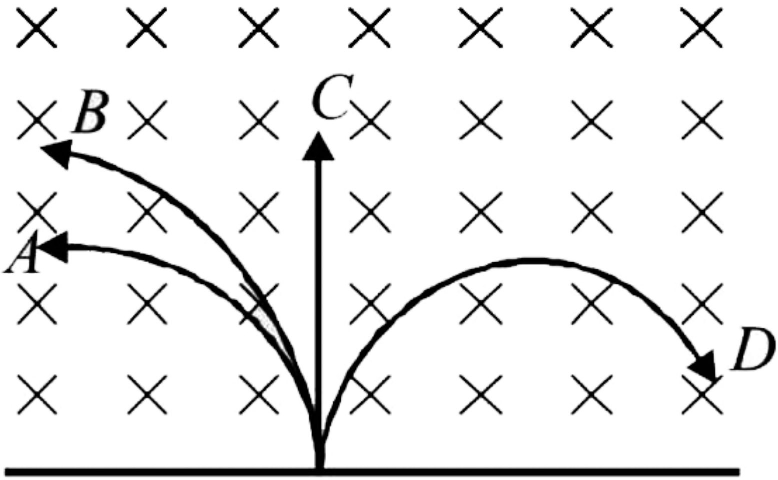
PHYSICS

BOOKS - SUNIL BATRA 41 YEARS IITJEE PHYSICS (HINGLISH)

MOVING CHARGES AND MAGNETISM

Jee Main And Advanced

1. A neutron, a proton , and 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 follows track .... and the alpha particle follows track.....



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2. A wire of length $L metre$, carrying a current Iampere is bent in the form of a circle . The magnitude of its magnetic moment is .... $MKS units$.

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3. In a hydrogen atom , the electron moves in an orbit of radius $0.5A$ making `10^(16) revolutions per second . The magnetic moment associtated with the orbital motion of the electron is ......

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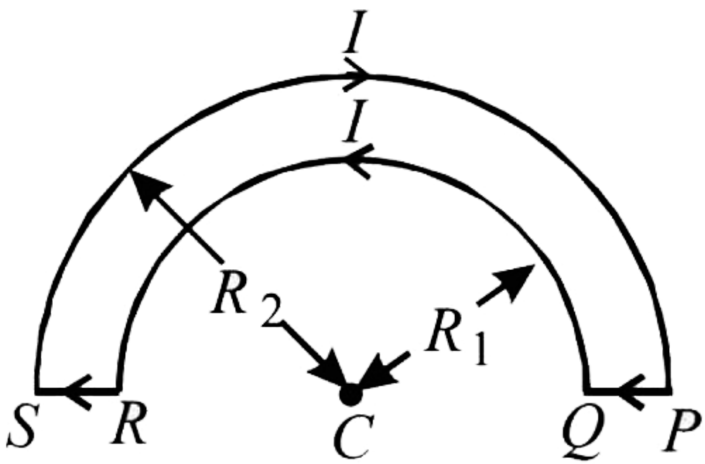
4. The wire loop $PQRSP$ formed by joining two semicircular wires of radii R_1 and R_2 carries a current I as shown . The magnitude of the magnetic induction at the center C is ....



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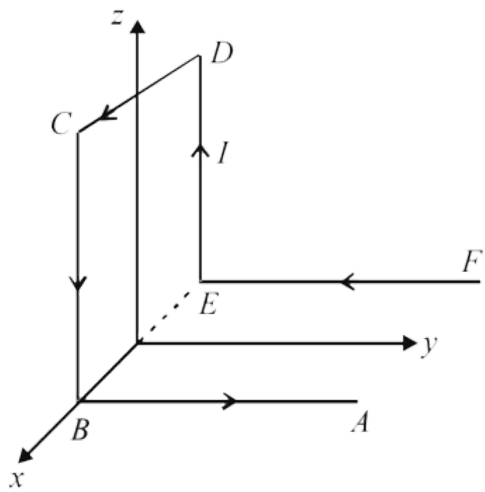
5. A wire $ABCDEF$ (with each side of length L) bent as shown in figure and carrying a current I is placed in a uniform magnetic induction B

parallel to the positive $y - direction$. The force experienced by the wire is .... In the .... direction .



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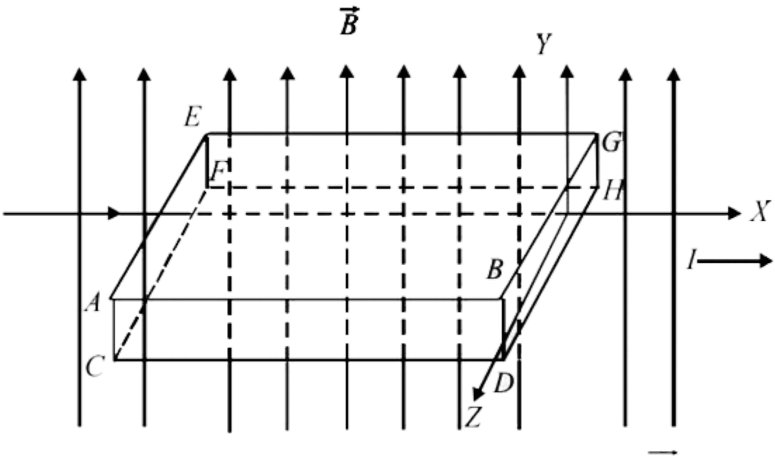
6. A metallic block carrying current I is subjected to a uniform magnetic induction

$\overrightarrow{B} asshown \in Figure. Themov \in gchar \geq s \exp eriencea f \text{ or } ce$

vec(F) given by ..... Which results in the lowering of the potential of the face .... Assume the speed of the carries to be v .



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7. No net force acts on a rectangular coil carrying a steady current when suspended freely in a uniform magnetic field.

A. No net force acts on a rectangular coil carrying a steady current when suspended freely in a uniform magnetic field.

B.

C.

D.

Answer:

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8. There is no change in the energy of a charged particle moving in a magnetic field although a magnetic force is acting on it .

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9. 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 .

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10. 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 paths of the same radius.

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11. A conducting circular loop of radiius r carries a constant current i. It is placed in a uniform magnetic field $\overrightarrow{B}_0$ such that $\overrightarrow{B}_0$ is perpendicular to the plane of the loop . The magnetic force acting on the loop is

A. irB_0

B. $2\pi irB_0$

C. $zero$

D. πirB_0

Answer: C

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12. A battery is connected between two points A and B on the circumference of a uniform conducting ring of radius r and resistance R . One of the arcs AB of the ring subtends an angle θ at the centre . The value of the magnetic induction at the centre due to the current in the ring is

A. proportional to $2(180^{\circ} - \theta)$

B. inversely proportional to r

C. $zero$, only if $\theta = 180^{\circ}$

D. $zero$ for all values of θ

Answer: D

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13. A proton , a deutron and 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. $r_\alpha > r_p > r_p$

C. $r_\alpha = r_d > r_p$

D. $r_p = r_d = r_\alpha$

Answer: A

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14. A circular loop of radius R , carrying I, lies in $x - y$ plane with its origin . The total magnetic flux through $x - y$ plane is

A. directly proportional to I

B. directly proportional to R

C. inversely proportional to R

D. $zero$

Answer: D

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

A. straight line

B. circle

C. helix

D. helix

Answer: A

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16. A particle of the charged q and $massm$ moves in a circular orbit of radius r with angular speed ω . The ratio of the magnitude of its magnetic moment to that of its angular momentum depends on

A. ω and q

B. ω, q and m

C. q and m

D. ω and m

Answer: C

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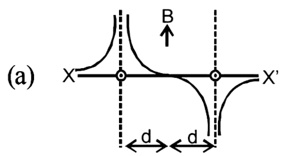
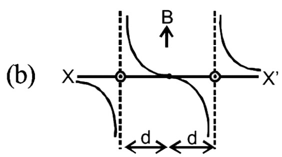
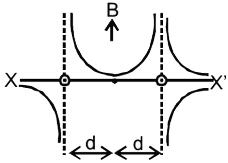
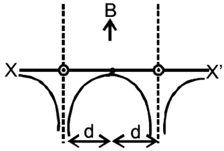
17. Two long parallel wires are at a distance $2d$ apart. They carry steady equal currents flowing out of the plane of the paper , as shown. The variation of the magnetic field B along the line XX is given by

A. 

B. 

(c) 

C.

(d) 

D.

Answer: B

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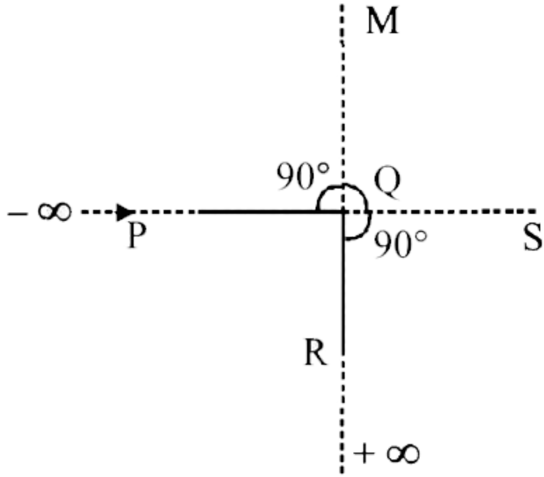
18. An infinitely long conductor PQR is bent to form a light angle as shown in Figure . A current I flows through PQR . The magnetic field due to this current at the point M is H_1. Now , another infinitely long straight conductor QS is connected at Q so that current is $\frac{I}{2}$ in QR as well as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

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19. An ionized gas contains both positive and negative ions . If it is subjected simultaneously to an electric field along the $+x$ - direction and a magnetic field along the $+y$ - direction and the negative ions towardws $-y$ - direction

A. positive ions deflect towards $+y - direction$ and negative ions towards $-ydirection$

B. all ions deflect towards $+y - direction$

C. all ions deflect towards $-y - direction$

D. positive ions deflect towards $-y - direction$ and negative ions towards $+ydirection$

Answer: C

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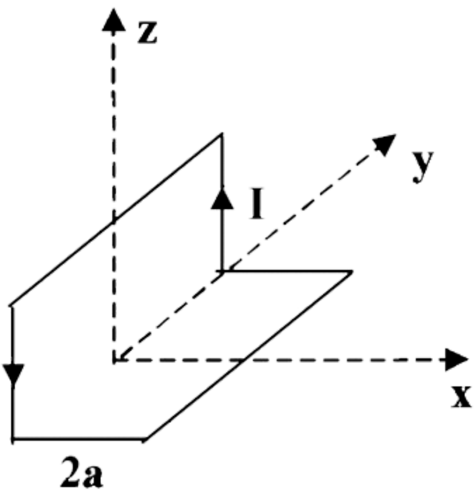
20. A non - planar loop of conducting wire carrying a current I is placed as shown in the figure . Each of the straighrt sections of the loop is of the length $2a$. The magnetic field due to this loop at the point $P(a, 0, a)$ points in the direction



A. $\frac{1}{\sqrt{2}}\left(-\hat{j}+\hat{k}\right)$

B. $\frac{1}{\sqrt{3}}\left(-\hat{j}+\hat{k}+\hat{i}\right)$

C. $\frac{1}{\sqrt{3}}\left(\hat{i}+\hat{j}+\hat{k}\right)$

D. $\frac{1}{\sqrt{2}}\left(\hat{i}+\hat{k}\right)$

Answer: D

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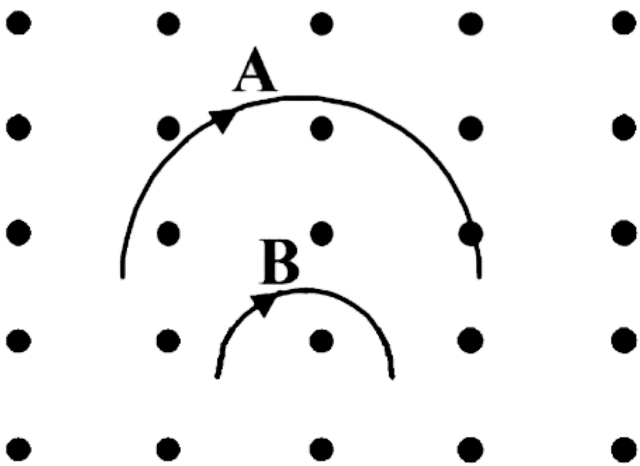
21. Two particles A and B of masses m_A and m_B respectively and having the same charge are moving in a plane . The speeds of the particles are v_A and v_B respectively and the trajectories are as shown in the figure. Then



A. $m_A v_A < m_B v_B$

B. $m_A v_A > m_B v_B$

C. $m_A v_A < m_B$ and $v_A < v_B$

D. $m_A = m_B$ and $v_a = v_B$

Answer: B

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22. A coil 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 $x = a \rightarrow x = b$. The minimum value of v required so that the paRTICLE CAN JUST ENTER THE REGION $X > B$ IS

A. $\dfrac{moNI}{b}$

B. $\dfrac{2moNI}{a}$

C. $\dfrac{moNI}{2}(b - a)$ in $\dfrac{b}{a}$

D. $\dfrac{moNI}{2}(b - a)$ in $\dfrac{a}{b}$

Answer: C

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23. A particle of the mass m and cgharge q moves with a constant velocity v along the positive $x-direction. Itentersaregionconta \in \in gaun$ if or $mmag \ne ticfiel$ B$directedalongthe \min i\mu mvalueof$v $requiredsott\hat{h}epartic \le canjustentertheregion$ xgtb` is

A. $\frac{qbB}{m}$

B. $\frac{q(b-A)B}{m}$

C. $\frac{qaB}{m}$

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

Answer: B

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

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

B. $\dfrac{\mu_0 I\left(x\hat{i}\right) + y\hat{j}}{2\pi(x^2 + y^2)}$

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

D. $\dfrac{\mu_0 I\left(yx\hat{i}\right) - y\hat{j}}{2\pi(x^2 + y^2)}$

Answer: A

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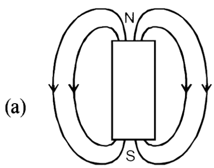
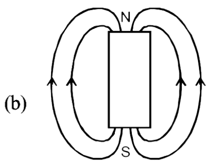
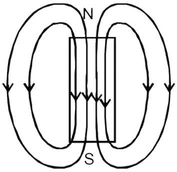
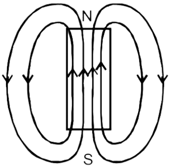
25. The magnet field lines due to a bar magnet are correctly shown in

A. 

B. 

C. (c) 

D. (d) 

Answer: D

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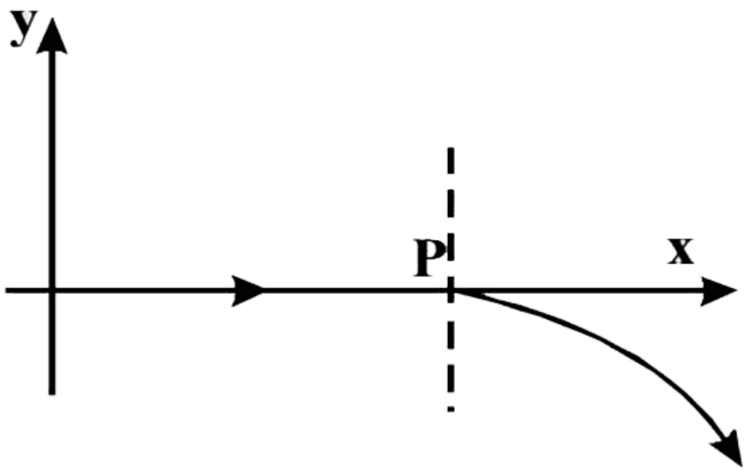
26. For a positively charged particle moving in a $x - y$ plane initially along the $x - a\xi s$, there is a sudden change in its path due to the presence of electric and//or magnetic fields beyond p . The curved path is shown in the $x - y$plane and is found to be non - circular. Which one of the following combinations is possible ?



A. $\overrightarrow{E} = 0, \overrightarrow{B} = b\hat{i} + c\hat{k}$

B. $\overrightarrow{E} = a\hat{i}, \overrightarrow{B} = c\hat{k} + a\hat{i}$

C. $\overrightarrow{E} = 0, \overrightarrow{B} = c\hat{j} + b\hat{k}$

D. $\overrightarrow{E} = a\hat{i}, \overrightarrow{B} = bc\hat{k} + b\hat{j}$

Answer: B

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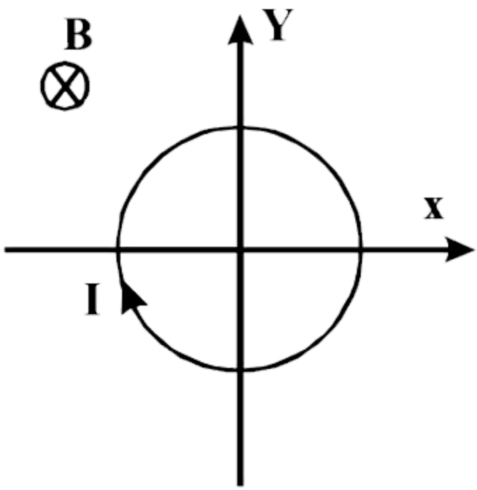
27. A conducting loop carrying a current I is placed in a uniform magnetic field ponting into the plane of the paper as shown. The loop will have a tendency to



A. contract

B. expand

C. move towards $+vex - a\xi s$

D. move towards $-vex - a\xi s$

Answer: B

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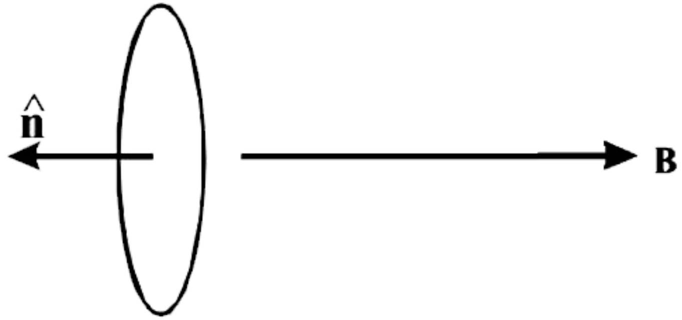
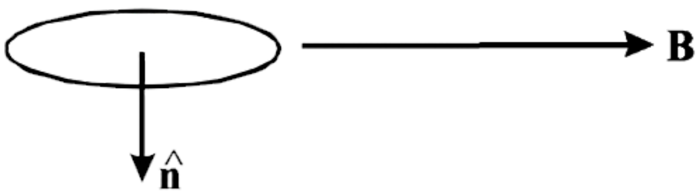
28. A current carrying loop is placed in a uniform magnetic field in four different orientations , I,ii,iii & iv arrange them in the decreasing order of potential Energy`

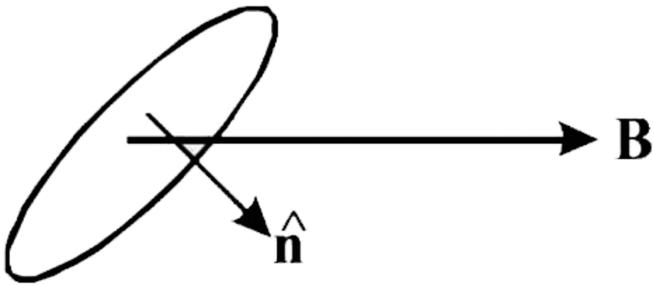
I.



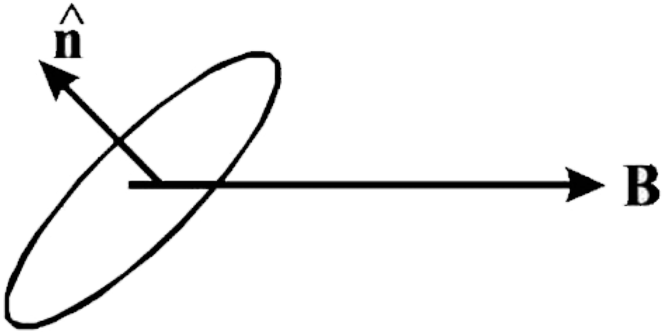
II.



III



IV



A. $I > III > II > IV$

B. $I > II > III > IV$

C. $I > IV > II > III$

D. $III > IV > I > II$

Answer: A

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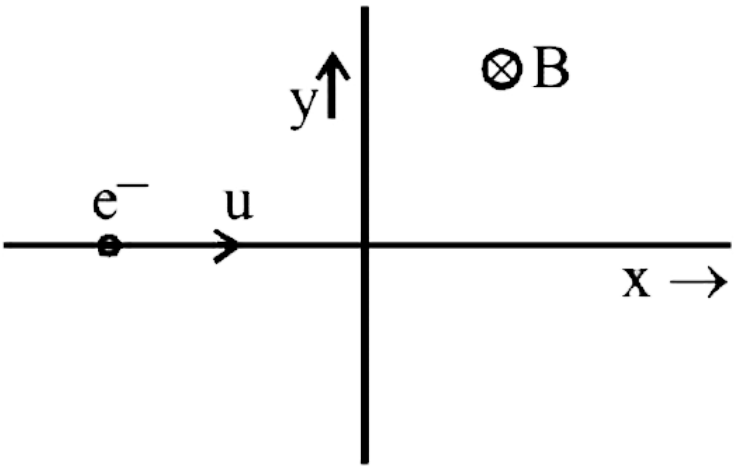
29. An electron travelling with a spped u along the positive $x - a\xi s$ enters into a region of magnetic field where $B = -B_0\widehat{K}(x > 0)$. It comes out of the region with speed v then



A. $v = uaty > 0$

B. $v = uaty < 0$

C. $v > uaty > 0$

D. $v > uaty < 0$

Answer: B

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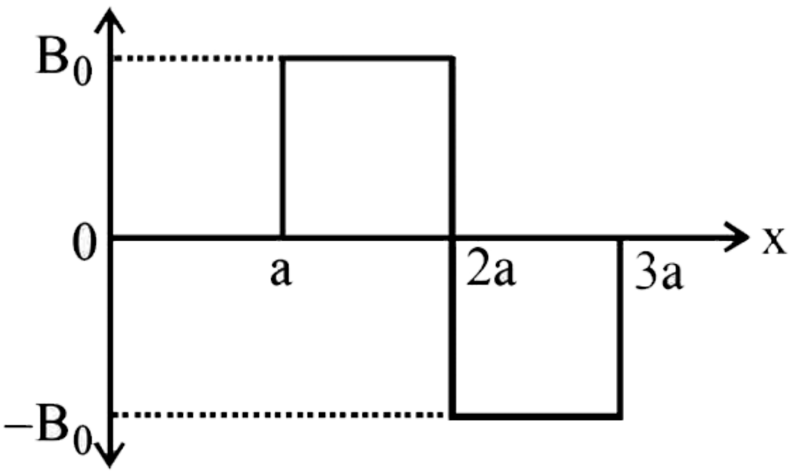
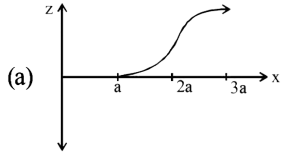
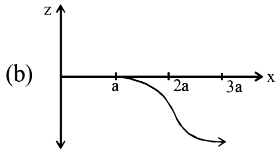
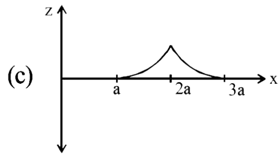
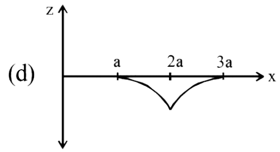
30. A magnetic field $\vec{B} = B_0\hat{j}$, exists in the region $a < x < 2a$, and vec(B) = -B_(0) hat(j), $\in theregion$2a lt xlt 3a, $where$B_(0) $isapositivecons\tan t. Apositivep\oint char \geq mov \in gwithavelocity$vec(v) = v_(0) hat (i), $where$v_(0) is a positive constant , enters the magnetic field at $x = a$. The trajectory of the charge in this region can be like



A. 

B. 

C. 

D. 

Answer: A

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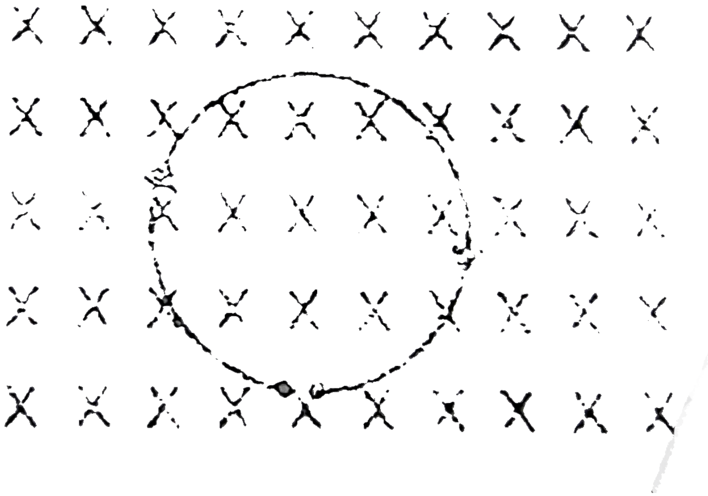
31. A thin flexible wire of length L is connected to two adjacent fixed points carries a current I in the clockwise direction, as shown in the figure.When system is put in a uniform magnetic field of strength B

going into the plane of paper, the wire takes the shape of a circle.The tension in the wire is:



A. IBL

B. $\frac{IBL}{\pi}$

C. $\frac{IBL}{2\pi}$

D. $\frac{IBL}{4\pi}$

Answer: C

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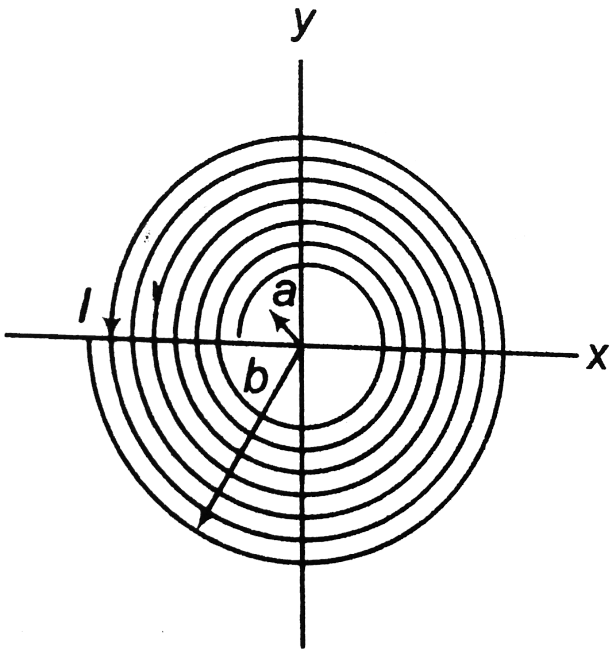
32. A long insulated copper wire is closely wound as a spiral of N turns. The spiral has inner radius a and outer radius b. The spiral lies in the xy-plane and a steady current I flows through the wire. The$z$-component of the magetic field at the centre of the spiral is



A. $\dfrac{\mu_0 N I}{2(b-a)} \ln\left(\dfrac{b}{a}\right)$

B. $\dfrac{\mu_0 N I}{2(b-a)} \ln\left(\dfrac{b+a}{b-a}\right)$

C. $\dfrac{\mu_0 N I}{2b} \ln\left(\dfrac{b}{a}\right)$

D. $\dfrac{\mu_0 N I}{2b} \ln\left(\dfrac{b+a}{b-a}\right)$

Answer: A

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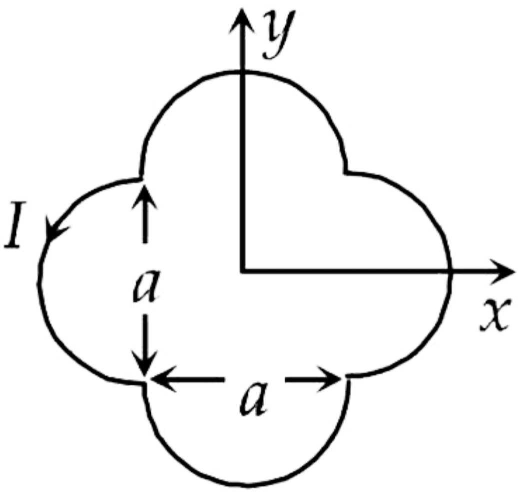
33. A loop carrying current I lies in the $x-y$ plane as shown in the figure . The unit vector $\hat{k}$ is coming out of the plane of the paper . The magnetic moment of the current loop is



A. $a^2\hat{k}$

B. $\left(\frac{\pi}{2}+1\right)a^2I\hat{k}$

C. $-\left(\frac{\pi}{2}+1\right)a^2I\hat{k}$

D. $(2\pi + 1)a^2 I\hat{k}$

Answer: B

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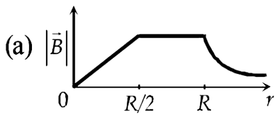
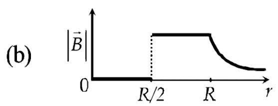
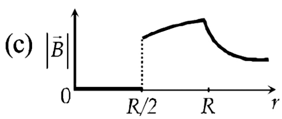
34. An infinitely long hollow conducting cylinder with inner radius $\frac{R}{2}$ and outer radius R carries a uniform current ra density along its length . The magnitude of the magnetic field , $\left|\overrightarrow{B}\right|$ as a function of the radial distance r from the axis is best represented by



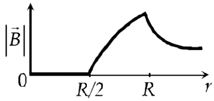
A.



B.



C.

(d) 

D.

Answer: D

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35. A magnetic needle is kept in a non uniform magnetic field . It experiences

A. a force and a torque

B. a force but not a torque

C. A torque but not a force

D. neither a force nor a torque

Answer: A

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36. A charged paricle goes undeflected in a region containing electric and magnetic field. It is possible that

A. $E = 0, B = 0$

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

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

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

Answer: A::B::D

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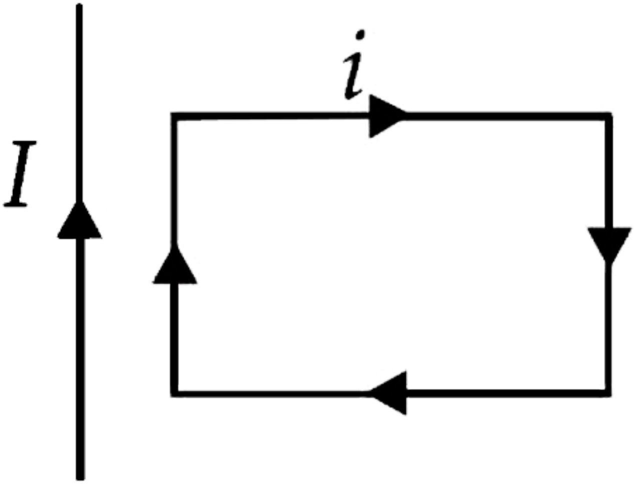
37. A rectangular loop carrying a current i is situated near a long straight wire such that the wire is parallel to one of the sides of the loop and is in the plane of the loop . If steady current I is established in the wire as shown in the figure ,



A. rotate about an axis parallel to the wire

B. move away from the wire

C. move towards the wire

D. remain stationary

Answer: C

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38. Two thin long parallel wires seperated by a distance 'b' are carrying a current ' I' amp each . The magnitude of the force3 per unit length exerted by one wire on the other is

A. $\frac{\mu_0 i^2}{b^2}$

B. $\frac{\mu_0 i^2}{2\pi b}$

C. $\frac{\mu_0 i^2}{2\pi b}$

D. $\frac{\mu_0 i^2}{2\pi b^2}$

Answer: B

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39. Two particle X and Y having equal charge, after being accelerated 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. $(R_1)/(R_2)$

C. $(R_1)/(R_2)^2$

D. $(R_1)/(R_2)$

Answer: C

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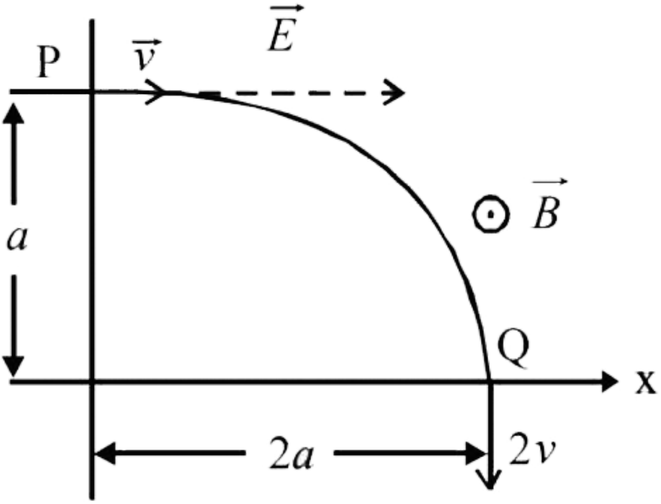
40. A particle of charge $+q$ and mass m moving under the influence of a uniform electric field $E\hat{i}$ and uniform magnetic field $B\hat{k}$ follows a trajectory from $P \rightarrow Q$ as shown in fig. The velocities at P and Q are $v\hat{i}$

and $-2v\hat{j}$. 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 the electric field at Q is zero

Answer: A::B::D

Watch Video Solution

41. A microameter has a resistance of 100ω and $a f \underline{l} sca \leq ran \geq of$ 50 muA`. It can be used as a voltmeter or as a higher range ammeter provides a resistance is added to it . Pick the correct range and resistance combination(s)

A. $50V$ range with $10k\omega$ resistance in series

B. $10V$ range with $200k\omega$ resistance in series

C. $5mA$ range with 1ω resistance in parallel

D. $10mA$ range with 1ω resistance in parallel

Answer: B::C

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42. 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 points 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.

Answer: B

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43. H^{+}, He^{+} and O^{++} all having the same kinetic energy pass through a region in which there is a uniform magnetic field perpendicular to their velocity . The masses of H^{+}, He^{+} and O^{2+} are $1a\mu$, $4a\mu$ and $16a\mu$ respectively . Then

A. H^{+} will be deflected most

B. O^{2+} will be deflected most

C. He^{+} and O^{2+} will be deflected equally

D. all will be deflected equally

Answer: A::C

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44. Two particles , each of mass m and charge q, are attached to the two ends of a light rigid rod of length $2R$. The rod is rotated at constant angular speed about a perpendicular axis passing through its centre. The ratio of the magnitudes of the magnetic moment of the system and its angular momentum about the centre of the rod is

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

B. $\frac{q}{m}$

C. $\frac{2q}{m}$

D. $\frac{q}{\pi m}$

Answer: A

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45. Two very long, straight , parallel wires carry steady currents $I \& -I$ respectively . The distance between the wires is d. At a certain instant of time, a point charge q is at a point equidistant from the wires , in the plane of the wires. Its instantaneous vel,ocity v is perpendicular to this plane. The magnitude of the force due to the magnetic field acting on the charge at this instant is

A. $\frac{\mu_0 I q v}{2\pi d}$

B. $\frac{\mu_0 I q v}{\pi d}$

C. $\frac{2\mu_0 I q v}{\pi d}$

D. 0

Answer: D

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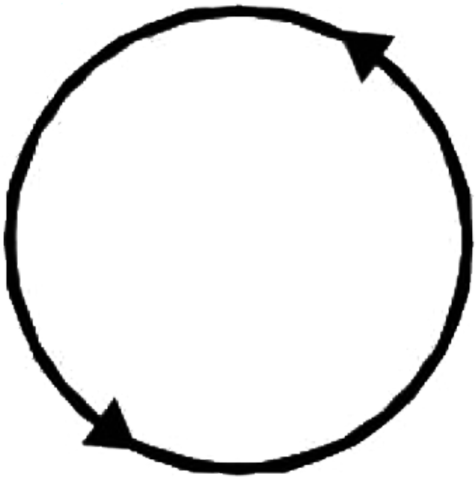
46. The following field line can never respresent



A. induced electric field

B. magnetostatic field

C. gravitational field of a mass at rest

D. electrostatic field

Answer: C::D

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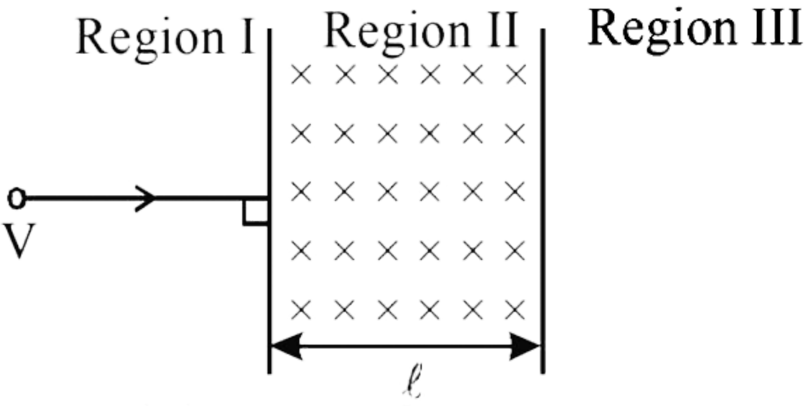
47. A particle of mass $m$and charge q, moving with velocity v enters Region II normal to the boundary as shown in the figure. Region II has a uniform magnetic field B perpendicular to the plane of the paper . The length of the region II is l. Choose the correct choice(s).



A. The particle enters Region III only if its velocity $v < \frac{qlB}{m}$

B. The particle enters Region III only if its velocity $v > \frac{qlB}{m}$

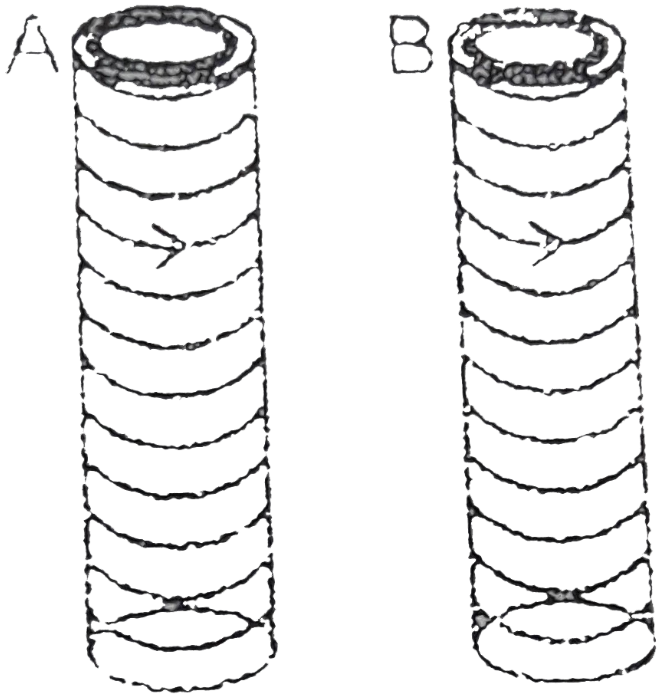
C. Path length of the particle in Region II is maximum when velocity $v = \frac{qlB}{m}$

D. Time spent in Region II is same for any velocity v as long as the particle returns to Region I

Answer: A::C::D

Watch Video Solution

48. Two metallic rings A and B identical in shape and size but having different resistivities ρ_A and ρ_B are kept on top of two idential solenoids as shown in the figure.When current I is switched on in both the solenoids in identical manner, the rings A and B jump to heights h_A and h_B respectively with h_A gt h_B. The possible relation(s) between their resistivities and their masses m_A and m_B is (are)



A. $\rho_A > \rho_B$ and $m_A = m_B$

B. $\rho_A < \rho_B$ and $m_A = m_B$

C. $\rho_A > \rho_B$ and $m_A > m_B$

D. $\rho_A < \rho_B$ and $m_A < m_B$

Answer: B::D

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49. An electron and a proton are moving on straight parallel paths with same velocity. They enter a semi infinite region of uniform magnetic field perpendicular to the velocity.

Which of the following statement(s) is /are true?

A. They will never come out of the magnetic field region.

B. They will come out travelling along parallel paths.

C. They will come out at the same time.

D. They will come out at different times.

Answer: B::D

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

A. If $\theta = 0 \circ$, the charge moves in a circular path in the $x - z$ plane.

B. If $\theta = 0 \circ$, the charge undergoes helical path motion with constant pitch along the $y - a\xi s$.

C. If

$\theta = 10 \circ$, $thechar \geq undergoeshelicalmotionwithitsπtch \in crea$ si

y - axis.

D. If $\theta = 90 \circ$ the charge undergoes linear but accelerated motion along the $y - a\xi s$.

Answer: C::D

Watch Video Solution

51. A particle of mass M and positive charge Q, moving with a constant velocity $\overrightarrow{u_1} = 4\hat{i}ms^{-1}$, enters a region of uniform static magnetic field , normal to the $x-y$ plane. The region of the magnetic field extends from $x=0$ to $x=L$ for all values of y. After passing through this region, the particle emerges on the other side after $10 milli \sec onds$ with a velocity $\overrightarrow{u_2} = 2\left(\sqrt{3}\hat{i}+\hat{j}\right)ms^{-1}$. The correct statement(s) is (are)

A. The direction of the magnitude field is $-z$ direction

B. The direction of the magnitude field is $+z$ direction

C. The magnitude of the magnetic field $\frac{50\pi M}{3Q} units$

D. The magnitude of the magnetic field $\frac{100\pi M}{3Q} units$

Answer: A::C

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52. A steady current I flows along an infinitely long hollow cylindrical conductor of radius R. This cylinder is placed coaxially inside an infinite solenoid of radius $2R$. The solenoid has a n turns per unit length and carries a steady current I. Consider a point p at a distance r from the common axis . The correct statement(s) is (are)

A. In the region $0 < r < R$, the magnetic field is non - zero

B. In the region $R < r < 2R$, the magnetic field is along the common axis

C. In the region $R < r < 2R$, the magnetic field is tangential to the circle of radius r, centered on the axis

D. In the region $r > 2R$, the magnetic field is non - zero

Answer: A::D

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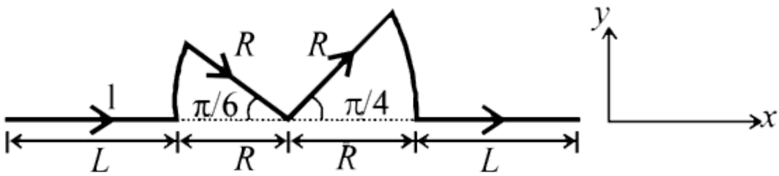
53. A conductor (shown in the figure) carrying constant current I is kept in the $x - y$ plane in a uniform magnetic field $\overrightarrow{B}$. If $\overrightarrow{F}$ is the magnitude of the total magnetic force acting on the conductor, then the correct statement(s) is (are)



A. If $\overrightarrow{B}$ is along $\hat{z}$, $F \propto (L+R)$

B. If $\overrightarrow{B}$ is along $\widehat{x}$,F = 0`

C. If $\overrightarrow{B}$ is along $\hat{y}$, $F \propto (L+R)$

D. If $\overrightarrow{B}$ is along $\hat{z}$, $F=0$

Answer: A::B::C

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54. Consider two identical galvanometers and two identical resistors with resistance R. If the internal resistance of the galvanometers $R_c < R/2$, which of the following statement(s) about any one of the galvanometers is (are) true?

A. The maximum voltage range is obtained when the two resistors and one galvanometer are connected in series

B. The maximum voltage range is obtained when the two resistors and one galvanometer are connected in series , and the second galvanometer is connected in parallel to the first galvanometer

C. The maximum current range is obtained when all the components are connected in parallel

D. The maximum current range is obtained when the two galvanometers are connected in series and the combination is connected in parallel with both the resistors

Answer: A::C

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55. A bar magnet with poles $25cm$ apart and of strength $14.4amp - m$ rests with centre on a frictionless pivot. It is held in equilibrium aat an angle of 60° with respect to a uniform magnetic field of induction $0.25Wb/m^2$, $byapply \in gaf$ or ceF$atright\angle s \rightarrow itsa\xi satap\oint$12 cm $\mathfrak{o}m\pi vot. Calc\underline{a}te$F$. W\widehat{w}illhappen$ if $thef$ or ceF` is removed?

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56. A bar magnet is placed with its north pole pointing north and its south pole pointing south. Draw a figure to show the location of neutral points .

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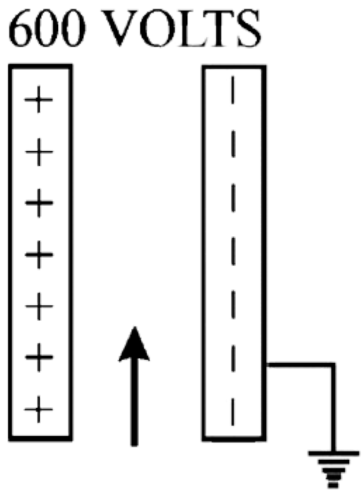
57. A potential difference of $600vo < s$ is applied across the plates of a parallel plate consenser . The separation between the plates is $3mm$. An electron projected vertically, parallel to the plates , with a velocity of $2 \times 10^6 m / \sec$ moves underflected between the plates. Find the magnitude and direction of the magnetic field in the region between the condenser plates. (Neglect the edge effects). (Charge of the electron `= -1.6xx10^(-19) coulomb)



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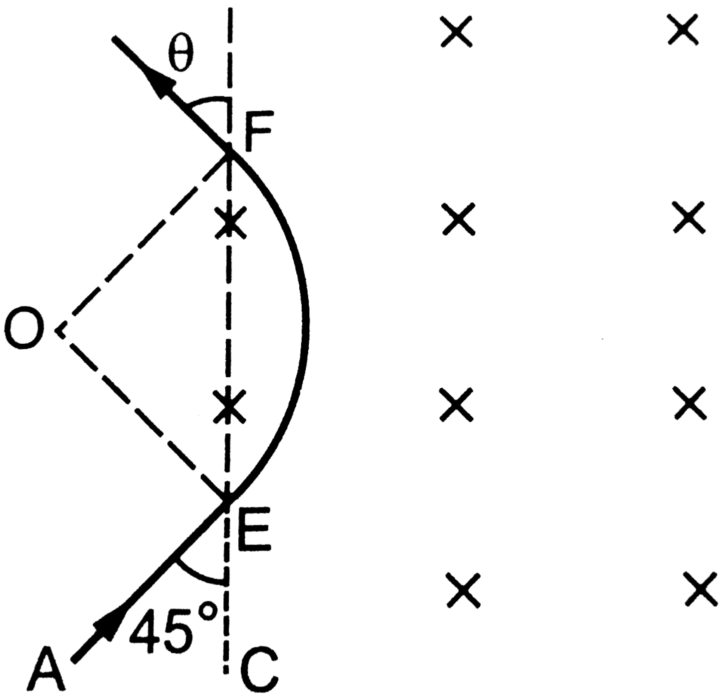
58. A particle of mass $m = 1.6X10^{-27}$ kg and charge $q = 1.6X10^{-19}$ C moves at a speed of $1.0X10^7 ms^{-1}$. It enters a region of uniform magnetic field at a point E, as shown in The field has a strength of 1.0 T. (a) The magnetic field is directed into the plane of the paper. The particle leaves the region of the filed at the point F. Find the distance EF and the angle theta. (b) If the field is coming out of the paper, find the time spent by the particle in the regio the magnetic feld after entering it at E.



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59. A beam of protons with a velocity of $4X10^5 ms^{-1}$ enters a uniform magnetic field of 0.3 T. The velocity makes an angle of 60° with the magnetic field. Find the radius of the helicla path taken by the proton beam and the pitch of the helix.

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60. Two long, straight wires a and b are $2 \cdot 0$ m apart,

perpendicular to the plane of the paper as shown in figure

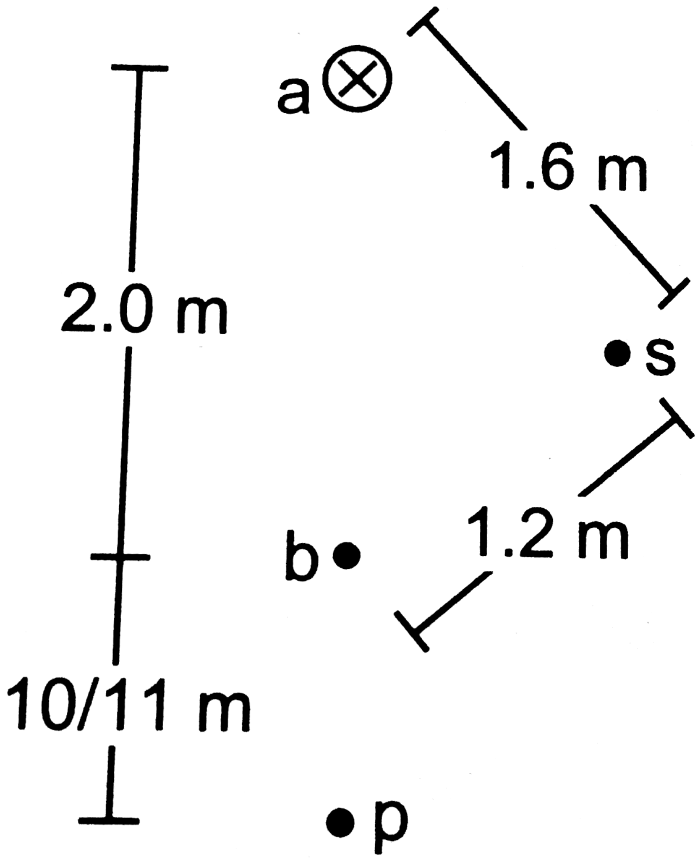
. The wire a carries a current of $9 \cdot 6A$ directed

into the plane of the figure,The magnetic field at the

point P at a distance of 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 B at the point s and (c) the force per unit length on the wire b`.



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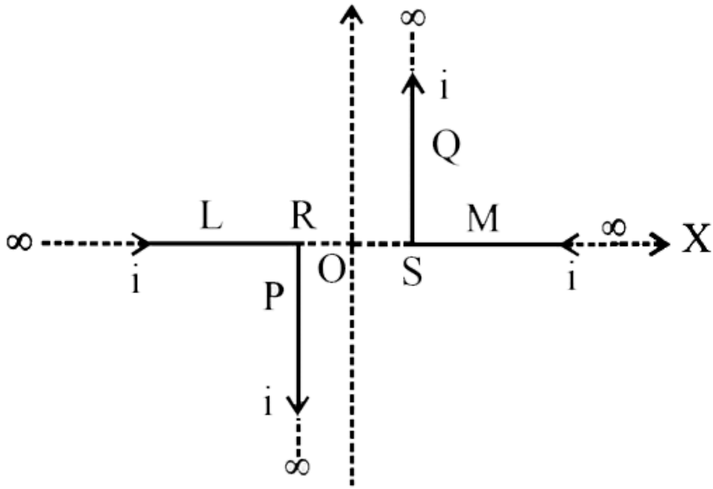
61. A pair of stationary and infintely long bent wires are placed in the XY planes as shown in fig. The wires carry currents of $I = 10 amperes$ each as shown . The segments P and Q are parallel to the $Y - a\xi s$ such that

$OS = OR = 0.02m$. Find the magnitude and direction of the magnetic induction at the origin O.



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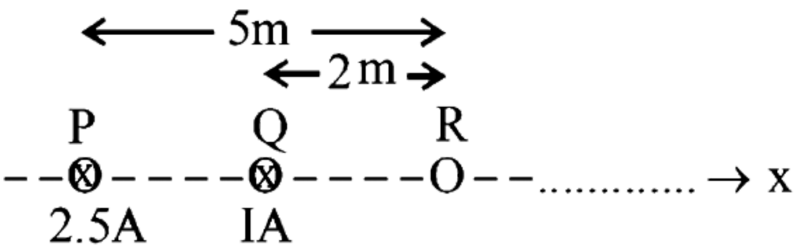
62. Two long parallel wires carrying current $2.5 amperes$ and $I ampere$ in the same direction (directed into the plane of the paper) are held at P and Q respectively such that they are perpendicular to the plane of paper. The points P and Q are located at a distance of $5 metres$ and $2 metres$ respectively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

(i) An electron moving with a velocity of $4 \times 10^5 m/s$ along the positive $x - direction$ experiences a force of magnitude $3.2 \times 10^{-20} N$ at the point R. Find the value of I.

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



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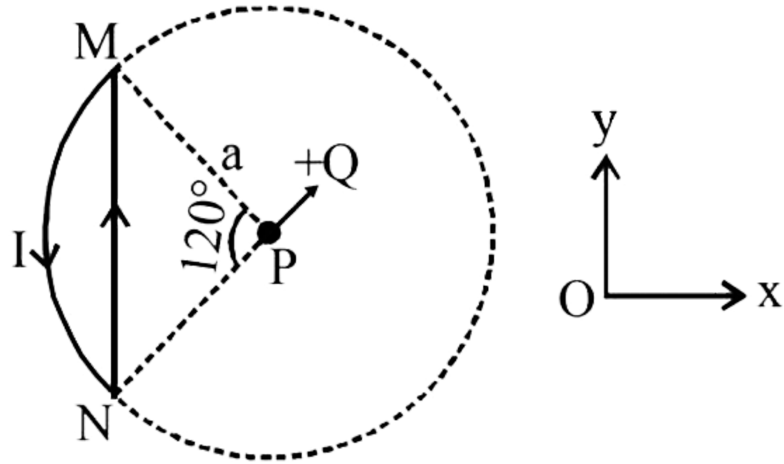
63. A wire loop carrying I is placed in the $x-y$plane as shown in fig.

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

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



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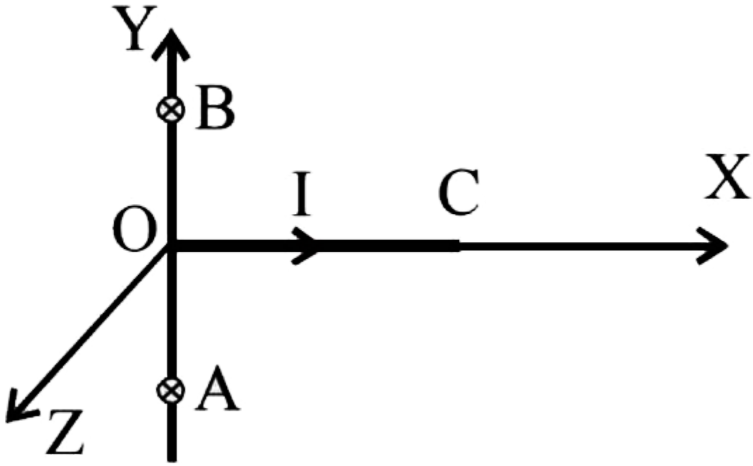
64. A straight segment OC(of length L meter) of a circuit carrying a current $Iamp$ is placed along the $x-a\xi s$ (fig.). Two infinetely long straight wires A and B , each extending from $z=-\infty \rightarrow +\infty$, are fixed at $y=-ameter$ and $y=+ameter$ respectively, as shown in the figure.

If the wires A and B each carry a current $Iamp$ 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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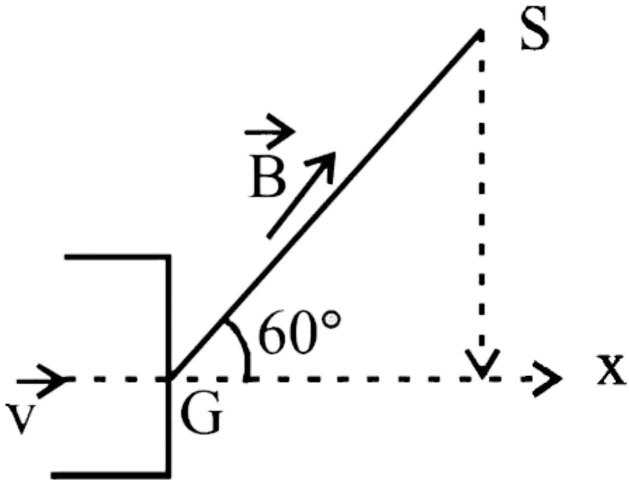
65. An electron gun G emits electrons of energy $2keV$ travelling in the positive $x - direction$. The electrons are required to hit the spot S where $GS = 0.1m$, and the line GS makes an angle of 60° with the $x - a\xi s$ as shown in the fig. A uniform magnetic field $\overrightarrow{B}$ parallel to GS exists in the region outside the electron gun. Find the GS exists in the region outside the electron gun. Find the minimum value of B needle to make the electron hit S.



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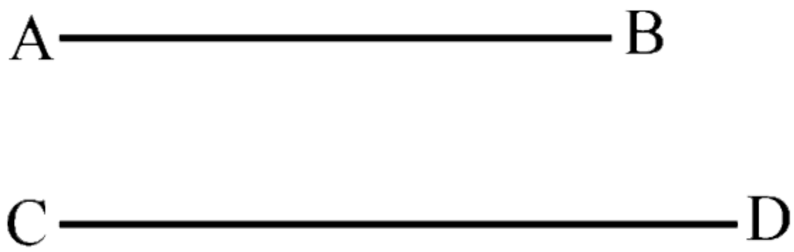
66. A long horizontal wire AB, which is free to move in a vertical plane and carries a steady current of $20A$, is in equilibrium at a height of $0.01m$ over another parallel long wire CD which is fixed in a horizontal plane and carries a steady current of $30A$, as shown in figure. Shown that when AB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



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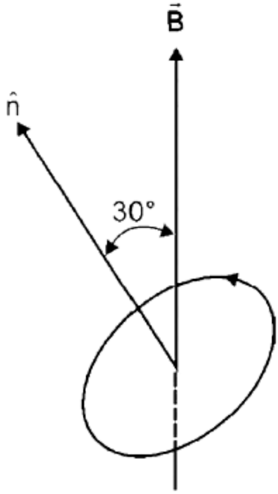
67. An electron in the ground state of hydrogen atom is revolving in anticlock-wise direction in a circular orbit of radius R.

(i) Obtain an experssion for the orbital magnetic dipole moment of the electron.

(ii) The atom is placed in a uniform magnetic induction $\vec{B}$ such that the plane - normal of the electron - orbit makes an angle of 30° with the magnetic induction . Find the torque experienced by the orbiting electron.



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68. Three infinitely long thin wires, each carrying current i in the same direction, are in the $x-y$ plane of a gravity free space . The central wire is along the $y-a\xi s$ 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 excecute simple harmonic motion . If the linear density of the wires is λ, find the frequency of oscillation.

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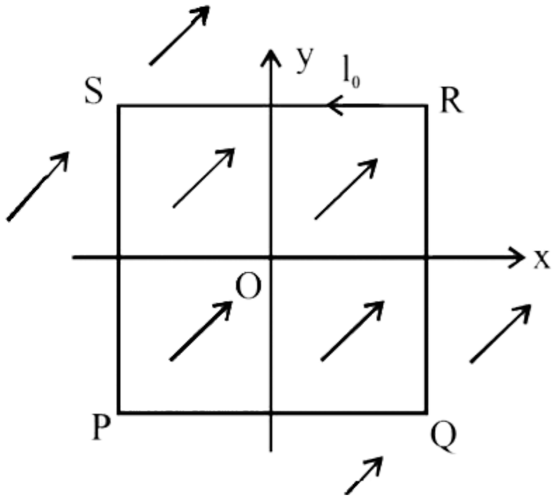
69. A uniform constant magnetic field B is directed at an angle of 45° to the $xa\xi s$ in the xy- plane . $PQRS$ is a rigid, square wire frame carrying a steady current I_0, with its centre at the origin O. At time $t = 0$, the frame is at rest in the position as shown in figure , with its sides parallel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

$$\left(\Delta tissosh \text{ or } tt\hat{an}yvariation \in the \rightarrow rquedur \in gthis \int ervalmaybe \neg \rightarrow itsaboutana\xi sthroughitscentreperpendic\underline{ar} \rightarrow itspla \neq is\right.$$

(4)/(3) ML^(2)`.



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70. The region between $x = o$ 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 $x - a\xi s$ and enters the region of the magnetic field. Neglect gravity throughout the question .

(a) Find the value of L if the particle emerges from the region of magnetic field with its final velocity at angle 30° to its initial velocity.

(b) Find the 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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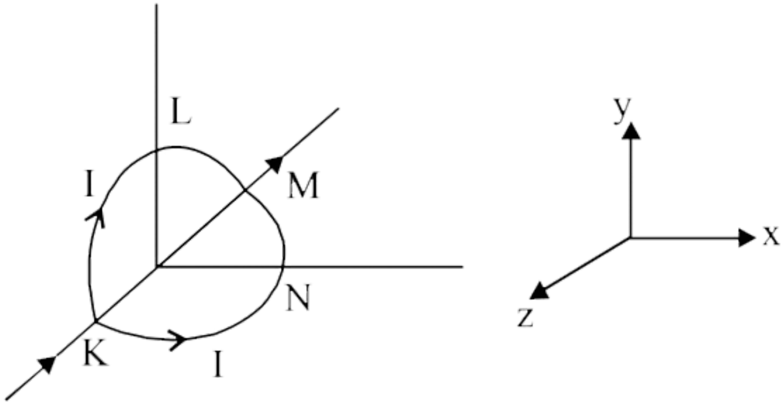
71. A circular loop of radius R is bent along a diameter and given a shapes as shown in the figure. One of the semicircles (KNM) lies in the $x-z$ plane with their centres and the other one (KLM) in the $y-z$ plane with their centres at the origin. current I is flowing through each of the semi circles as shown in figure.

(a) A particle of charge q is released at the origin with a velocity $\overrightarrow{v} = -v_0\hat{i}$. Find the instantaneous force $\overrightarrow{F}$ 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 $\overrightarrow{F}_1$ and $\overrightarrow{F}_2$ on the semicircles KLM and KNM due to the field and the net force $\overrightarrow{F}$ on the loop.



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72. A current of $10A$ flows around a closed path in a circuit which is in horizontal plane as shown in the figure . The circuit consists of eight alternating arcs of

$radiir_1 = 0.08m$ and $r_1 = 0.12m. Eacharc \subset tendsthesameathecenter.$
$\in itelylongstraightwirecarry \in gacurrentof$

10 A

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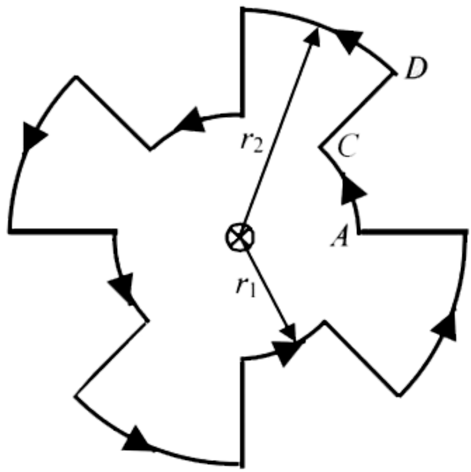
AC and $thestraightsegment$ CD` due to the current at the center?



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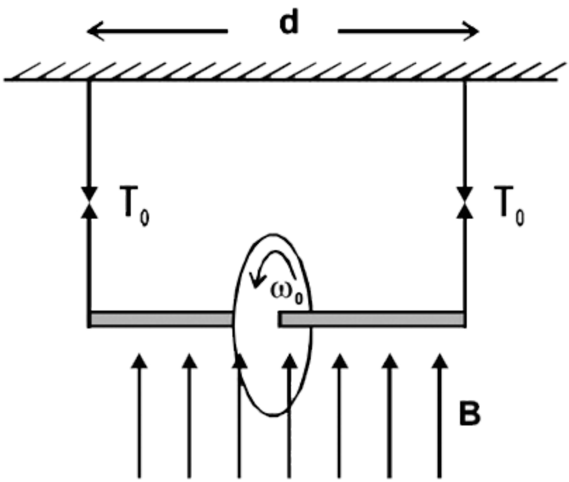
73. A wheel of radius R having charg Q, uniformly distributed on the rim of the wheel is free to rotate about a light5 horizontal rod. The rod is suspended by light inextensible strings and a magnetic field B is applied as shown in the figure. The initial tensions in the strings are $T_0. Ifthebreak \in gtensionofthestr \in gsare$(3T_(0))/(2)

, $f \in dthe$ max $i\mu mang\underline{a}rvelocity$omega_(0)` with which the wheel can be rotated.



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74. A proton and $\alpha - partic \leq$ are accelerated with same potential difference and they enter in the region of constant magnetic field B perpendicular to the velocity of particles. Find the ratio of radius of curvature of $alpa - partic \leq$.

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75. In a moving coil galvanometer, torque on the coil can be experessed as $\tau = ki$, where i is current through the wire and k is constant . The rectangular coil of the galvanometer having number of turns N , area A and moment of interia I is placed in magnetic field B. Find

(a) k in terms of given parameters N, I, A and B

(b) the torsion constant of the spring , if a current i_0 produces a deflection of $(\pi)/(2)$ in the coil .

(c) the maximum angle through which the coil is deflected, if charge Q is passed through the coil almost instaneously. (ignore the daming in mechinal oscillations).

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76. Advanced countries are making use of powerful electromagnets to move trains at very high speed. These trains are called maglev trains (abbreviated from magnetic levitation).These trains float on a guideway and do not run on steel rail tracks.

Instead of using a engine based on fossil fuels, they make use of magnetic field forces. The magnetized coils are arranged in the guide way which repels the strong magnets placed in the train's under carriage. This helps train move over the guideway, a technic called electro - dynamic suspension. When current passes in the coils of guideway , a typical magnetic field is set up between the undercarriage of train and guideway which pushes and pull the train along the guideway depending on the requirement.

The lack of friction and its aerodynamic style allows the train to more at very high speed.

(i) The levitation of the train is due to

A. Mechanical force

B. Electrostatic attraction

C. Electrostatic repulsion

D. Magnetic repulsion

Answer:

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(2) The disadvantage of maglev trains is that

A. More friction

B. Less pollution

C. Less wear & tear

D. High initial cost

Answer:

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78. Advanced countries are making use of powerful electromagnets to move trains at very high speed. These trains are called maglev trains (abbreviated from magnetic levitation).These trains float on a guideway and do not run on steel rail tracks.

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The lack of friction and its aerodynamic style allows the train to more at very high speed.

(3) The force which makes maglev move

A. Gravitational field

B. Magnetic field

C. Nuclear forces

D. Air drag

Answer: D

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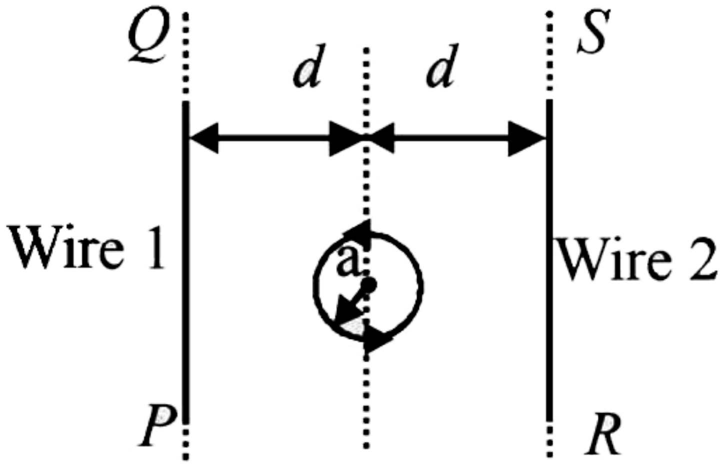
79. The figure shows a circular loop of radius a with two long parallel wires $(\nu mbered 1 \text{ and } 2)$ all in the plane of the paper . The distance of each wire from the centre of the loop is d. The loop and the wire are carrying the same current I. The current in the loop is in the counterclockwise direction if seen from above.

(q) The magnetic fields(B) at P due to the currents in the wires are in opposite directions.

(r) There is no magnetic field at P.

(s) The wires repel each other.



(4) When $d \approx a$ but wires are not touching the loop , it is found that the net magnetic field on the axis of the loop . In that case

A. (a) current in wire 1 and $wire2$ in the direction PQ and RS, respectively and $h \approx a$

B. (b) current in wire 1 and $wire2$ in the direction PQ and SR, respectively and $h \approx a$

C. current in wire 1 and $wire2$ in the direction PQ and SR, respectively and $h \approx 1.2a$

D. current in wire 1 and $wire2$ in the direction PQ and RS, respectively and $h \approx 1.2a$

Answer: D

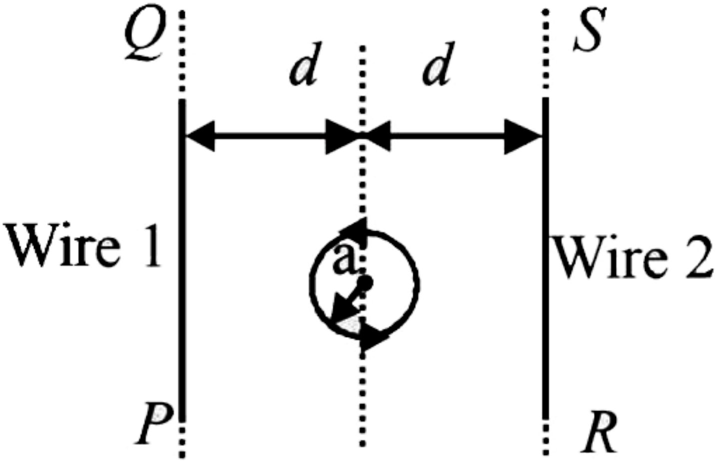
Watch Video Solution

80. The figure shows a circular loop of radius a with two long parallel wires $(\nu mbered1 \text{ and } 2)$ all in the plane of the paper . The distance of each wire from the centre of the loop is d. The loop and the wire are carrying the same current I. The current in the loop is in the counterclockwise direction if seen from above.

(q) The magnetic fields(B) at P due to the currents in the wires are in opposite directions.

(r) There is no magnetic field at P.

(s) The wires repel each other.



(4) When $d \approx a$ but wires are not touching the loop , it is found that the net magnetic field on the axis of the loop . In that case

A. $\frac{\mu_0 I^2 a^2}{d}$

B. $\frac{\mu_0 I^2 a^2}{2d}$

C. $\sqrt{3}\frac{\mu_0 I^2 a^2}{d}$

D. $\sqrt{3}\frac{\mu_0 I^2 a^2}{2d}$

Answer: B

Watch Video Solution

81. In a thin rectangular metallic strip a constant current I flows along

the positive

$x - direction, asshown \in the figure. The \le n > h, width$ and $thick \ne$

l, w and d, $respectively. A un$ if or $mmag \ne ticfield$vec(B)

$isappliedonthestripalongthepositive$y- direction

$. Due \rightarrow this, thechar \ge carriers \exp eriencea \ne tdef \le ctionalongthe$

z- direction. $Thisrests \in au\mu lationofchar \ge carriersonthesurface$

PQRS

$ansdapperanceofequal$ and $oppositechar \ge sonthefaceopposite \rightarrow$

PQRS. $Apotentiald \Leftrightarrow erencealongthe$z-direction

$isthusdeveloped. Char \ge au\mu lationcontiuesuntillthemag \ne ticf$ or cei

if or $mlydistributedonthecross - \sec tionofthestrip$ and $carriedbye$

(1 and 2)$ofthesamematerial. Their \le n > hsarethesame, widthsare$

w_(1) and w_(2) and $thick \ne ssare$d_(1) and d_(2)$respectively. Twop\oint s$

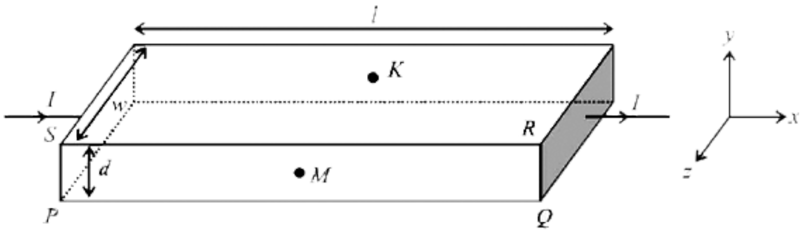
K and M$aresymmetricallylocatedontheoppositefacesparal \le l \rightarrow the$

x-y$pla \ne (seefigure)$. V_(1) and V_(2)

$arethepotentiald \Leftrightarrow erencesbetween$K and M $\in strips$ 1 and 2

$, respectively. Then, f$ or $agivencurrent$I

$flow \in gthroughthem \in agivenmag \ne ticfieldstren > h$B`, the correct statement(s) is (are)



A. If $w_1 = w_2$ and $d_1 = 2d_2$, $then V_2 = 2V_1$

B. If $w_1 = w_2$ and $d_1 = 2d_2$, $then V_2 = V_1$

C. If $w_1 = 2w_2$ and $d_1 = d_2$, $then V_2 = 2V_1$

D. If $w_1 = 2w_2$ and $d_1 = 2d_2$, $then V_2 = V_1$

Answer: C

Watch Video Solution

82. In a thin rectangular metallic strip a constant current I flows along the positive

$x - direction, asshown \in thefigure. The \leq n > h, width$ and $thick \neq$.

l, w and d, $respectively. Aun$ if or $mmag \neq ticfield$vec(B)

$isappliedonthestripalongthepositive$y- direction

$. Due \rightarrow this, thechar \geq carriers \exp eriencea \neq tdef \leq ctionalongthe$

z- direction. $Thisrest\underline{s} \in au\mu lationofchar \geq carriersonthesurface$

PQRS

$ansdapperanceofequal$ and $oppositechar \geq sonthefaceopposite \rightarrow$

PQRS. $Apotentiald \Leftrightarrow erencealongthe$z-direction

$isthusdeveloped. Char \geq au\mu lationcontiuesuntillthemag \neq ticf$ or $ceis$

if or $mlydistributedonthecross - \sec tionofthestrip$ and $carriedbye$

(1 and 2)$ofsame$ $\dim$ $ensions$n_(1) and n_(2)

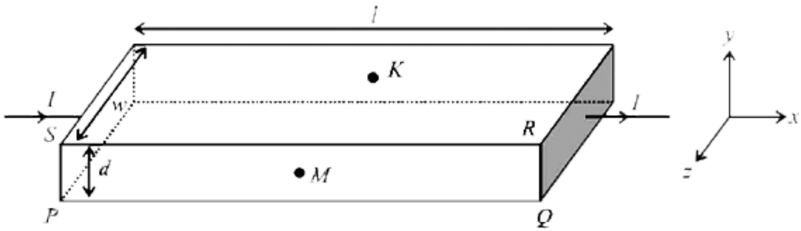
$, repectrively. Strip1isplaced \in mag \neq ticfield$B_(1)

and $strip2isplaced \in mag \neq ticfield$B_(2), $\perp halongpositive$ y-

directions. $Then$ V_(1) and V_(2)

$arethepotentiald \Leftrightarrow erencesdevelopedbetween$K and M

$\in strips1$ and $2, respectively. As \sum \in gtt\hat{h}ecurrent$I` is the same for both the strips, the correct option(s) is (are)



A. If $B_1 = B_2$ and $n_1 = 2n_2, then V_2 = 2V_1$

B. If $B_1 = B_2$ and $n_1 = 2n_2, then V_2 = V_1$

C. If $B_1 = 2B_2$ and $n_1 = 2n_2, then V_2 = 0.5V_1$

D. If $B_1 = 2B_2$ and $n_1 = 2n_2, then V_2 = V_1$

Answer: B

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83. Statement -1 : The sensitvity of a moving coil galvanometer is increased by placing a suitable magnetic material as a core inside the coil.

Statement - 2: Soft iron has a high magnetic permeability and cannot be easily magnetized or demagnetized.

A. Statement -1 is True, statement -2 is True , statement -2 is a correct explanation for statement -1.

B. Statement -1 is True, statement -2 is True , statement -2 is not a correct explanation for statement -1.

C. Statement -1 is True, statement -2 is False

D. Statement -1 is False, statement -2 is True

Answer: C

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84. A steady current I goes through a wire loop PQR having shape of a right angle triangle with $PQ = 3x, PR = 4x$ and $QR = 5x$. If the magnitude of the magnetic field at P due to this loop is $k\left(\frac{\mu_0 I}{48\pi x}\right)$, find the value of K.

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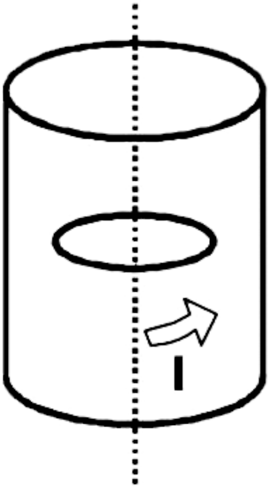
85. A long circular tube of length $10m$ and radius $0.3m$ carries a current I along its curved surface as shown . A wire - loop of resistance $0.005ohm$ and of radius $0.1m$ is placed inside the tube its axis coinciding with the axis of the tube . The current varies as $I = I_0 \cos(300t)$ where I_0 is constant. If the magnetic moment of the loop is $N\mu_0 I_0 \sin(300t)$, then 'N' is



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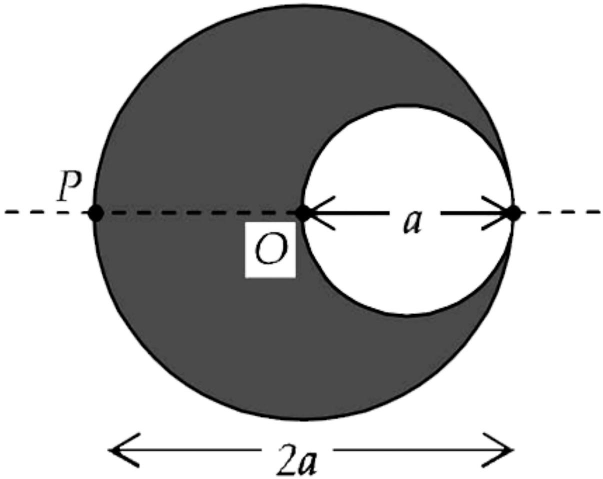
86. A cylindrical cavity of diameter a exists inside a cylinder of diameter $2a$ as shown in the figure. Both the cylinder and the cavity are infinitity long. A uniform current density j flows along the length . If the magnitude of the magnetic field at the point P is given by $\frac{N}{12}\mu_0 aJ$, then the value of

N is



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87. Two parallel wires in the plane of the paper are distance X_0 apart. A point charge is moving with speed u between the wires in the same plane at a distance X_1 from one of the wires. When the wires carry current of magnitude I in the same direction , the radius of curvature of the path of the point charge is R_1. In contrast, if the currents I in the two wires have directions opposite to each other, the radius of curvature of the path is R_2. if $\frac{X_0}{X_1} = 3$, the value of $\frac{R_1}{R_2}$ is

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88. If in circular coil of radius R, current I is flowing and in another coil B of radius $2R$ a current $2I$ is flowing , then the raatio of the magnetic fields B_A and B_B, produced by them will be

A. 1

B. 2

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

D. $4)$

Answer: A

Watch Video Solution

89. If an electron and a proton having same momenta enter perpendicular to a magnetic field, then

A. curved path of electron and proton will be same (ignoring the sense of revolution)

B. they will move undeflected

C. curved path of electron is more curved than that of the proton

D. path of proton is more curved.

Answer: A

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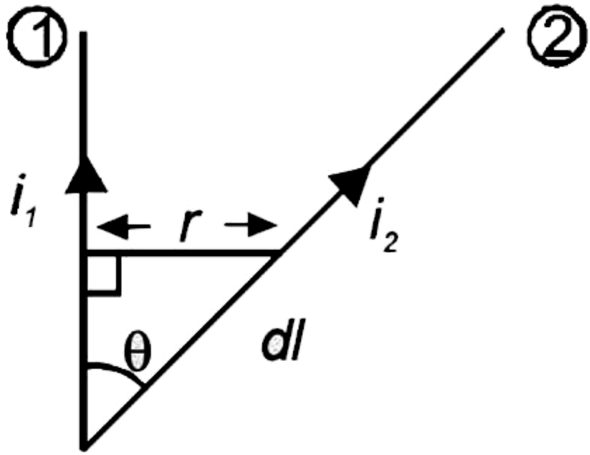
90. Wires 1 and 2 carrying currents i_1 and i_2 respectively are inclined at an angle θ to each other. What is the force on a small element dl of wire 2 at a distance of r from wire 1 (as shown in figure) due to the magnetic field of wire 1`?



A. $\frac{\mu_0}{2\pi r} i_1 i_2 dl \tan\theta$

B. $\frac{\mu_0}{2\pi r} i_1 i_2 dl \sin\theta$

C. $\frac{\mu_0}{2\pi r} i_1 i_2 dl \cos\theta$

D. $\frac{\mu_0}{4\pi r} i_1 i_2 dl \sin\theta$

Answer: C

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91. The time period of a charged particle undergoing a circular motion in a uniform magnetic field is independent of its

A. speed

B. mass

C. charge

D. magnetic induction

Answer: A

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92. A particle of mass M and charge Q moving with velocity $\vec{v}$ describe a circular path of radius R when subjected to a uniform transverse magnetic field of induction B. The work done by the field when the particle completes one full circle is

A. ((Mv^(2)/(R)) 2 pi R `

B. $zero$

C. $BQ2\pi R$

D. $BQv2\pi R$

Answer: B

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93. A particle of charge $-16 \times 10^{-18} co\underline{o}mb$ moving with velocity $10ms^{-1}$ along the $x - a\xi s$, and an electric field of magnitude $(10^4) / (m)$ is along the negative $z - ais$. If the charged particle continues moving along the $x - a\xi s$, the magnitude of B is

A. $(10^3 Wb) / (m^2)$

B. $(10^5 Wb) / (m^2)$

C. $(10^{16} Wb) / (m^2)$

D. $(10^{-3} Wb) / (m^2)$

Answer: A

Watch Video Solution

94. A thin rectangular magnet suspended freely has a period of oscillation equal to T . Now it is broken into two equal halves (each having half of the original length) and $o \neq \pi eceismade \rightarrow oscillateely \in thesamefield. Ifitsperiodofm$

(T')/(T)` is

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

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

C. 2

D. $\frac{1}{4}$

Answer: B

Watch Video Solution

95. A magnetic needle lying parallel to a magnetic field requires $W units$ of work to turn it through 60°. The torque needed to maintain the needle in this position will be

A. $\sqrt{3}W$

B. W

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

D. $2W$

Answer: A

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96. the magnetic lines of force inside a bar magnet

A. are from north - pole to south - pole of the magnet

B. do not exist

C. depend upon the area of cross - section of the bar magnet

D. are from south - pole to north- pole of the magnet

Answer: D

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97. Curie temperature is the temperature above which

A. a ferromagnetic material becomes paramagnetic

B. a paramagnetic material becomes diamagnetic

C. a ferromagnetic material becomes diamagnetic

D. a paramagnetic material becomes ferromagnetic

Answer: A

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

A. $\frac{\mu_0}{4\pi}.\frac{2i}{r}$ tesla

B. $zero$

C. infinite

D. $\frac{2i}{r}$ tesla

Answer: B

Watch Video Solution

99. A long wire carries a steady curent . It is bent into a circle of one turn and the magnetic field at the centre of the coil is B. It is then bent into a circular loop of n turns. The magnetic field at the centre of the coil will be

A. $2nB$

B. n^2B

C. nB

D. $2n^2B$

Answer: B

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

A. $125\mu T$

B. $150\mu T$

C. $250\mu T$

D. $75\mu T$

Answer: C

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101. Two long conductors, separated by a distance d carry current I_1 and I_2 in the same direction . They exert a force F on each other. Now the current in one of them is increased to two times and its direction is reversed . The distance is also increased to $3d$. The new value of the force between them is

A. `-(2 F)/(3)

B. $\frac{F}{3}$

C. $-2F$

D. $-\frac{F}{3}$

Answer: A

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102. The length of a magnet is large compared to its width and breadth. The time period of its oscillation in a vibration magnetometer is $2s$. The magnet is cut along its length into three equal parts and these parts are then placed on each other with their like poles together . The time period of this combination will be

A. $2\sqrt{3}s$

B. $\frac{2}{3}s$

C. $2s$

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

Answer: B

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103. The material suitable for making electromagnets should have

A. high retentivity and low coercivity

B. low retentivity and low coercivity

C. high retentivity and high coercivity

D. low retentivity and high coercivity

Answer: B

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104. Two concentric coils each of radius equal to $2\pi cm$ are placed at right angles to each other $3ampere$ and $4ampere$ are the currents flowing in each coil respectively. The magnetic induction in $weber/m^2$ at the centre of the coils will be

$(\mu_0 = 4\pi \times 10^{-7} Wb/A.m)$

A. 10^{-5}

B. 12×10^{-5}

C. 7×10^{-5}

D. 5×10^{-5}

Answer: D

Watch Video Solution

105. A charged particle of mass m and charge q travels on a circular path of radius r that is perpendicular to a magnetic field B. The time takeen by the particle to complete one revolution is

A. $\frac{2\pi q^2 B}{m}$

B. $\frac{2\pi m q}{B}$

C. $\frac{2\pi m}{q^B}$

D. $\frac{2\pi q B}{m}$

Answer: C

Watch Video Solution

106. A magnetic needle is kept in a non uniform magnetic field . It experiences

A. neither a force nor a torque

B. a torque but not a force

C. a force but not a torque

D. a force a torque

Answer: D

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107. A uniform electric field and a uniform magnetic field are acting along the same direction in a certain region. If an electron is projected along the direction of the fields with a certain velocity then

A. its velocity will increase

B. its velocity will decrease

C. it will turn towards left of direction of motion

D. it will turn towards right of direction of motion

Answer: B

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108. Needles $N_1, N_2, \text{ and } N_3$ are made of a ferromagnetic, a paramagnetic and a diamagnetic substance respectively . A magnet when brought close to them will

A. attract $N_1 \text{ and } N_2$ strongly but repel N_3

B. attract $N_1 strongly, N_2$ weakly and repel N_3 weakly

C. attract $N_1 strongly, butrepel N_2 N_3$ weakly

D. attract all three of them

Answer: B

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109. In a region, steady and uniform electric and magnetic fields are present . These two fields are parallel to each other. A charged particle is released from rest in this region . The path of the particle will be a

A. helix

B. straight line

C. ellipse

D. circle

Answer: B

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110. A long solenoid has $200 turns per cm$ and carries a current i. The magnetic field at its centre is $6.28 \times 10^{-2} weber / cm^2$. Another long soloenoid has $100 turns per cm$ and it carries a current $\frac{i}{3}$. The value of the magnetic field at its centre is

A. $1.05 \times 10^{-2} Weber / m^2$

B. $1.05 \times 10^{-5} Weber / m^2$

C. $1.05 \times 10^{-3} Weber / m^2$

D. $1.05 \times 10^{-4} Weber / m^2$

Answer: A

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111. A long straight wire of radius a carries a steady current i. The current is uniformly distributed across its cross section. The ratio of the magnetis field at $(a)/(2)$ and $(2a)$ is

A. $(1/2)$

B. $(1/4)$

C. 4

D. 1

Answer: D

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112. 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 is zero only on the axis of the pipe

C. the magnetic field is different at different points inside the pipe

D. the magnetic field at any point inside the pipe is zero

Answer: D

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113. A charged particle with charge q enters a region of constant, uniform and mututally orthogonal fields $\vec{E}$ and $\vec{B}$ with a velocity $\vec{v}$ perpendicular to both $\vec{E}$ and $\vec{B}$, and comes out without any change in magnitude or direction of $\vec{v}$. Then

A. $\vec{v} = \vec{B} \times \vec{E} / \left(\vec{E}^2\right)$

B. $\vec{v} = \vec{E} \times \vec{B} / \left(\vec{B}^2\right)$

C. $\vec{v} = \vec{B} \times \vec{E} / \left(\vec{B}^2\right)$

D. $\vec{v} = \vec{E} \times \vec{B} / \left(\vec{E}^2\right)$

Answer: B

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114. A charged particle moves through a magnetic field perpendicular to its direction. Then

A. Kinetic energy changes but the momentum is constant

B. the momentum changes but the kinetic energy is constant

C. both momentum and kinetic energy of the particle are not constant

D. both momentum and kinetic energy of the particle are constant

Answer: B

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115. Two identical conducting wires AOB and COD are placed at right angles to each other. The wire AOB carries an electric current I_1 and COD carries a current I_2. The magnetic field on a point lying at a distance d from O, $\in adirectionperpendic\underline{a}r \rightarrow thepla \neq ofthewires$ AOB and COD`, will be given by

A. $\frac{\mu_0}{2\pi d}\left(I_1^2 + I_2^2\right)$

B. $\frac{\mu_0}{2\pi}\frac{I_1^2 + I_2^2}{d}\Bigg)1/2$

C. $\frac{\mu_0}{2\pi d}\left(I_1^2 + I_2^2\right)1/2$

D. $\frac{\mu_0}{2\pi d}(I_1 + I_2)$

Answer: C

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116. A horizontal overheadpowerline is at height of $4m$ from the ground and carries a current of $100A$ from east to west. The magnetic field directly below it on the ground is

$(\nu_0 = 4\pi \times 10^{-7} TmA^{-1}$

A. $2.5 \times 10^{-7} T$ southward

B. $5 \times 10^{-6} T$ northward

C. $5 \times 10^{-6} T$ southward

D. $2.5 \times 10^{-7} T$ northward

Answer: C

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117. Relative permitivity and permeability of a material ε_r and μ_r, respectively . Which of the following values of these quantities are allowed for a diamagnetic material?

A. $\varepsilon_r = 0.5$, $\mu_r = 1.5$

B. $\varepsilon_r = 1.5$, $\mu_r = 0.5$

C. $\varepsilon_r = 0.5$, $\mu_r = 0.5$

D. $\varepsilon_r = 1.5$, $\mu_r = 1.5$

Answer: B

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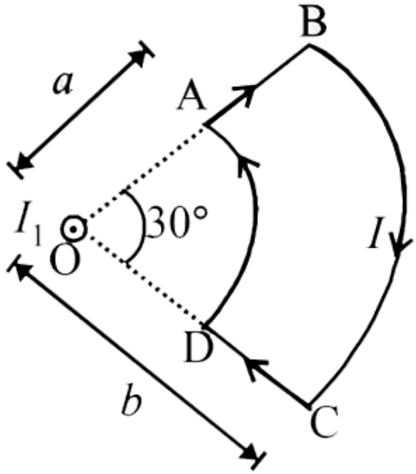
118. A current loop $ABCD$ is held fixed on the plane of the paper as shown in figure. The arcs $BC(radius = b)$ and $DA(radius = a)$ of the loop are joined by two straight wires AB and CD at the origin O is 30^(@). $A \neg herstraightth \in wirewithsteadycurrent$I_(1)` flowing out of the plane of the paper is kept at the origin .



The magnitude of the magnetic field (B) due to the loop $ABCD$ at the origin (o) is :

A. $\frac{\mu_0 I(b-a)}{24ab}$

B. $\frac{\mu_0 I}{4\pi}\left[\frac{b-a}{ab}\right]$

C. $\frac{\mu_0 I}{4\pi}[2(b-a)+\pi/3(a+b)]$

D. zero

Answer: A

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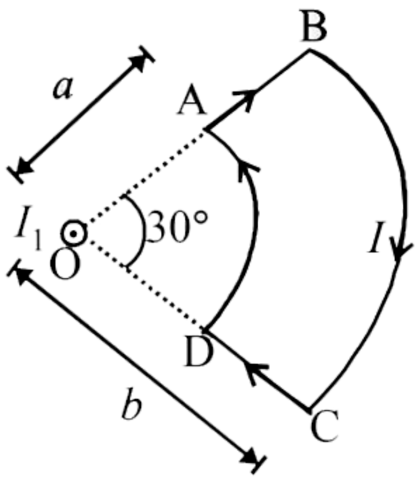
119. A current loop $ABCD$ is held fixed on the plane of the paper as shown in figure. The arcs $BC(radius = b)$ and $DA(radius = a)$ of the loop are joined by two straight wires AB and CD at the origin O is 30^(@). $A \neg herstraightth \in wirewithsteadycurrent$I_(1)` flowing out of the plane of the paper is kept at the origin .



Due to the process of the current I_1 at the origin:

A. The forcwes on AD and BC are zero.

B. The magnitude of the net force on the loop is given by

$$\frac{I_1 I}{4\pi}\mu_0[2(b-a)+\pi/3(a+b)]$$

C. The magnitude of the net force on the loop is given by

$$\frac{\mu_0 I I}{24ab}(b-a)$$

D. The forces on AB and DC are Zero.

Answer: A

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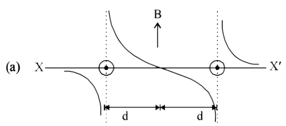
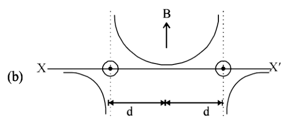
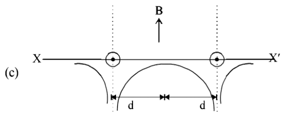
120. Two long parallel wires are at a distance $2d$ apart. They carry steady equal currents flowing out of the plane of the paper , as shown. The variation of the magnetic field B along the line XX is given by



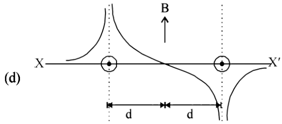
A.



B.



C.



D.

Answer: A

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121. A current I flows an infinitely long wire with cross section in the form of a semi - circular ring of radius R. The magnitude of the magnetic induction along its axis is :

A. $\frac{\mu_0 I}{2\pi^2 R}$

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

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

D. $\frac{\mu_0 I}{\pi^2 R}$

Answer: D

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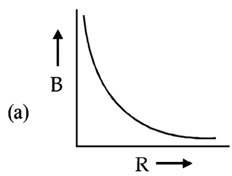
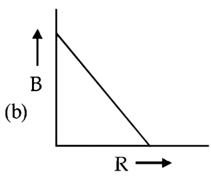
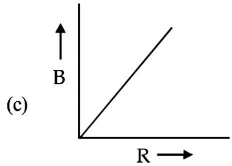
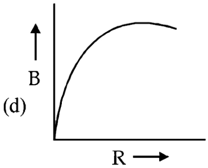
122. A charge Q is uniformly distributed over the surface of non - conducting disc of radius R. The disc rotates about an axis perpendicular to its plane and passing through its centre with an angular to its plane and passing through its centre of the disc. If we keep both the amount of charge placed on the disc and its angular velocity to be constant and vary the radius of the disc then the variation of the magnetic induction at the centre of the disc will br represented by the figure:

A. 

B. 

C. 

D. 

Answer: A

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123. Proton , deuton and alpha particle of same kinetic energy are moving in circular trajectories in a constant magnetic field. The radii of proton , deuteron and alpha particle are respectively r_p, r_d and r_α. Which one of the following relation is correct?

A. $r_\alpha = r_p = r_d$

B. $r_\alpha = r_p < r_d$

C. $r_\alpha > r_d > r_p$

D. $r_{\alpha} = r_d > r_p$

Answer: B

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124. Two short bar magnets of length $1cm$ each have magnetic moments $1.20Am^2$ and $1.00Am^2$ respectively. They are placed on a horizontal table parallel to each other with their N poles pointing towards the south. They have a common magnetic equator and are separted by a distance of $20.0cm$. The value of the resultant horizontal magnetic induction at the mid - point O of the line joining their centres is close to (Horizontal component of earths magnetic induction is $3.6 \times 10.5Wh/m^2$

A. $3.6 \times 10.5Wh/m^2$

B. $2.56 \times 10.4Wh/m^2$

C. $3.50 \times 10.4Wh/m^2$

D. $5.80 \times 10.4Wh/m^2$

Answer: B

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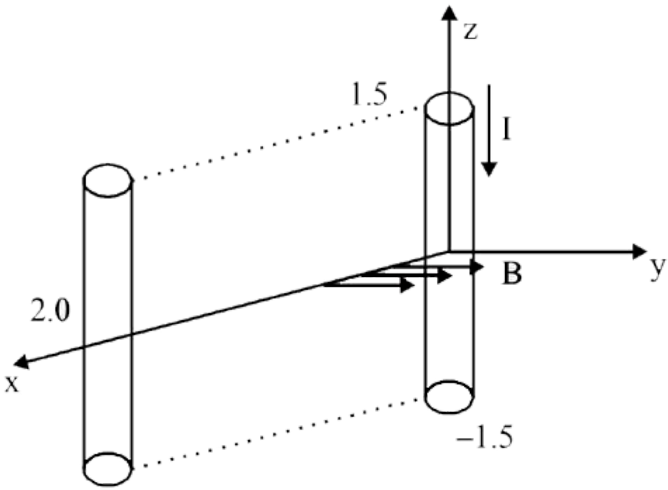
125. A conductor lies along the $z-a\xi s$ at $-1.5 \leq z < 1.5m$ and carries a fixed current of $10.0A$ in $-\hat{a}_z$ direction (see figure). For a field $\vec{B} = 3.0 \times 10^{-4} e^{-0.2x} \hat{a}_y T$, find the power required to move the conductor at constant speed to $x = 2.0m, y = 0m$ in $5 \times 10^{-3} s$. Assume parallel motion along the $x-a\xi s$.



A. $1.57W$

B. $2.97W$

C. $14.85W$

D. $29.7W$

Answer: B

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126. The coercitivity of a small magnet where the ferromagnet gets demagnetized is $3 \times 10^3 Am^{-1}$. The current required to be passed in a solenoid of length $10cm$ and number of turns 100, so that the magnet gets demagnetized when inside the solenoid , is :

A. $30mA$

B. $60mA$

C. $3A$

D. $6A$

Answer: C

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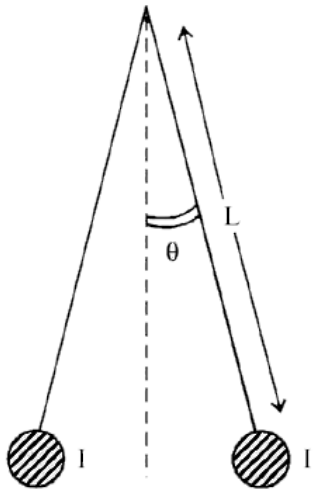
127. Two long current carrying thin wires , both with current I, are held by insulating threads of length L and are in equilibrium as shown in the gigure , With threads making an angle θ with the vertical . If wires have mass λ per unit length then the value of I is :



A. $2\dfrac{\sqrt{\pi gL}}{\mu_0}\tan\theta$

B. $\dfrac{\sqrt{\pi\lambda gL}}{\mu_0}\tan\theta$

C. $\sin\theta\dfrac{\sqrt{\pi\lambda gL}}{\mu_0\cos\theta}$

D. $2\sin\theta\dfrac{\sqrt{\pi\lambda gL}}{\mu_0\cos\theta}$

Answer: D

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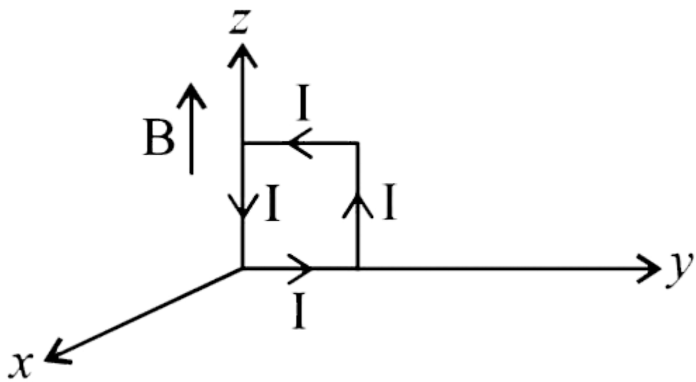
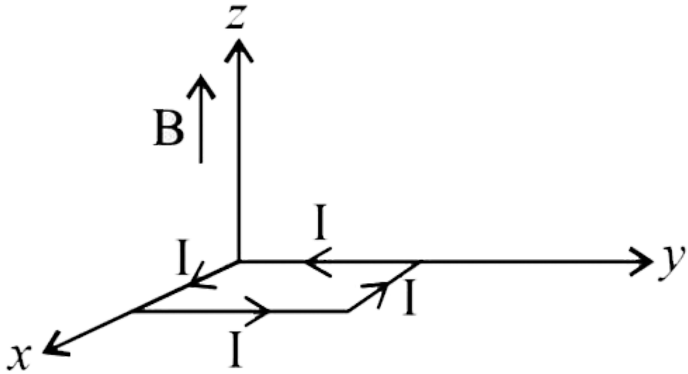
128. A rectangular loop of sides $10cm$ and $5cm$ carrying a current $1of12A$ is placed in different orientations as shown in the figure below:

If there is auniform magnetic field of $0.3t$ in the positive z direction , in which orientations the loop would be in (i) stable equilibrium and (ii) unstable equilibrium ?

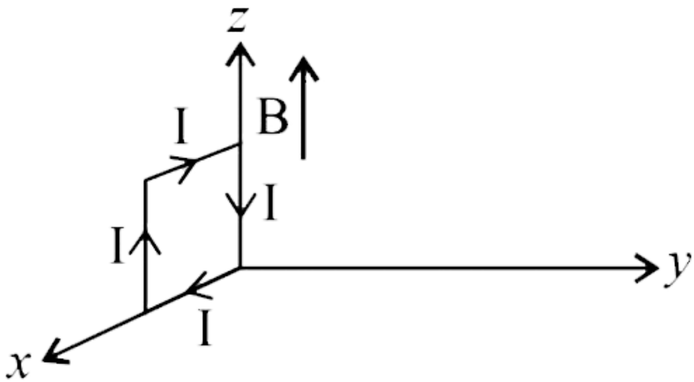
(A)



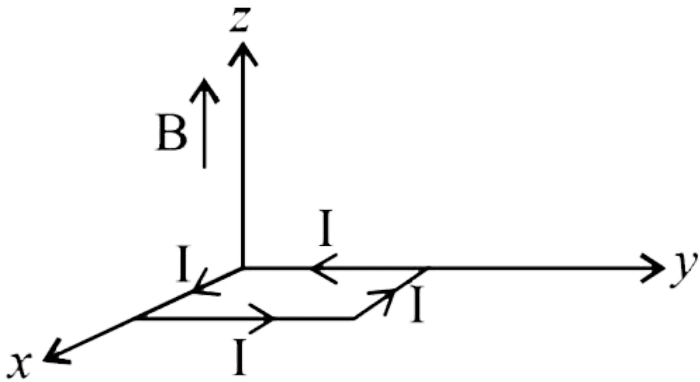
(B)



(C)



(D)



A. (B) and (D), respectively

B. (B) and (C), respectively

C. (A) and (B), respectively

D. (A) and (C), respectively

Answer: A

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129. Two identical wires A and B, each of length 'l', carry the same current I. Wire A is bent into a circle of radius R and $wire B$ is bent to form a square of side 'a' . If B_A and B_B are the values of magnetic field at the centres of the circle and square respectively , then the ratio $\frac{B_A}{B_B}$ is :

A. $\frac{\pi^2}{16}$

B. $\frac{\pi^2}{8\sqrt{2}}$

C. (pi^(2))/(8)`

D. $\frac{\pi^2}{16\sqrt{2}}$

Answer: B

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130. A galvanometer having a coil resistance of 100ω gives a full scale deflection , when a current of $1mA$ is passed through it. The value of the resistance, which can convert this galvanometer into ammeter giving a full scale deflection for a current of $10A$, is :

A. 0.1ω

B. 3ω

C. 0.01ω

D. 2ω

Answer: C

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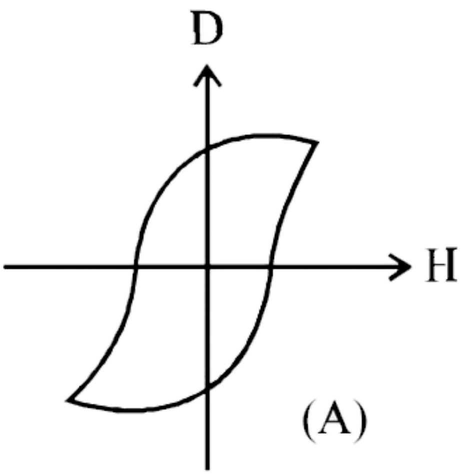
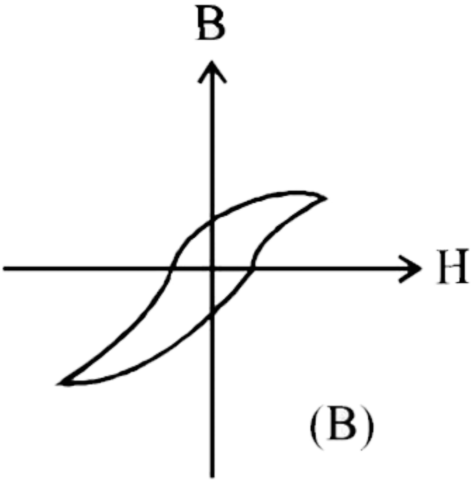
131. Hysteresis loops for two magnetic materials A and B are given below :





(B)

These materials are used to make magnets for electric generators , transformer core and electromagnet core. Then it is proper to use :

A. A for transformers and B for electric generators.

B. B for electromagnets and transformers.

C. A for electric generators and transformers

D. A for electromagnets and B for electric generators.

Answer: B

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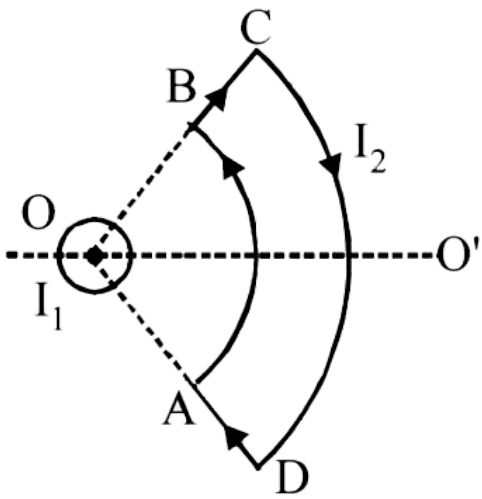
Mcqs D

1. A long current carrying wire , carrying current I_1 such that I_1 is flowing out from the plane of paper is placed at O. A steady state current I_2 is flowing in the loop $ABCD$



A. the net force is zero

B. the net torque is zero

C. as seen from O , the loop will rotate in clockwise along OO' axis

D. as seen from O, the loop will rotate in anticlockwise direction along OO' axis

Answer: A::C

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