PHYSICS

BOOKS - RESNICK AND HALLIDAY PHYSICS (HINGLISH)

MAGNETIC FIELDS DUE TO CURRENTS

Sample Problem

1. The magnetic field on the axis of a long solenoid having n turns per unit length and carrying a current is

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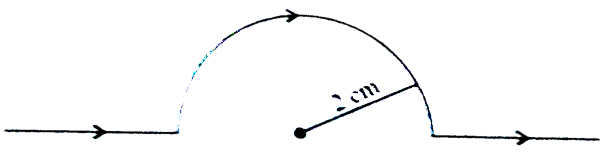
2. A straight wire carrying a current of 13 A is bent into a semi-circular arc of radius 2 cm as shown in figure. The magnetic field is $1.5 \times 10^{-4} T$ at the centre of arc, then the magnetic field due to straight segment is



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3. Two long parallel conductors carry currents $i_1 = 3A$ and $i_2 = 3A$ both are directed into the plane of paper. The magnitude of resultant magnetic field at point $'P'$, is

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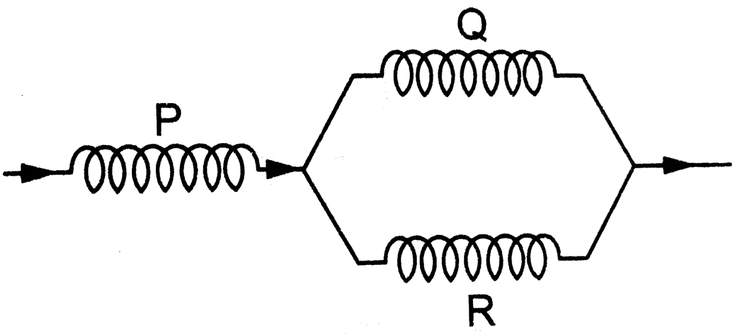
4. A long , straight wire carries a current i. A particle having a positive charge q and mass m, kept at a distance x_0 from the wire is projected towards it with a speed v. Find the minimum separation between the wire and the particle.



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5. A proton moving with a velocity of $2.5 \times 10^7 \frac{m}{s}$, enter a magnetic feildof 2T, making an angle of 30° with the magnetic field. The force acting on the proton

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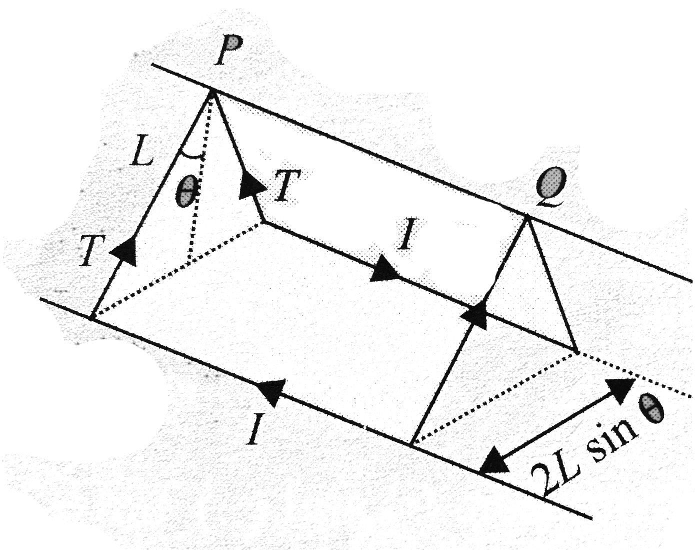
6. Two long parallel wires carry currents of equal magnitude but in opposite directions. These wires are suspended from rod PQ by four chords of same length L as shown in Fig The mass per unit length of the wires is λ. Determine the value of θ assuming it to be small.



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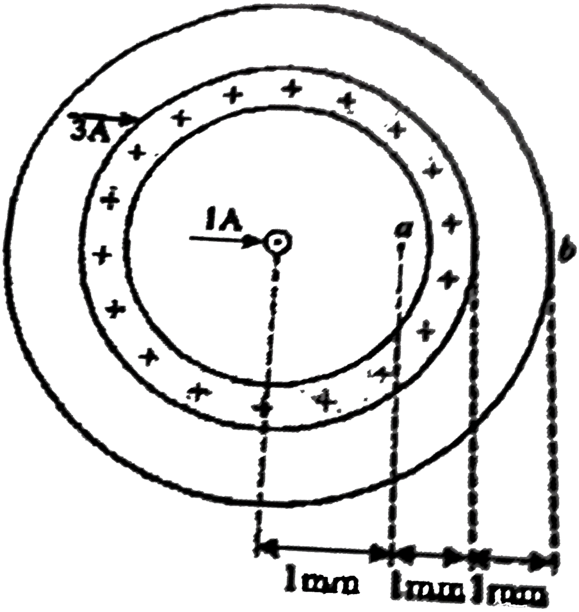
7. Figure given in the question is a cross-sectional view of a coaxial cable. The centre conductor is surrounded by a rubber layer, which is surrounded by an outer conductor, which is surrounded by another rubber layer. The current in the inner conductor is $1.0A$ out of the page, and the current in the outer conductor is 3.0A into the page. Determine the magnitude and direction of the magnetic field at points a and b.



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8. A long solenoid has 800 turns per meter length of solenoid. What is the magnatic

induction at the end of the solenoid if it carries a current of 2.5 A?

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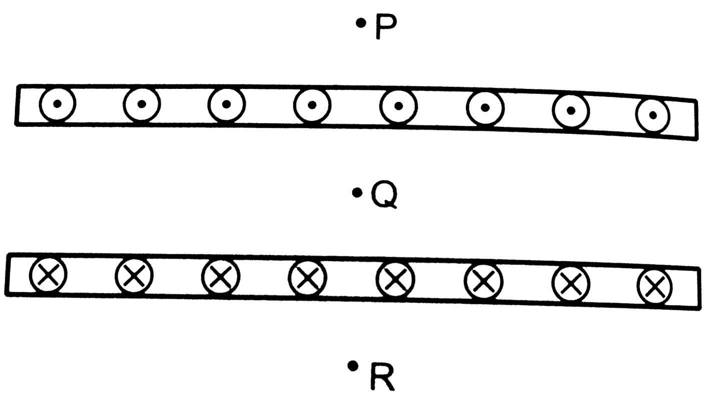
9. Two large metal sheets carry surface currents as shown in figure . The current through a strip of width dl is Kdl where K is a constant . Find the magnetic field at the points P,Q and R. `



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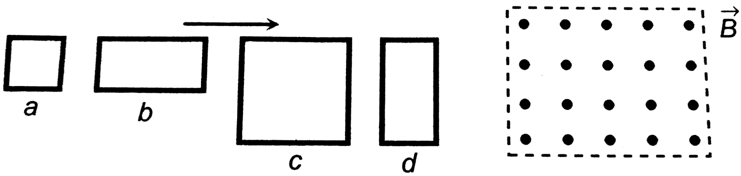
Check Point

1. The figure shows four wire loops, with edge length of either L or $2L$. All four loops will move through a region of uniform magnetic field $\vec{B}$ (directed out of the page) at the same constant velocity . Rank the four loops according to the maximum magnitude of the e.m.f. induced as they move through the field, greatest first



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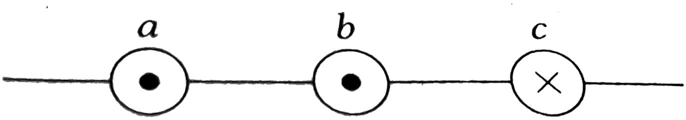
2. Figure shows, three long straight wires parallel and equally spread with identical currents. Then, the force acting on each wire due to the other is



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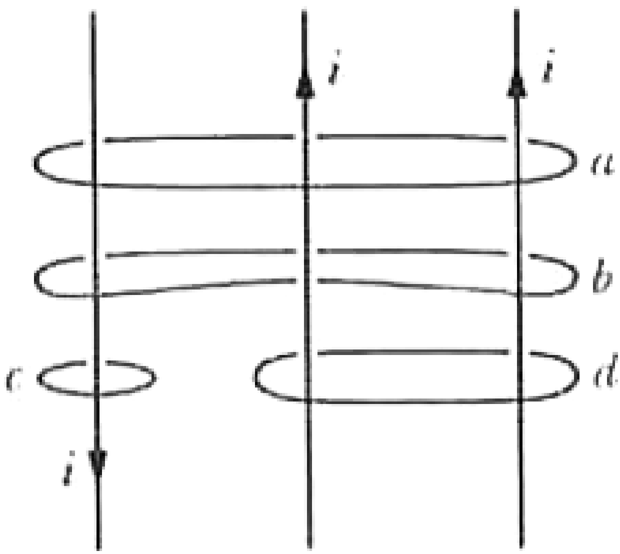
3. The figure here shows three equal currents i (two parallel and one antiparallel) and four Amperian loops. Rank the loops according to the magnitude of $\oint$ along each, greatest first.



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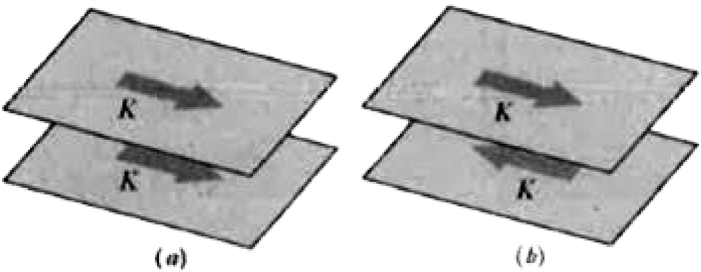
4. What are the directions of the magnetic field between and outside a pair of two parallel sheets carrying currents in (a) the same and (b) opposite directions, as illustrated in the adjoining figure ?



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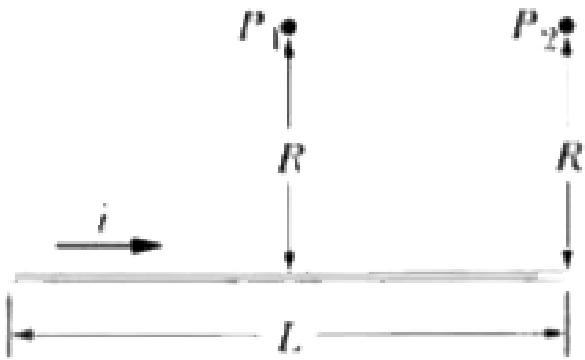
Problems

1. In Fig. $29-40$ point P, is at distance $R=24.0$ cm on the perpendicular bisector of a straight wire of length $L=18.0\mathrm{cm}$ carrying current $i=58.2$ mA. (Note that the wire is not long). What are the (a) magnitude and (b) direction of the magnetic field at P, due to i ? (c) If R is increased, what happens to the magnitude of the field ?



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2. In Fig $29 - 40$ point P_2 is at perpendicular distance $R = 25.1$ cm from one end of a straight wire of length $L = 13.6$ cm carrying current $i = 0.500$ A. (Note that the wire is not long) (a) What is the magnitude of the magnetic field at P_2 ? (b) If the point of measurement is moved from P_2 to P_1 does the field magnitude increase, decrease, or remain the same ?

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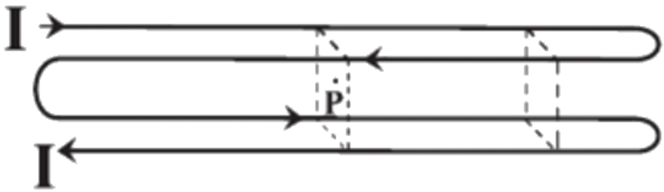
3. Four very long wires are arranged as shown in the figure, so that their cross - section forms a square, with connections at the ends so that current I flow through all four wires. Length of each side of the formed such square is b. The magnetic field at the central point P (centre of the square) is



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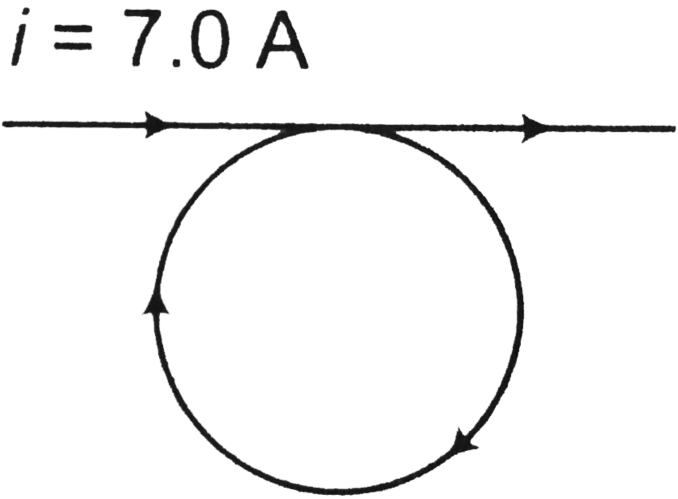
4. A conductor consists of a circular loop of radius $R = 10cm$ and two straight, long sections as shown in figure. The wire lies in the plane of the paper and carries a current of $i = 7.00A$ Determine the magnitude and direction of the magnetic field at the centre of the loop.



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5. In Fig. $29-41$ four long straight wires are perpendicular to the page, and their cross sections form a square of edge length $a = 13.5$

cm. Each wire carries 7.50 A, and the currents are out of the page in wires $1, 3,$ and 4 and into the page in wire 2. In unit - vector notation, what is the net magnetic force per meter of wire length on wire 4 ?

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6. In Fig. $29-41$ four long straight wires are perpendicular to the page, and their cross sections form a square of edge length $a=8.50$ cm. Each wire carries 15.0 A, and all the currents are out of the page. In unit - vector notation, what is the net magnetic force per meter of wire length on wire 1 ?

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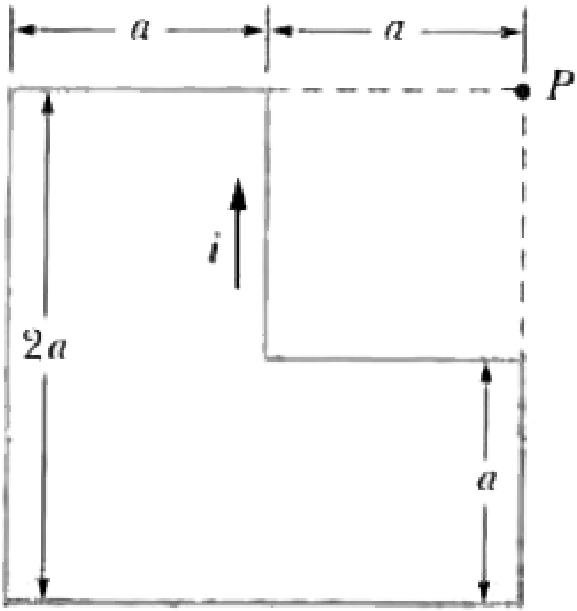
7. In Fig. $29-43,$ length a is 2.3 cm (short) and current i is 18 A. What are (a) magnitude and (b) direction (into or out of the page) of the magnetic field at point P ?



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8. Two long parallel wires are separated by a distance of $2.50 cm$. 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 $0.600A$.

a. What is the current in the second wire ?

b. Are the two currents in the same direction or in opposite direction?

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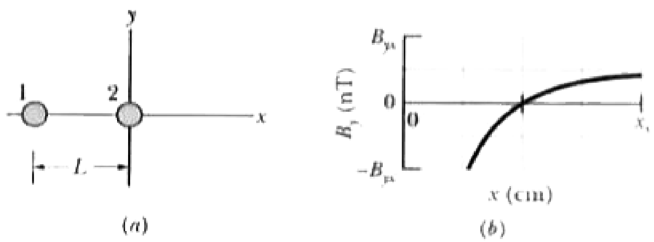
9. Figure $29 - 45$ a shows, in cross section, two long, parallel wires carrying current and separated by distance L. The ratio i_1 / i_2 of their currents is $4.00,$ the directions of the currents are not indicated. Figure $29 - 45b$ shows the y component B_y of their net magnetic field along the x axis to the right of wire 2. The vertical scale is set by $B_{ys} = 4.0$ nT, and the horizontal scale is set by $x_s = 20.0$ cm. (a) At what value of $x > 0$ is B_y maximum ? (b) If $i_2 = 3$ mA, What is the value of that maximum ? What is the direction (into or out of the page) of (c) i_1 and (d) i_2 ?



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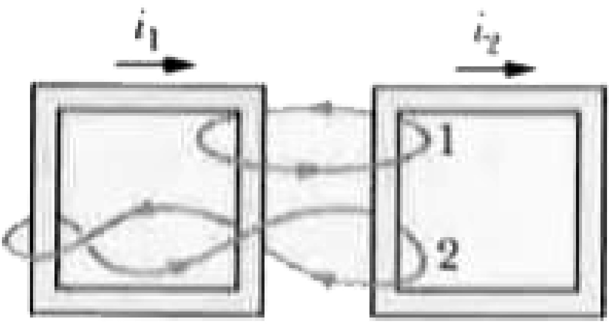
10. Figure $29 - 46$ shows two closed paths wrapped around two conducting loops carrying currents $i_1 = 5.0$ A and $i_2 = 3.0$ A What is the value of the integral $\oint \overrightarrow{B} . d\overrightarrow{s}$ for (a) path 1 and (b) path 2 ?



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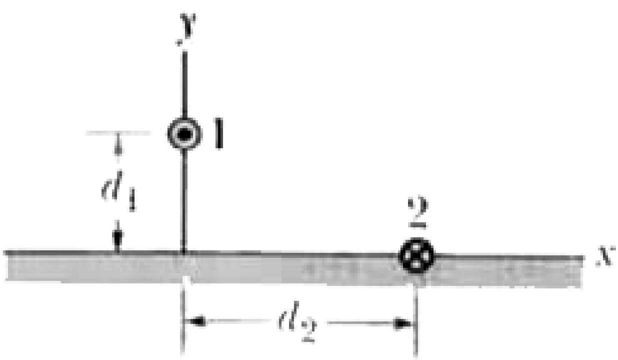
11. Figure $29-47$ shows wire 1 in cross section, the wire is long and straight, carries a current of 2.50 mA out of the page, and is at distance $d_1 = 4.00$ cm from a surface. Wire 2, which is parallel to wire 1 and also long, is at horizontal distance $d_2 = 5.00$ cm wire 1 and carries a current of 6.80 mA into the page. What is the x component of the magnetic force per unit length on wire 2 due to wire 1 ?



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12. An electron is shot into one end of a solenoid.As it enters the uniform magnetic field within the solenoid, its speed is $800m/s$ and its velocity vector makes an angle of 30° with the central axis of the solenoid.The solenoid carries $4.0A$ current and has 8000 turn along its length.Find number of revolutions made by the electron within the solenoid by the time it emerges from the solenoid's opposite end. (Use charge of mass ratio $\frac{e}{m}$ for electron

$= \sqrt{3} \times 10^{11} C / kg$)Fill your answer in multiple of 10^3 (neglect end effect)

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13. A toroid with mean radius r_0, diameter $2a$ have N turns carrying current I. What is the magnetic field B inside the the toroid?

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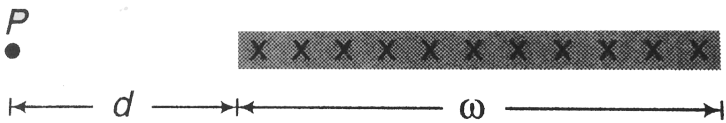
14. Figure shows a cross-section of a long ribbon of width ω that is carrying a uniformly distributed total current i into the page. Calculate the magnitude and direction of the magnetic field B at a point P in the plane of the ribbon at a distance d from its edge. `



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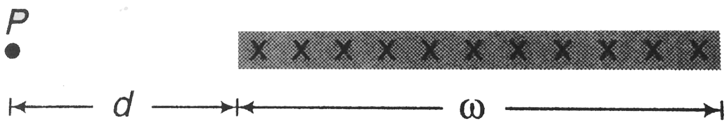
15. Figure shows a cross-section of a long ribbon of width ω that is carrying a uniformly distributed total current i into the page. Calculate the magnitude and direction of the magnetic field B at a point P in the plane of the ribbon at a distance d from its edge. `



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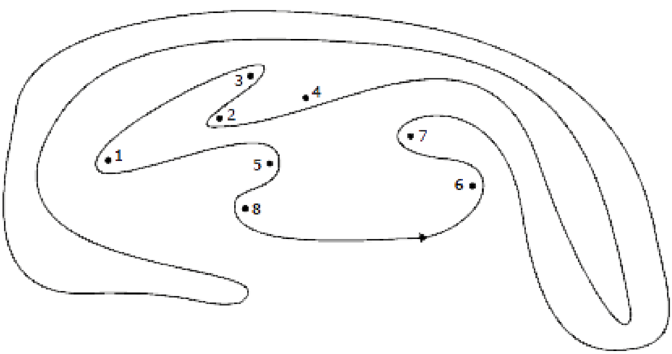
16. Eight wires cut the page perpendicularly at the points show in figure. A wire labeled with the integer k $(k = 1.2, \ldots\ldots 8)$ bears the current ki_0. For those with odd k, the current flows up out of the page, for those with even k it flows down into the page. The value of $\oint \vec{B} \,.\, d\vec{r}$ along the close path (as shown in the figure) in the direction indicated by the arrow is



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17. A current of $1/(4\pi)$ ampere is flowing in a long straight conductor. The line integral of magnetic induction around a closed path enclosing the current carrying conductor is

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18. A long solenoid with 10 turn / cm and a radius of 7.0 cm carries a current of 20.0 mA .A current of 6.0 A exists in a straight conductor loacted along the central axis of the solenoid at what radial distance from the axis will the direction of the magneitic field be at 45° to the axial direction

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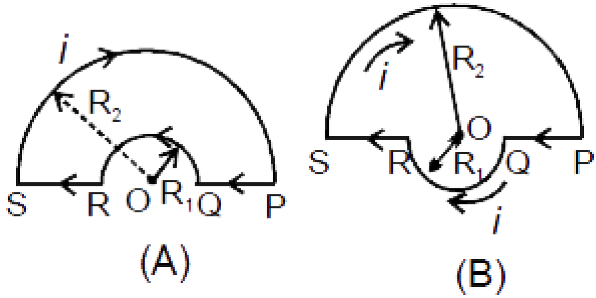
19. Two wire loop PQRSP formed by joining two semicircular wires of radii R_1 and R_2 carries a current i as shown in the figure given below. What is the magnetic field induction at the centre O in cases (A) and (B) ?



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20. A 470 - turn solenoid having a length of 25 cm and a diameter of 10 cm carries a current of 0.29A. Calculate the magnitude of the magnetic field $\overrightarrow{B}$ inside the solenoid.

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21. What is magnetic dipole moment? Calculate the magnetic dipole moment of a revolving electron.

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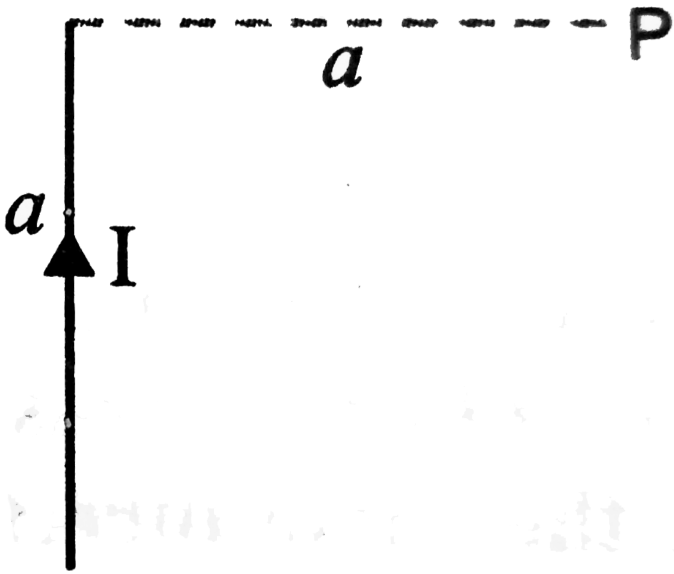
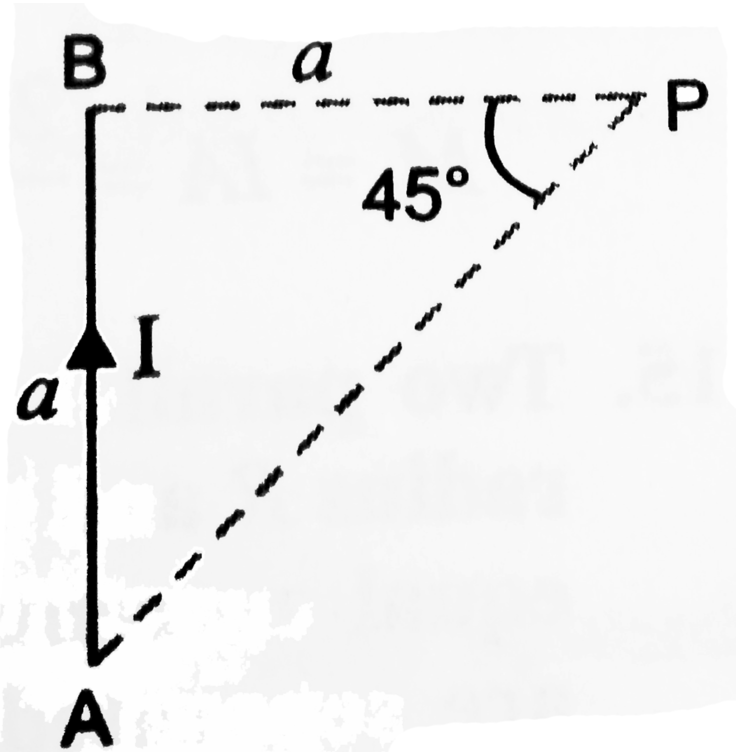
22. Figure shows a straight wire of length a carrying a current I. What is the magnitude of magnetic field induction produced by the current at P, which is lying at a perpendicular distance a from one end of the wire.


a
P
a
I


B
a
P
45°
I
a
A

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23. A long solenoid has 200 turns per cm and carries a current of 2.5A. The magnetic field at its centre is

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24. The current density $\bar{J}$ inside a long, solid cylindrical wire of radius $a = 12mm$ is in the direction of the central axis, and its magnitude varies linearly with radial distance r from the axis according to $J = \frac{J_0 r}{a}$, where $J_0 = \frac{10^5}{4\pi} A/m^2$.

Find the magnitude of the magnetic field at $r = \frac{a}{2}$ in μT

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25. A circular loop of radius 12 cm carries a current of 7.2 A. A flat coil of radius 0.82 cm, having 50 turns and a current of 1.3 A, is concentric with the loop. The plane of the loop is perpendicular to the plane of the coil. Assume the loop's magnetic field is uniform across the coil. What is the magnitude of (a) the magnetic field produced by the loop at its centre and (b) the torque on the coil due to the loop ?

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26. At a place, the horizontal component of earth's magnetic field is B and angle of dip is 60°. What is the value of horizontal component of earth's magnetic field at equator?

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27. A student makes a short electromagnet by winding 280 turns of wire around a wooden cylinder of diameter $d = 5.0$ cm. The coil is connected to a battery producing a current of 3.8 A in the wire. (a) What is the magnitude of the magnetic dipole moment of this device ? (b) At what axial distance $z > >$ d will the magnetic field have the magnitude 5.0μ T (approximately one - tenth that of Earth's magnetic field) ?

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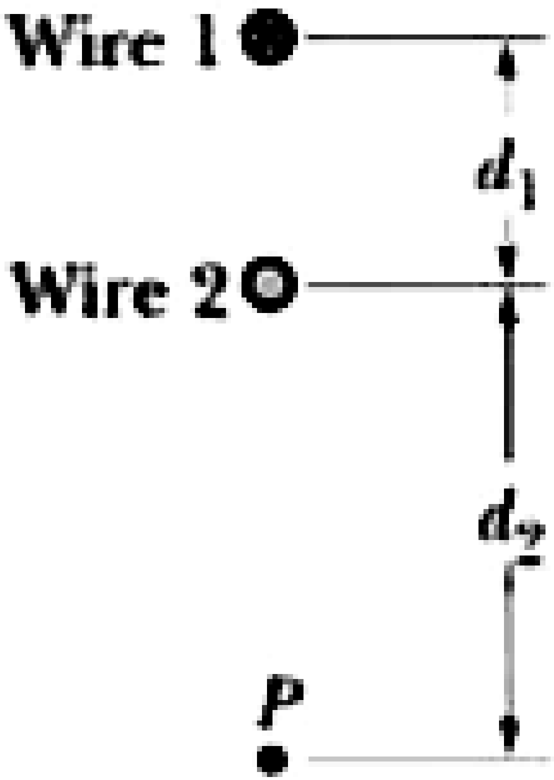
28. In Fig $29 - 54$, two long straight wires are perpendicular to the page and separated by distance $d_1 = 0.75$ cm. Wire 1 carries 6.5 A into the page. What are the (a) magnitude and (b) direction (into or out of the page) of the current in wire 2 if the net magnetic field due to the two currents is zero at point P located at distance $d_2 = 2.50$ cm from wire 2 ? If the current in wire 2 is then reversed, what are the (c) size and (d) direction of the net field at point P ?



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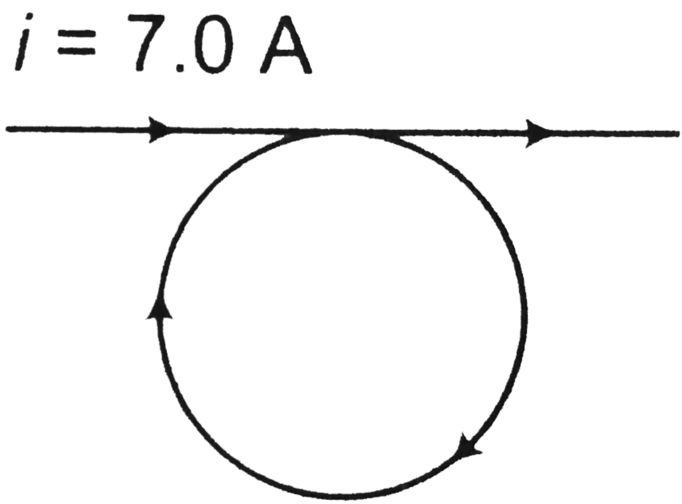
29. A conductor consists of a circular loop of radius $R = 10cm$ and two straight, long sections as shown in figure. The wire lies in the plane of the paper and carries a current of $i = 7.00A$ Determine the magnitude and direction of the magnetic field at the centre of the loop.



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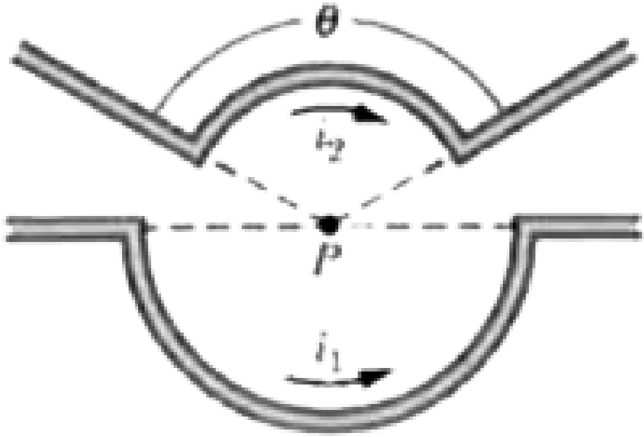
30. Figure $29-56$ shows two current segments. The lower segment carries a current of $i_1=0.40$ A and includes a semicircular are with radius 5.0 cm, angle 180° and center point P. The upper segment carries current $i_2=3i_1$ and includes a circular are with radius 4.0 cm, angle 120° and the same centre point P. What are the (a) magnitude and (b) diretion of the net magnetic field $\overrightarrow{B}$ at P for the indicated current directions ? What are the (c) magnitude and (d) direction of

$\vec{B}$ if i_1 is reversed ?



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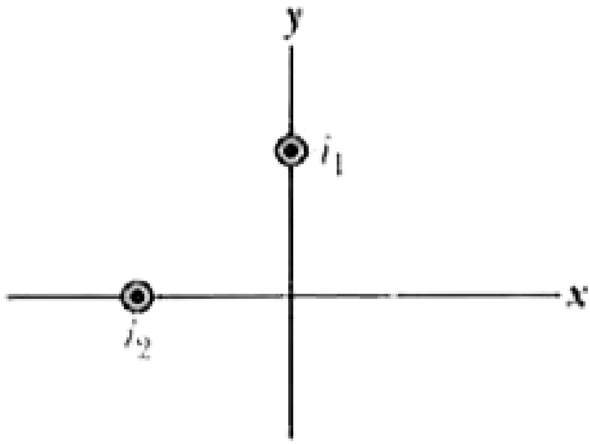
31. In Fig. $29-57,$ two long straight wires (shown in cross section) carry the currents $i_1 = 30.0$ mA and $i_2 = 50.0$ mA directly out of the page. They are equal distances from the origin, where they set up a ,magnetic field $\vec{B}$. To what value must current i_1 be changed in order to rotate $\vec{B}$ 25° clockwise ?



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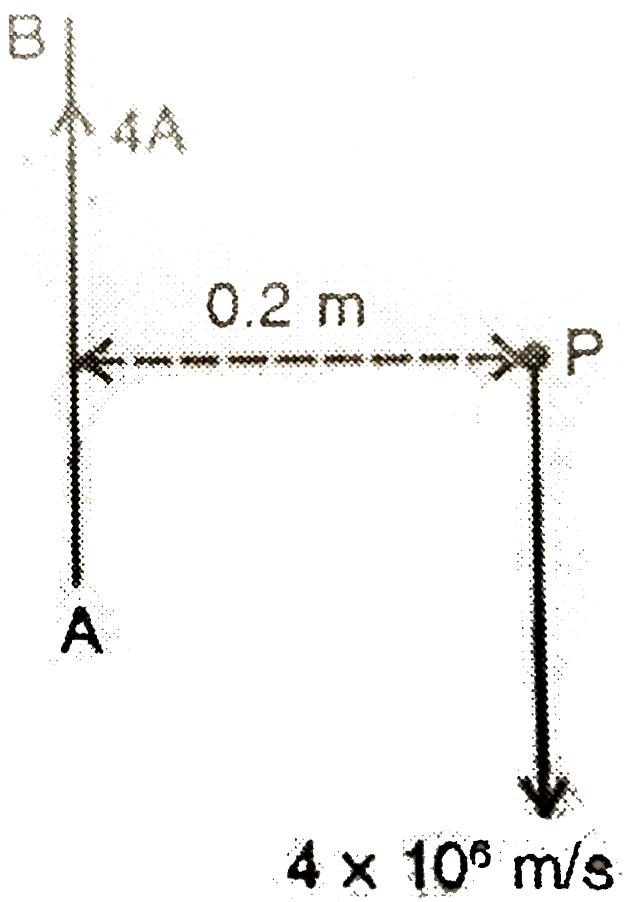
32. A long straight wire AB carries a current of 4 A. A proton P travels at $4 \times 10^6 ms^{-1}$ parallel to the wire 0.2 m from it and in a direction opposite to the current as shown in the figure. Calculate the force which the magnetic field due to the current carrying wire exerts on the proton. Also specify its direction.



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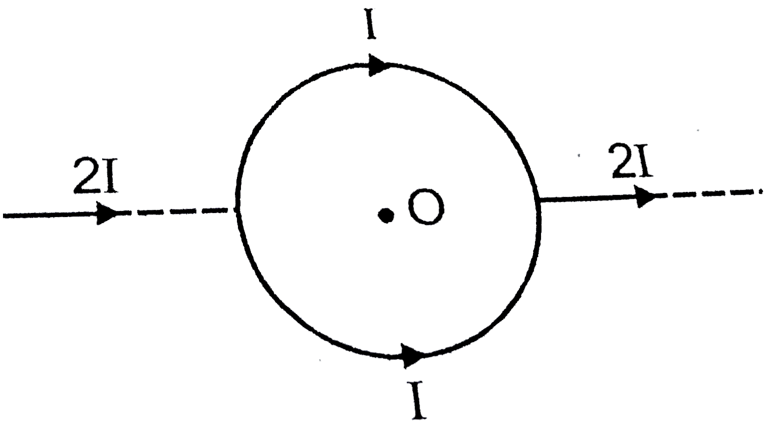
33. An infinite straigh conductor carrying current 2 I is split into a loop of radius r as shown in fig. the magnetic field at the centre of the coil is



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34. A long wire is along $x = 0$, $z = d$ and carries current in positive y direction. Another wire is along $x = y$, $z = 0$ and carries current in direction making acute angle with positive x direction. Both the wires have current I. Find the magnitude of magnetic induction at $(0, 0, 2d)$.

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35. Two identical coaxial circular loops carry a current i each circulating int the same direction. If the loops approch each other the current in

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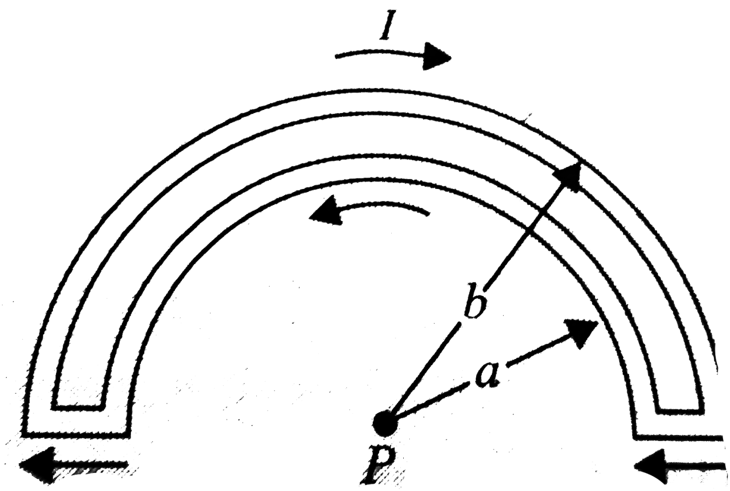
36. Two semicircles shown in Fig. have radii a and b. Calculate the net magnetic field (magnitude and direction) that the current in the wires produces at point P.



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37. Two straight infinitely long and thin parallel wires are spaced 0.1m apart and carry a current of 10A each. Find the magnetic field at a point distance 0.1m from both wires in the two cases when the currents are in the (a) same and (b) opposite directions.

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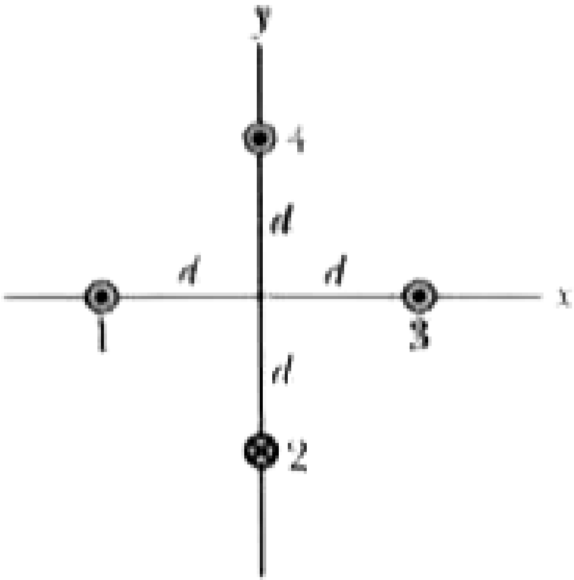
38. Figure$29 - 62$ shows, in cross section, four thin wires that are parallel, straight, and very long. They carry identical currents in the directions indicated. Initially all four wires are at distance $d = 15.0$ cm from the origin of the coordinate system, where they create a net magnetic field $\vec{B}$.

(a) To what value of x must you move wire 1 along the x axis in order to rotate $\vec{B}$ counterclockwise by 30°?

(b) With wire 1 in that new position, to what value of x must you move wire 3 along the x axis to rotate $\vec{B}$ by 30° back to its initial orientation

?



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39. Find the intensity of gravitational field at a point lying at a distance x from the centre on the axis of a ring of radius a and mass M.

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40. How are the magnitude and direction of magnetic field at a point denoted by the magnetic lines of force ?

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41. In a homogeneous magnetic field B there is an electron moving in a circular orbit with a speed v. Find the ratio of the magnetic field generated by the moving electron at the middle

of the circle and the magnetic field making it revolve.

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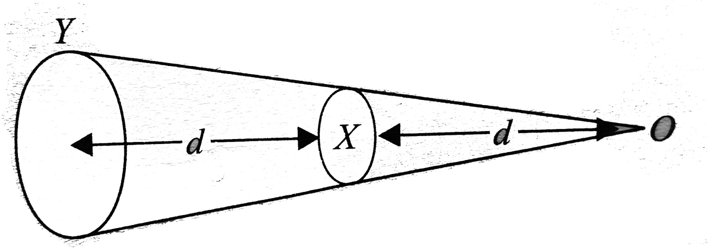
42. Two circular coils X and Y, having equal number of turns and carrying currents in the same sense, subtend same solid angle at point O. If the smaller coil X is midway between O and Y and if we represent the magnetic induction due to bigger coil Y at O as B_y and the due to smaller coil X at O as B_x,then find the ratio

B_x / B_y.



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43. Two protons move parallel to each other with an equal velocity $v = 300 km s^{-1}$. Find the ratio of forces of magnetic and electric interaction of the protons.

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44. A long solenoid is fabricated by closely winding a wire of radius 0.5 mm over a cylindrical nonmagnetic frame so that the successive turns nearly touch each other. What would be the magnetic field B at the centre of the solenoid if it carries a current of 5 A?

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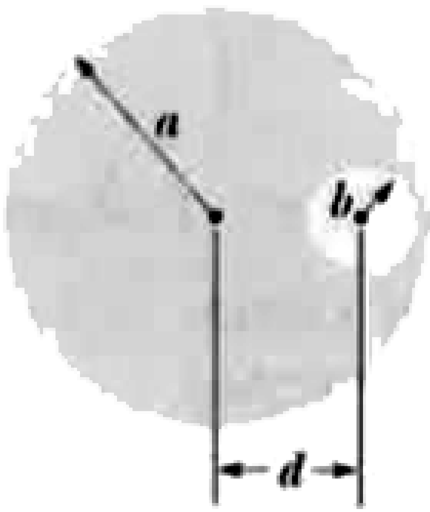
45. Figure $29-64$ shows a cross section of a long cylindrical conductor of radius $a = 4.00$ cm containing a long cylindrical hole of radius $b = 1.50$ cm. The central axes of the cylinder and hole are parallel and are distance $d = 2.00$ cm apart, current $i = 5.25$ A is uniformly distributed over the tinted area. (a) What is the magnitude of the magnetic field at the centre of the hole ? (b) Discuss the two special cases $b = 0$ and $d = 0$.



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Practice Question Single Correct

1. A beam of proton passes undeflected with a horizontal velocity v, through a region of electric and magnetic fields, mutually perpendicular to each other and perpendicular to the direction of the beam. If the magnitudes of the electric and magnetic fields are $100kV/m$, $50mT$ respectively, calculate the velocity of the beam v.

A. $1.18 \times 10^{-9} T$

B. $2.62 \times 10^{-3} T$

C. $5.33 \times 10^{-7} T$

D. $4.14 \times 10^{8} T$

Answer: C

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2. The magnetic field inside a solenoid is

A. The magnetic field is zero

B. The magnetic field is non-zero and nearly uniform

C. The magnetic field is independent of the number of windings

D. The magnetic field is independent of the current in the solenoid

Answer: B

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3. A solenoid of length 0.250 m and radius 0.0200 m is comprised of 120 turns of wire. Determine the magnitude of the magnetic field at the center of the solenoid when it carries a current of 15.0 A.

A. $2.26 \times 10^{-3} T$

B. $9.05 \times 10^{-3} T$

C. $4.52 \times 10^{-3} T$

D. $7.50 \times 10^{-3} T$

Answer: B

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4. A long wire is along $x = 0, z = d$ and carries current in positive y direction. Another wire is along $x = y, z = 0$ and carries current in direction making acute angle with positive x direction. Both the wires have current I. Find the magnitude of magnetic induction at $(0, 0, 2d)$.

A. zero tesla

B. $1 \times 10^{-6} T$

C. $3 \times 10^{-6} T$

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

Answer: C

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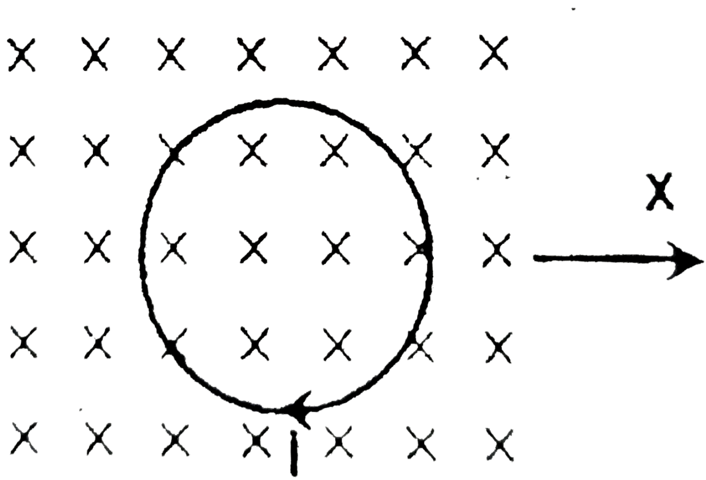
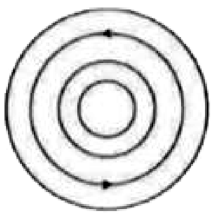
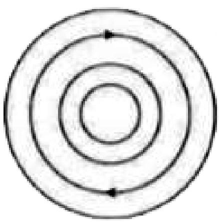
5. A circular loop of wire is carring a current i (as shown in the figure). On applying a uniform magnetic field inward perpendicular to the plane of the loop, the loop

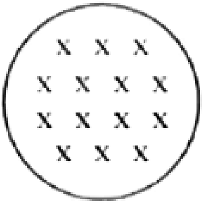


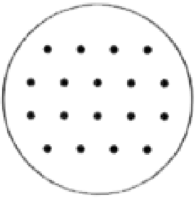


A.



B.

C. 

D. 

Answer: C

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6. A small circular loop is suspended from an insulating thread. Another coaxial circular loop carrying a current I and having radius much larger than the first loop starts moving towards the smaller loop. The smaller loop will :

A. 5.3 A

B. 6.0 A

C. 8.8 A

D. 12A

Answer: A

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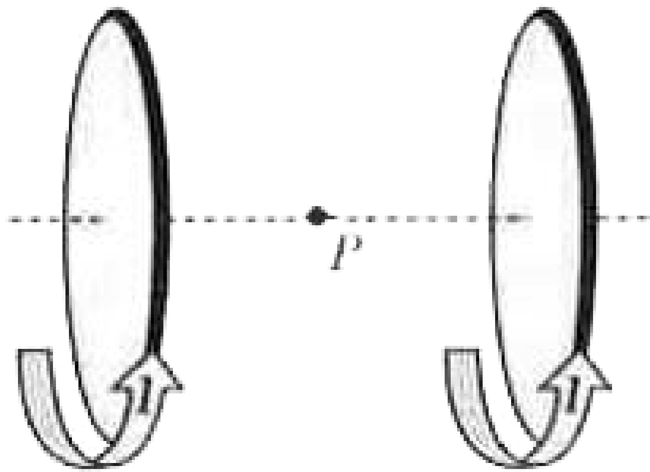
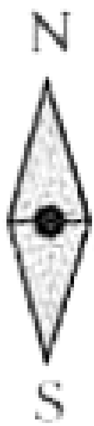
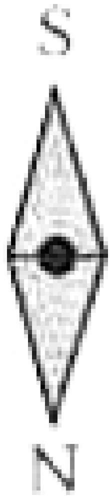
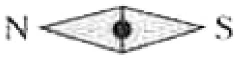
7. Two loops carry equal currents I in the same direction. They are held in the positions shown in the figure and project above and below the plane of the paper. The point P lies exactly halfway between them on the line that joins their centers. The centers of the loops and the point P lie in the plane of the paper. Which one of the figures below shows the position of a compass needle if the compass were placed in the plane of the paper at P ?



A. 

B. 

C. 

D. 

Answer: D

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8. An electron is moving with a speed of 3.5×10^5 m//s when it encounters a magnetic field of 0.60 T. The direction of the magnetic field makes an angle of 60.0° with respect to the velocity of the electron. What is the magnitude of the magnetic force on the electron ?

A. 4.9×10^{-13} N

B. 2.9×10^{-14} N

C. 3.2×10^{-13} N

D. 3.4×10^{-14} N

Answer: B

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9. An electron travels through a region of space with no acceleration . Which one of the following statements is the best conclusion ?

A. Both E and B must be zero in that region

B. E must be zero, but B might be non-zero in that region

C. E and B might both be non-zero , but they be mutually perpendicular

D. B must be zero, but E mightbe non-zero in that region

Answer: C

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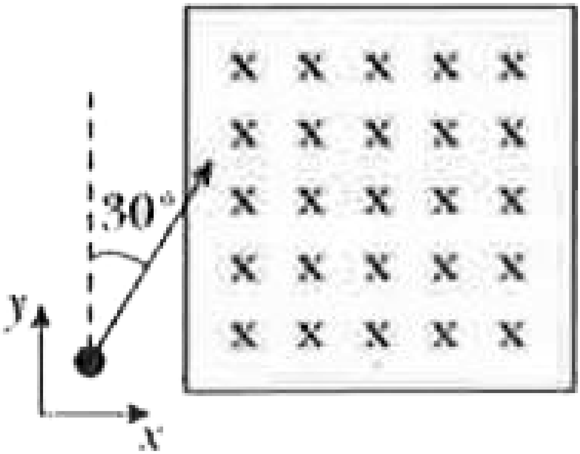
10. An electron enters a region that contains a magnetic field directed into the page as shown. The velocity vector of the electron makes an angle of 30° with the $+y$ axis. What is the direction of the magnetic force on the electron when it enters the field ?



A. Up, out of the page

B. At an angle of 30° below the positive x axis

C. At an angle of 30° above the positive x axis

D. At an angle of 60° below the positive x axis

Answer: B

Watch Video Solution

11. A wire carries current toward the north. In the region beneath this wire, What is the direction of the magnetic field due to the current ?

A. Northward

B. Southward

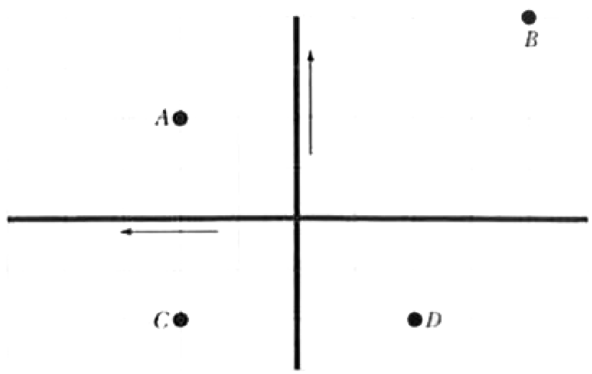
C. Eastward

D. Westward

Answer: D

Watch Video Solution

12. Two infinitely long perpendicular wires carry equal currents in the directions indicated in the following figure. At which of the labeled points is the magnitude of the magnetic field created by the currents the greatest ? Note: All gridlines are equally spaced.



A. A

B. B

C. C

D. D

Answer: C

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13. A circular loop is kept in that vertical plane which contains the north- south direction. It carries a current that is towards north at the topmost point. Let A be a point on the axis of the circle to the east of it and B a point on this axis to the west of it. The magnetic field due to the loop.

A. Is toward east at A and toward west at B

B. Is toward east at both A and B

C. Is toward west at A and toward east at B

D. Is toward west at both A and B

Answer: D

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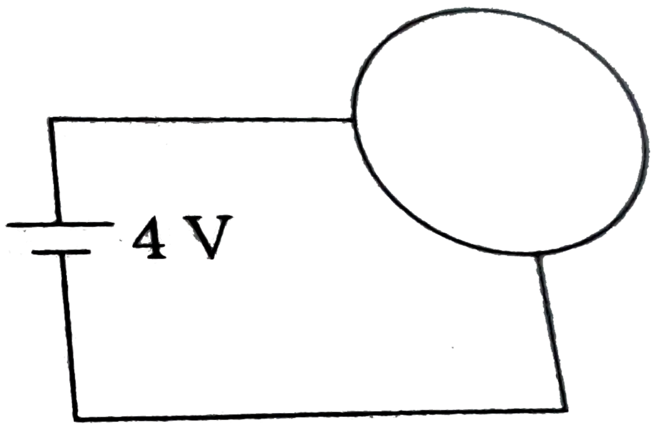
14. A circular conductor of uniform resistance per unit length, is connected to a battery of 4 V. The total resistance of the conductor is 4ω. The net magnetic field at the centre of the conductor is



A. Equal to B_0

B. Greater than B_0

C. Less than B_0

D. Less than B_0

Answer: A

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15. Figure. Shows two long wires carrying equal currents $I_1 \text{ and } I_2$ flowing in opposite directions. Which of the arrows labeled A to D correctely represents the direction of the magnetic field due to the wires at a point located at an equal distance d from each wire?

A. A

B. B

C. C

D. D

Answer: B

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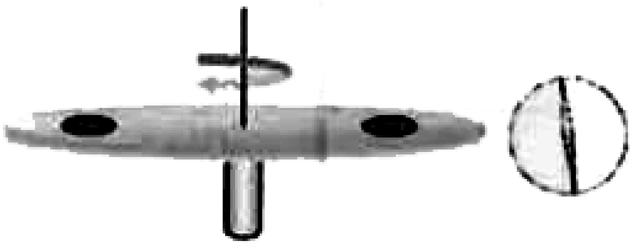
16. Rowland (1876) placed some charges (in a fixed location) on a nonconducting disk, which he then rotated at high speed about its central axis near a delicate compass (as shown in the following figure). Rowland observed that :



A. There was no magnetic field, so nothing happened to the compass

B. The current created a magnetic field that deflected the compass

C. The charges repelled the compass by Coulomb's Law.

D. None of the above

Answer: B

Watch Video Solution

17. Consider a long, straight wire of cross-sectional area A carrying a current i. Let there be n free electrons per unit volume. An observed places himself on a trolley moving in the direction opposite to the current with a moving in the direction opposite to the current with a speed `(v= i/nAe) and separated from the wire by a distance r. The magnetic field seen by the observer is very nearly

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

B. Zero

C. $\frac{\mu_0 i}{\pi r}$

D. $\frac{2\mu_0 i}{\pi r}$

Answer: A

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18. Four very long straight wires carry equal electric currents in the $+z$ direction. They intersect the xy plane at $(x, y) = (-a, 0), (0, a), (a, 0),$ and $(0, -a)$. The magnetic force exerted on the wire at position $(-a, 0)$ is along

A. $+y$

B. $-y$

C. $+x$

D. $-x$

Answer: C

Watch Video Solution

19. Cross section of three wires is shown in the following figure. If the current in the bottom two wires is opposite in direction to each other as indicated by $plus$ for into the page and O for out of the page, and the top wire has current flowing into the page $plus$ what is the direction of net force on the top wire ?

A. Left

B. Right

C. Up

D. Down

Answer: C

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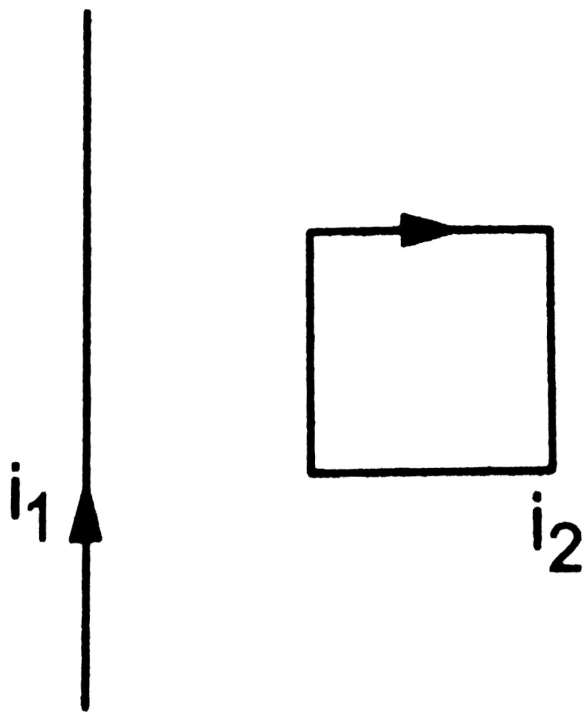
20. Consider the situation shown in figure. The straight wire is fixed but the loop can move under magnetic force. The loop will



A. Remain stationary

B. Move toward the wire

C. Move away from the wire

D. Rotate about the wire

Answer: B

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21. Two long straight wires, each carrying current of 5.0 A, are kept parallel to each other at a separation of 2.5 cm. The magnitude by 5.0 cm of a wire is

A. They will move away from each other, parallel to their original positions

B. They will move toward each other parallel to their original position

C. They will rotate about the line of the shortest distance between them and tend to be parallel to each other

D. They will rotate about the line of the shortest distance between them and tend to be anti - parallel to each other

Answer: C

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22. In a coaxial, straight cable, the central conductor and the outer conductor carry equal currents in opposite directions. The magnetic field is zero.

A. Outside the cable

B. Inside the inner conductor

C. Inside the outer conductor

D. In between the two conductors

Answer: A

Watch Video Solution

23. A solenoid is connected to a battery so that a steady current flows through it. If an iron core is inserted into the solenoid, then

A. Putting an iron core in the solenoid

B. Cooling the solenoid to reduce the resistance of the coil

C. Increasing the current flow through the coil

D. All of the above

Answer: D

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24. A proton $(mass = 1.67 \times 10^{-27} kg$ and charge $1.6 \times 10^{-19} C)$ enters perpendicular to a magentic field of intensity $2weber/m^2$ with a speed of $2.6 \times 10^7 m/\sec$. The acceleration of the proton should be

A. $6.5 \times 10^{15} m/s^2$

B. $6.5 \times 10^{13} m/s^2$

C. $6.5 \times 10^{11} m/s^2$

D. $6.5 \times 10^{9} m/s^2$

Answer: A

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25. If only 2% of the main current is to be passed through a galvanometer of resistance G, then the resistance of the shunt will be

A. $\frac{G}{50}$

B. $\frac{G}{49}$

C. $50G$

D. $49G$

Answer: B

Watch Video Solution

26. A deutron of kinetic energy 50 keV is describing a circular orbit of radius 0.5 meter in a plane perpendicular to magnetic field $\overrightarrow{B}$. The kinetic energy of the proton that describes a circular orbit of radius 0.5 meter in the same plane with the same $\overrightarrow{B}$ is

A. $25keV$

B. $50keV$

C. $200keV$

D. $100keV$

Answer: D

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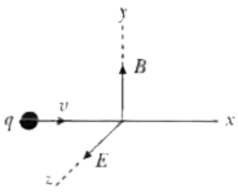
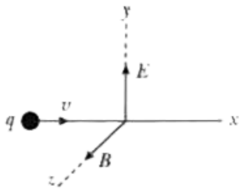
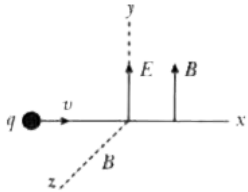
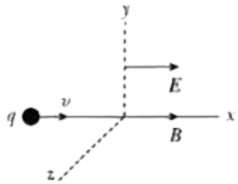
27. A particle of charge q and mass m is moving along the x-axis with a velocity v and enters a region of electric field E and magnetic field B as shown in figures below. For which figure the net force on the charge may be zero?

A. 

B. 

C. 

D. 

Answer: B

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28. The ratio of the magnetic field at the centre of a current carrying circular wire and the magnetic field at the centre of a square coil made from the same length of wire will be

A. $\frac{\pi^2}{4\sqrt{2}}$

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

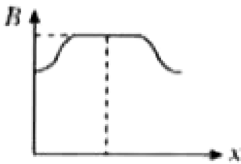
C. $\frac{\pi}{2\sqrt{2}}$

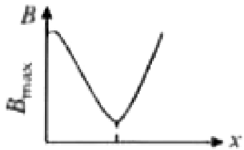
D. $\frac{\pi}{4\sqrt{2}}$

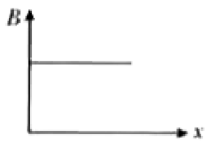
Answer: B

Watch Video Solution

29. The correct curve between the magnetic induction (B) along the axis of a along solenoid due to current flow i in it and distance x from one end is -

A. 

B. 

C. 

D. 

Answer: A

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30. Currents of $10A, 2A$ are passed through two parallel wires A and B respectively in opposite directions. If the wire A is infinitely long and the length of the wire B is 2 metre, the force on the conductor B, which is situated at $10cm$ distance from A will be

A. 8×10^{-5} N

B. 5×10^{-5} N

C. $8\pi \times 10^{-5}$ N

D. $4\pi \times 10^{-5}$ N

Answer: A

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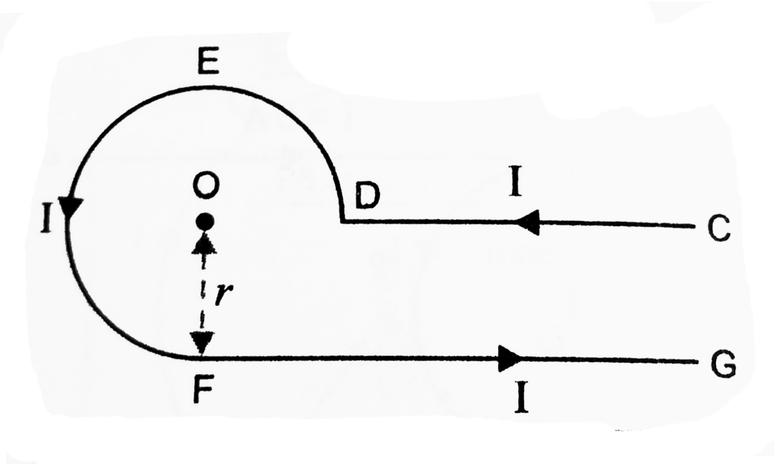
31. A current I is flowing in a conductor shaped as shown in figure. The radius of the curved part is r and length of straight portion is very large.

Find the magnetic field induction at the centre O.



A. $\frac{\mu_0}{4\pi r}\left(\frac{\pi}{2}+1\right)$

B. $\frac{\mu_0 I}{4\pi r}\left(\frac{\pi}{2}-1\right)$

C. $\frac{\mu_0 I}{4\pi r}\left(\frac{3\pi}{2}+1\right)$

D. $\frac{\mu_0 I}{4\pi r}\left(\frac{3\pi}{2}-1\right)$

Answer: C

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32. A proton of mass m and charge $+e$ is moving in a circular orbit in a magnetic field with energy $1 MeV$. What should be the energy of alpha-particle (mass=$4m$ and charge=$+2e$), so that it can revolve in the path of same radius?

A. 1 MeV

B. 4 MeV

C. 2 MeV

D. 0.5 MeV

Answer: A

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33. A proton and an $\alpha -$ particle enter a uniform magnetic field moving with the same speed. If the proton takes $25\mu s$ to make 5 revolutions, then the periodic time for the $\alpha -$ particle would be

A. $50\mu s$

B. $25\mu s$

C. $10\mu s$

D. $5\mu s$

Answer: C

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34. A strong magnetic field is applied on a stationary electron, then

A. The electron moves in the direction of the field

B. The electron moves in an opposite direction

C. The electron remains stationary

D. The electron starts spinning

Answer: C

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35. Two concentric circular coils of ten turns each are situated in the same plane. Their radii are 20 and $40cm$ and they carry respectively 0.2 and 0.3

ampere current in opposite direction. The magnetic field in Wb/m^3 at the centre is

A. $\frac{35}{4}\mu_0$

B. $\frac{5}{4}\mu_0$

C. $\frac{7}{80}\mu_0$

D. $\frac{\mu_0}{80}$

Answer: B

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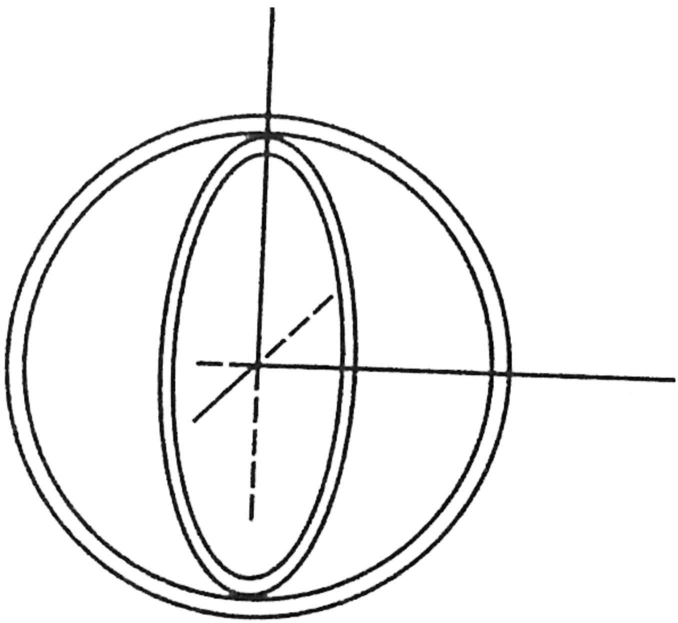
36. Two insulated rings, one of a slighlty smaller diameter than the other are suspended along their common diameter as shown. Initially the planes of the rings are mutually perpendicular. When a steady current is set up each of them



A. The two rings rotate into a common plane.

B. The inner ring oscillates about its initial position.

C. The inner ring stays stationary while the outer one moves into the plane of the inner ring.

D. The outer ring stays stationary while the inner one moves into the plane of the outer ring.

Answer: A

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Practice Question More Than One Correct Choice

1. 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: A::B::D

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2. The radius of curvature of the path of a charged particle moving in a static uniform magnetic field is

A. Directly proportional to the magnitude of the charge on the particle

B. Directly proportional to the magnitude of the linear momentum of the particle

C. Directly proportional to the kinetic energy of the particle

D. Inversely proportional to the magnitude of the magnetic field

Answer: B::D

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3. The current sensitivity of a moving coil galvanometer can be increased by

A. Increasing the magnetic field of the permanent magnet

B. Increasing the area of the deflecting coil

C. Increasing the number of turns in the coil

D. Increasing the restoring couple of the coil

Answer: A::B::C

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4. Two coaxil solenoids 1 and 2 of the same length are set so that one is inside the other. The number of turns per unit length are n_1 and n_2. The current i_1 and i_2 are flowing in opposite directions. The magnetic field inside the inner coil is zero. This is possible when

A. $I_1 \neq I_2$ and $n_1 = n_2$

B. $I_1 = I_2$ and $n_1 \neq n_2$

C. $I_1 = I_2$ and $n_1 = n_2$

D. $I_1 n_1 = I_2 n_2$

Answer: C::D

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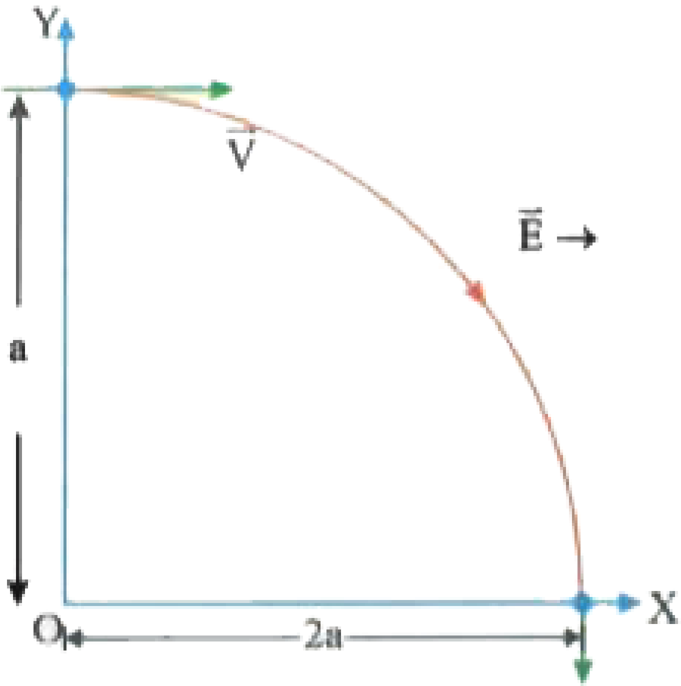
5. A particle of charge +q and mass m moving under the influnce of a uniform electric field $E\hat{i}$ and a uniform magnetic field $B\hat{k}$ follows trajectory from P to Q as shown in figure. The velocities at P and Q $v\hat{i}$ and $-2v\hat{j}$ respectively. Which of the following statement(s) is/are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



A. $E = \frac{3}{4}\frac{mv^2}{qa}$

B. Rate of work done by electric field at P is

$\frac{3}{4}\frac{mv^2}{a}$

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

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

Answer: A::B::D

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6. 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 $1 a\mu, 4 a\mu$ and $16 a\mu$ respectively . Then

A. H^+ ions will be deflected most

B. O^{++} ions will be deflected least

C. He^+ and O^{++} ions will suffer same deflection

D. All ions will suffer the same deflection

Answer: A::C

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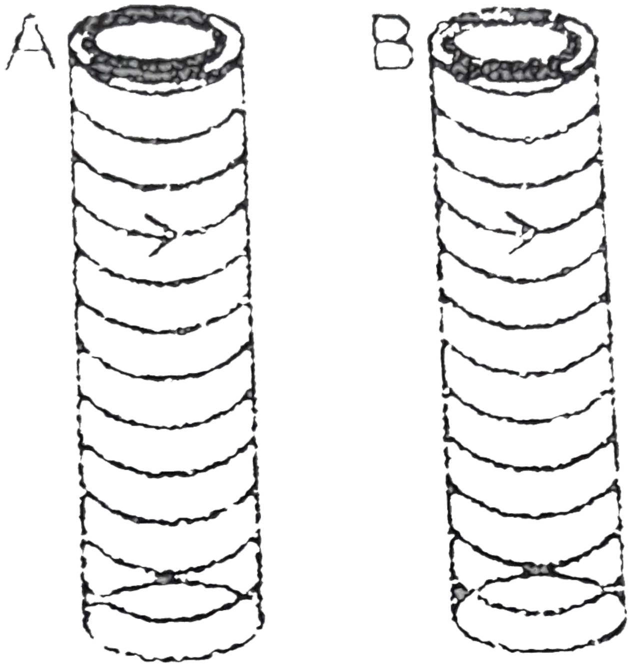
7. Two metallic rings A and B identical in shape and size but having different resistivities ρ_A and ρ_B are kept on top of two idential solenoids as shown in the figure.When current I is switched on in both the solenoids in identical manner, the rings A and B jump to heights h_A and h_B respectively 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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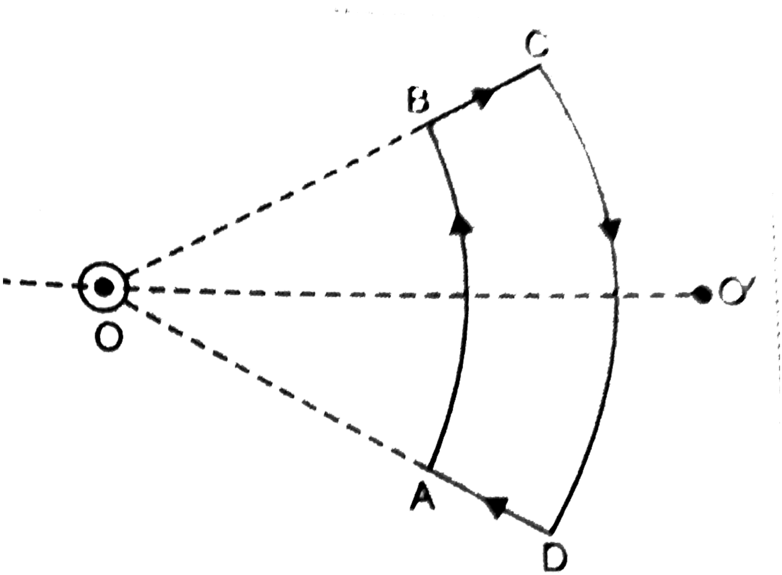
8. An infinite current carrying wire passes through point O and is perpendicular to the plane containing a current carrying loop ABCD as shown in figure. Choose the correct option(s).



A. Net force on the loop is zero

B. Net torque on the loop is zero

C. As seen from O, the loop rotates clockwise

D. As seen from O, the loop rotates anticlockwise

Answer: A::C

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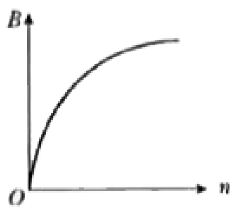
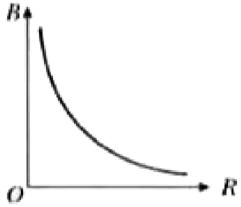
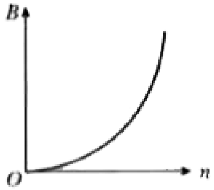
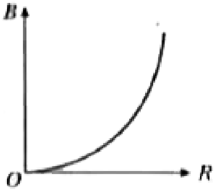
9. A thin wire of length l is carrying a constant current. The wire is bent to form a circular coil. If radius of the coil, thus formed, is equal to R and number of turns in it is equal to n, then which of the following graphs represent (s) variation of magnetic field induction (B) at centre of the coil

A. 

B. 

C. 

D. 

Answer: B::C

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10. A long, straight wire carries a current along the z-axis. One can find two points in the x-y plane such that

A. The magnetic field are equal

B. The directions of the magnetic field are the same

C. The magnitudes of the magnetic fields are equal

D. The field at one points is opposite to that at the other point

Answer: B::C::D

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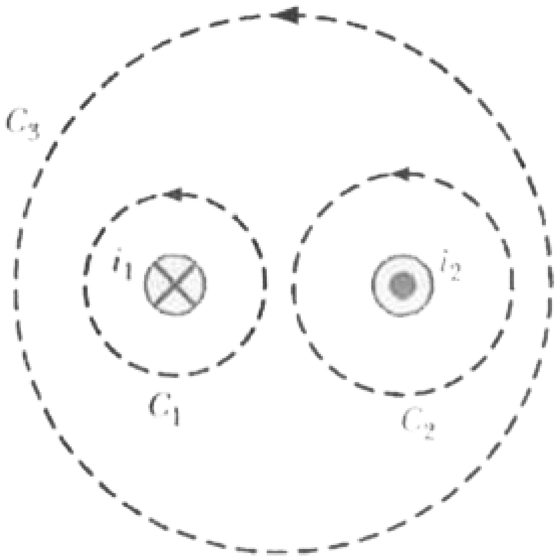
11. Which one of the following line integrals is correct ? Note : The direction of the loops orientation is shown in the following figure.



A. $\oint_{c_1} \vec{B} . \vec{d} l = \mu_0 i_1$

B. $\oint_{c_2} \vec{B} . \vec{d} l = \mu_0 i_2$

C. $\oint_{c_1} \vec{B} . \vec{d} l = - \mu_0 i_2$

D. $\oint_{c_1} \vec{B} . \vec{d} l = - \mu(i_1 - 1_2)$

Answer: B::D

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12. A steady electric current is flowing through a cylindrical conductor. Then,

A. The electric field at the axis of the conductor is zero

B. The magnetic field at the axis of the conductor is zero

C. The electric field in the vicinity of the conductor is zero

D. The magnetic field in the vicinity of the conductor is zero

Answer: B::C

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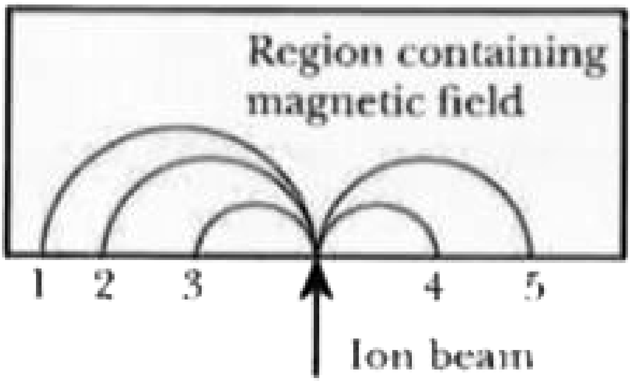
Practice Question Linked Comprehension



1.

Ion	Mass	Charge
A	2 units	$+e$
B	4 units	$+e$
C	6 units	$+e$
D	2 units	$-e$
E	4 units	$-e$

Which ion falls at position 2 ?

A. A

B. C

C. B

D. D

Answer: C

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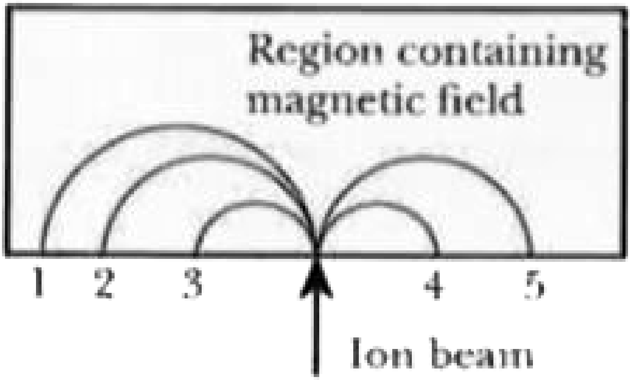

Ion	Mass	Charge
A	2 units	+e
B	4 units	+e
C	6 units	+e
D	2 units	−e
E	4 units	−e

2.

What is the direction of the magnetic field ?

A. Toward the right

B. Into the page

C. Toward the bottom

D. Out of the page

Answer: B

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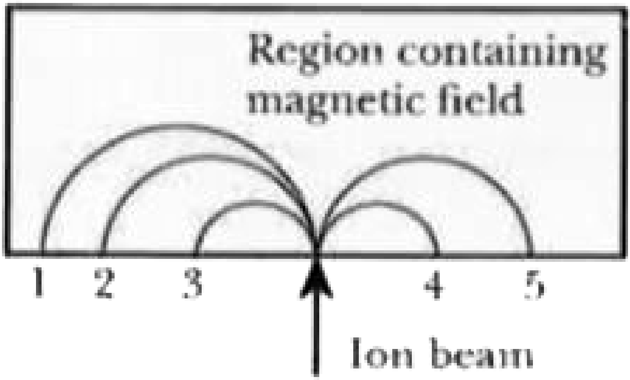

Ion	Mass	Charge
A	2 units	$+e$
B	4 units	$+e$
C	6 units	$+e$
D	2 units	$-e$
E	4 units	$-e$

3.

Determine the magnitude of the magnetic fielf if ion A travels in a semicircular path of radius 0.50 m at a speed of 5.0×10^6 m//s.

A. 1.0 T

B. 0.84 T

C. 0.42 T

D. 0.21 T

Answer: D

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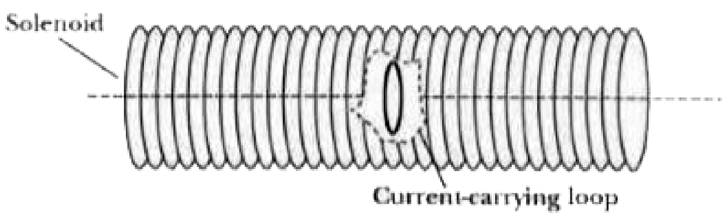
4. 

Determine the value of the current in the solenoid so that the magnetic field at the center of the loop is zero tesla.

A. 1.4×10^{-1}A

B. 4.4×10^{-2}A

C. 9.3×10^{-2}A

D. 2.5×10^{-4}A

Answer: C

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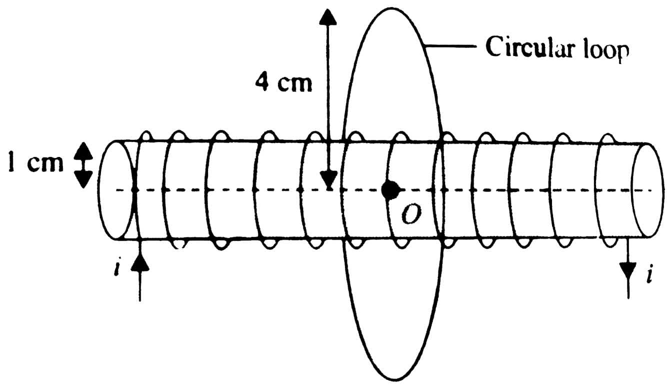
5. A long solenoid having n = 200 turns per metre has a circular cross-section of radius $a_1 = 1cm$. A circular conducting loop of radius $a_2 = 4cm$ and resistance $R = 5(\Omega)$ encircles the solenoid such that the centre of circular loop coincides with the midpoint of the axial line of the solenoid and they have the same axis as shown in Fig.



A current 't' in the solenoid results in magnetic field along its axis with magnitude $B=(\mu)ni$ at points well inside the solenoid on its axis. We can neglect the insignificant field outside the solenoid. This results in a magnetic flux $(\phi)_B$ through the circular loop. If the current in the winding of solenoid is changed, it will also change the magnetic field $B=(\mu)_0 ni$ and hence also the magnetic flux through the circular loop. Obvisouly, it will result in an induced emf or induced electric field in the circular loop and an induced current will appear in the loop. Let current in the winding of solenoid be reduced at a rate of $75A/\sec$.

Magnetic of induced electric field strength in the circular loop is nearly We know that there is magnetic flux through the circular loop because of the magnetic field of current in the solenoid. For the purpose of circular loop, let us call it the external magnetic field. As current in the solenoid is reducing, external magnetic field for the circular loop also reduced resulting in induced current in the loop. Finally, as the solenoid current becomes zero, external field for the loop also becomes zero and stop changing. However, induced current in the loop will not stop at the instant at which the external field stops changing. This is because induced current itself produces a magnetic field that results in a flux through the loop. External field becoming zero without any further change will compel the induced current in the loop to become zero and so magnetic flux through the loop due to change in induced current will also change resulting in a further induced phenomenon that sustains currents in the loop even after the external field becomes zero.

A. 2.5×10^{-4} T

B. 6.4×10^{-4} T

C. 5.0×10^{-4} T

D. 8.7×10^{-4} T

Answer: C

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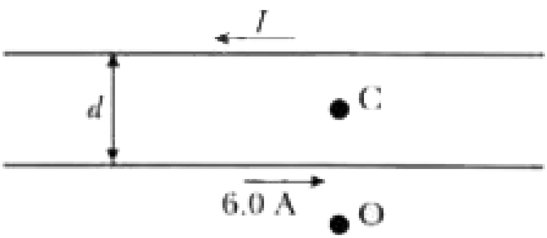
6. 

Determine the value of the current , I, in the top wire.

A. 2 A

B. 3 A

C. 6 A

D. 18 A

Answer: D

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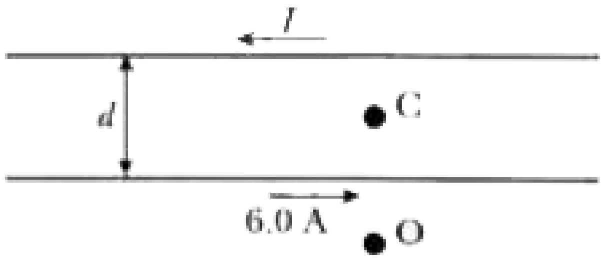
7.



Determine the magnitude of the total magnetic field at point C if $d = 0.10m.$

A. 2.4×10^{-5} T

B. 9.6×10^{-5} T

C. 4.8×10^{-5} T

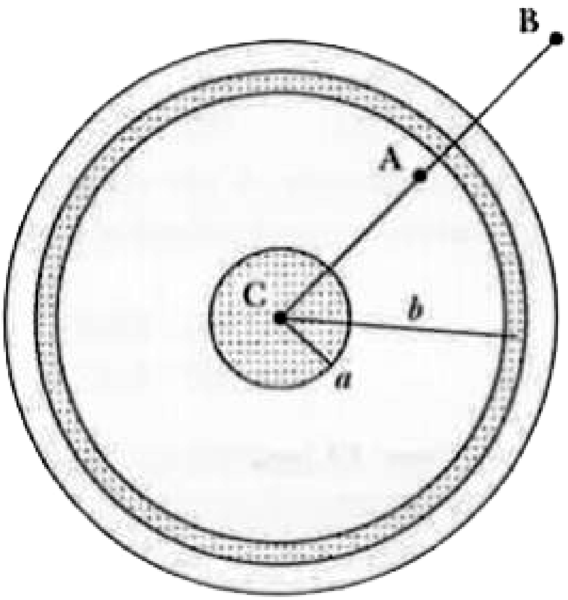
D. 1.1×10^{-4} T

Answer: B

[View Text Solution]

8.

Paragraph for Questions 56 and 57: A long, coaxial cable, shown in cross-section in the drawing, is made using two conductors that share a common central axis, labeled **C**. The conductors are separated by an electrically insulating material that is also used as the outer cover of the cable. The current in the *inner* conductor is 2.0 A directed *into the page* and that in the *outer* conductor is 2.5 A directed *out of the page*. The distance from point **C** to point **A** is 0.0015 m; and the distance from **C** to **B** is 0.0030 m. The radii *a* and *b* of the conductors are 6.0×10^{-4} m and 1.9×10^{-3} m, respectively.



What is the magnitude and direction of the magnetic field at point A ?

A. 3.3×10^{-5} T, clockwise

B. 6.8×10^{-5} T, counterclockwise

C. 3.3×10^{-5} T, counterclockwise

D. 2.7×10^{-4} T, clockwise

Answer: D

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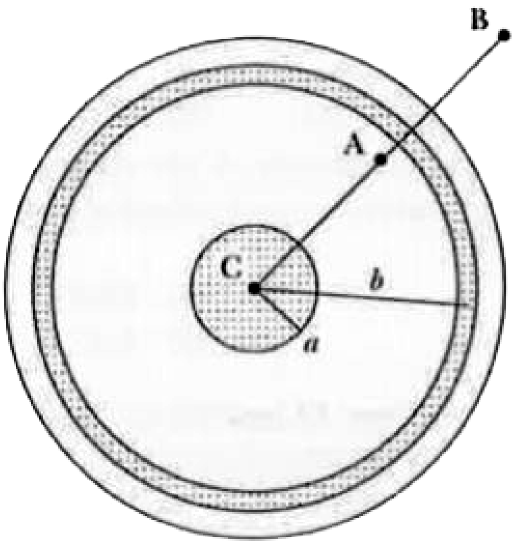
Paragraph for Questions 56 and 57: A long, coaxial cable, shown in cross-section in the drawing, is made using two conductors that share a common central axis, labeled **C**. The conductors are separated by an electrically insulating material that is also used as the outer cover of the cable. The current in the *inner* conductor is 2.0 A directed *into the page* and that in the *outer* conductor is 2.5 A directed *out of the page*. The distance from point **C** to point **A** is 0.0015 m; and the distance from **C** to **B** is 0.0030 m. The radii *a* and *b* of the conductors are 6.0×10^{-4} m and 1.9×10^{-3} m, respectively.

9.



What is the magnitude and direction of the magnetic field at point B ?

A. 3.3×10^{-5} T, clockwise

B. 6.8×10^{-5} T, counterclockwise

C. 3.3×10^{-5} T, counterclockwise

D. 2.7×10^{-4} T, clockwise

Answer: C

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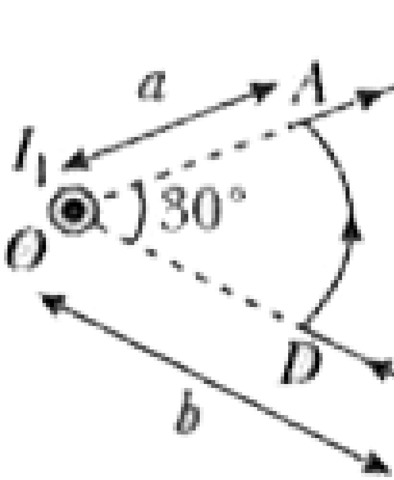

10.

The magnitude of the magnetic filed B due to the loop ABCD at origin (O) is

A. zero

B. $\dfrac{\mu_0 I(b-a)}{24\pi ab}$

C. $\dfrac{\mu_0 I(b-a)}{4\pi ab}$

D. $\dfrac{\mu_0 I}{4\pi}\left[2(b-a)+\dfrac{\pi}{3}(a+b)\right].$

Answer: B

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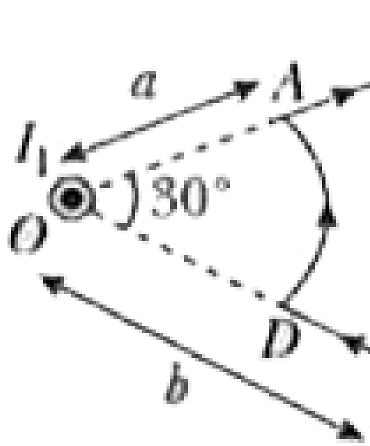
11. 

Due to the presence of the current I_1 at the origin

A. The forces on AB and DC are zero.

B. The forces on AD and BC are zero.

C. The magnitude of the net force on the loop is given by $\frac{I_1 I}{4\pi}\mu_0\left[2(b-a)+\frac{\pi}{3}(a+b)\right]$.

D. The magnitude of the net force on the loop is given by $\frac{\mu_0 I_1 I}{24ab}(b-a)$.

Answer: B

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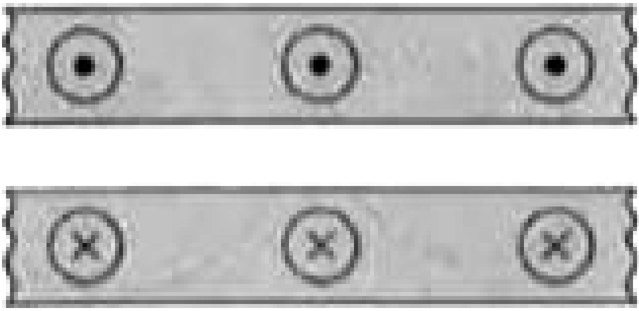
12. 

Magnetic field in space between the plates is

A. $\frac{1}{2}\mu_0 j^2$

B. zero

C. $\mu_0 j$

D. $2\mu_0 j$

Answer: C

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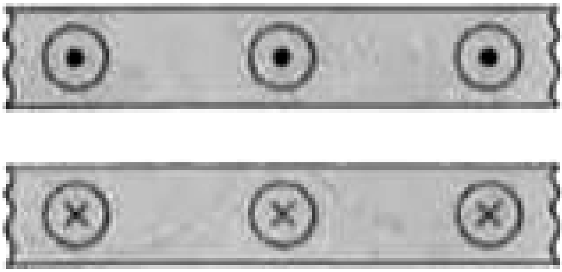
13. 

Force acting per unit area of each plate

A. $\frac{1}{2}\mu_0 j^2$

B. zero

C. $m_0 j$

D. $2m_0$

Answer: A

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14. 

Choose the correct statement :

A. Kinetic energy of the particle is maximum at outer part of the spiral

B. Kinetic energy of the particle is maximum at inner part of the spiral

C. Kinetic energy of the particle first decreases then increases during motion

D. Kinetic energy of the particle remains constant during motion along spiral path

Answer: A

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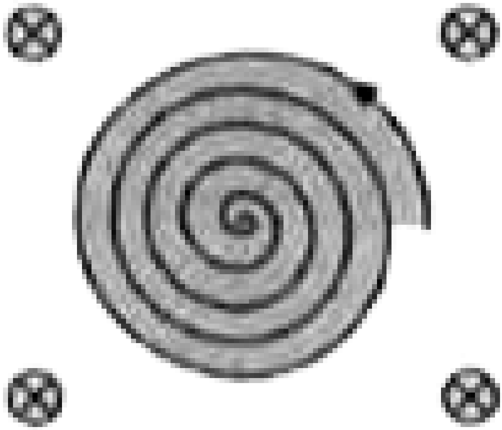
15.



Regarding the nature of the charge, we can conclude that :

A. The charge is negative

B. The charge is positive

C. The particle has no charge

D. No conclusion can be made regarding nature of charge

Answer: B

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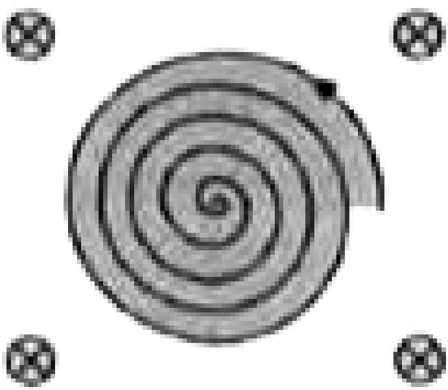

B is into the page

16.

The radius of curvature ranges from 70 to 10 mm. What is the range of values of the magnitude of momenyum (p) if the magnitude of the charge is e ?

A.

$$8e \times 10^{-2} kgm/s \leq p \leq 28e \times 10^{-3} kgm/s$$

B.

$$4e \times 10^{-2} kgm/s \leq p \leq 28e \times 10^{-3} kgm/s$$

C.

$$10e \times 10^{-2} kgm/s \leq p \leq 32e \times 10^{-3} kgm/s$$

D.

$$5e \times 10^{-2} kgm/s \leq p \leq 20e \times 10^{-3} kgm/s$$

Answer: B

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Practice Question Matirx Match

1. Match the statements in Column I labeled as (a), (b), (c), and (d) with those in column II labeled as (p), (q), (r), and (s). Any given statement in column I can have correct matching with one or more statements in Column II.

Column I	Column II
(a) Stationary dielectric ring having uniform charge.	(p) Electric field.
(b) Dielectric ring having uniform charge is rotating with constant angular speed.	(q) Magnetostatic field.
(c) A constant current I_0 in the loop.	(r) Time dependent induced electric field outside the loop.
(d) Time varying sinusoidal current in the loop $I = I_0 \sin \omega t$.	(s) Magnetic moment in the loop.

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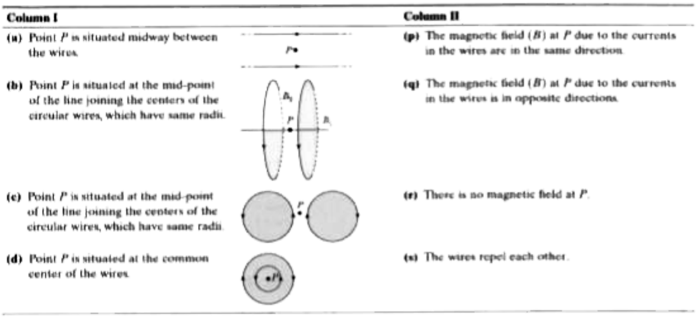
2. Match the statements in Column I labeled as (a), (b), (c), and (d) with those in column II labeled as (p), (q), (r), and (s). Any given statement in column I can have correct matching with one or more statements in Column II.



Column I	Column II
(a) Point P is situated midway between the wires.	(p) The magnetic field (B) at P due to the currents in the wires are in the same direction.
(b) Point P is situated at the mid-point of the line joining the centers of the circular wires, which have same radii.	(q) The magnetic field (B) at P due to the currents in the wires is in opposite directions.
(c) Point P is situated at the mid-point of the line joining the centers of the circular wires, which have same radii.	(r) There is no magnetic field at P.
(d) Point P is situated at the common center of the wires.	(s) The wires repel each other.

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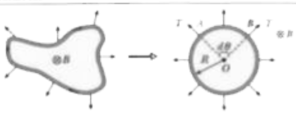
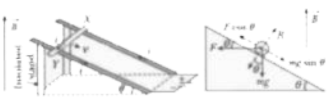
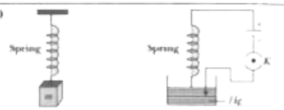
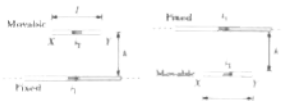
3. Consider standrad cases for force on current carrying conductors. In the given table, Column I shows the action of current on the element, Column II shows the effect of the current in the element, Column II shows the effect of the current in the element and Column III shows the figure of the element under force of current and magnetic field and its equivalent figure in general mechanical form.

Column I	Column II	Column III
(I) Each element of loop experiences a magnetic force	(i) turns in the same direction	(J) 
(II) When a conducting rod	(ii) loop stretches and open into circular loop and tension developed in its each part	(K) 

(Contd.)

Column I	Column II	Column III
(III) Wire is suspended freely in air	(iii) Equilibrium of a current carrying conductor	(L) 
(IV) Current will flow through	(iv) slides on conducting rails	(M) 

What happens when a finite length current carrying wire is kept parallel to another infinite length current carrying wire ?

A. (I)(ii)(J)

B. (IV)(ii)(M)

C. (II)(i)(M)

D. (III)(iii)(M)

Answer: B

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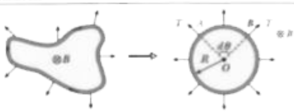
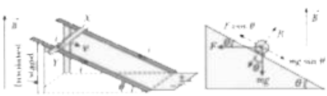
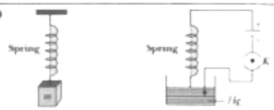
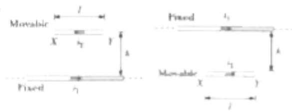
4. Consider standrad cases for force on current carrying conductors. In the given table, Column I shows the action of current on the element, Column II shows the effect of the current in the element, Column II shows the effect of the current in the element and Column III shows the figure of the element under force of current and magnetic field and its equivalent figure in general mechanical form.

Column I	Column II	Column III
(I) Each element of loop experiences a magnetic force	(i) turns in the same direction	(J) 
(II) When a conducting rod	(ii) loop stretches and open into circular loop and tension developed in its each part	(K) 
(III) Wire is suspended freely in air	(iii) Equilibrium of a current carrying conductor	(L) 
(IV) Current will flow through	(iv) slides on conducting rails	(M) 

(Contd.)

What happens when an arbitrary current carrying loop is placed in a magnetic field (perpeendicular to the plane of loop) ?

A. (I)(ii)(J)

B. (IV)(iii)(L)

C. (II)(iii)(L)

D. (I)(i)(M)

Answer: A

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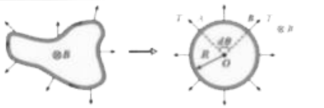
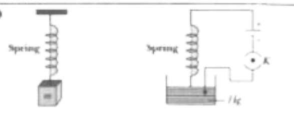
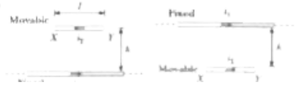
5. Consider standrad cases for force on current carrying conductors. In the given table, Column I shows the action of current on the element, Column II shows the effect of the current in the element, Column II shows the effect of the current in the element and Column III shows the figure of the element under force of current and magnetic field and its equivalent figure in general mechanical form.

Column I	Column II	Column III
(I) Each element of loop experiences a magnetic force	(i) turns in the same direction	(J) 
(II) When a conducting rod	(ii) loop stretches and open into circular loop and tension developed in its each part	(K) 

(Contd.)

Column I	Column II	Column III
(III) Wire is suspended freely in air	(iii) Equilibrium of a current carrying conductor	(L) 
(IV) Current will flow through	(iv) slides on conducting rails	(M) 

What happens when current is passed through a spring ?

A. (III)(i)(K)

B. (I)(i)(L)

C. (IV)(i)(L)

D. (II)(iii)(M)

Answer: D

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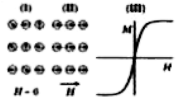
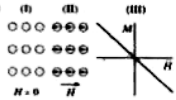
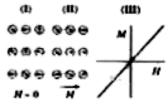
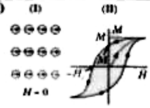
6. We know that magnetic substances follow curie- weiss Law. In the given table, Column I shows the type of attraction with magnets of magnetic substances, Column II shows the example of magnetic substances and Column III shows the three figures- figure (I) shows direction of magnetic momentum of each electron when there is no magnetic field inside magnetic substance, figure (II) shows the direction of magnetic momentum of electron when there is magnetic field inside magnetic substance and figure (III) shows the curve between M and H inside magnetic substance.

Column I	Column II	Column III
(I) Substances that are weakly attracted by the magnets	(i) antimony, bismuth	(J) 
(II) Substances that are repelled by the magnets	(ii) oxygen, manganese.	(K) 
(III) Substances that get magnetized in the direction opposite to that of magnetic field	(iii) chromium, nickel	(L) 
(IV) substances which are strongly attracted by the magnets	(iv) iron, cobalt	(M) 

Which combination is characteristic of ferromagnetic materials ?

A. (I)(iii)(L)

B. (IV)(iv)(M)

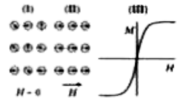
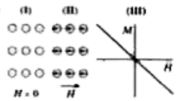
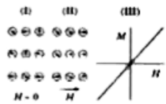
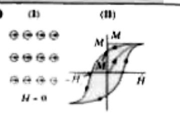
C. (II)(i)(M)

D. (I)(iii)(J)

Answer: D

View Text Solution

7. We know that magnetic substances follow curie- weiss Law. In the given table, Column I shows the type of attraction with magnets of magnetic substances, Column II shows the example of magnetic substances and Column III shows the three figures- figure (I) shows direction of magnetic momentum of each electron when there is no magnetic field inside magnetic substance, figure (II) shows the direction of magnetic momentum of electron when there is magnetic field inside magnetic substance and figure (III) shows the curve between M and H inside magnetic substance.

Column I	Column II	Column III
(I) Substances that are weakly attracted by the magnets	(i) antimony, bismuth	(J) 
(II) Substances that are repelled by the magnets	(ii) oxygen, manganese.	(K) 
(III) Substances that get magnetized in the direction opposite to that of magnetic field	(iii) chromium, nickel	(L) 
(IV) substances which are strongly attracted by the magnets	(iv) iron, cobalt	(M) 

Which combination is characteristic of paramagnetic materials ?

A. (I)(ii)(L)

B. (IV)(iii)(L)

C. (II)(iii)(K)

D. (I)(i)(M)

Answer: A

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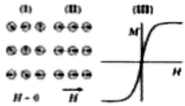
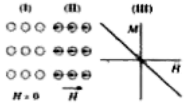
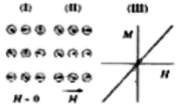
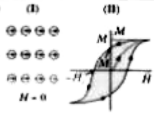
8. We know that magnetic substances follow curie- weiss Law. In the given table, Column I shows the type of attraction with magnets of magnetic substances, Column II shows the example of magnetic substances and Column III shows the three figures- figure (I) shows direction of magnetic momentum of each electron when there is no magnetic field inside magnetic substance, figure (II) shows the direction of magnetic momentum of electron when there is magnetic field inside magnetic substance and figure (III) shows the curve between M and H inside magnetic substance.

Column I	Column II	Column III
(I) Substances that are weakly attracted by the magnets	(i) antimony, bismuth	(J) 
(II) Substances that are repelled by the magnets	(ii) oxygen, manganese.	(K) 
(III) Substances that get magnetized in the direction opposite to that of magnetic field	(iii) chromium, nickel	(L) 

Column I	Column II	Column III
(IV) substances which are strongly attracted by the magnets	(iv) iron, cobalt	(M) 

Which combination is characteristic of diamagnetic materials ?

A. (III)(i)(L)

B. (I)(i)(J)

C. (III)(iii)(J)

D. (II)(i)(K)

Answer: C

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Practice Question Integer Type

1. 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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2. A non-conducting ring of mass m and radius R has a charge Q uniformly distributed over its circumference. The ring is placed on a rough horizontal surface such that plane of the ring is parallel to the surface. A vertical magnetic field $B = B_0 t^2$ tesla is switched on. After 2 a from switching on the magnetic field the ring is just about to rotate about vertical axis through its centre.

(a) Find friction coefficient μ between the ring and the surface.

(b) If magnetic field is switched off after $4s$, then find the angle rotated by the ring before coming to stop after switching off the magnetic field.

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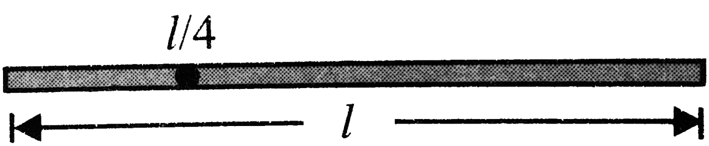
3. A uniform thin rod of length l and mass m is hinged at a distance $l/4$ from one of the end and released from horizontal position as shown in Fig. The angular velocity of the rod as it passes the vertical position is



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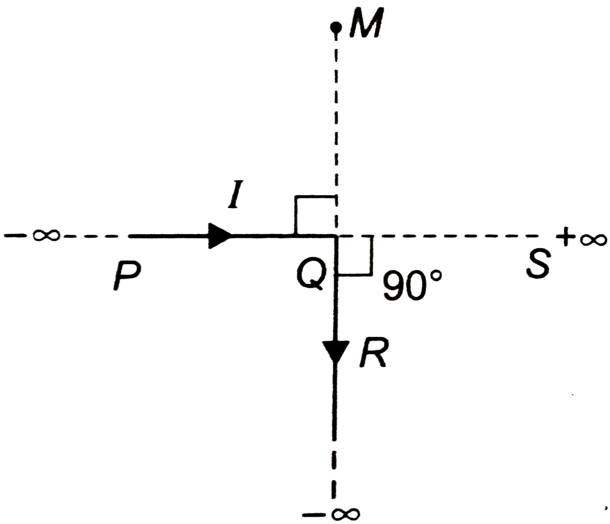
4. An infinetely long conductor PQR is bent to from a right angle as shown. A current I flows through PQR. The magnetic field due to this current at the point M is H_1.Now, another infinitely long straight conductor QS is connected at Q so that the current is $I/2$ in QR as well as in QS, the current in PQ remaining unchanged. The magnetic field at M is now H_z, the ratio H_1 / H_2 is given by



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