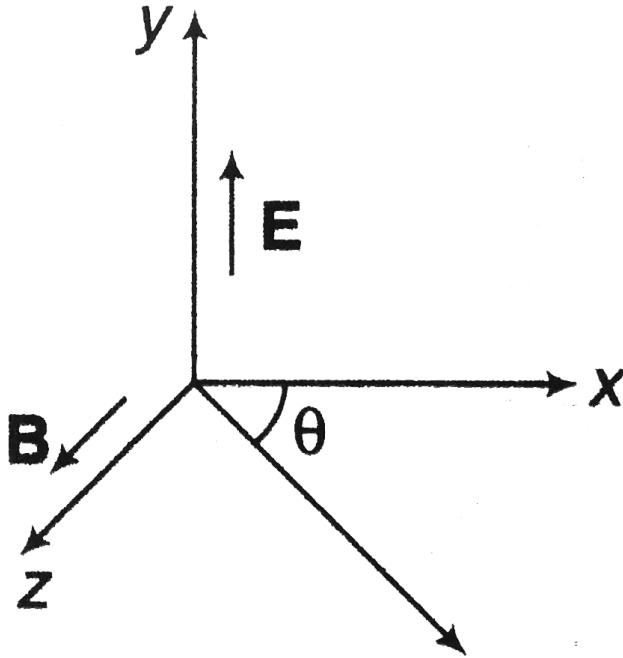
Find the y- component of the velocity and the speed of the particle as a function of its z-coordinate.



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87. Protons move rectilinearly in the region of space where there are uniform mutually perpendicular electric and magnetic fields E and B . The

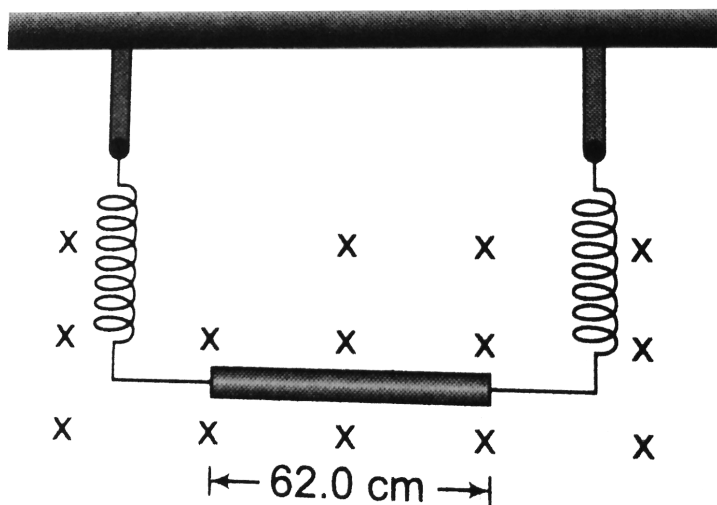
trajectory of protons lies in the plane xz as shown in the figure and forms an angle θ with x -axis. Find the pitch of the helical trajectory along which the protons will move after the electric field is switched off.



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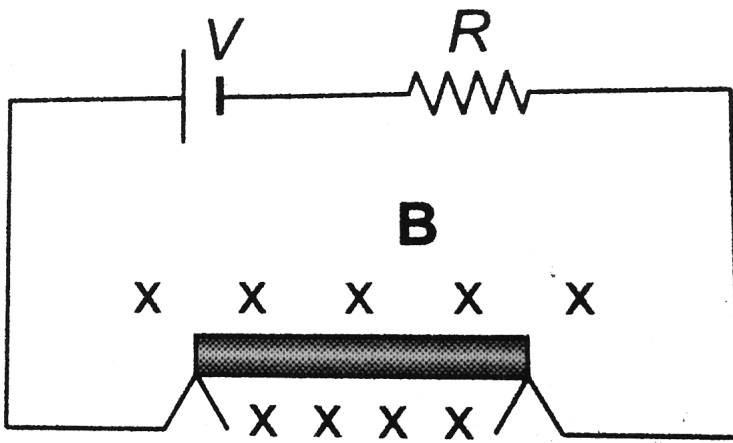
88. A wire of 62.0cm length and 13.0g mass is suspended by a pair of flexible leads in a uniform magnetic field of magnitude 0.440T in figure. What are the magnitude and direction of the current required to remove

the tension in the supporting leads? Take $g = 10 \frac{m}{s^2}$



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89. A thin, 50.0cm long metal bar with mass 750g rests on, but is not attached to, two metal supports in a 0.950T magnetic field as shown in figure. A battery and a resistance $R = 25.0\Omega$ in series are connected to the supports.



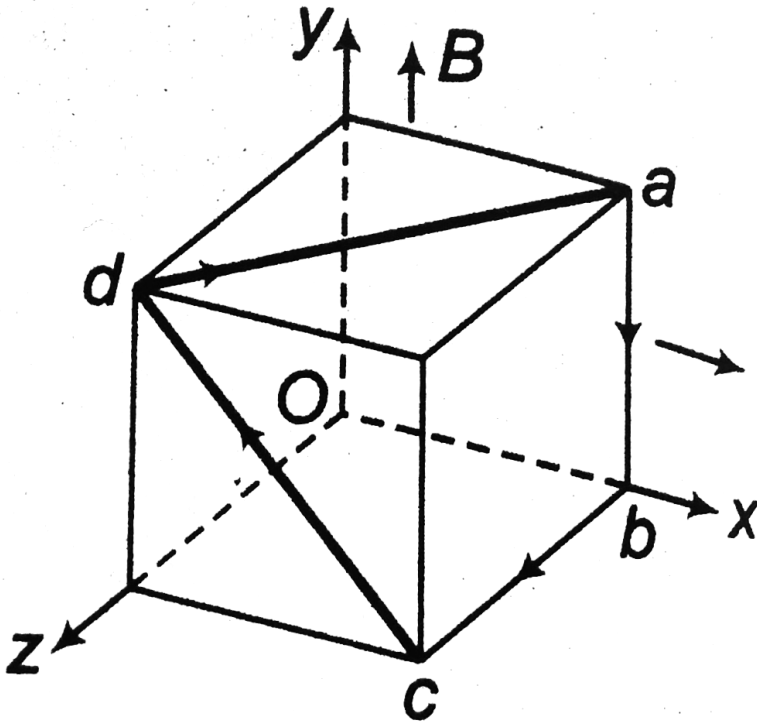
- (a) What is the largest voltage the battery can have without breaking the circuit at the support
- (b) The battery voltage has this maximum value calculated. Decreasing the resistance to 2.0Ω the initial acceleration of the bar.



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90. In figure, the cube is 40.0cm on each edge. Four straight segments of wire ab , bc , cd and da form a closed loop that carries a current $I = 5.00\text{A}$, in the direction shown. A uniform magnetic field f magnitude the positive y -direction. Determine the magnitude and $B = 0.020\text{T}$ is in

direction of the magnetic force on each segment.



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91. Find the ratio of magnetic dipole moment and magnetic field at the centre of a disc. Radius of disc is R and it is rotating at constant angular speed ω about its axis. The disc is insulating and uniformly charged

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92. A magnetic dipole with a dipole moment of magnitude $0.020 \frac{J}{T}$ is released from rest in a uniform magnetic field of magnitude $52mT$. The rotation of the dipole due to the magnetic force on it is unimpeded. When the dipole rotates through the orientations where its dipole moment is aligned with the magnetic field, its kinetic energy is $0.80mJ$.

(a) What is the initial angle between the dipole moment and the magnetic field?

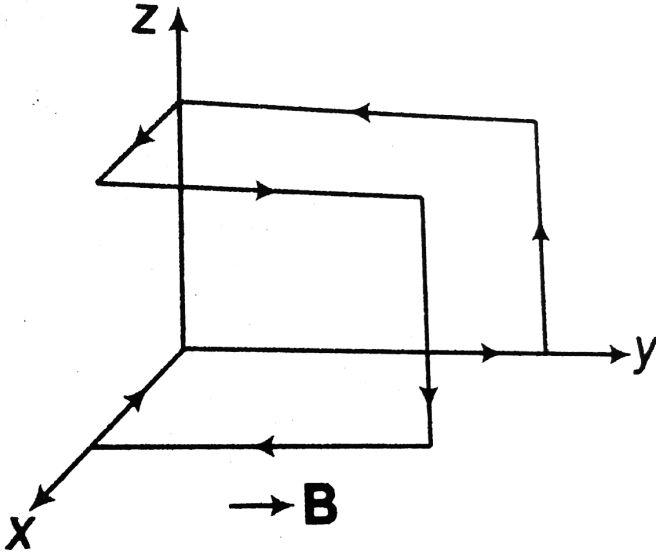
(b) What is the angle when the dipole is next (momentarily) at rest?

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93. A conductor carries a constant current I along the closed path abcdefgha involving 8 of the 12 edges of length l . Find the magnetic dipole moment of the closed path.

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94. Given figure shows a coil bent with all edges of length $1m$ and carrying a current of $1A$. There exists in space a uniform magnetic field of $2T$ in positive y -direction. Find the torque on the loop.

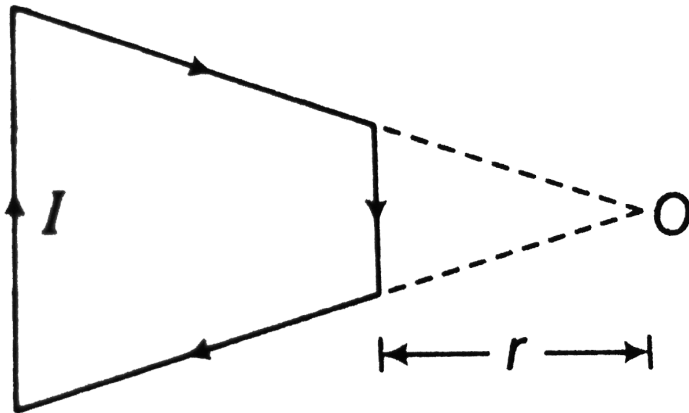


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95. A very long wire carrying a current $I = 5.0A$ is bent at right angles. Find the magnetic induction at a point lying on a perpendicular normal to the plane of the wire drawn through the Point of bending at a distance $l = 35cm$ from it.

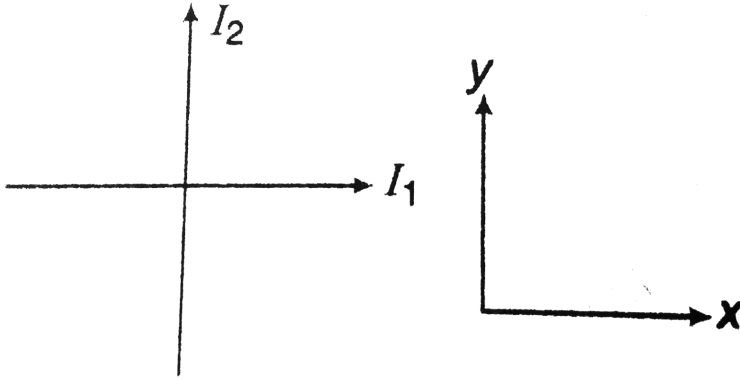
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96. A current $I = \sqrt{2}$ A flows in a circuit having the shape of isosceles trapezium. The ratio of the bases of the trapezium is 2. Find the magnetic induction B at symmetric point O in the plane of the trapezium. The length of the smaller base of the trapezium is 100mm and the distance $r = 50\text{mm}$.



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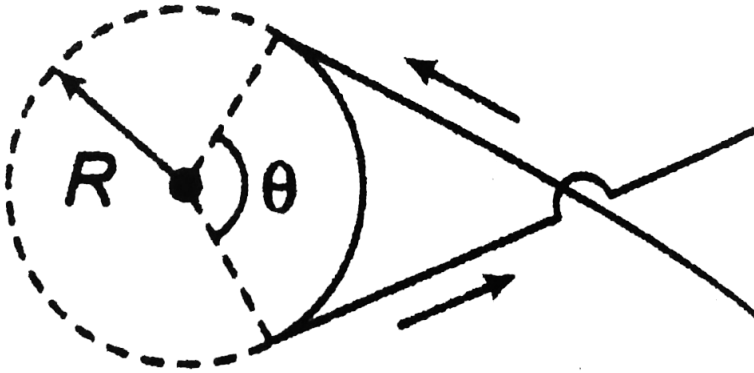
97. Two long mutually perpendicular conductors carrying currents I_1 and I_2 lie in one plane, Find the locus of points at which the magnetic induction is zero.



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98. A wire carrying current i has the configuration as shown in figure. Two semi-infinite straight sections, both tangent to the same circle, are connected by a circular arc of central angle θ , along the circumference of the circle, with all sections lying in the same plane. What

must be for B to be zero at the centre of the circle?



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99. Two long parallel transmission lines 40.0cm apart carry 25.0A and 75.0A currents. Find an locations where the net magnetic field of the two wires is zero if these currents are in
- (a) the same direction (b) the opposite direction

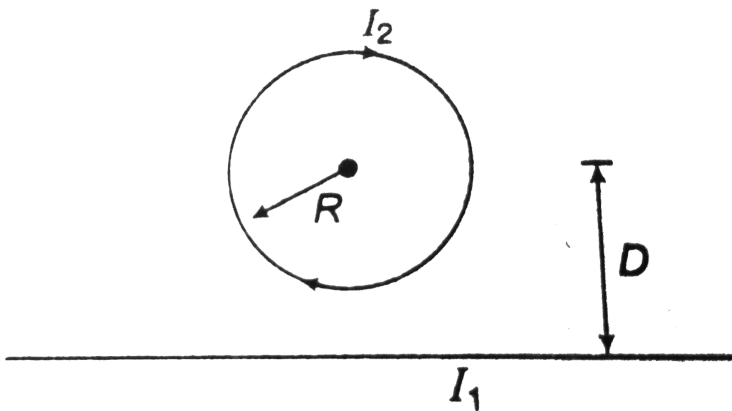
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100. A closely wound coil has a radius of 6.00 cm and carries a current of 2.50 A. How many turns must it have if, at a point on the coil axis 6.00 cm from the centre of the coil, the magnetic field is $6.39 \times 10^{-4} T$?



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101. A circular loop of radius R carries current I_2 in a clockwise direction as shown in figure. The centre of the loop is a distance D above a long, straight wire. What are the magnitude and direction of the current I_1 in the wire if the magnetic field at the centre of loop is zero?



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102. A closely wound, circular coil with radius 2.40cm has 800 turns.

(a) What must the current in the coil be if the magnetic field at the centre of the coil is 0.0580T ?

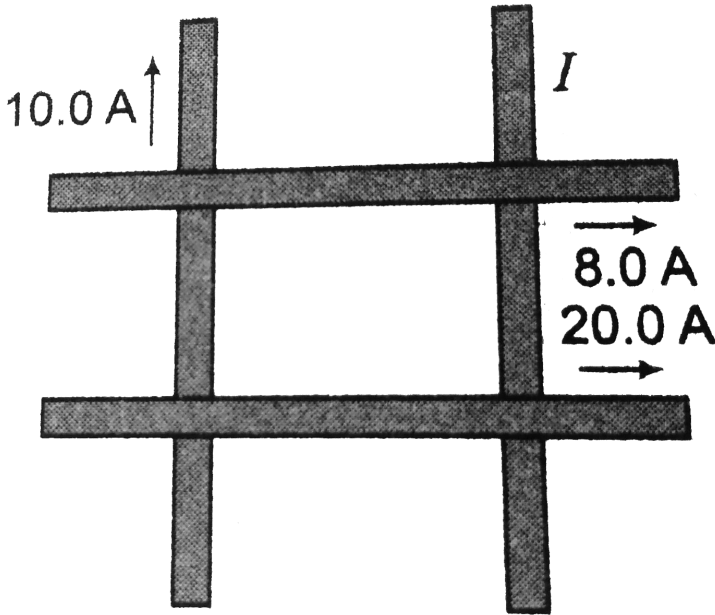
(b) At what distance x from the centre of the coil, on the axis of the coil, is the magnetic field half its value at the centre?



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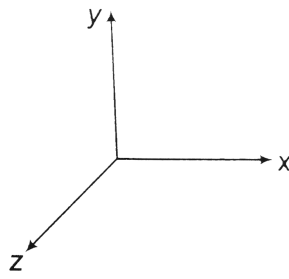
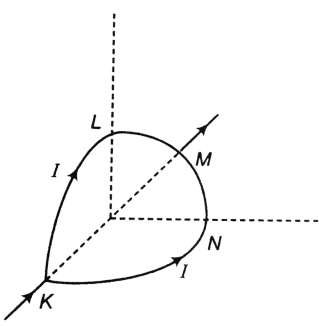
103. Four very long, current carrying wires in the same plane intersect to form a square 40.0cm on each side as shown in figure. Find the magnitude and direction of the current I so that the magnetic field at

the centre of square is zero. Wires are insulated from each other.



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104. A circular loop of radius R is bent along a diameter and given a shape as shown in figure. One of the semicircles (KNM) lies in the xz -plane and the other one (KLM) in the yz -plane with their centres at origin. Current I is flowing through each of the semicircles as shown in figure.



(a) A particle of charge q is released at the origin with a velocity $v = -v_0 \hat{i}$. Find the instantaneous force F on the particle. Assume that space is gravity free.

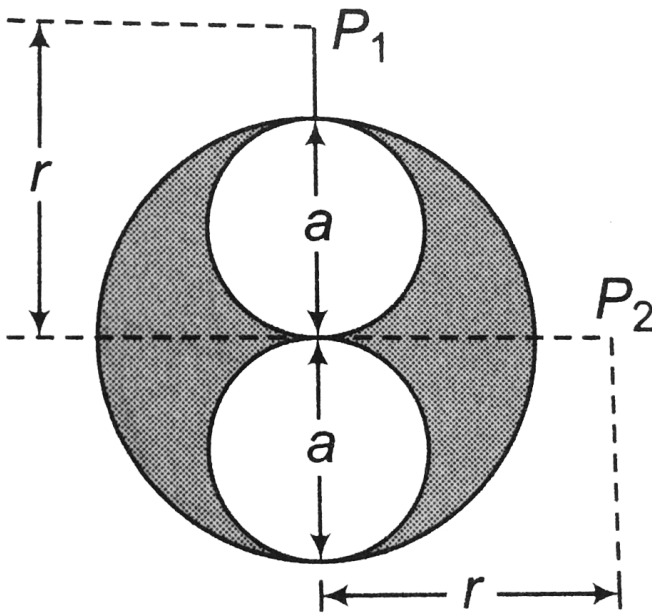
(b) If an external uniform magnetic field $B_0 \hat{j}$ is applied, determine the force F_1 and F_2 on the semicircles KLM and KNM due to the field and the net force F on the loop.

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105. A regular polygon of n sides is formed by bending a wire of total length $2\pi r$ which carries a current i . (a) Find the magnetic field B at the centre of the polygon. (b) By letting $n \rightarrow \infty$, deduce the expression for the magnetic field at the centre of a circular current.

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106. A long cylindrical conductor of radius a has two cylindrical cavities of diameter a through its entire length as shown in cross-section in figure. A current I is directed out of the page and is uniform throughout the cross-section of the conductor. Find the magnitude and direction of the magnetic field in terms of μ_0 , I , r and a .

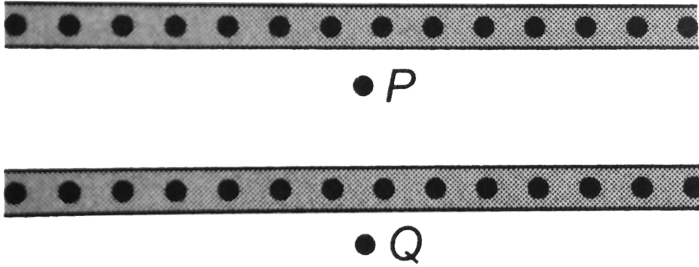


(a) at point P_1 and (b) at point P_2



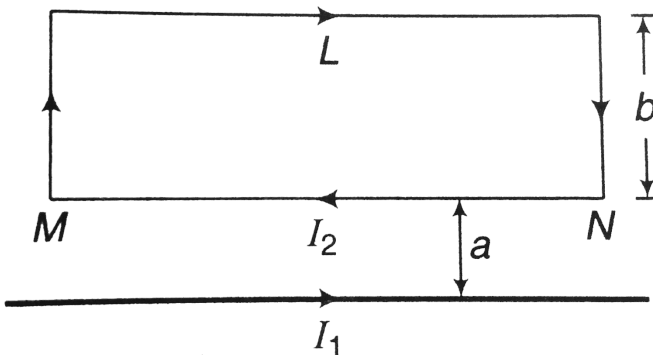
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107. Two infinite plates shown in cross-section in figure carry λ amperes of current out of the page per unit width of plate. Find the magnetic field at points P and Q .



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108. For the situation shown in figure, find the force experienced by side MN of the rectangular loop. Also, find the torque on the loop.



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109. In a region of space, a uniform magnetic field B is along positive x-axis. Electrons are emitted from the origin with speed u at different angles. Show that the paraxial electrons are refocused on the x-axis at a distance $\frac{2\pi mv}{Be}$. Here, m is the mass of electron and e the charge on it.

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110. A particle of mass m and charge q is projected into a region having a perpendicular magnetic field B . Find the angle of deviation of the particle as it comes out of the magnetic field if the width of the region is

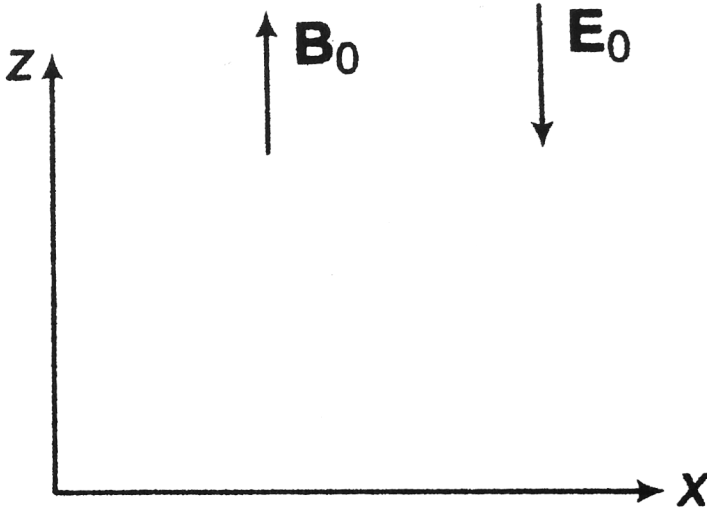
(b)

(a) $\frac{2mv}{Bq}$ (b) $(mv)/(Bq)$ (c) $(mv)/(2 Bq)$

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111. In a certain region, uniform electric field $E = -E_0\hat{k}$ and magnetic field $B = B_0\hat{k}$ are present. At time $t = 0$, a particle of mass m and charge

q is given a velocity $v = v_0 \hat{j} + v_0 \hat{k}$. Find the minimum speed of the particle and the time when it happens so.



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112. A particle of mass m and charge q is lying at the origin in a uniform magnetic field B directed along x -axis. At time $t = 0$, it is given a velocity v_0 , at an angle θ with the y -axis in the xy -plane. Find the coordinates of the particle after one revolution.

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113. Find the magnetic moment of the current carrying loop $OABCO$ shown in figure.



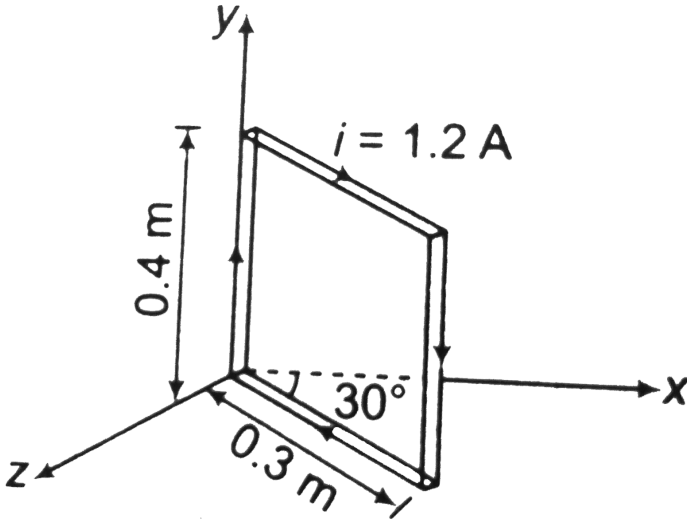
Given that $i = 4.0A$, $OA = 20cm$ and $AB = 10cm$.



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114. A rectangular loop consists of $N = 100$ closed wrapped turns and has dimensions $(0.4m \times 0.3m)$. The loop is hinged along the y-axis and its plane makes an angle $\theta = 30^\circ$ with the x-axis. What is the magnitude of the torque exerted on the loop by a uniform magnetic field $B = 0.8T$ directed along the x-axis when current is $i = 1.2A$ in the direction

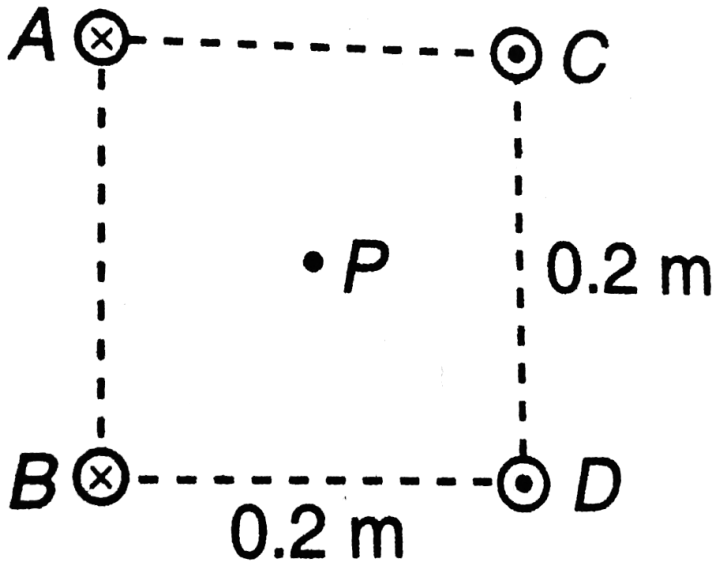
shown. What is the expected direction of rotation of the loop?



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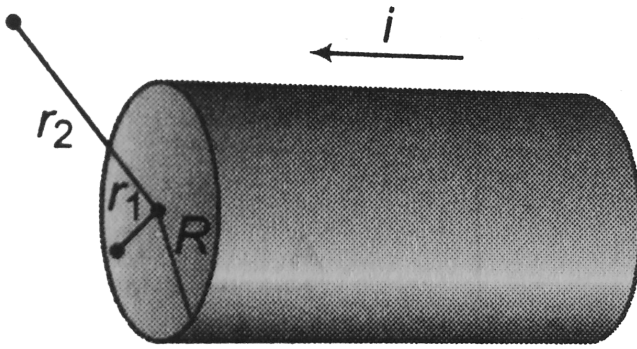
115. Four long, parallel conductors carry equal currents of 5.0 . The direction of the currents is into the page at points A and B and out of the page at C and D . Calculate the magnitude and direction of the

magnetic field at point P , located at the centre of the square.



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116. A long cylindrical conductor of radius R carries a current i as shown in figure. The current density J is a function of radius according to $J = br$, where b is a constant. Find an expression for the magnetic field B



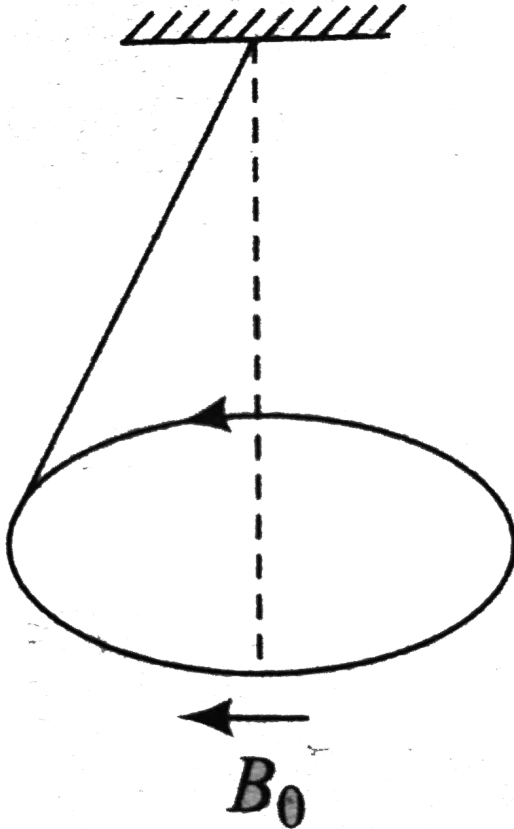
a. at a distance $r_1 < R$ and

b. at a distance $r_2 > R$, measured from the axis.

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117. A uniform current carrying ring of mass m and radius R is connected by a massless string as shown in Fig. 1.142. A uniform magnetic field B_0 exists in the region to keep the ring in horizontal position, then the

current in the ring is (l =length of string)



A. $\frac{mg}{\pi R B_0}$

B. $\frac{mg}{R B_0}$

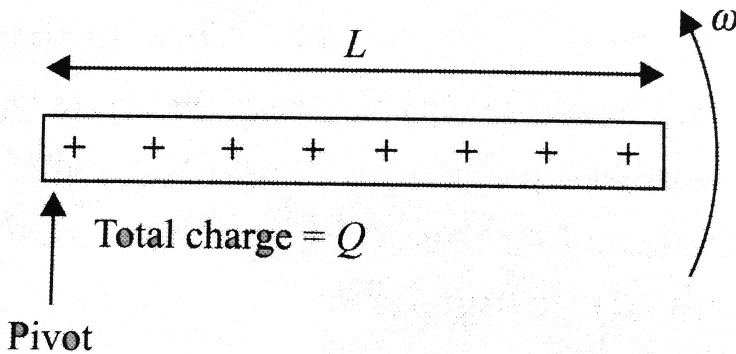
C. $\frac{mg}{3\pi R B_0}$

D. $\frac{mg}{\pi R^2 B_0}$

Answer: A

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118. A rod has a total charge Q uniformly distributed along its length L . If the rod rotates with angular velocity ω about its end, compute its magnetic moment.



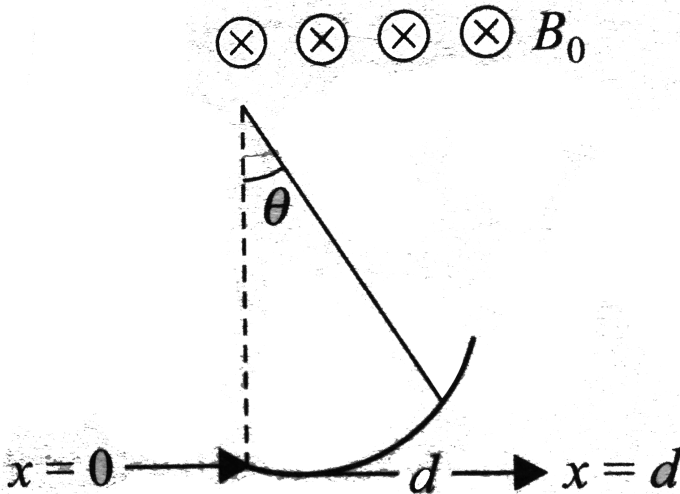
- A. $\frac{1}{3}qR^2\omega$
- B. $\frac{2}{3}qR^2\omega$
- C. $\frac{1}{5}qR^2\omega$
- D. $\frac{2}{5}qR^2\omega$

Answer: C

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119. A charged particle moving along +ve x-direction with a velocity v enters a region where there is a uniform magnetic field $B_0(-\hat{k})$, from $x=0$ to $x=d$. The particle gets deflected at an angle θ from its initial path.

The specific charge of the particle is



A. $\frac{Bd}{v \cos \theta}$

B. $\frac{v \tan \theta}{Bd}$

C. $\frac{B \sin \theta}{vd}$

D. $\frac{v \sin \theta}{Bd}$

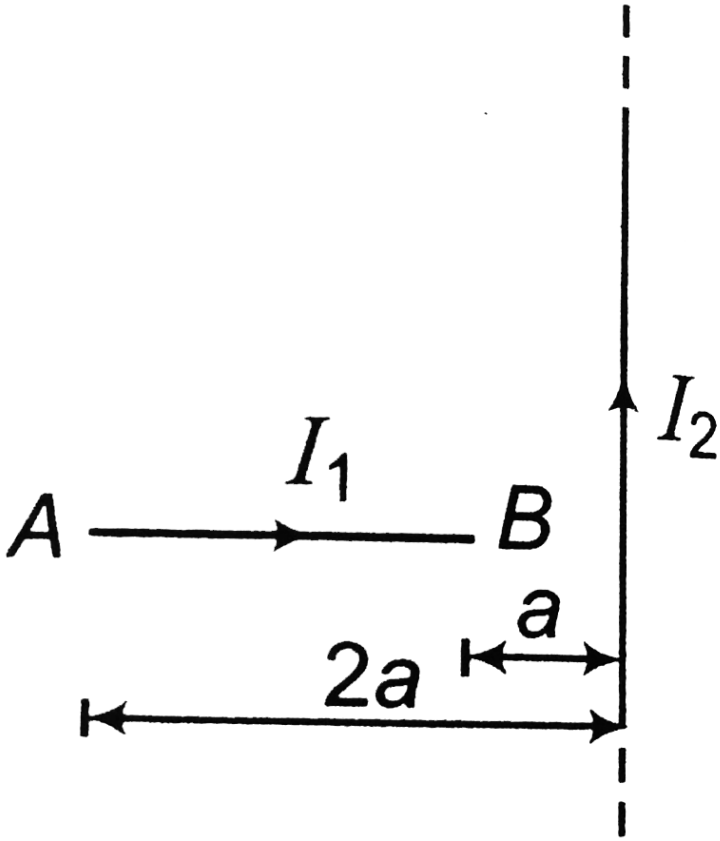
Answer: D



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120. A segment AB of wire carrying current I_1 is placed perpendicular to a long straight wire carrying current I_2 as shown in figure. The magnitude

of force experienced by the straight wire AB is



A. $\frac{\mu_0 I_1 I_2}{2\pi} \ln 3$

B. $\frac{\mu_0 I_1 I_2}{2\pi} \ln 2$

C. $\frac{2\mu_0 I_1 I_2}{2\pi}$

D. $\frac{\mu_0 I_1 I_2}{2\pi}$

Answer: B



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121. A straight long conductor carries along the positive x-axis. Identify the correct statement related to the four points $A(a, a, 0)$, $B(a, 0, a)$, $C(a, -a, 0)$ and $D(a, 0, -a)$.

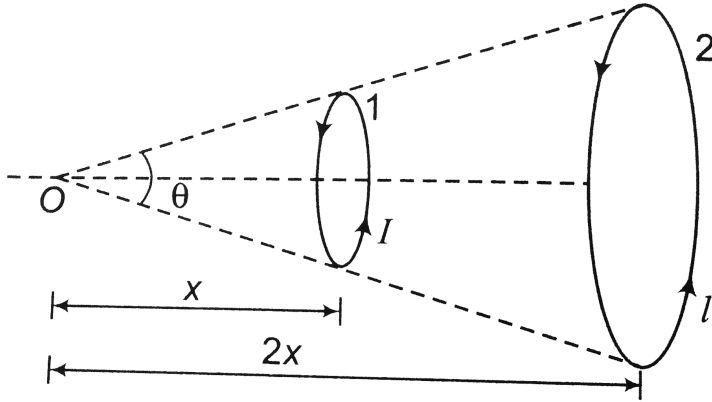
- A. The magnitude of magnetic field at all points is same
- B. Fields at A and B are mutually perpendicular
- C. Fields at A and C are antiparallel
- D. All of the above

Answer: D



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122. The figure shows two coaxial circular loops 1 and 2, which form the same solid angle θ at point O . If B_1 and B_2 are the magnetic fields produced at the point O due to loop 1 and 2 respectively, then



- A. $\frac{B_1}{B_2} = 1$
- B. $\frac{B_1}{B_2} = 2$
- C. $\frac{B_1}{B_2} = 8$
- D. $\frac{B_1}{B_2} = 4$

Answer: B



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123. 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. $\frac{qBa}{m}$

C. $\frac{qB(b - a)}{m}$

D. $\frac{qB(b + a)}{2m}$

Answer: C



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124. An insulating rod of length l carries a charge q distributed uniformly on it. The rod is pivoted at its mid-point and is rotated at a frequency f

about a fixed axis perpendicular to the the rod and passing through the pivot . The magnetic moment of the rod system is

A. $\frac{\pi qfl^2}{12}$

B. $\frac{\pi qfl^2}{2}$

C. $\frac{\pi qfl^2}{6}$

D. $\frac{\pi qfl^2}{3}$

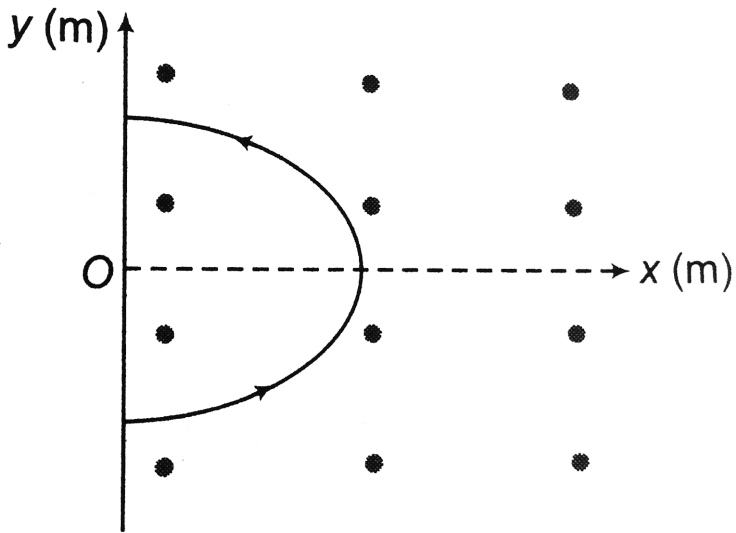
Answer: D



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125. A wire carrying a current of $3A$ is bent in the form of a parabola $y^2 = 4 - x$ as shown in figure, where x and y are in meter. The wire is placed in a uniform magnetic field $B = 5\hat{k}$ tesla. The force acting on the

wire is



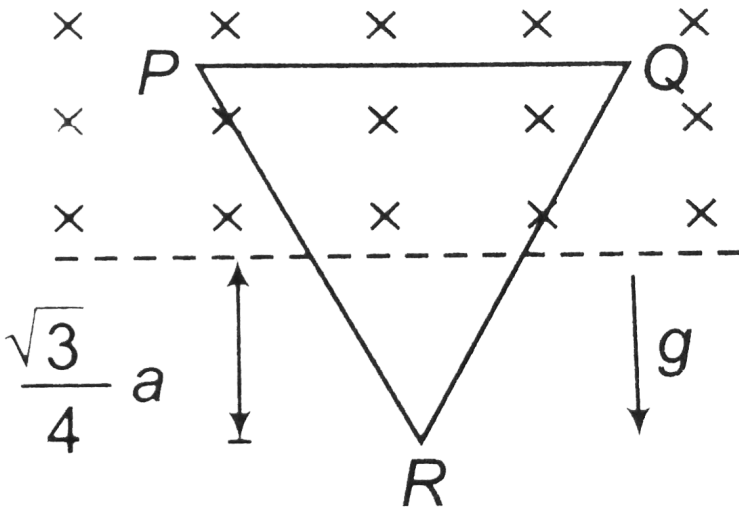
- A. $60\hat{i}N$
- B. $-60\hat{i}N$
- C. $30\hat{i}N$
- D. $-30\hat{i}N$

Answer: A



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126. An equilateral triangle frame PQR of mass M and side a is kept under the influence of magnetic force due to inward perpendicular magnetic field B and gravitational field as shown in the figure. The magnitude and direction of current in the frame so that the frame remains at rest is



A. $I = \frac{2Mg}{a}B$, anti clockwise

B. $I = \frac{2Mg}{aB}$, clockwise

C. $I = \frac{Mg}{aB}$, anticlockwise

D. $I = \frac{Mg}{aB}$, clockwise

Answer: B



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127. A tightly-wound, long solenoid has n turns per unit length, a radius r and carries a current i . A particle having charge q and mass m is projected from a point on the axis in a direction perpendicular to the axis. What can be the maximum speed for which the particle does not strike the solenoid?

A. $\frac{\mu_0 q r n i}{2m}$

B. $\frac{\mu_0 q r n i}{m}$

C. $\frac{2\mu_0 q r n i}{3m}$

D. none of these

Answer: A



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128. If the acceleration and velocity of a charged particle moving in a constant magnetic region is given by $a = a_1\hat{i} + a_2\hat{k}$, $v = b_1\hat{i} + b_2\hat{k}$. [a_1 , a_2 , b_1 and b_2 are constant]. Then choose the wrong statement

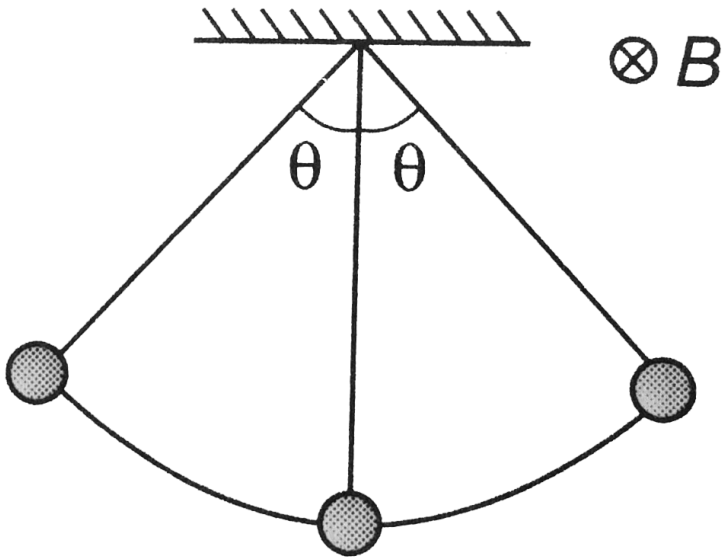
- A. magnetic field may be along y-axis
- B. $a_1b_1 + a_2b_2 = 0$
- C. magnetic field is along x-axis
- D. kinetic energy of particle is always constant

Answer: C

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129. A simple pendulum with charge bob is oscillating as shown in the figure. Time period of oscillation is T and angular amplitude is θ . If a uniform magnetic field perpendicular to the plane of oscillation is

switched on, then



- A. T will decrease but θ will remain constant
- B. T will remain constant but θ will decrease
- C. Both T and θ will remain the same
- D. Both T and θ will decrease

Answer: C



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130. Consider a cable which consists of an inner wire of radius a surrounded by an outer shell of inner and outer radii b and c respectively. The inner wire carries a current I and outer shell carries an equal and opposite current. The magnetic field at a distance x from the axis where $b < x < c$ is

A. $\frac{\mu_0 I (c^2 - b^2)}{2\pi x (c^2 - a^2)}$

B. $\frac{\mu_0 I (c^2 - x^2)}{2\pi x (c^2 - a^2)}$

C. $\frac{\mu_0 I (c^2 - x^2)}{2\pi x (c^2 - b^2)}$

D. zero

Answer: C



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131. A particle of mass $1 \times 10^{-26} \text{ kg}$ and charge $+1.6 \times 10^{-19} \text{ C}$ travelling with a velocity $1.28 \times 10^6 \text{ ms}^{-1}$ in the $+x$ direction enters a region in which uniform electric field E and a uniform magnetic field of induction B

are present such that

$$E_x = E_y = 0, E_z = -102.4 \text{ kV m}^{-1}, \text{ and } B_x = B_z = 0, B_y = 8 \times 10^{-2} \text{ T}.$$

The particle enters this region at time $t = 0$. Determine the location (x,y,z coordinates) of the particle at $t = 5 \times 10^{-6} \text{ s}$. If the electric field is switched off at this instant (with the magnetic field present), what will be the position of the particle at $t = 7.45 \times 10^{-6} \text{ s}$?

- A. net force acts on the particle along the +ve z-direction.
- B. net force acts on the particle along -ve z-direction
- C. net force acting on particle is zero
- D. net force acts in xy-plane

Answer: C



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132. A wire lying along y-axis from $y = 0$ to $y = 1 \text{ m}$ carries a current of 2 mA in the negative y-direction. The wire lies in a non uniform magnetic

field given by $B = \left(0.3\frac{T}{m}\right)y\hat{i} + (0.4Tm)y\hat{j}$. The magnetic force on the entire wire is

A. $-3 \times 10^{-4}\hat{j}N$

B. $6 \times 10^{-3}\hat{k}N$

C. $-3 \times 10^{-4}\hat{k}N$

D. $3 \times 10^{-4}\hat{k}N$

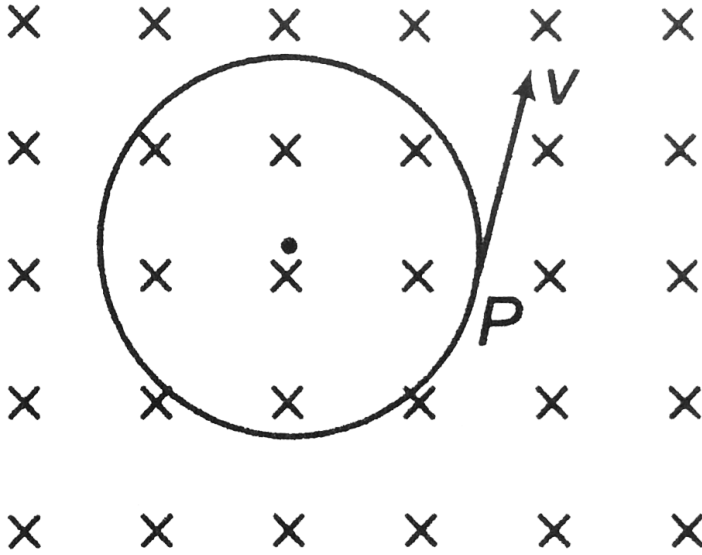
Answer: D



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133. A particle having charge of $20\mu C$ and mass $20\mu g$ moves along a circle of radius $5cm$ under the action of a magnetic field $B = 0.1$ tesla. When the particle is at P , uniform transverse electric field is switched on and it is found that the particle continues along the tangent with a

uniform velocity. Find the electric field



A. $2\frac{V}{m}$

B. $0.5\frac{V}{m}$

C. $5\frac{V}{m}$

D. $1.5\frac{V}{m}$

Answer: B



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134. Two circular coils A and B of radius $\frac{5}{\sqrt{2}}\text{cm}$ and 5cm respectively current 5amp and $\frac{5}{\sqrt{2}}\text{Amp}$ respectively The plane of B is perpendicular to plane of A their centres coincide Find the magnetic field at the centre .

A. 0

B. $4\pi\sqrt{2} \times 10^{-5}\text{T}$

C. $4\pi \times 10^{-5}\text{T}$

D. $2\pi\sqrt{2} \times 10^{-5}\text{T}$

Answer: C



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135. A charged particle of specific charge s moves undeflected through a region of space containing mutually perpendicular and uniform electric and magnetic fields, E and B . When the field E is switched off, the particle will move in a circular path of radius

A. $\frac{E}{Bs}$

B. $\frac{Es}{B}$

C. $\frac{Es}{B^2}$

D. $\frac{E}{B^2s}$

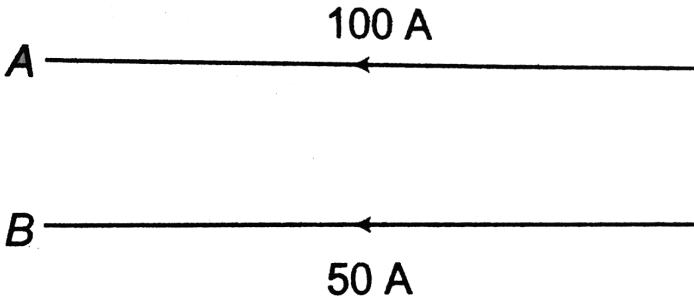
Answer: D



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136. Two long parallel conductors are carrying currents in the same direction as shown in the figure. The upper conductor A carrying a current of $100A$ is held firmly in position. The lower conductor B carries a current of $50A$ and free to move up and down. The linear mass density of

the lower conductor is 0.01 kg/m .



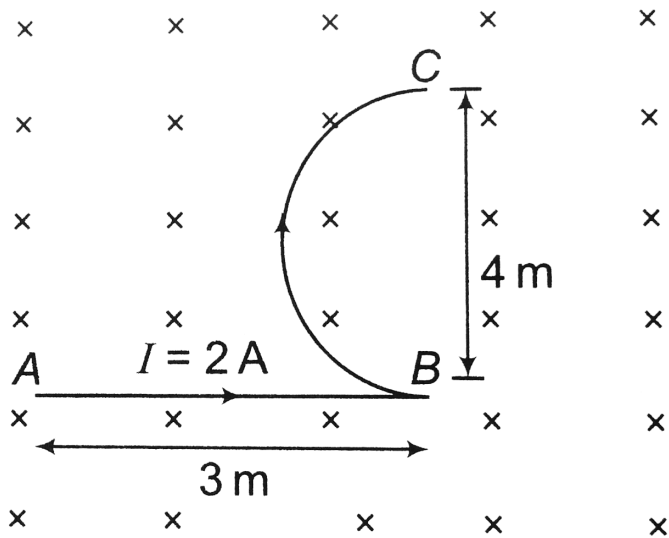
- A. conductor B will be in equilibrium if the distance between the conductors is 0.1 m
- B. Equilibrium of conductor B is unstable
- C. both a and b are wrong
- D. both a and b are correct

Answer: D



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137. In the figure, the force on the wire ABC in the given uniform magnetic field will be ($B = 2 \text{ tesla}$)



A. $4(3 + 2\pi)N$

B. $20N$

C. $30N$

D. $40N$

Answer: B

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138. A uniformly charged ring of radius R is rotated about its axis with constant linear speed v of each of its particle. The ratio of electric field to magnetic field at a point P on the axis of the ring distant $x = R$ from centre of ring is (c is speed of light)



A. $\frac{c^2}{v}$

B. $\frac{v^2}{c}$

C. $\frac{v}{c}$

D. $\frac{c}{v}$

Answer: A



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139. a charged particle moves in a gravity free space without change in velocity. Which of the following is/are possible?

A. $E = 0$ and $B \neq 0$

B. $E \neq 0$ and $B = 0$

C. $E \neq 0$ and $B \neq 0$

D. $E = 0, B = 0$

Answer: A::C::D

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140. A charged particle of unit mass and unit charge moves with velocity $\vec{v} = (8\hat{i} + 6\hat{j})ms^{-1}$ in magnetic field of $\vec{B} = 2\hat{k}T$. Choose the correct alternative (s).

A. The path of the particle may 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

Answer: A::B::D



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141. When a current carrying coil is placed in a uniform magnetic field with its magnetic moment anti-parallel to the field.

- A. torque on it is maximum
- B. torque on it is zero
- C. potential energy is maximum
- D. dipole is in unstable equilibrium

Answer: B::C::D



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142. If a long cylindrical conductor carries a steady current parallel to its length, then

- A. the electric field along the axis is zero
- B. the magnetic field along the axis is zero
- C. the magnetic field outside the conductor is zero
- D. the electric field outside the conductor is zero

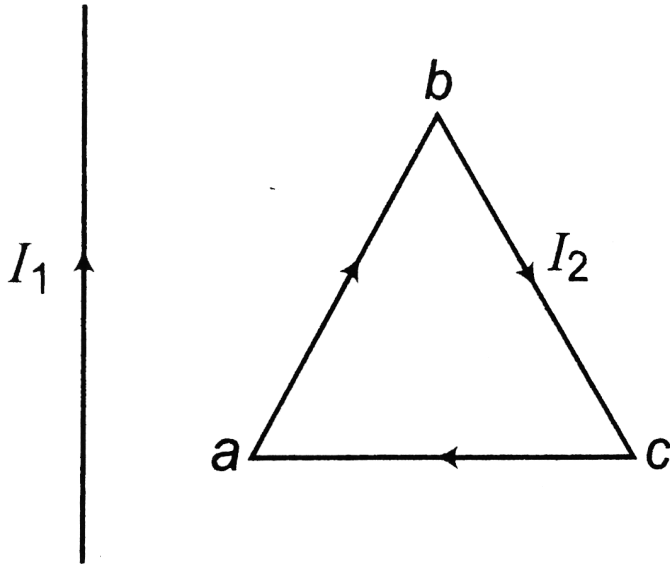
Answer: B::D



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143. An infinitely long straight wire is carrying a current I_1 . Adjacent to it there is another equilateral triangular wire having current I_2 . Choose the

wrong options



- A. net force on loop is leftwards
- B. net force on loop is rightwards
- C. net force on loop is upwards
- D. net force on loop is downwards

Answer: A::B::C::D



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144. A charge particle is moving along positive y-axis in uniform electric and magnetic fields

$$E = E_0 \hat{k}$$

$$\text{and } B = B_0 \hat{i}$$

Here E_0 and B_0 are positive constants. choose the correct options.

- A. particle may be deflected towards positive x-axis
- B. particle may be deflected towards negative z-axis
- C. particle may pass undeflected
- D. kinetic energy of particle may remain constant

Answer: A::B::C::D



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145. A charged particle revolves in circular path in uniform magnetic field after accelerating by a potential difference of V volts. Choose the correct options if V is doubled.

A. kinetic energy of particle will become two times

B. radius in circular path will become two times

C. radius in circular path will become $\sqrt{2}$ times

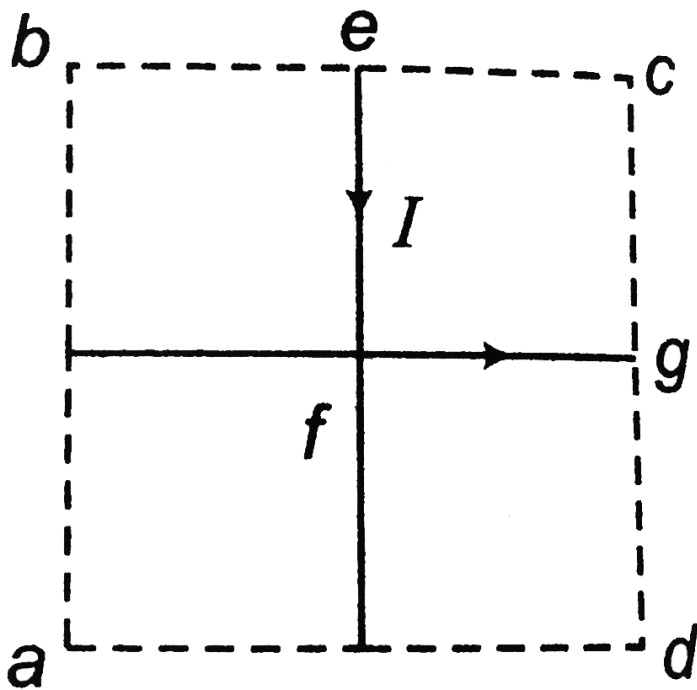
D. angular velocity will remain unchanged

Answer: A::C::D



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146. $abcd$ is a square. There is a current I in wire efg as shown. Choose the correct options.

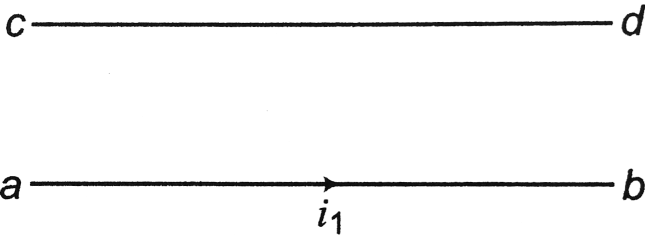


- A. Net magnetic field at a is inwards
- B. Net magnetic field at b is zero
- C. Net magnetic field at c is outwards
- D. Net magnetic field at d is inwards

Answer: A::C::D

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147. There are two wires ab and cd in a vertical plane as shown in figure. Direction of current in wire a is rightwards. Choose the correct options.



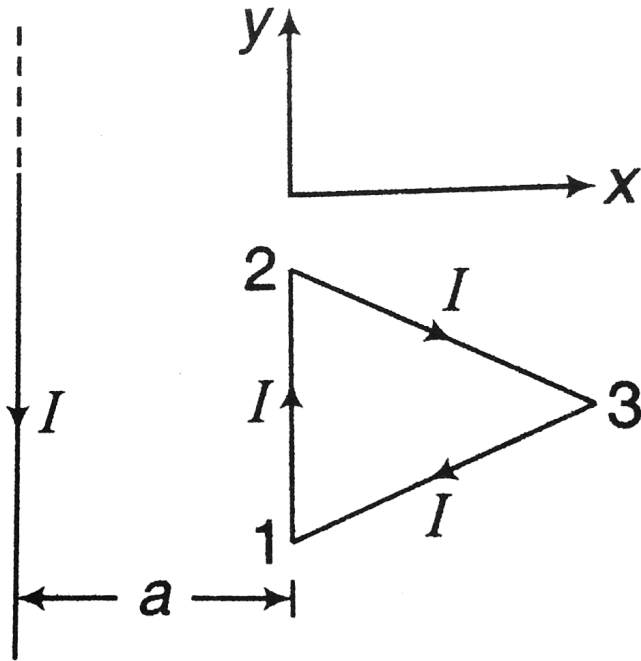
- A. if wire ab fixed, then wire cd can be kept in equilibrium by the current in cd in leftward direction.
- B. equilibrium of wire cd will be stable equilibrium
- C. if wire cd is fixed, then wire ab can be kept in equilibrium by flowing current in cd in rightward direction
- D. equilibrium of wire ab will be stable equilibrium

Answer: A::B::C::D



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148. An equilateral triangular frame with side a carrying a current I is placed at a distance a from an infinitely long straight wire carrying a current I as shown in the figure. One side of the frame is parallel to the wire. The whole system lies in the xy -plane. Find the magnetic force F acting on the frame.



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149. Find an expression for the magnetic dipole moment and magnetic field induction at the center of Bohr's hypothetical hydrogen atom in the n th orbit of the electron in terms of universal constant.



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150. A square loop of side 6cm carries a current of 30A . Calculate the magnitude of magnetic field B at a point P lying on the axis of the loop and a distance $\sqrt{7}\text{cm}$ from centre of the loop.



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151. A positively charged particle having charge $q_1 = 1\text{C}$ and mass $m_1 = 40\text{gm}$ is revolving along a circle of radius $R = 40\text{cm}$ with velocity $v_1 = 5\text{ms}^{-1}$ in a uniform magnetic field with center of circle at origin O of a three-dimensional system. At $t = 0$, the particle was at $(0, 0.4\text{m}, 0)$ and velocity was directed along positive x direction. Another particle having charge $q_2 = 1\text{C}$ and mass $m_2 = 10\text{g}$ moving uniformly parallel to

positive z-direction with velocity $v_2 = 40/\pi m s^{-1}$ collides with revolving particle at $t = 0$ and gets stuck to it. Neglecting gravitational force and coulomb force, calculate x-, y- and z-coordinates of the combined particle at $t = \pi/40s$.

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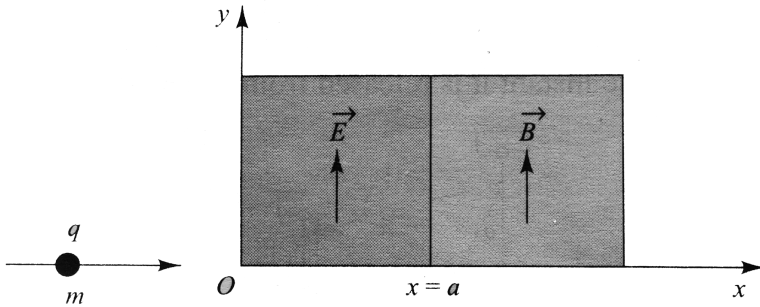
152. A non-relativistic proton beam passes without deviation through a region of space where there are uniform transverse mutually perpendicular electric and magnetic fields with $E = 120kVm^{-1}$ and $B = 50mT$. Then the beam strikes a grounded target. Find the force which the beam acts on the target if the beam current is equal to $i = 0.8mA$.

Mass of protons = $1.67 \times 10^{-27}kg$.

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153. A positively charged particle, having charge q , is accelerated by a potential difference V . This particle moving along the x-axis enters a

region where an electric field E exists. The direction of the electric field is along positive y -axis. The electric field exists in the region bounded by the lines $x = 0$ and $x = a$. Beyond the line $x = a$ (i.e., in the region $x > a$), there exists a magnetic field of strength B , directed along the positive y -axis. Find

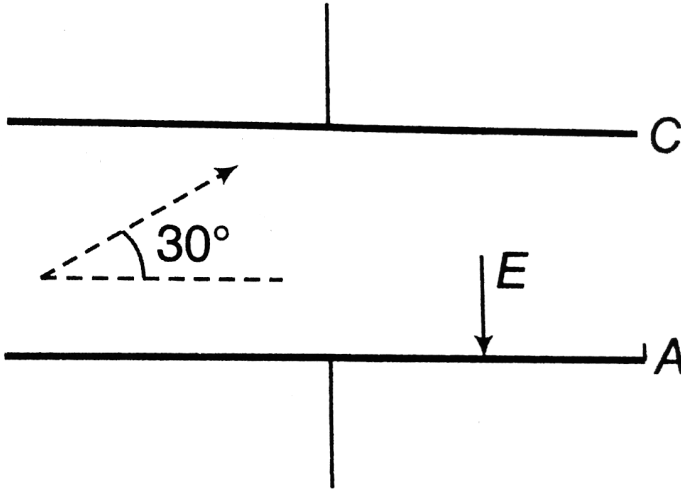


- at which point does the particle meet the line $x = a$.
- the pitch of the helix formed after the particle enters the region $x \geq a$. (Mass of the particle is m .)

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154. A charged particle having charge 10^{-6} C and mass of 10^{-10} kg is fired from the middle of the plate making an angle 30° with plane of the plate. Length of the plate is $0.17m$ and it is separated by $0.1m$. Electric

field $E = 10^{-3} \frac{N}{C}$ is present between the plates. Just outside the plates magnetic field is present. Find the velocity of projection of charged particle and magnitude of the magnetic field perpendicular to the plane of the figure, if it has to graze the plate at C and A parallel to the surface of the plate. (Neglect gravity)



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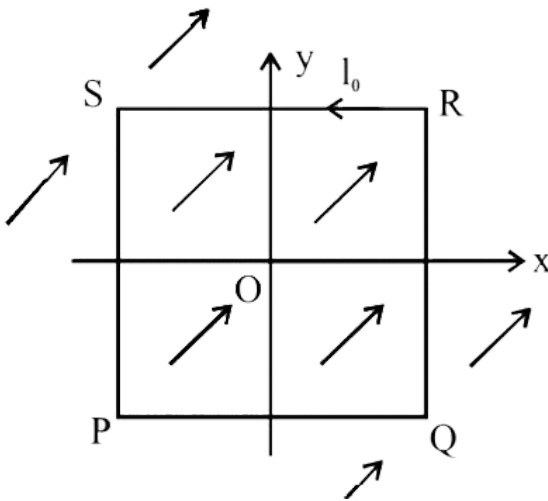
155. A uniform constant magnetic field B is directed at an angle of 45° to the $xa\xi s$ in the xy plane. $PQRS$ is a rigid, square wire frame carrying a steady current I_0 , with its centre at the origin O . At time $t = 0$, the frame is at rest in the position as shown in figure, with its sides parallel to the

x and y axis. Each side of the frame is of mass M and length L .

(a) What is the torque τ about O acting on the frame due to the magnetic field?

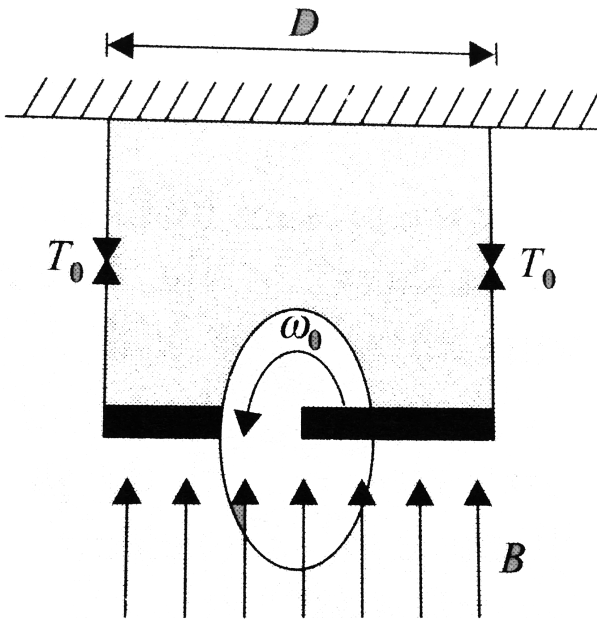
(b) Find the angle by which the frame rotates under the action of this torque in a short interval of time Δt , and the axis about this rotation occurs .

(Δt is small or $\Delta t \rightarrow 0$ variation in the \rightarrow required in this interval maybe \rightarrow its about an axis through its centre perpendicular \rightarrow its plane is $(4)/(3) ML^2$).



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156. A ring of radius R having uniformly distributed charge Q is mounted on a rod suspended by two identical strings. The tension in strings in equilibrium is T_0 . Now a vertical magnetic field is switched on and ring is rotated at constant angular velocity ω . Find the maximum ω with which the ring can be rotated if the strings can withstand a maximum tension of $3T_0/2$.



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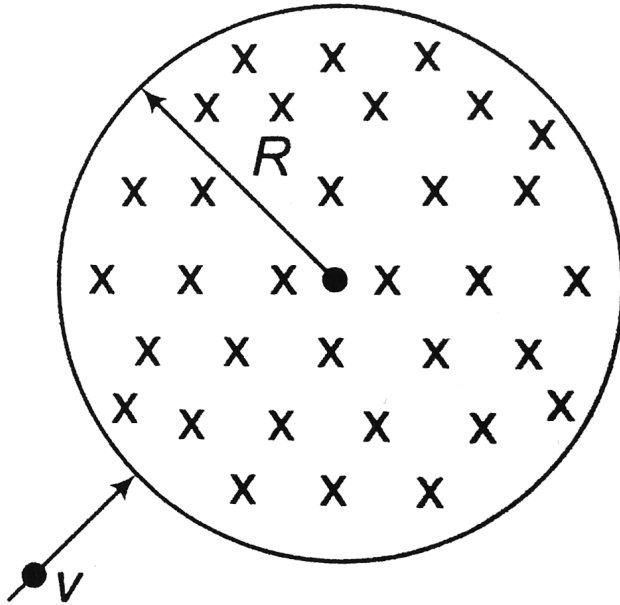
157. Figure shows a cross-section of a long ribbon of width ω that is carrying a uniformly distributed total current i into the page. Calculate the magnitude and direction of the magnetic field B at a point P in the plane of the ribbon at a distance d from its edge.



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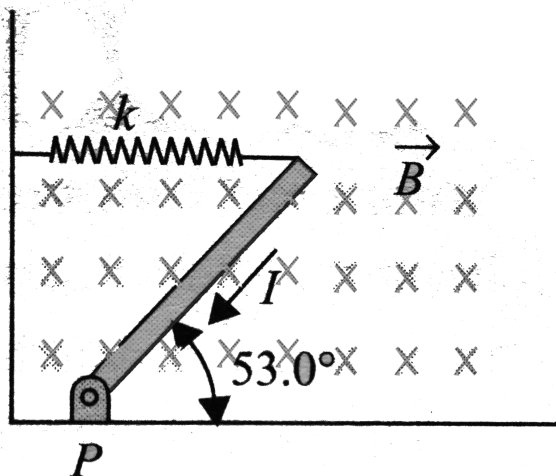
158. A particle of mass m having a charge q enters into a circular region of radius R with velocity v directed towards the centre. The strength of

magnetic field is B . Find the deviation in the path of the particle.



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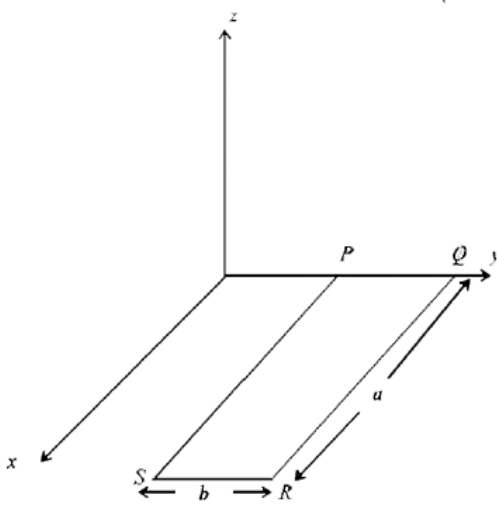
159. A thin, uniform rod with negligible mass and length 0.200m is attached to the floor by a frictionless hinge at point P (as shown in fig) A horizontal spring with force constant $k = 4.80\text{Nm}^{-1}$ connects the other end of the rod to a vertical wall. The rod is in a uniform magnetic field $B=0.340\text{T}$ directed into the plane of the figure. There is current $I=6.50\text{A}$ in the rod, in the direction shown.



When the rod is in equilibrium and makes an angle of 53.0° with the floor, is the spring stretched or compressed?

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160. A rectangular loop PQRS made from a uniform wire has length a , width b and mass m . It is free to rotate about the arm PQ, which remains hinged along a horizontal line taken as the y -axis (see figure). Take the vertically upward direction as the z -axis. A uniform magnetic field $\vec{B} = (3\hat{i} + 4\hat{k})B_0$ exists in the region. The loop is held in the x - y plane and a current I is passed through it. The loop is now released and is found to stay in the horizontal position in equilibrium



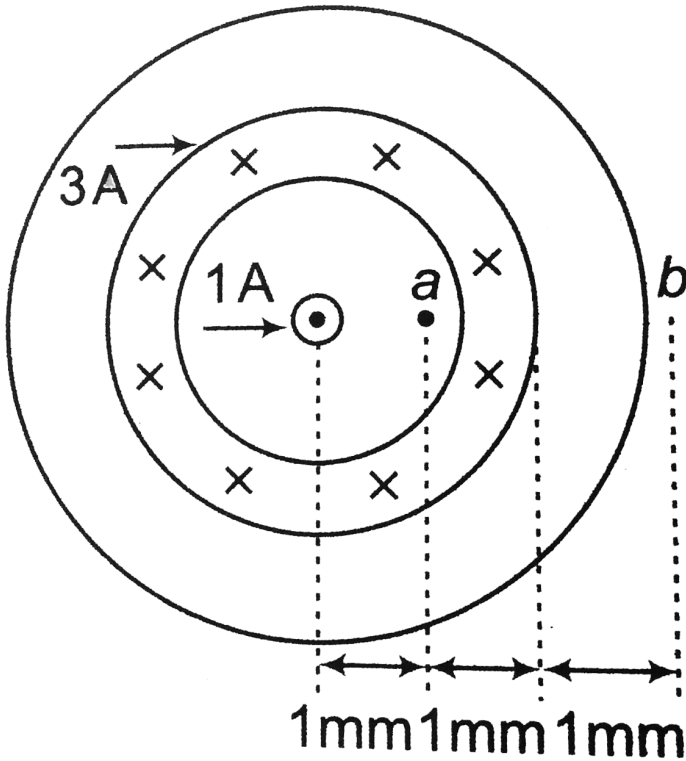
- What is the direction of the current I in PQ ?
- Find the magnetic force on the arm RS .
- Find the expression for I in terms of B_0 , a , b and m

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Introductory Exercise

1. Figure given in the question is a cross-sectional view of a coaxial cable. The centre conductor, surrounded by a rubber layer, which is surrounded by an outer conductor, which is surrounded by another rubber layer. The current in the inner conductor is $1.0A$ out of the page, and the current in

the outer conductor is 3.0 A into the page. Determine the magnitude and direction of the magnetic field at points a and b.



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Subjective Type

1. In the Bohr model of the hydrogen atom, in the lowest energy state the electron revolves round the proton at a speed of $2.2 \times 10^6 \frac{m}{s}$ in a circular orbit of radius 5.3×10^{-11} m.

(a) What is the orbital period of the electron?

(b) If the orbiting electron is considered to be a current loop, what is the current I? (c) What is the magnetic moment of the atom due to the motion of the electron?



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Scq Type

1. A wire of mass $100g$ is carrying a current of $2A$ towards increasing x in the form of $y = x^2$ ($-2m \leq x \leq +2m$). This wire is placed in a magnetic field $B = -0.02\hat{k}$ tesla. The acceleration of the wire $\left(\text{in } \frac{m}{s^2}\right)$ is`

A. $-1.6\hat{j}$

B. $-3.2\hat{j}$

C. $1.6\hat{j}$

D. zero

Answer: C



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2. A conductor of length l is placed perpendicular to a horizontal uniform magnetic field B . Suddenly, a certain amount of charge is passed through it, when it is found to jump to a height h . The amount of charge that passes through the conductor is

A. $\frac{m\sqrt{gh}}{Bl}$

B. $\frac{m\sqrt{ht}}{2Bl}$

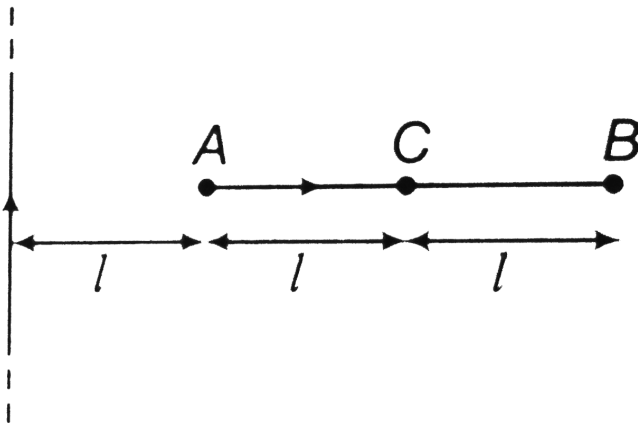
C. $\frac{m\sqrt{2gh}}{Bl}$

D. none of these

Answer: C

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3. A current carrying rod AB is placed perpendicular to an infinitely long current carrying wire as shown in figure. The point at which the conductor should be hinged so that it will not rotate ($AC = CB$)

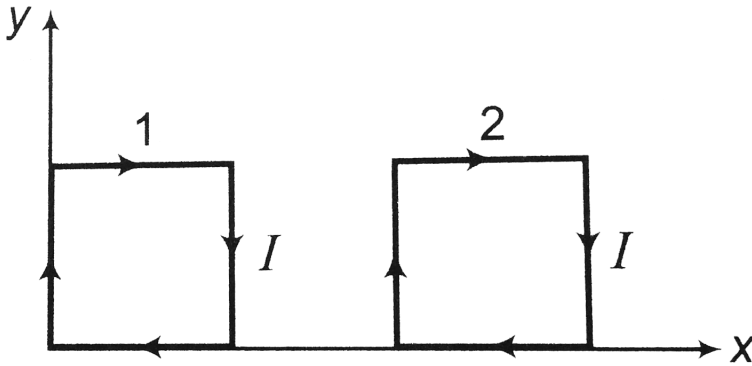


- A. A
- B. somewhere between B and C
- C. C
- D. somewhere between A and C

Answer: D

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4. Magnetic field in a region is given by $B = B_0 + \hat{k}$. Two loops each of side a is placed in the magnetic region in the xy -plane with one of its sides on x -axis. If F_1 is the force on loop 1 and F_2 be the force on loop 2, then



A. $F_1 = F_2 = 0$

B. $F_1 > F_2$

C. $F_2 > F_1$

$$D. F_1 = F_2 = 0$$

Answer: D



View Text Solution

5. Same current i is flowing in the three infinitely long wires along positive x -, y - and z -directions. The magnetic field at a point $(0,0,-a)$ would be

A. $\frac{\mu_0 i}{2\pi a} (\hat{j} - \hat{i})$

B. $\frac{\mu_0 i}{2\pi a} (\hat{i} - \hat{j})$

C. $\frac{\mu_0 i}{2\pi a} (\hat{i} + \hat{j})$

D. $\frac{\mu_0 i}{2\pi a} (-\hat{i} - \hat{j})$

Answer: A



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1. Two circular coil of radii 5cm and 10cm carry equal currents of 2A. The coils have 50 and 100 turns, respectively, and are placed in such a way that their planes as well as their centers coincide. Magnitude of magnetic field at the common centre of coils is

- A. $8\pi \times 10^{-4}T$ if currents in the coils are in same sense
- B. $4\pi \times 10^{-4}T$ if current in the coils are in opposite sense
- C. zero if currents in the coils are in opposite sense
- D. $8\pi \times 10^{-4} T$ if currents in the coils are in opposite sense

Answer: A:C



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