PHYSICS

BOOKS - DC PANDEY PHYSICS (HINGLISH)

MAGNETIC FIELD AND FORCES

Example

1. A current of $10A$ is flowing east to west in a long wire kept in the east-west direction. Find magnetic field in a horizontal plane at a distance of (i) $10cm$. North (ii) $20cm$ south from the wire, and in a vertical plane at a distance of (iii) $40cm$ downwards, (iv) $50cm$ upwards.

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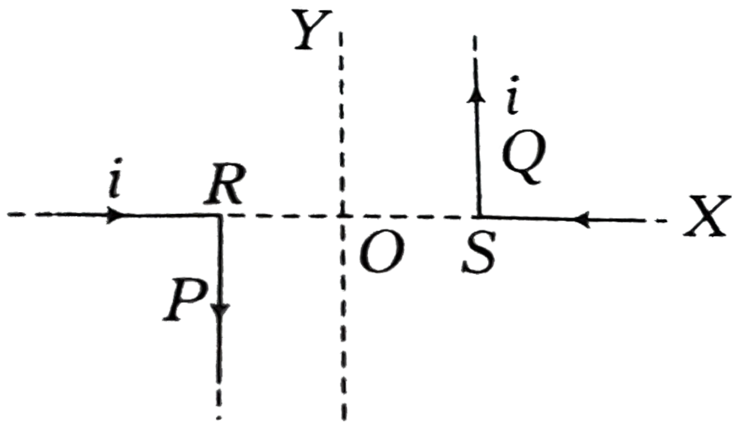
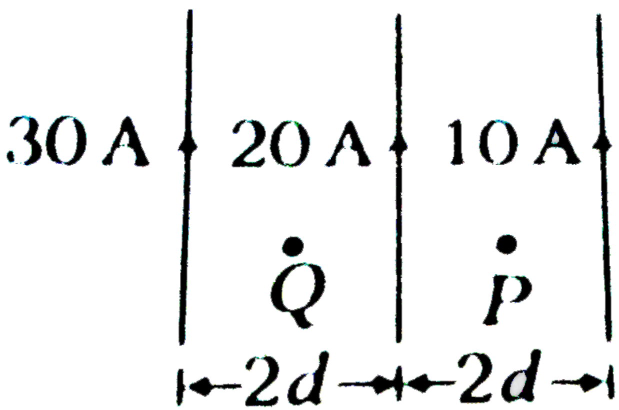
2. (i) A pair of stationary and infinitely long bent wires are aplced in the XY- plane as shown.The wires carry currents 10 A each. The segment P and Q are parallel to the Y-axis such as OS =OR = 0.02 m. Find the magnitude field at the origin O



(ii) three long wires carrying 10 A 20 A and 30 A are placed parallel to each other as shown field at P and Q



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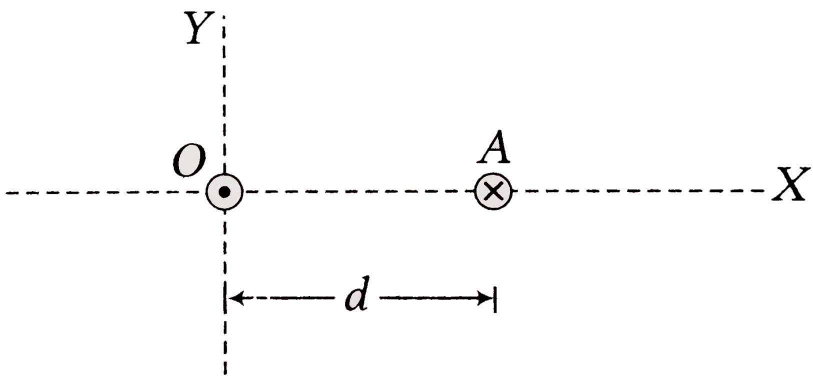
3. Two long wires carrying same currents in opposite directions are placed at separation D as shown.Predict variation of magnetic field as one moves from the point O and A



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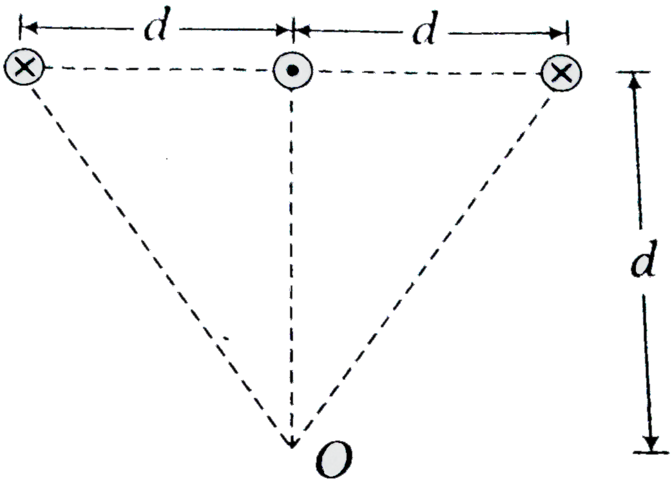
4. (i) A very long wire carrying a current I is bent at right angles .Find magnetic field at a point lying on a perpendicular to the wire , drawn through the point of bending at a distance d from it

(ii) Three long wires carrying same currect are placed as shown Find magnetic field at O.



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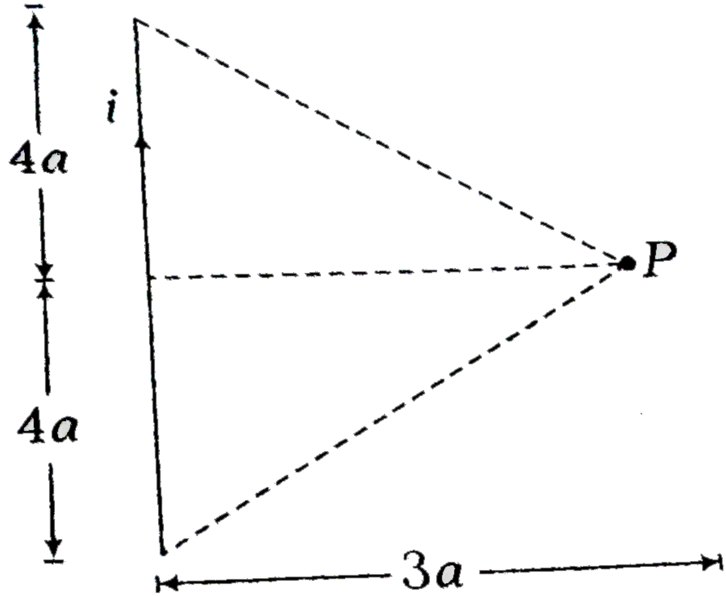
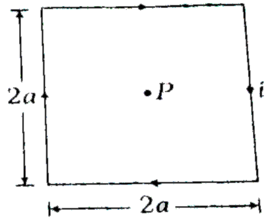
5. Evaluate magnitude and direction of magnetic field at a point P in the following cases



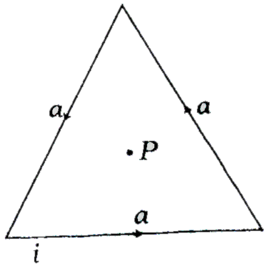
i
4a
4a
P
3a

(ii)



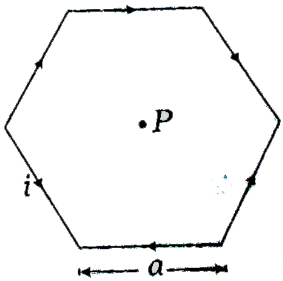
P is the centre of square.

(iii)



P is the centre of equilateral triangle.

(iv)



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6. A wire shaped to a regular hexagon of side $2cm$ carries a current of $2A$.

Find the magnetic field at the cetre of the hexagon.

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

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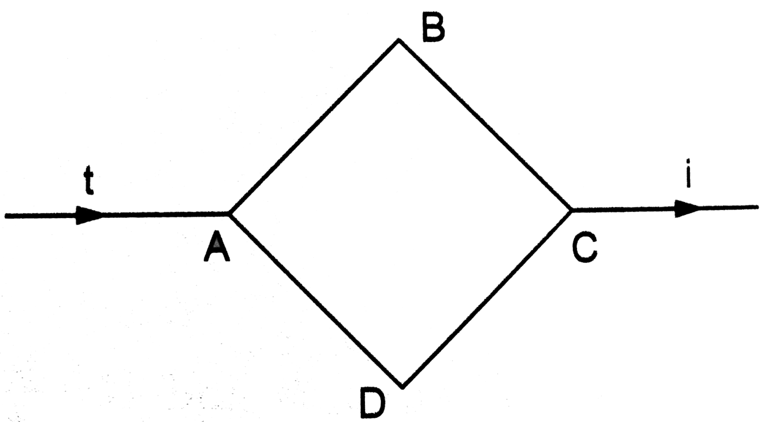
8. Figure shows a square loop ABCD with edge length a. The resistance of the wire ABC is r and that of ADC is $2r$. Find the magnetic field B at the centre of the loop assuming uniform wires. `



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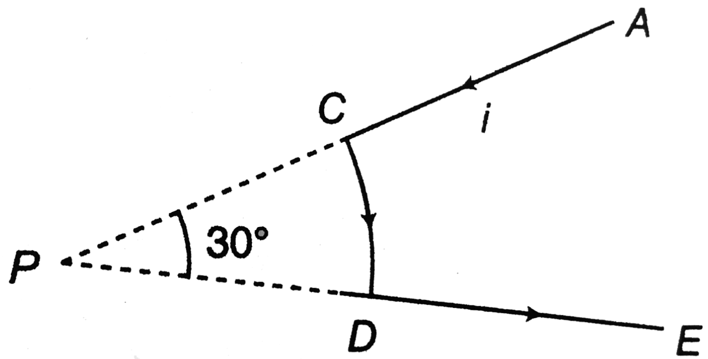
9. A current path shaped as shown in figure produces a magnetic field at P, the centre of the arc. If the arc subtends an angle of 30° and the radius of the arc is $0.6m$, what are the magnitude and direction of the field produced at P if the current is $3.0A$.



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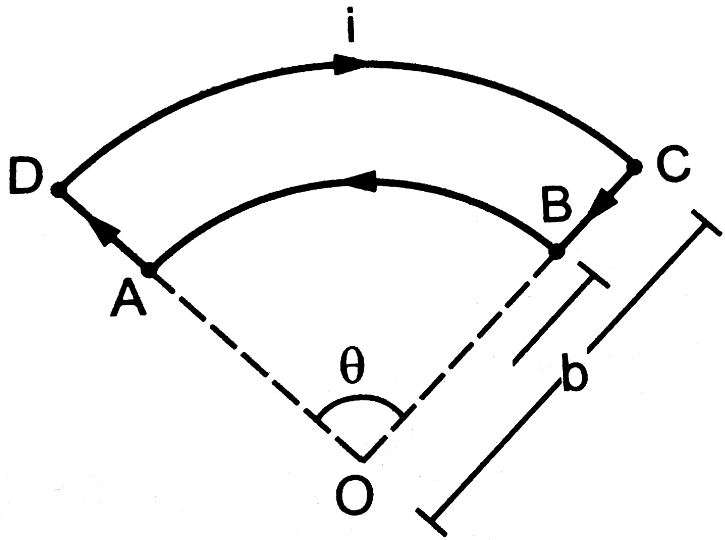
10. Figure shows a current loop having two circular arcs joined by two radial lines. Find the magnetic field B at the centre O.



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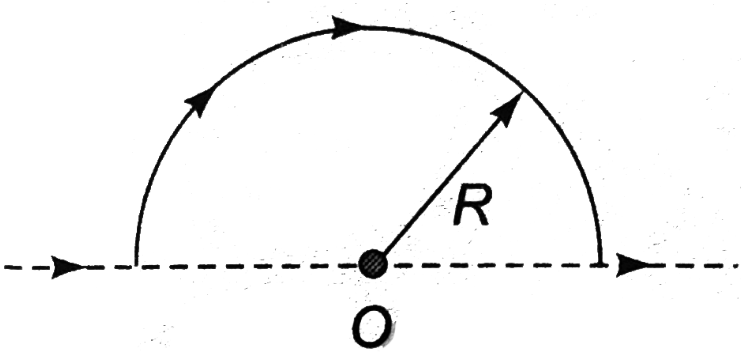
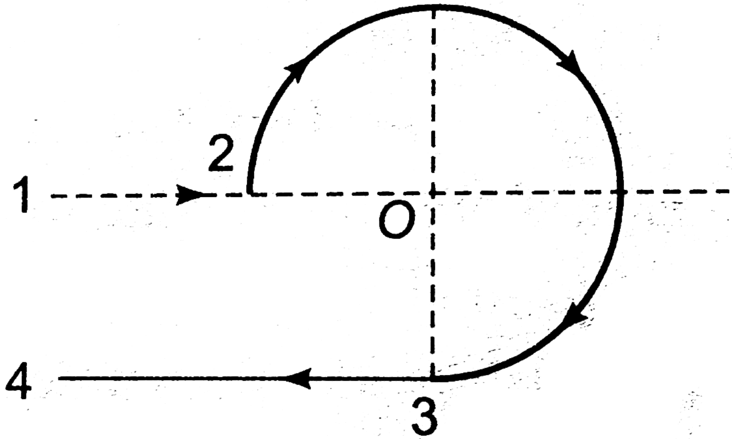
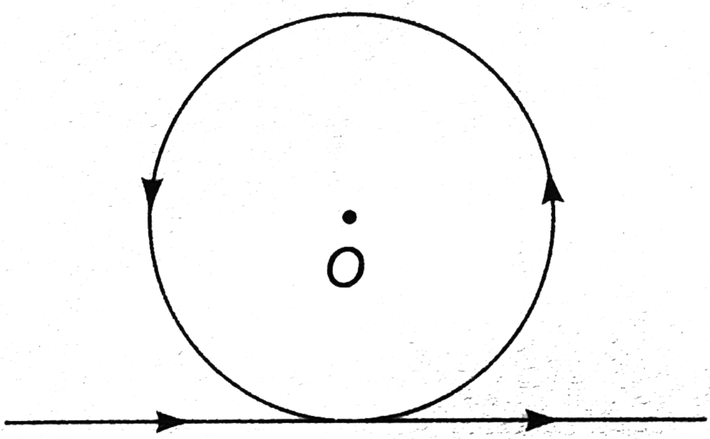
11. Calculate the magnetic field at point O in each of the following cases:

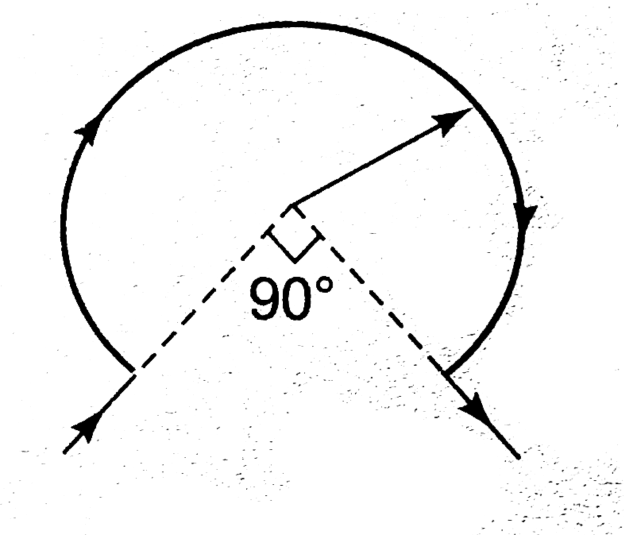




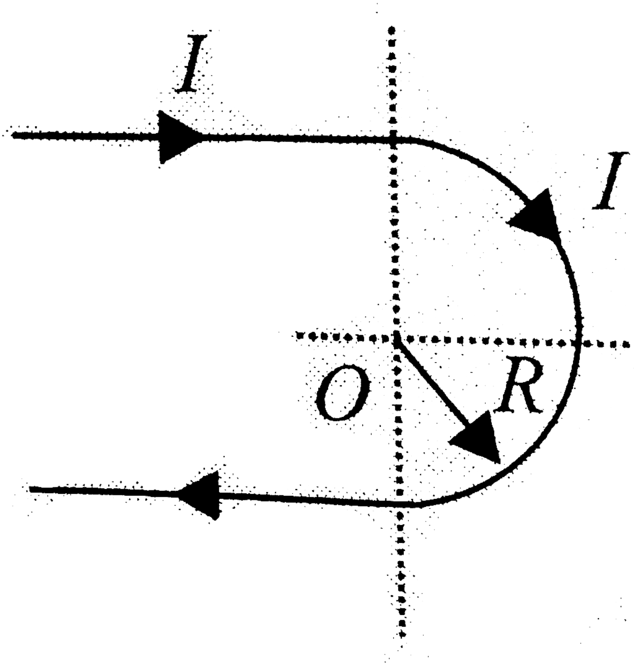
2
1
O
4
3



O



e.



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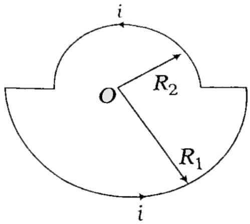
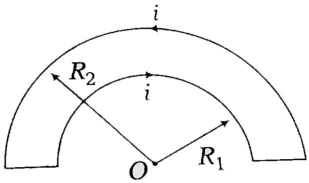
12. Find the magnitude and direction of magnetic field at point I in the following caese

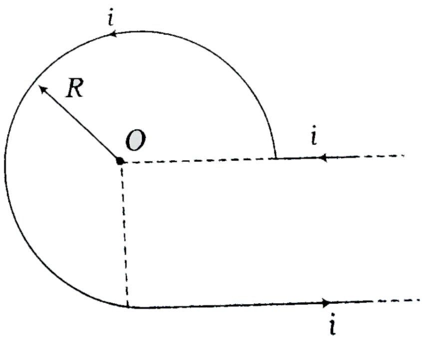
(i)



(ii)



(iii)



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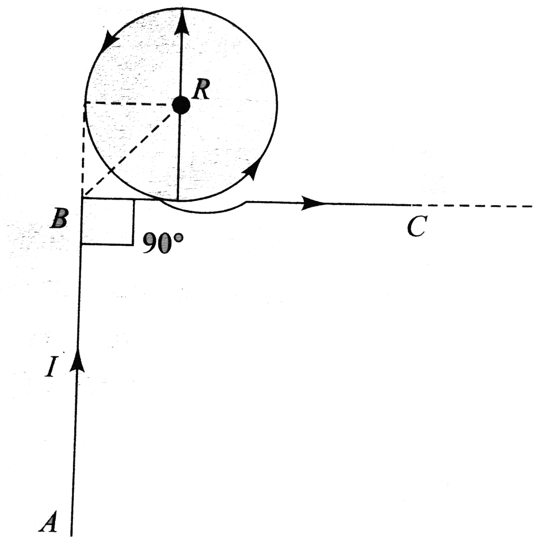
13. The magnetic field at the centre of the circular loop as shown in Fig. when a single wire is bent to form a circular loop and also extends to form straight sections is



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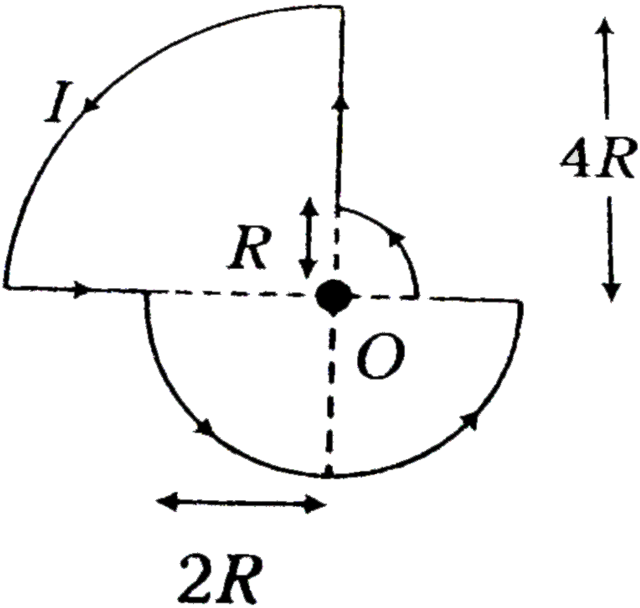
14. Find the magnetic field at the centre O of the loop shown in the figure



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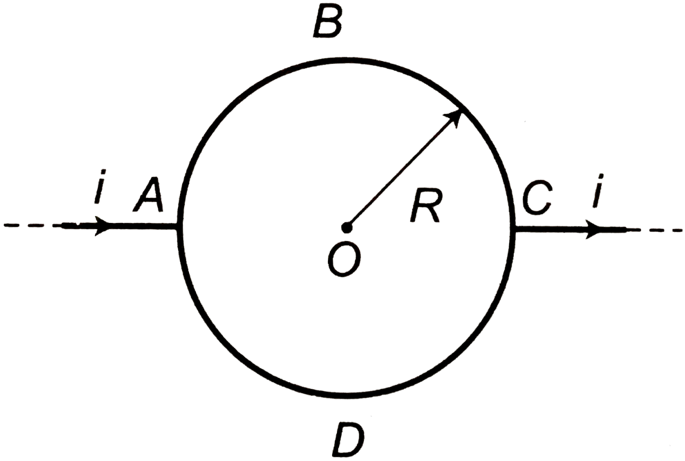
15. The resistance of wire ABC is double of resistance of wire ADC. The magnetic field at O is



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16. The magnetic field B due to a current- carrying circular loop of radius 12cm at its center is $0.50 \times (10^{-4})T$. Find the magnetic field due to this loop at a point on the axis at a distance of 5.0 cm from the centre.

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17. 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

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

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18. A 0.8 m long solenoid has 800 turns and a field density of 2.52×10^{-3} T at its certre .Find the current in the solenoid

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19. A copper wire having resistance 0.01 ohm in each metre is used to wind a 400 turn solenoid of radius 1.0 cm and length 20 cm. Find the emf of a battery which when connected across the solenoid will cause a magnetic field of (1.0×10^{-2}) T near the centre of the solenoid.

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20. A coil wrapped around a toroid has inner redius of 20.0 cm amd an outer radius of 25.0 cm .If the wire wrapped makes 800 turns and carries a current of 12.0 A Fimd the maximum and minimum values of the magnetic field within the toroid ?

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21. 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

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22. A solenoid $50cm$ long has 4 layers of windings of 350 turns each. The radius of the lowest layer is $1 \cdot 4cm$. If the current carried is $6 \cdot 0A$, estimate the magnitude of magnetic flux density (i) near the centre of the solenoid on its axis, (ii) near the ends on its axis, (iii) outside the solenoid near its centre.

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23. A charged particle of specific change (i.e.,Change per unit mass 0 0.2 C/kg has velocity $2\hat{i} - 3\hat{j} ms^{-1}$ at some instant in a unifrom magnetic field $5\hat{i} + 2\hat{j}$ (tesla).Find the acceleration of the particle at this instant

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

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25. A charged particle projected in a magnetic field

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

The acceleration of the particle is found to be

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

find the value of x

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

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27. A charged particle carrying charge $q = 10\mu C$ moves with velocity $v_1 = 10^6, s^{-1}$ at angle 45° with x-axis in the xy plane and experience a force $F_1 = 5\sqrt{2}mN$ along the negative z-axis. When the same particle moves with velocity $v_2 = 10^6 ms^{-1}$ along the z-axis, it experiences a force F_2 in y-direction.

Find the magnitude of the force F_2.

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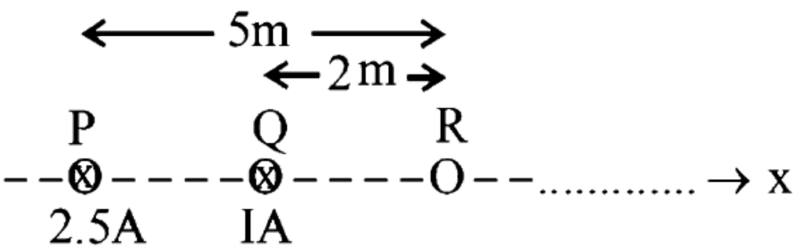
28. Two long parallel wires carrying current $2.5 amperes$ and $I ampere$ in the same direction (directed into the plane of the paper) are held at P and Q respectively such that they are perpendicular to the plane of paper. The points P and Q are located at a distance of $5 metres$ and $2 metres$ respectively 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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29. What is the value of B that can be set up at the equator to permit a proton of speed $10^7 m/s$ to circulate around the earth?

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

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30. A proton and α - particle 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 α - particle`.

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31. A charged particle having mass m and charge q is acceleration by a potential difference V, it files through a uniform tranverse magnetic field b.The field occupies a region of space d.Find the time interval for which it remains inside the magnetic field

(i) An α particle is acceleration by a potential difference of 10^4V. Find the change in tis direction of motiom if it enters normally in a region of thicknees 0.1 , having transverse magnetic induction of $0.1T\left(m_{aplha} = 6.4 \times 10^{-27} kg\right)$

(ii) a 10 g bullet having a charge of $4\mu C$ is fired at a speed $270ms^{-1}$ in a horizontal direction,A vertical magnetic field as it travels through 100 m .Make appropriate approximations

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32. 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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33. A beam of protons with a velocity $4 \times 10^5 m / \sec$ enters a uniform magnetic field of $0.4T$ at an angle of 37° to the magnetic field. Find the radius of the helical path taken by proton beam. Also find the pitch of helix.

$\sin 37^\circ = 3/5 \cos 37^\circ = 4/5. m_p \cong 1.6 \times 10^{-27} kg.$

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34. 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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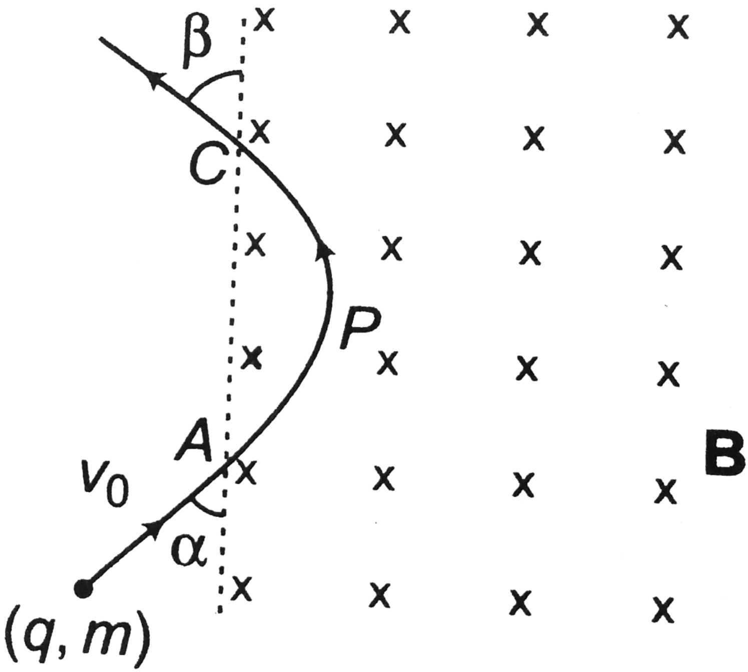
35. A charged particle (q, m) enters uniform magnetic field B at angle α shown in figure with speed v_0. Find



a. The angle β at which it leves the magnetic field

b. time spent by the particle in magnetic field and

c. the distance C.

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36. A charge particle having charge 2 coulomb is thrown with velocity $2\hat{i} + 3\hat{j}$ inside a region having $\overrightarrow{E} = 2\hat{j}$ and magnetic field $5\hat{k}$. Find the initial Lorentz force acting on the particle

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37. A proton beam passes without deviation through a region of space where there are uniform transverse mutually perpendicular electric and magnetic field with E and B Then the beam strikes a grounded target. Find the force imparted by the beam on the target if the beam current is equal to I .

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38. The magnetic flux density applied in a cyclotron is $3 \cdot 5T$. What will be the frequency of electric field that must be applied between the dees in order (a) to accelerate protons (b) α-particles? mass of proton $1 \cdot 67 \times 10^{-27} kg.$

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39. Magnetic field applied on a cyclotron is $0 \cdot 7T$ and radius of its dees is $1 \cdot 8m$. What will be the energy of the emergent protons in MeV? Mass of proton $= 1 \cdot 67 \times 10^{-27} kg$.

A. 76

B. 70

C. 67

D. 50

Answer: A

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40. Deuterons in a cyclotron describes a circle of radius $32.0cm$. Just before emerging from the $D's$. The frequency of the applied alternating voltage is $10MHz$. Find, (a) the magnetic flux density $(i.e.,$ the magnetic field $), (b)$ the energy and speed of the deuterons upon emergence.

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41. A wire of length a'a carries a current I along the y-axis.A magnetic field exists given by

$$B = B_0\left(3\hat{i} + 2\hat{j} + \hat{k}\right)T$$

Calculate magnetic force in vector from and its magnitude

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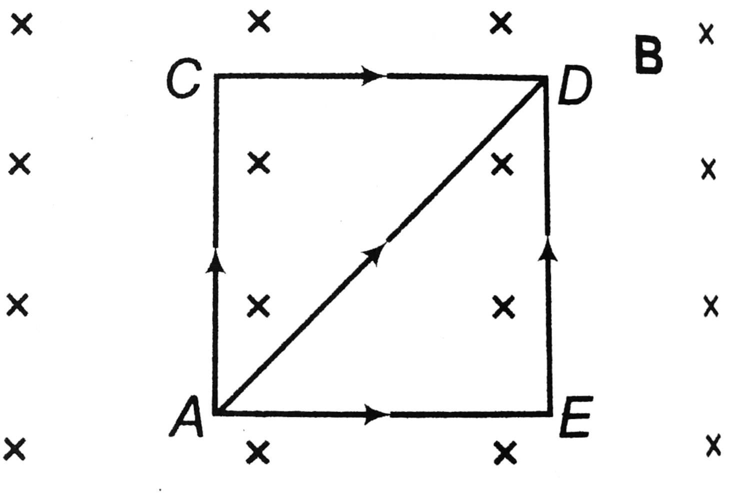
42. A square of side $2.0m$ is placed in a uniform magnetic field $B = 2.0T$ in a direction perpendicular to the plane of the square inwards. Equal current $i = 3.0A$ is flowing in the directions shown in figure. Find the magnitude of magnetic force on the loop.



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43. A straight wire of length 30 cm and mass 60 mg lies in a direction 30° east of north.The earth's magnetic field at this is horizontal and has a magnitude of 0.8 G.What current must bre passed through the wire,so that it may float in air ?

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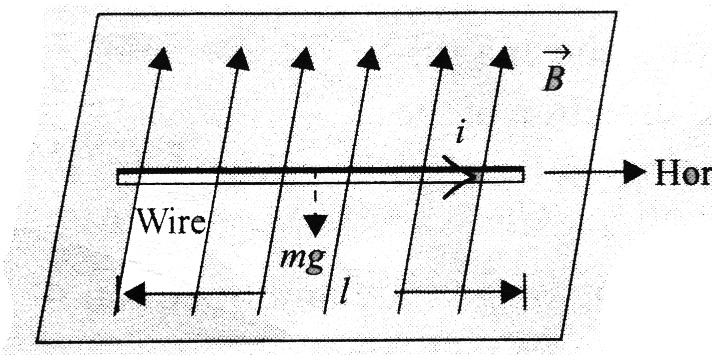
44. A straight wire of mass 200 g and length 1.5 m carries a current of 2 A. It is suspended in mid-air by a uniform horizontal magnetic field B. What is the magnitude of the magnetic field?



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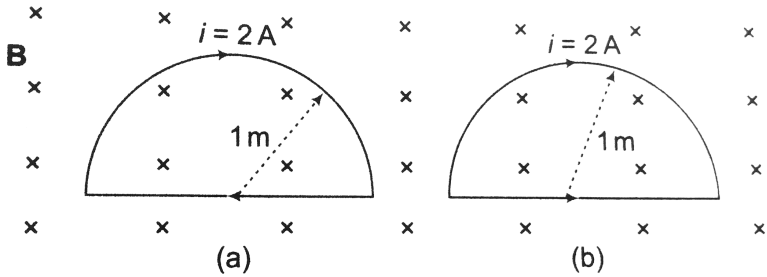
45. In the figure shown a semicircular wire loop is placed in a uniform magnetic field $B = 1.0T$. The plane of the loop is perpendicular to the magnetic field. Current $i = 2A$ flows in the loop in the directions shown. Find the magnitude of the magnetic force in both the cases a and b. The radius of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



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46. A wire, carriying a current I is kept in the x-y plame the curve y -(2 cm)

$A \sin\left(\frac{2\pi}{\lambda} x\right). Amag \neq ticfieldB \exists \in thez - direction. F \in dthemagnit$

x=lambda//2`

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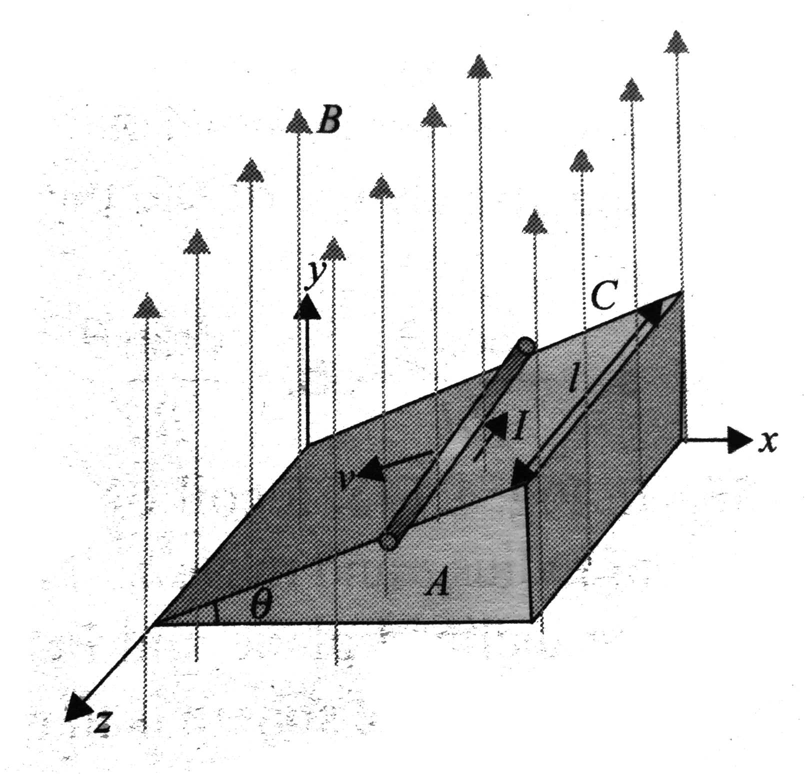
47. A conducting rod of length l and mass m is moving down a smooth inclined plane of inclination θ with constant i is flowing in the conductor in a direction perpendicular to paper inwards. A vertically upward magnetic field $\overrightarrow{B}$ exists in space. Then, magnitude of magnetic field $\overrightarrow{B}$ is



A. $\left(\frac{mg}{iL\cos\theta}\right)$

B. $\left(\frac{mg}{iL\tan\theta}\right)$

C. $\left(\frac{mg\tan\theta}{iL}\right)$

D. $\left(\frac{mg}{iL\sin\theta}\right)$

Answer: C

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48. 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

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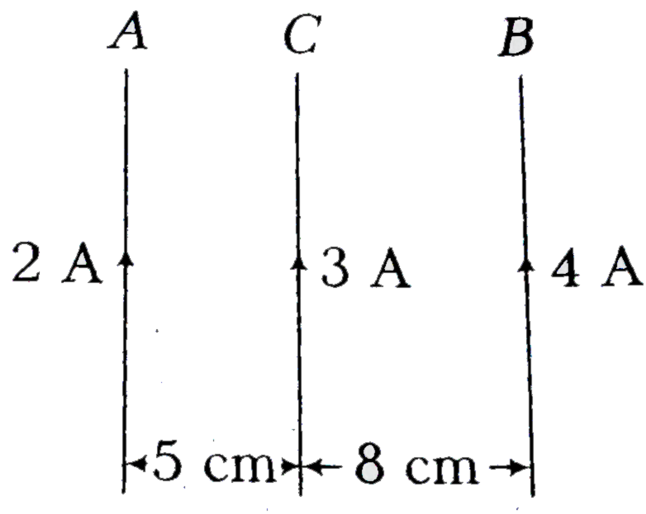
49. A and B are two infinitely long straight parallel cinductors C is another straight of length 1 m parallel to A and B direction of the force experienced by C



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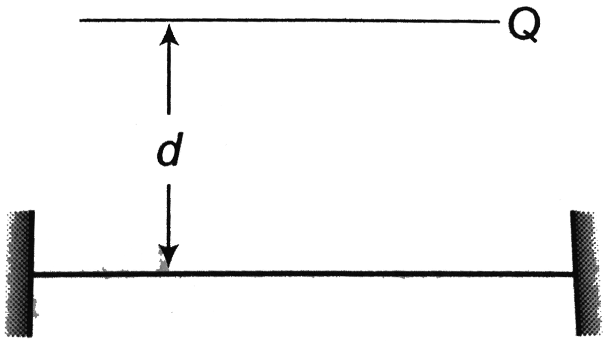
50. A long horizontal wire P carries of $50A$. It is rigidly fixed. Another fine wire Q is placed directly above and parallel to P. The wieght of wire Q is $0.075N/m$ and carries a current of $25A$. Find the position of wire Q from

P so that the wire Q remains suspended due to magnetic repulsion.



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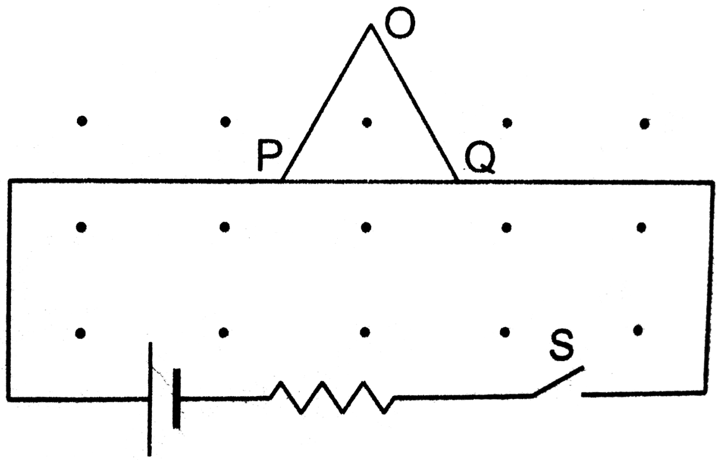
51. Shows a rod PQ of length 20.0 cm and mass 200g suspended through a fixed point O by two threads of lengths 20.0 cm each. A magnetic field of strenght 0.500 T exists in the vicinity of the wire PQ as shown in the figure. The exists in the vicinity of the wire PQ as shown in the figure. The wires conecting PQ with the battery are loose and exert no force on PQ. (a) find the tension in the threads when the switch S is open. (b) A current of 2.0 A is established when the switch S is closed. Find the tension in the threads now.



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52. Two electrons move parallel to each other with equal speed $'V'$ the ratio of magnetic $\&$ electric force between them is

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53. Find the magnetic moment (in Am^2) of a thin round loop with current if the radius of the loop is equal to $R = 100mm$ and the magnetic induction at its centre is equal to $B = 6.0\mu T$.

A. 0.02

B. 0.03

C. 0.04

D. 0.06

Answer: B

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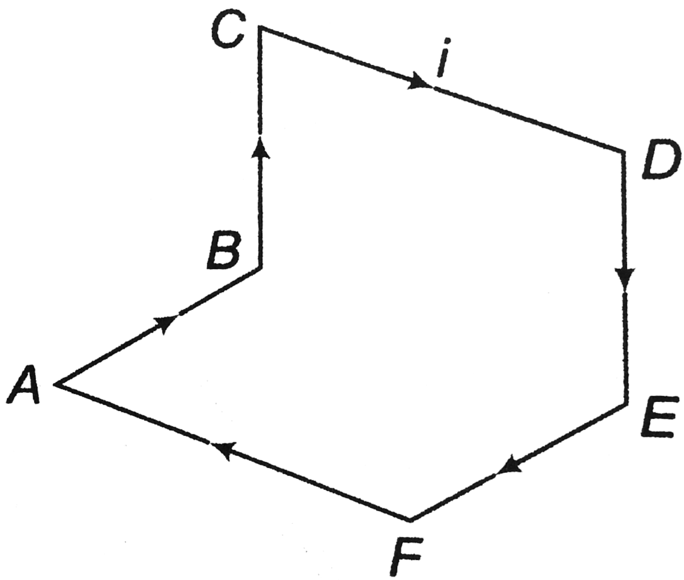
54. Find the magnitude of magetic moment of the current carrying lop $ABCDEFA$. Each side of the loop is $10cm$ long and current in the loop is $i = 2.0A$



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

a. What value of magnetic field is set up at the centre of the orbit?

b. What is the equivalent magnetic dipole moment?

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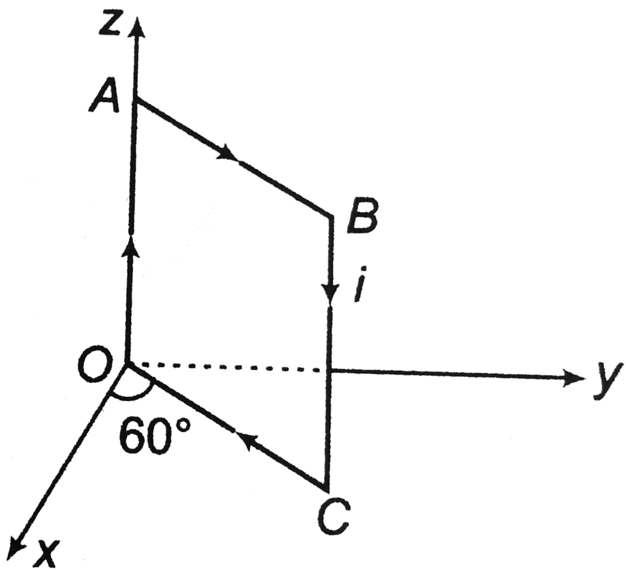
56. A square loop $OABCO$ of side of side l carries a current i. It is placed as shown in figure. Find the magnetic moment of loop.



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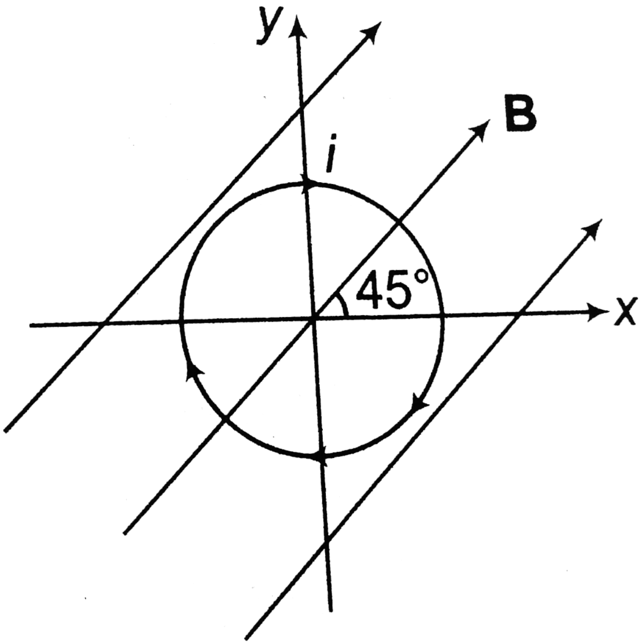
57. A circular loop of radius $R = 20$ cm is placed in a uniform magnetic field $B = 2T$ in xy-plane as shown in figure. The loop carries a current $i = 1.0A$ in the direction shown in figure. Find the magnitude of torque acting on the loop.



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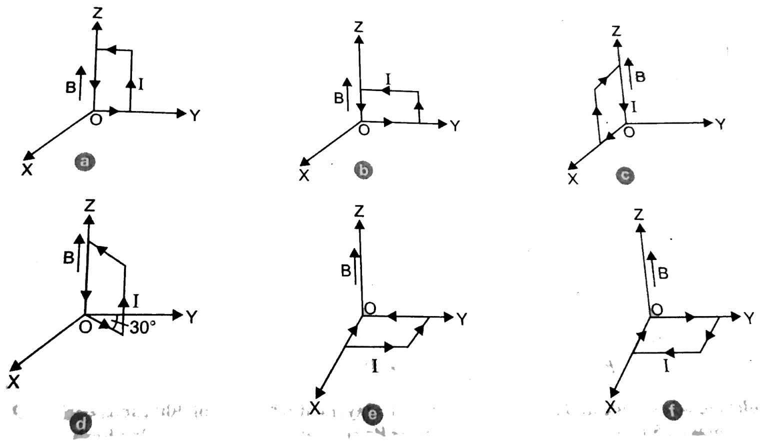
58. A uniform magnetic field of $3000G$ is established along the positive z-direction. A rectangular loop of sides $10cm$ and $5cm$ carries a current $12A$. What is the torque on the loop in the different cases shown in the figure. What is the force on each case? Which case corresponds to stable equilibrium?



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59. The coil of a moving coil galvanometer has an effective area of $5 \times 10^{-2} m^2$. It is suspended in a magnetic field of $2 \times 10^{-2}\ Wbm^{-2}$.If the torsional constant of the senpension fibre is $4 \times 10^{-9} \text{Nmdeg}^{-1}$. Then find its current sensitivity in degree per microampere

A. 0.25

B. 25

C. 50

D. 2.5

Answer: A

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60. A moving coil galvanometer has 100 turns and each turn has an area $2.0cm^2$. The magnetic field produced by the magnet is $0.01T$. The deflection in the coil is 0.05 radian when a current of $10mA$ is passed through it. Find the torsional constant of the suspension wire.

A. 44×10^{-7} Nmdeg^{-1}

B. 4×10^{-5} Nmdeg^{-1}

C. 0.4×10^{-5} Nmdeg^{-1}

D. 40×10^{-5} Nmdeg^{-1}

Answer: B

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61. A current of 0.5 A is passed through the coil of a galvanometer having 500 turns and each turns has an average area of $3 \times 10^{-4} m^2$ if a torque of 1.5 N-m is required for this coil carrying same current to set it parallel to a magnetic field calculate the strength of the magnetic field

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Check Point

1. Which of the following gives the value of magnetic field due to small current elememt accordong to Biot -Savart's law

A. $\frac{i\Delta l \sin\theta}{r^2}$

B. $\frac{\mu_0}{4\pi}\frac{i\Delta l \sin\theta}{r}$

C. $\frac{\mu_0}{4\pi}\frac{i\Delta l \sin\theta}{r^2}$

D. $\frac{\mu_0}{4\pi}\frac{i\Delta l \sin\theta}{r^3}$

Answer: C

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2. A current $'I'$ flows along an infinitely long straight conductor. If $'r'$ is the perpendicular distance of a point from the lower end of the conductor, then the magnetic induction B is given by

A. $1/r^2$

B. 1/r

C. $1/r^3$

D. $1/\sqrt{r}$

Answer: B

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3. The strength of the magnetic field at a point r near a long straight current carrying wire is B. The field at a distance $\frac{r}{2}$ will be

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

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

C. 2B

D. 4B

Answer: C

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4. The current is flowing in south direction along a power line. The direction of magnetic field above the power line (neglecting earth's field) is

A. south

B. east

C. north

D. west

Answer: D

Watch Video Solution

5. Two infinitely long, thin, insulated, straight wires lie in the x-y plane along the x- and y- axis respectively. Each wire carries a current I, respectively in the positive x-direction and positive y-direction. The magnetic field will be zero at all points on the straight line:

A. $y = x$

B. $y = -x$

C. $y = x-1$

D. $y = -x+1$

Answer: A

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6. The magnetic field produced at the center of a current carrying circular coil of radius r, is

A. directly proportional to r

B. inversely proportional to r

C. directly proportional to r^2

D. inversely proportional to r^2

Answer: B

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7. An arc of a circle of raduis R subtends an angle $\frac{\pi}{2}$ at the centre. It carriers a current i. The magnetic field at the centre will be

A. $\frac{\mu_0 i}{2R}$

B. $\frac{\mu_0 i}{8R}$

C. (mu_(0)i)/(4R)`

D. $\frac{2\mu_0 i}{5R}$

Answer: B

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8. A particle carrying a charge equal to 100 times the charge on an electron is rotating per second in a circular path of radius $0.8 metre$. The value of the magnetic field produced at the centre will be ($\mu_0 =$ permeability for vacuum)

A. $\frac{10^{-7}}{\mu_0}$

B. $10^{-17}\mu_0$

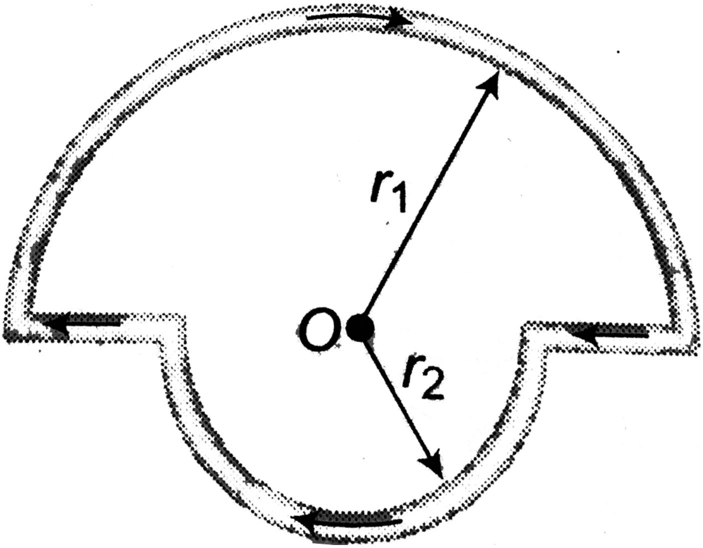
C. $10^{-6}\mu_0$

D. $10^{-7}\mu_0$

Answer: B

Watch Video Solution

9. In the figure shown there are two semicircles of radii r_1 and r_2 in which a current i is flowing. The magnetic induction at the centre O will be



A. $\frac{\mu_0 i}{4}(r_1 + r_2)$

B. $\frac{\mu_0 i}{4}(r_1 - r_2)$

C. $\frac{\mu_0 i}{4}\left[\frac{r_1 + r_2}{r_1 r_2}\right]$

D. $\frac{\mu_0 i}{4}\left[\frac{r_1 - r_2}{r_1 r_2}\right]$

Answer: C

Watch Video Solution

10. A current of $0.1A$ circulates around a coil of 100 turns and having a radius equal to $5cm$. The magnetic field set up at the centre of the coil is ($\mu_0 = 4\pi \times 10^{-7}$ weber/amper-metre)

A. $5\pi \times 10^{-5}T$

B. $8\pi \times 10^{-5}T$

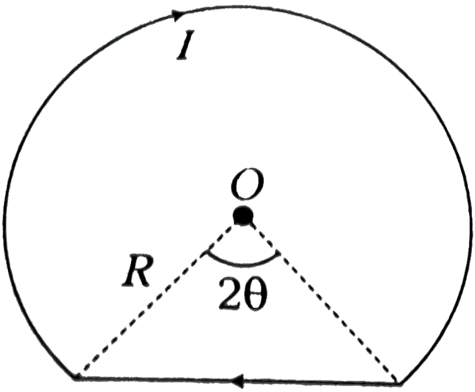
C. $4\pi \times 10^{-5}T$

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

Answer: C

Watch Video Solution

11. A current I flows through a closed loop as shown in figure .The magnetic field at the centre O is



A. $\frac{\mu_0 I}{2\pi R}(\pi - \theta + \tan\theta)$

B. $\frac{\mu_0 I}{2\pi R}(\pi - \theta + \sin\theta)$

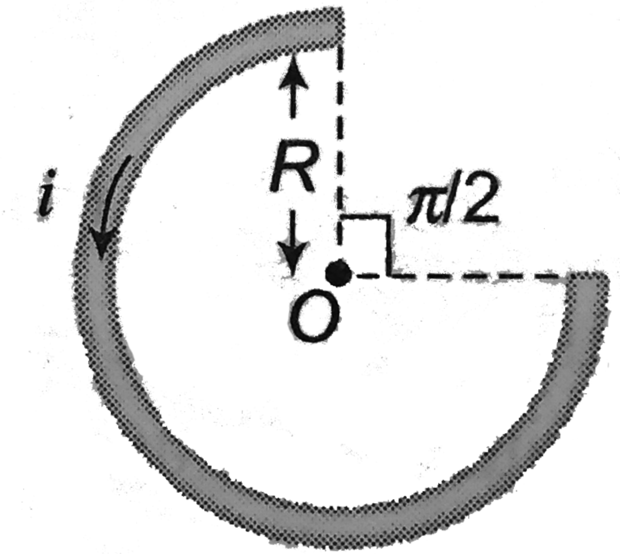
C. $\frac{\mu_0 I}{2\pi R}(\theta + \sin\theta)$

D. None of these

Answer: A

Watch Video Solution

12. A current i ampere flows in a circular arc of wire whose radius is R, which subtend an angle $3\pi/2$ radian at its centre. The magnetic induction B at the centre is



A. $\frac{\mu_0 i}{R}$

B. $\frac{\mu_0 i}{2R}$

C. $2\mu_0 i \frac{)}{R}$

D. $3\mu_0 \frac{i}{8R}$

Answer: D

Watch Video Solution

13. Magnetic field due to a ring having n turns at a distance x on its axis is proportional to (if $r =$ radius of ring)

A. $\frac{r}{(x^2 + r^2)}$

B. $\frac{r}{(x^2 + r^2)^{3/2}}$

C. $\frac{nr^2}{(x^2 + r^2)^{3/2}}$

D. $\frac{n^2 r^2}{(x^2 + r^2)^{3/2}}$

Answer: C

Watch Video Solution

14. The ratio of the magnetic field at the centre of a current carrying coil of the radius a and at distance $'a'$ from centre of the coil and perpendicular to the axis of coil is

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

B. $\sqrt{2}$

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

D. $2\sqrt{2}$

Answer: D

Watch Video Solution

15. A circular current carrying coil has a radius R. The distance from the centre of the coil on the axis where the magnetic induction will be $(1/8)^{th}$ of its value at the centre of the coil is,

A. $\sqrt{3}R$

B. $R/\sqrt{3}$

C. $(2/\sqrt{3})R$

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

Answer: A

Watch Video Solution

16. 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. $(35/4)\mu_0$

B. $(\mu_0/80)$

C. $(7/80)\mu_0$

D. $(25/2)\mu_0$

Answer: B

Watch Video Solution

17. A length of wire carries a steady current. It is first bent to form a circular coil of one turn. The same length is now bent more sharply to give a loop of two turns of smaller radius. The magnetic field at the centre caused by the same current now will be

A. A quarter of its first is

B. unaltered

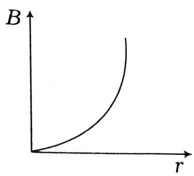
C. four times of its first value

D. two times of its first value

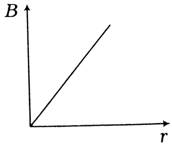
Answer: C

Watch Video Solution

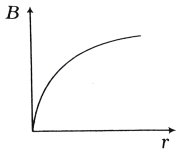
18. Which of the following figure shown the magnetic flux denstiy b at a distance r from a long straight rod carrying a steady current I ?

A. (a) 

B. (b)



C. (c)



D. (d)

Answer: D

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19. In using Ampere's law, to find the magnetic field inside a straight long solenoid the loop that is taken is

A. A circular loop in a with the soleniod

B. a rectangular loop in a plane is perpendicular to the axis of the solenoid

C. A rectangulr loop in a plane containing the axis of the solenoid the loop being totally within the soleniod

D. A rectangular loop in a plane containing the axis of the soleniod the loop being partly inside and partly outside it

Answer: D

Watch Video Solution

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

A. moves in the direction of the field

B. moves in an opposite direction of the field

C. remains stationary

D. stats sprining

Answer: C

Watch Video Solution

21. A particle of mass m and charge Q moving with a velocity v enters a region on uniform field of induction B Then its path in the region is s

A. Aways circular

B. circular, If $v \times B = 0$

C. circular,If $v.\ B = 0$

D. None of these

Answer: C

Watch Video Solution

22. An electron is moving on a circular path of radius r with speed v in a transverse magnetic field B. e/m for it will be

A. $\frac{v}{B}r$

B. $\frac{B}{r}v$

C. Brv

D. $v\frac{r}{B}$

Answer: A

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23. An electron and a proton with equal momentum enter perpendicularly into a uniform magnetic field, then

A. the path of proton shall be more curved then that of electron

B. the path of proton shall be less curved then that of electron

C. Both are equally curved

D. path of both will be straight line

Answer: C

Watch Video Solution

24. A charge particle travels along a straight line with a speed v in region where both electric field E and magnetic field b are present.It follows that

A. $|E| = |B|$ and the two field are perpendicular

B. $|E| = v|B|$ and the two field are perpendicular

C. $|B| = v|E|$ and the two field are parallel

D. $|B| = v|E|$ and the two fields are perpendicular

Answer: B

Watch Video Solution

25. A proton, a deuteron and an α- particle having the same kinetic energy are moving in circular trajectors in a constant magnetic field. If r_p, r_d and r_α denote respectively the radii of the trajectories of these particles then

A. $r_\alpha = r_p < r_d$

B. $r_{\alpha} > r_d > r_p$

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

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

Answer: A

Watch Video Solution

26. When a charged particle enters a uniform magnetic field its kinetic energy

A. remains constant

B. increases

C. decreases

D. becomes zero

Answer: D

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27. A proton of energy $8eV$ is moving in a circular path in a uniform magnetic field. The energy of an alpha particle moving in the same magnetic field and along the same path will be

A. 4eV

B. 22eV

C. 8eV

D. 6eV

Answer: A

Watch Video Solution

28. A charged particle of mass m and charge q describes circular motion of radius r in a unifrom magnetic fiels of strenght b the frequency of revolution is

A. $\frac{Bq}{2\pi m}$

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

C. $\frac{2\pi m}{Bq}$

D. $\frac{Bq}{2\pi q}$

Answer: A

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29. A proton and an electron both moving with the same velocity v enter into a region of magnetic field directed perpendicular to the velocity of the particles. They will now move in cirular orbits such that

A. their time periods will be same

B. the time period for proton electron will be higher

C. the time period for electron will be higher

D. their orbital radii will be same

Answer: B

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30. If a charged particle is a plane perpendicular to a uniform magnetic field with a time period T Then

A. $T^2 \propto r^3$

B. $T^2 \propto r$

C. $T \propto r^2$

D. $T \propto r^0$

Answer: D

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31. A particle is projected in a plane perpendicular to a uniform magnetic field. The area bounded by the path described by the particle is proportional to

A. the velocity

B. the momentum

C. the kinetic energy

D. None of these

Answer: C

Watch Video Solution

32. Lorentx force can be calculated by using the formula.

A. $F = q(E + v \times B)$

B. $F = q(E - v \times B)$

C. $F = q(E + v. B)$

D. $F = q(E \times v + B)$

Answer: B

Watch Video Solution

33. If a electron velocity is (2hatixx3hatj) and $it \subset jected \rightarrow amag \neq ticfield$4hatk` then

A. speed of electon will charge

B. path of electron will charge

C. Both (a) and (b)

D. None of above

Answer: B

Watch Video Solution

34. 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.

A. 0.036

B. $0.012m$

C. $0.024m$

D. $0.048m$

Answer: B

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35. A proton and a deuteron both having the same kinetic energy, enter perpendicularly into a uniform magnetic field B. For motion of proton and deuteron on circular path or radius R_p and R_d respectively, the correct statement is

A. $R_d = \sqrt{2}R_p$

B. $R_d = R_9p) / \sqrt{2}$

C. $R_d = R_p$

D. $R_d = 2R_p$

Answer: A

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36. If a charged particle at rest experiences no electromagnetic force,

A. electron field must be zero

B. magnetic field must be zero

C. electron field must be zero

D. None of above

Answer: A

Watch Video Solution

37. if a charged particle projected in a gravity free room deflects,

A. there must be an electric field

B. there must be a magnetic field

C. Both fields cannot be zero

D. None of above

Answer: C

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38. Two ions having masses in the ratio $1:1$ and charges $1:2$ are projected into uniform magnetic field perpendicular to the field with speeds in the ratio $2:3$. The ratio of the radius of circular paths along which the two particles move is

A. $4:3$

B. $2:3$

C. $3:1$

D. $1:4$

Answer: A

Watch Video Solution

39. Which of the follwing particles will have minimum frequency of revolution when projected with the same velocity perpendicular to a magnetic field?

A. Li^{+}

B. Electron

C. Proton

D. He^{+}

Answer: A

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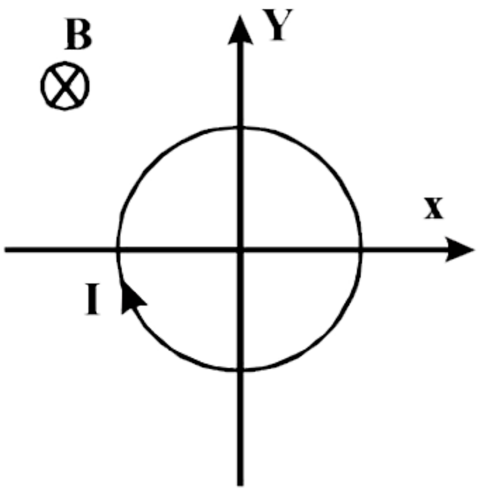
40. A conducting loop carrying a current I is placed in a uniform magnetic field ponting into the plane of the paper as shown. The loop will have a tendency to



A. contract

B. expand

C. move towards +ve X-axis

D. move towards -ve X-axis

Answer: B

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41. Two parallel wires carrying current in the same direction attract each other while two beams of electrons travelling in the same direction repel each other. Why?

A. potential difference between them

B. mutual inductance between them

C. electric force between them

D. magnetic force between them

Answer: D

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42. Two parallel conductors A and B of equal lengths carry currents I and $10I$, respectively, in the same direction. Then

A. A and B will repel each other with same force

B. A and B with attract each other with same force

C. A will attract B but B will repel A

D. A and B will attract each other with different forces

Answer: B

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43. Two thin, long, parallel wires, separated by a distance 'd' carry a current of 'i' A in the same direction. They will

A. attract each other with a force of $\mu_0 i / 2\pi d^2$

B. repel each other with a force of $\mu_0 i^2 / 2\pi d^2$

C. attract each other with a force of $\mu_0 i / 2\pi d$

D. repel each other with a force of $\mu_0 i / 2\pi d$

Answer: C

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

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

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

D. $\frac{-2F}{3}$

Answer: D

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45. 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. $8 \times 10^{-5} N$

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

C. $4 \times 10^{-7} N$

D. $8 \times 10^{-7} N$

Answer: A

Watch Video Solution

46. The force between two long parallel wires A and B carrying current is $0.004 Nm^{-1}$. The conductors are 0.01 m apart. If the current in conductor A is twice that of conductor B, then the current in the conductor B would be

A. $5A$

B. $50A$

C. $10A$

D. $100A$

Answer: C

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47. A metallic loop is placed in a magnetic field. If a current is passed through it, then

A. the ring will feel a force of attraction

B. the ring will feel a force of repulsion

C. it will move to and fro about its centre of gravity

D. None of above

Answer: D

View Text Solution

48. A current carrying loop is placed in a uniform magnetic field. The torque acting on it does not depend upon

A. shape of the loop

B. area of the loop

C. number of turns in the loop

D. strength of the current

Answer: A

Watch Video Solution

49. Current i is carried in a wire of length L. If the wire is turned into a circular coil, the maximum magnitude of torque in a given magnetic field B will be

A. $\frac{L^2 B^2}{2}$

B. $\frac{L^2 B}{2}$

C. $\frac{L^2 iB}{4\pi}$

D. $\frac{L^2 B}{4\pi}$

Answer: C

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50. A circular coil of $20 turns$ and radius $10 cm$ carries a current of $5A$. It is placed in a uniform magnetic field of $0 \cdot 10T$. Find the torque acting on the coil when the magnetic field is applied (a) normal to the plane of the coil (b) in the plane of coil. Also find out the total force acting on the coil.

A. 31.4 Nm

B. 3.14 Nm

C. 0.314 Nm

D. zero

Answer: D

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51. The pole pieces of the magnet used in a pivoted coil galvanometer are

A. plane surfaces of a bar magnetic

B. plane surfaces of a horse-shoe magnet

C. cylindrical surfaces of a bar magnet

D. cylindrical sufaces of a horse-shoe magnet

Answer: D

View Text Solution

52. In a moving coil galvanometer, the deflection of the coil q is related to the electrical current i by the relation

A. $I \propto \tan \theta$

B. $I \propto \theta$

C. $I \propto \theta^2$

D. $I \propto \sqrt{\theta}$

Answer: B

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53. In order to increase the sensitivity of a moving coil galvanometer, one should decrease

A. the strength of its magnet

B. the torsional constant of its suspension

C. the number of turns in its coil

D. the area of its coil

Answer: B

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54. Two galvanometers A and B require 3 mA and 5 mA respectively to produce the same deflection of i_0 division. Then

A. A is more sensitive than B

B. B is more sensitive than A

C. A and B are equally sensitive

D. sensitiveness of B is 5/3 times of that of A

Answer: A

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Taking It Together

1. Biot-Savart law indicates that the moving electrons (velocity $\overrightarrow{v}$) produce a magnetic field $\overrightarrow{B}$ such that

A. B is perpendicular to v

B. B is parallel to v

C. it obeys inverse cube law

D. it is along the line joining the electron and point of observation

Answer: A

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2. A current flows in a conductor from east to west. The direction of the magnetic field at a points above the conductor is

A. towards north

B. towards south

C. towards east

D. towards west

Answer: A

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3. In a cyclotron, a charged particle

A. undergoes acceleration all the time

B. speeds up between the does because of the magnetic fiels

C. speeds up in a dee

D. slows down within a dee and speeds up between dees

Answer: A

Watch Video Solution

4. An electron is projected with uniform velocity along the axis of a current carrying long solenoid. Which of the following is true?

A. The electron will be accelerated along the axis

B. The electron path will be circular about the axis

C. The electron will experience a force at 45° to the axis and hence execute a helical path

D. The electron will continue to move with uniform velocity along the axis of the solenoid

Answer: D

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5. A proton is moving along the negative direction of X-axis in a magnetic field directed along the positive direction of Y-axis. The proton will be deflected along the negative direction of

A. X-axis

B. Y-axis

C. Z-axis

D. None of these

Answer: C

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6. Let $[\varepsilon_0]$ denote the dimensional formula of the permittivity of the vacuum, and $[\mu_0]$ that of the permeability of the vacuum. If $M = mass, L = \leq n > h, T = time$ and $I = e \leq ctriccurrent,$

A. $\varepsilon_0 = [M^{-1}L^{-3}T^2I]$

B. $\varepsilon_0 = [M^{-1}L^{-3}T^4I^2]$

C. $\mu_0 = [MLT^{-2}I^{-2}]$

D. $\mu_0 = [ML^2T^{-1}I]$

Answer: C

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7. 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

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8. A current $-$ carrying circular loop of radius R is placed in the $XY -$ plane with centre at the origin. Half of the loop with $x > 0$ is now bent so that is now lies in the $XY -$ plane

A. The magnitude of magnetic moment now diminishes

B. The magnetic moment does not change

C. The magnetic of B at (0,0,z), z gt R increases

D. The magnitude of B at (0,0,z), z gt gt R is unchanged

Answer: A

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9. A particle of charge q and mass m 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

Watch Video Solution

10. The maximum energy of a deuteron coming out a cyclotron is 20 MeV. The maximum energy of proton that can be obtained from this acceleration is

A. 10 MeV

B. 20 MeV

C. 30 MeV

D. 40 MeV

Answer: D

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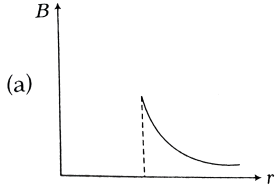
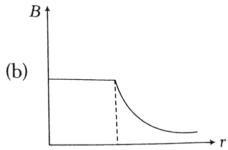
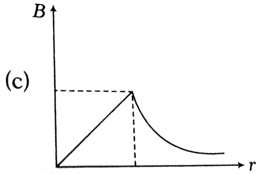
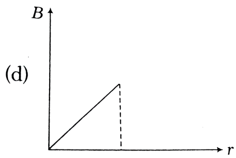
11. A long thin hollow metallic cylinder of radius $'R'$ has a current i ampere. The magnetic induction $'B'$ -away from the axis at a distance r from the axis varies as shown in

A. 

B. 

C. 

D. 

Answer: A

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12. In hydrogen atom, an electron is revolving in the orbit of radius 0.53Å with $6.6 \times 10^{15} rotations / \sec ond$. Magnetic field produced at the centre of the orbit is

A. $0.125Wb/m^2$

B. $1.25Wb/m^2$

C. $12.5Wb/m^2$

D. $125W\frac{b}{m^2}$

Answer: C

Watch Video Solution

13. A particle of charge q and velocity v passes undeflected through a space with non-zero electric field E and magnetic field B. The undeflecting conditions will hold, if

A. signs of both q and E are reversed

B. signs of both q and B are reversed

C. Both B and E are changed in magnitude but keeping the product of B and E fixed

D. Both B and E are doubled in magnitude

Answer: C

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14. The magnetic field at the centre of a circular coil of radius r carrying current l is B_1. The field at the centre of another coil of radius $2r$ carrying same current l is B_2. The ratio $\frac{B_1}{B_2}$ is

A. $1/2$

B. 1

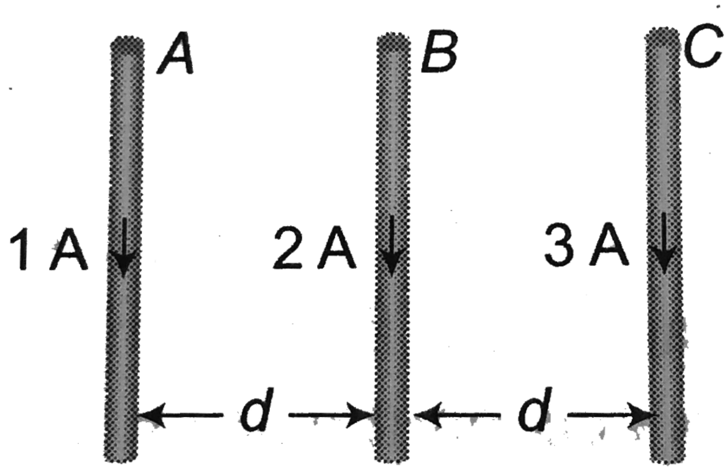
C. 2

D. 4

Answer: C

Watch Video Solution

15. Three long straight wires A, B and C are carrying current as shown in figure. Then the resultant force on B is directed



A. towards A

B. towards C

C. perpendicular to the plane of paper and outward

D. Perpendicular to the plane of paper and inward

Answer: A

Watch Video Solution

16. A wire of length 2 m carrying a current of 1 A is bend to form a circle. The magnetic moment of the coil is (in $A-m^2$)

A. 2π

B. $\pi/2$

C. $\pi/4$

D. $1/\pi$

Answer: D

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17. A current carrying conductor of length l is bent into two loops one by one. First loop has one turn of wire and the second loop has two turns of wire. Compare the magnetic fields at the centre of the loops

A. $B' = 4B$

B. $4B' = B$

C. $2B' = B$

D. $B' = 2B$

Answer: A

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18. Two charged particles traverse identical helical paths in a completely opposite sense in a uniform magnetic field $\overrightarrow{B} = B_0\widehat{K}$

A. They have equal z-components of moment

B. They must have equal charges

C. They necessarily represent a particles, anti-particle pair

D. The charge to mass ratio satisfy

$$\left(\frac{e}{m}\right)_1 + \left(\frac{e}{m}\right)_2 = 0$$

Answer: D

Watch Video Solution

19. When a certain length of wire is turned into one circular loop, the magnetic induction at the centre of coil due to some current flowing is B_1 If the same wire is turned into three loops to make a circular coil, the magnetic induction at the center of this coil for the same current will be

A. B_1

B. $9B_1$

C. $3B_1$

D. $27B_1$

Answer: B

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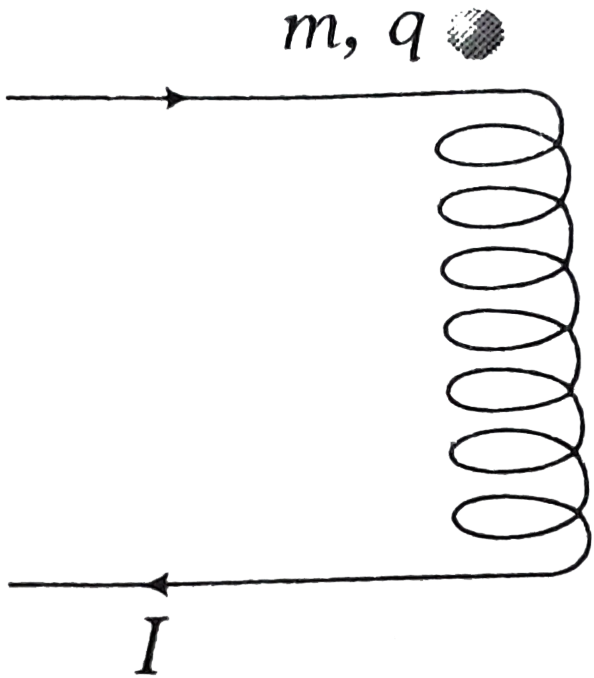
20. A long solenoid carrying a current I is placed with its axis vertical as shown in the figure. A particle of mass m and charge q is released from the top of the solenoid. Its acceleration is (g being acceleration due to gravity)



A. greater than g

B. less than g

C. equal to g

D. None of these

Answer: C

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21. A proton moves at a speed $v = 2 \times 10^6 m/s$ in a region of constant magnetic field of magnitude B = 0.05 T. The direction of the proton when it enters this field is $\theta = 30^\circ$ to the field. When you look along the direction of the magnetic field, then the path is a circle projected on a plane perpendicular to the magnetic field. How far will the proton move along the direction of B when two projected circles have been completed?

A. $4.35m$

B. $0.209m$

C. $2.82m$

D. $2.41m$

Answer: A

Watch Video Solution

22. An electric current I enters and leaves a uniform circular wire of radius a through diametrically opposite points. A charged paricle q moving along the axis of the circular wire passes through its centre at speed v. The magnetic force acting on the particle when it passes through the centre has a magnitude

A. $qv\frac{\mu_0 i}{2a}$

B. $qv\frac{\mu_0 i}{2\pi a}$

C. $qv\frac{\mu_0 i}{a}$

D. zero

Answer: D

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23. A particle of mass m and charge q moves with a constant velocity v along the positive x direction. It enters a region containing a uniform magnetic field B directed along the negative z direction, extending from

$x = a$ to $x = b$. The minimum value of v required so that the particle can just enter the region $x > b$ is

A. qpB / m

B. $q(b - a)B / m$

C. qaB / m

D. $q(b + a)B / 2m$

Answer: B

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24. A proton of mass 1.67×10^{-27} kg charge $1.6 \times 10^{-19} C$ is projected in xy-plane with a speed of $2 \times 10^{6} m / s$ at an angle of 60° to the X-axis. If a uniform magnetic field of 0.14 T is applies along the Y-axis, then the path of the proton is

A. a circle of radiuis 0.2 m and time period $\pi \times 10^{-7} s$

B. a circle of radius 0.1 m and time period $2\pi \times 10^{-7} s$

C. a helix of radius 0.07 m and time period $0.5 \times 10^{-6} s$

D. a helix of radius 0.14 m and time period $1.0 \times 10^{-7} s$

Answer: C

Watch Video Solution

25. An equilateral triangle of side length l is formed from a piece of wire of uniform resistance. The current I is as shown in figure. Find the magnitude of the magnetic field at its centre O.

A. $\dfrac{\sqrt{3}\mu_0 I}{2\pi l}$

B. $\dfrac{3\sqrt{3}\mu_0 I}{2\pi l}$

C. $\dfrac{\mu_0 I}{2\pi l}$

D. zero

Answer: D

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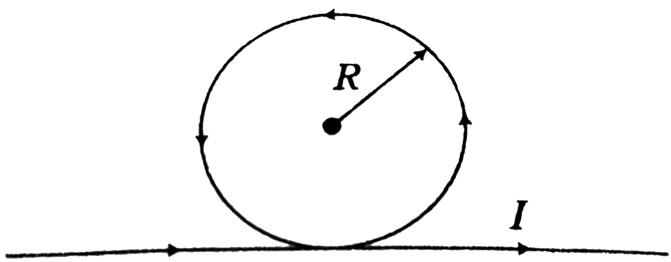
26. An infinitely long conductor is bent into a circle as shown in figure. It carries a current I ampere and the radius of loop is R meter. The magnetic induction at the centre of loop is



A. $\frac{\mu_0 2I}{4\pi R}(\pi + 1)$

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

C. $\frac{\mu_0 I}{8\pi R}(\pi + 1)$

D. zero

Answer: A

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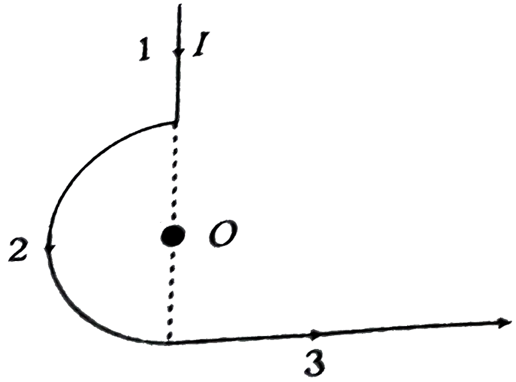
27. Magnetic field produced at the point O due to current flowing in an infinite wire shaped as shown in the figure is



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

B. $\frac{\mu_0 I}{4R} - \frac{\mu_0 I}{4\pi R}$

C. $\frac{\mu_0 I}{4R} - \frac{\mu_0 I}{2\pi R}$

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

Answer: D

Watch Video Solution

28. Two identical coils carry equal currents have a common centre and their planes are at right angles to each other. The ratio of the magnitude of the resulatant magnetic field at the centre and the field due to one coil is

A. $2:1$

B. $1:1$

C. $1:\sqrt{2}$

D. $\sqrt{2}:1$

Answer: C

Watch Video Solution

29. A circular flexible loop of wire of radius r carrying a current I is placed in a uniform magnetic field B . If B is doubled, then tension in the loop

A. remains unchanged

B. is doubled

C. is halved

D. becomes 4 times

Answer: B

Watch Video Solution

30. An electron moves in a circular orbit with a uniform speed v.It produces a magnetic field B at the centre of the circle. The radius of the circle is proportional to

A. $\frac{B}{v}$

B. $\frac{v}{B}$

C. $\sqrt{\frac{v}{B}}$

D. $\sqrt{\frac{B}{v}}$

Answer: C

Watch Video Solution

31. Two wires of same length are shaped into a square and a circle. If they carry same current, ratio of the magnetic moment is

A. $2 : \pi$

B. $\pi : 2$

C. $\pi : 4$

D. $4 : \pi$

Answer: C

Watch Video Solution

32. Two particles X and Y with equal charges, after being accelerated throuhg 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. $\left(\left(\frac{R_1}{(R_2)^{1/2}}\right.\right.$

B. $\frac{R_2}{R_1}$

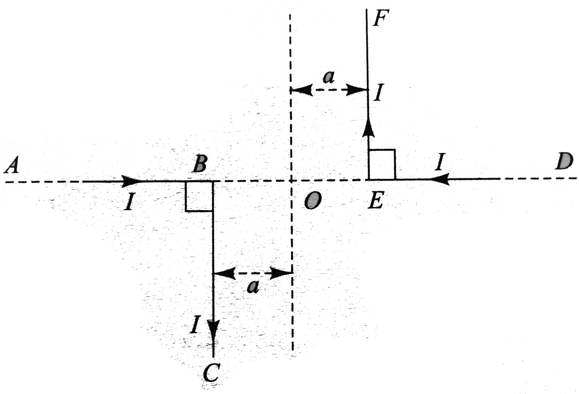
C. $\left(\frac{R_1}{R_2}\right)^2$

D. $\left(\frac{R_1}{R_2}\right.$

Answer: C

Watch Video Solution

33. Two long thin wires ABC and DEF are arranged as shown in Fig. They carry equal currents I as shown. The magnitude of the magnetic field at O is



A. $\frac{\mu_0 I}{4\pi r}$

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

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

D. zero

Answer: D

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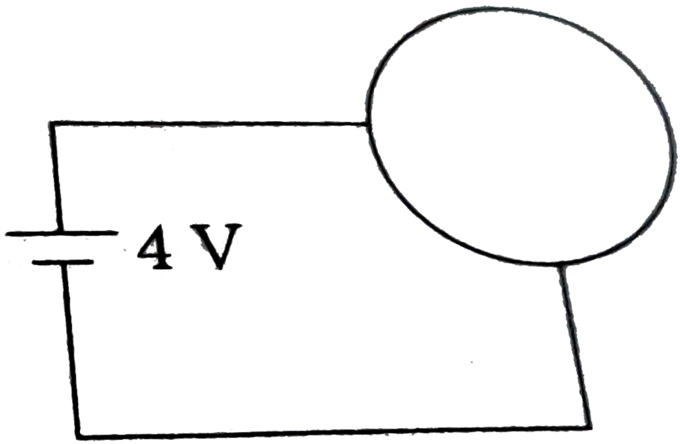
34. A circular conductor of uniform resistance per unit length, is connected to a battery of 4 V. The total resistance of the conductor is 4ω.

The net magnetic field at the centre of the conductor is



A. $\frac{\mu_0}{2}$

B. $\frac{8\mu_0}{3}$

C. $2\mu_0$

D. zero

Answer: D

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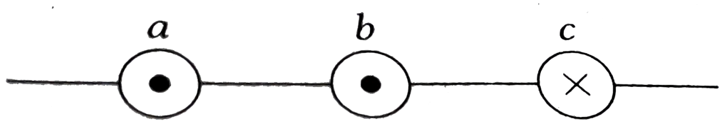
35. Figure shows, three long straight wires parallel and equally speed with identical currents. Then, the force acting on each wire due to the other is



A. $F_a > F_b > F_c$

B. $F_b > F_c > F_a$

C. $F_c > F_a > F_b$

D. $F_b > F_a > F_c$

Answer: B

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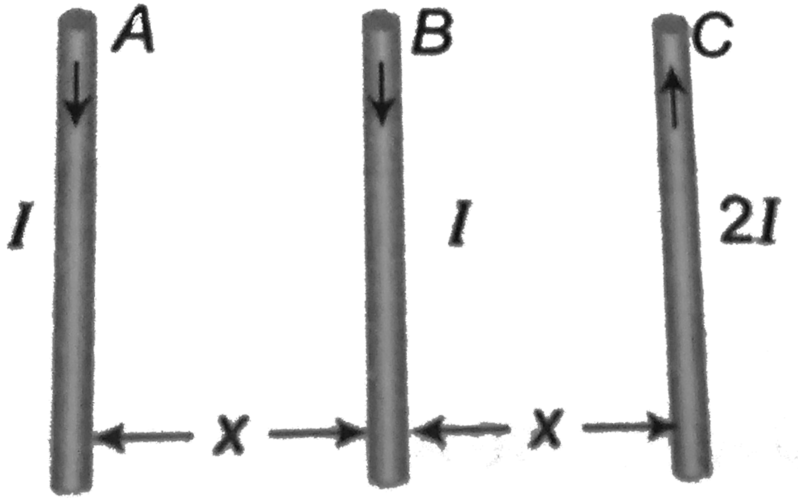
36. A, B and C are parallel conductors of equal length carrying currents I, I and $2I$ respectively. Distance between A and B is x. Distance between B and C is also x. F_1 is the force exerted by B on A and F_2 is the force exerted by B on C choose the correct answer



A. $F_1 = 2F_2$

B. $F_2 = 2F_1$

C. $F_1 = F_2$

D. $F_1 = - F_2$

Answer: C

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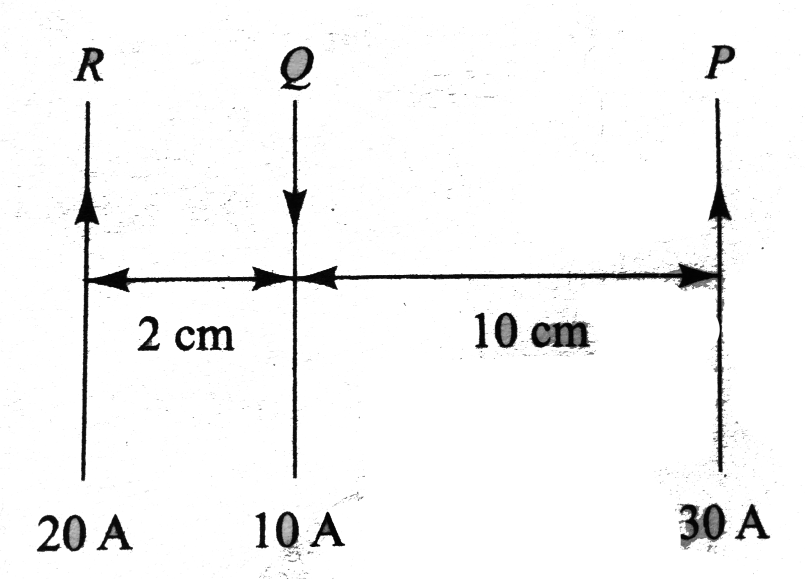
37. Three long, straight and parallel wires are arranged as shown in Fig.

The forces experienced by 10 cm length of wire Q is



A. 1.4×10^{-4}N towards the right

B. 1.4×10^{-4}N towards the left

C. 2.6×10^{-4}N towards the right

D. 2.6×10^{-4}N towards the left

Answer: C

Watch Video Solution

38. A current of 10 ampere is flowing in a wire of length $1.5m$. A force of $15N$ acts on it when it is placed in a uniform magnetic field of 2 tesla. The angle between the magnetic field and the direction of the current is

A. 30°

B. 45°

C. 60°

D. 90°

Answer: A

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39. 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-y-direction

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 +y-direction

Answer: C

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40. A charged particle P leaves the origin with speed $v = v_0$ at some inclination with the x-axis. There is a uniform magnetic field B along the x-axis. P strikes a fixed target T on the x-axis for a minimum value of $B = B_0$. P will also strike T if

A. $B = 2B_0, v = 2v_0$

B. $B = 2B_0, v = v_0$

C. Both are correct

D. Both are wrong

Answer: A

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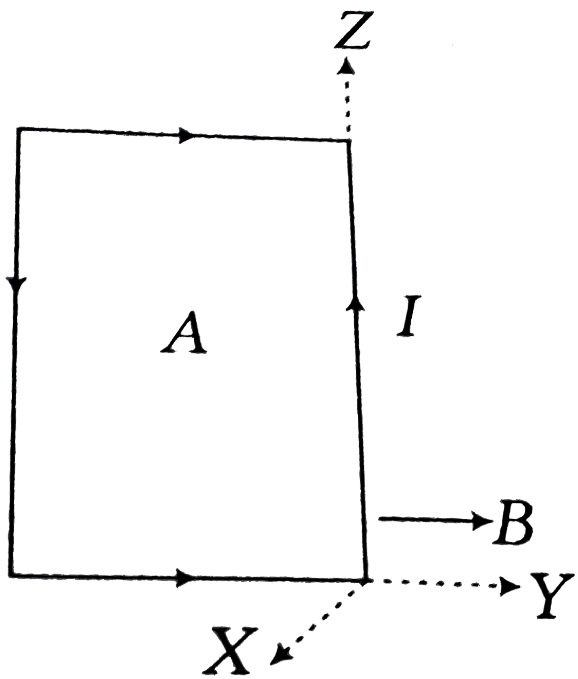
41. The rectangular coil of area A is in a field B. Find the torque about the Z-axis when the coil lies in the position shown and carries a current I.



A. IAB in negative Z-axis

B. IAB in positive Z-axis

C. 2IAM in positive Z-axis

D. 2IAB in negative Z-axis

Answer: B

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42. In hydrogen atom, the electron is making $6.6 \times 10^{15} rev/\sec$ around the nucleus in an orbit of radius $0.528A$. The magnetic moment `(A-m^(2)) will be

A. 1×10^{-15}

B. 1×10^{-10}

C. 1×10^{-23}

D. 1×10^{-27}

Answer: C

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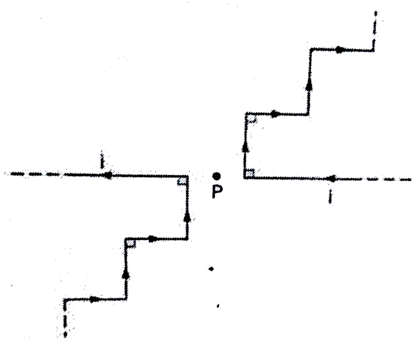
43. Two infinitely long conductors carrying equal currents are shaped as shown. The short sections are all of equal lengths. The point P is located symmetrically with respect to the two conductors. The magnetic filed at due to any one conductor is B. The total field at P is:



A. zero

B. B

C. 2B

D. $\sqrt{2}B$

Answer: A

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44. A particle of mass m and having a positive charge q is projected from origin with speed v_0 along the positive X-axis in a magnetic field B = $-B_0\widehat{K}$, where B_0 is a positive constant. If the particle passes through (0,y,0), then y is equal to

A. $-\dfrac{2mv_0}{qB_0}$

B. $\dfrac{mv_0}{qB}$

C. $-\dfrac{mv_0}{qB}$

D. $\dfrac{2mv_0}{qB_0}$

Answer: D

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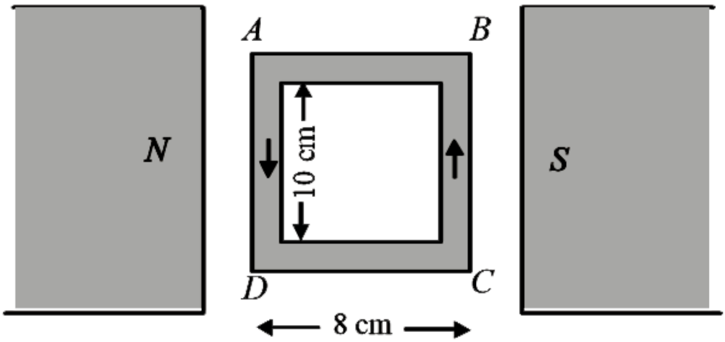
45. A 100 turns coil shown in figure carries a current of 2 amp in a magnetic field $B = 0.2 Wb/m^2$. The torque acting on the coil is



A. $0.32N - m$ tending to rotate the side AD out of the page

B. $0.32N - m$ tending to rotate the side AD into of the page

C. $0.0032N - m$ tending to rotate the side AD out of the page

D. $0.0032N - m$ tending to rotate the side AD into of the page

Answer: A

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46. 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^{+} ions will be deflected most

B. O^{2+} ions will be deflected least

C. He^{+} and O^{2+} ions will suffer same deflection

D. All ions will suffer the same deflection

Answer: A::C

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47. 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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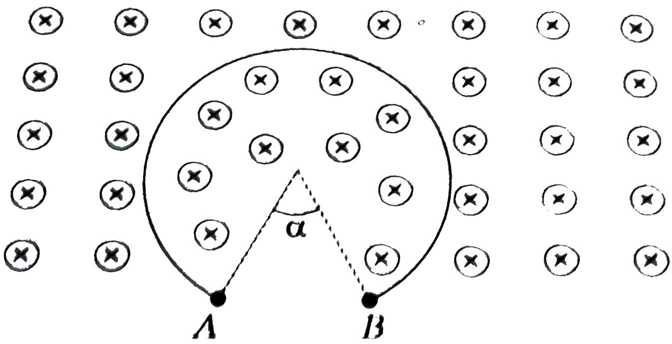
48. A circular loop which is in the form of a major arc of a constant magnetic field B is applied in the vertical direction such that the magnetic lines of forces go into the plane. If R is the radius of circle and it carries a current I in the clockwise direction, then the force on the loop will be



A. $BIR\tan\alpha$

B. $2BIR\cos(\alpha/2)$

C. $2BIR\sin(\alpha/2)$

D. None of these

Answer: C

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49. Two protons are projected simultaneously from a fixed point with the same velocity v into a region, magnetic there exists a uniform magnetic field. The magnetic field strength is B and it is perpendicular to the initial direction of v. One proton starts at time t=0 and another proton at $t=\frac{\pi m}{2qB}$. The separation between them at time $t=\frac{\pi m}{qB}$ (where, m and q are the mass and charge of proton), will be approximately

A. $2\frac{mv}{qB}$

B. $\frac{\sqrt{2}mv}{qB}$

C. $\frac{mv}{qB}$

D. $\frac{mv}{2qB}$

Answer: B

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50. A disc of radius R rotates with constant angular velocity ω about its own axis. Surface charge density of this disc varies as $\sigma=\alpha r^2$, where r is the distance from the centre of disc. Determine the magnetic field intensity at the centre of disc.

A. $\mu_0\alpha\omega R^3$

B. $\dfrac{\mu_0 \alpha \omega R^3}{6}$

C. $\dfrac{\mu_0 \alpha \omega R^3}{8}$

D. $\dfrac{\mu_0 \alpha \omega R^3}{3}$

Answer: B

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51. A rigid circular loop of radius r and mass m lies in the $XY-$ plane of a flat table and has a current I flowing in it. At this particular place. The Earth's magnetic field $\overrightarrow{B} = B_x i + B_z k$. The value of I so that the loop starts tilting is :

A. $\dfrac{mg}{\pi r \sqrt{B_x^2 + B_z^2}}$

B. $\dfrac{mg}{\pi r B_x}$

C. $\dfrac{mg}{\pi r B_z}$

D. $\dfrac{mg}{\pi r \sqrt{B_x B_z}}$

Answer: B

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52. Two circular coils 1 and 2 are made from the same wire but the radius of the 1st coil is twice that of the 2nd coil. What is the ratio of potential difference applied across them so that the magnetic field at their centres is the same?

A. 3

B. 4

C. 6

D. 2

Answer: B

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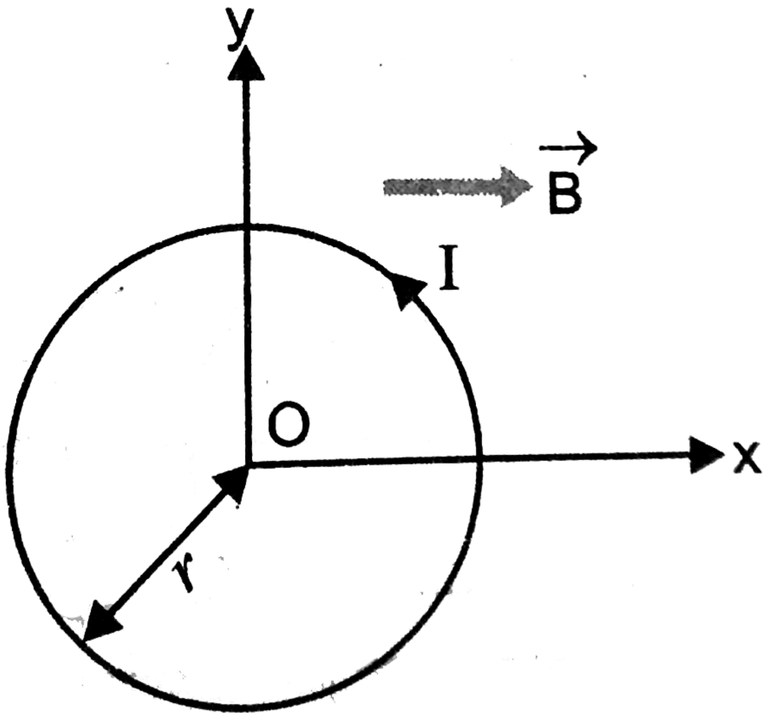
53. A circular loop of mass m and radius r in X-Y plane of a horizontal table as shown in figure. A uniform magnetic field B is applied parallel to X-axis. The current I in the loop, so that its one edge just lifts from the table is



A. $\dfrac{mg}{\pi r^2 B}$

B. $\dfrac{mg}{\pi r B}$

C. $\dfrac{mg}{2\pi r B}$

D. $\frac{\pi r B}{mgl}$

Answer: B

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

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

B. $\frac{ES}{B}$

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

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

Answer: D

Watch Video Solution

55. The coil of a moving coil galvanometer has an effective area of 4xx10^(-2)m^(2). $Itissuspended \in amag \neq ticfieldof$5xx10^(-2)$Wb$ m^(-2)`. If deflection in the galvanometer coil is 0.2 rad when a current of 5 mA is passed through it, then

A. torsional constant is $5 \times 10^{-5} N - m \quad \text{rad}^{-1}$

B. current sensitivity is $40 rad\ A^{-1}$

C. torsional constant is $3 \times 10^{-3}\ N - m \quad \text{rad}^{-1}$

D. current sensitivity is $40 deg\ A^{-1}$

Answer: A::B

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56. A large metal sheet carries an electric current along its surface. Current per unit length is λ . Magnetic field near the metal sheet is.

A. $\lambda\mu_0$

B. $\frac{\lambda\mu_0}{2}$

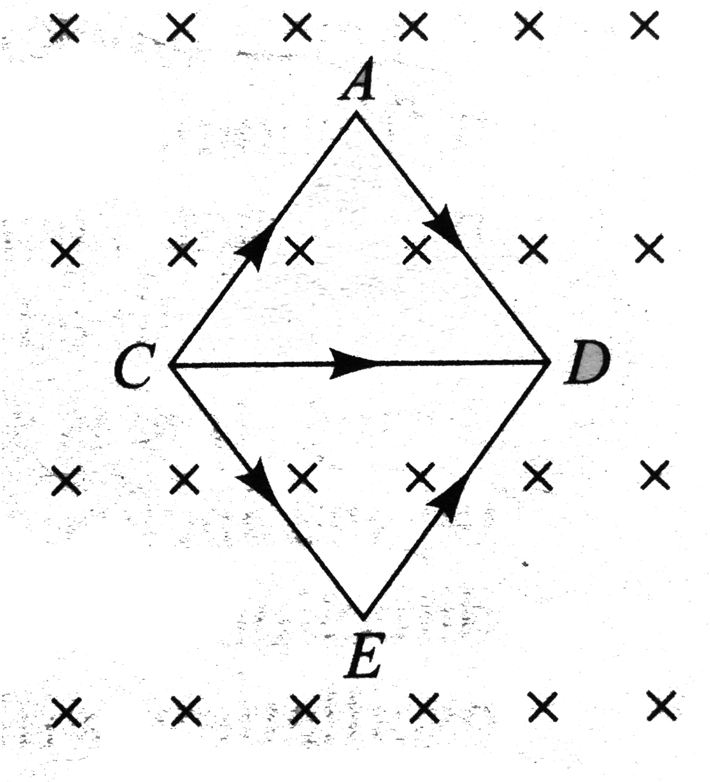
C. $\frac{\lambda\mu_0}{2\pi}$

D. $\frac{\mu_0}{2\pi\lambda}$

Answer: B

Watch Video Solution

57. Let current $i = 2A$ be flowing in each part of a wire frame as shown in Fig. 1.138. The frame is a combination of two equilateral triangles ACD and CDE of side 1 m. It is placed in uniform magnetic field $B = 4T$ acting perpendicular to the plane of frame. The magnitude of magnetic force acting on the frame is



The pithc of the helical path followed by the particle is p. The radius of the helix will be

A. 24 N

B. zero

C. 16 N

D. 8 N

Answer: A

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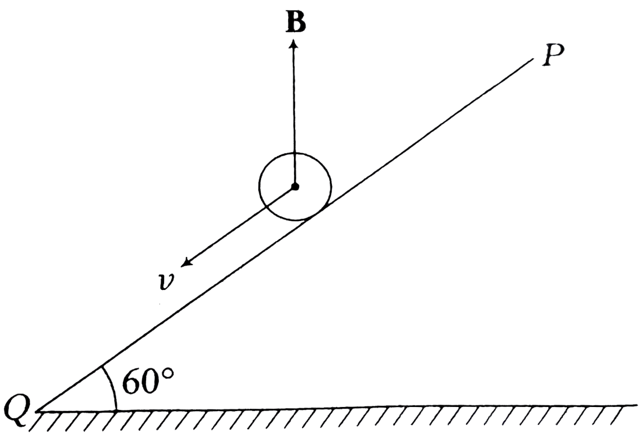
58. A conducting stick of length 2L and mass m is moving down a smooth inclined plane of inclination 60° with constant speed 5m/s. A current 2A is flowing in the conductor perpendicular to the paper inwards. A vertically upward magnetic field B exists in space there. The magnitude of magnetic field B is



A. $\frac{mg}{4L}$

B. $\frac{mg}{L}$

C. $\frac{\sqrt{3}mg}{4L}$

D. $\frac{\sqrt{3}mg}{2L}$

Answer: C

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59. A charge q is moving with a velocity $v_1 = 1\hat{i}$ m/s at a point in a magnetic field and experiences a force $F = q\left[-\hat{j} + 1\hat{k}\right]$ N. If the charge is moving with a velocity $v_2 = \hat{j}$ m/s at the same point then it experiences a force $F_2 = q\left(1\hat{i} - 1\hat{k}\right)$ N. The magnetic induction B at that point is

A. $\left(\hat{i} + \hat{j} + \hat{k}\right)Wb/m^2$

B. $\left(\hat{i} - \hat{j} + \hat{k}\right)Wb/m^2$

C. $\left(-\hat{i} + \hat{j} - \hat{k}\right)Wb/m^2$

D. $\left(\hat{i} + \hat{j} - \hat{k}\right)Wb/m^2$

Answer: A

Watch Video Solution

60. A square frame of side l carries a current produces a field B at its center. The same current is passed through a circular loop having same perimeter as the square. The field at its center is B', the ratio of B/B' is

A. $\frac{8}{\pi^2}$

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

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

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

Answer: B

Watch Video Solution

61. The magnetic field existing in a region is given by $\vec{B} = B_0\left(1 + \frac{x}{l}\right)\vec{k}$. A square loop of edge l and carrying a current I, is placed with its edges parallel to the x-y axes. Find the magnitude of the net magnetic force experienced by the loop.

A. $2B_0Il$

B. zero

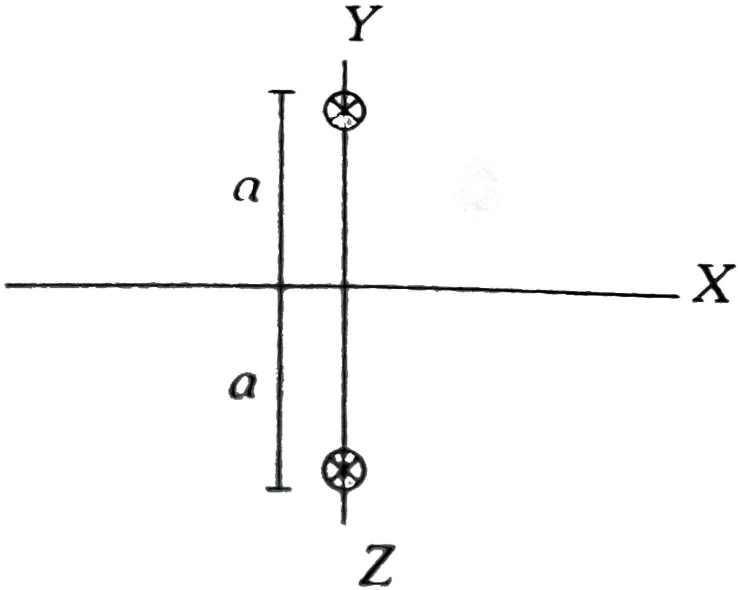
C. B_0Il

D. $4B_0Il$

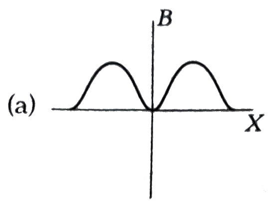
Answer: C

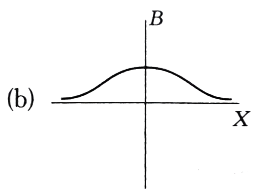
Watch Video Solution

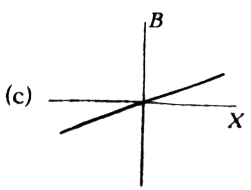
62. Two straight infinitely long current carrying wires are kept along Z-axis at the coordinates (0,a,0) and (0, -a, 0) respectively, as shown in the figure. The current in each of the wire is equal and along negative Z-axis (into the plane of the paper).



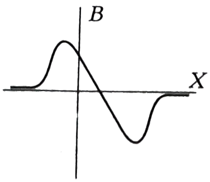
The variation of magnetic field on the X-axis will be approximately

A. 

B. 

C. 

(d)



D.

Answer: D

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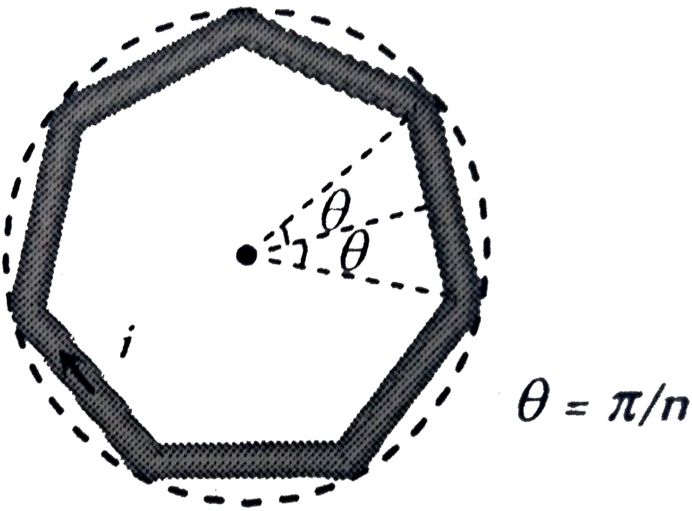
63. In the following figure a wire bent in the form of a regular polygon of n sides is inscribed in a circle of radius a. Net magnetic field at centre will be



A. $\frac{\mu_0 i}{2\pi a} \tan . \frac{\pi}{n}$

B. $\frac{\mu_0 n i}{2\pi a} \tan . \frac{\pi}{n}$

C. $\frac{2}{\pi} \frac{n i}{a} \mu_0 \tan . \frac{\pi}{n}$

D. $\frac{n i}{2a} \mu_0 \tan . \frac{\pi}{n}$

Answer: B

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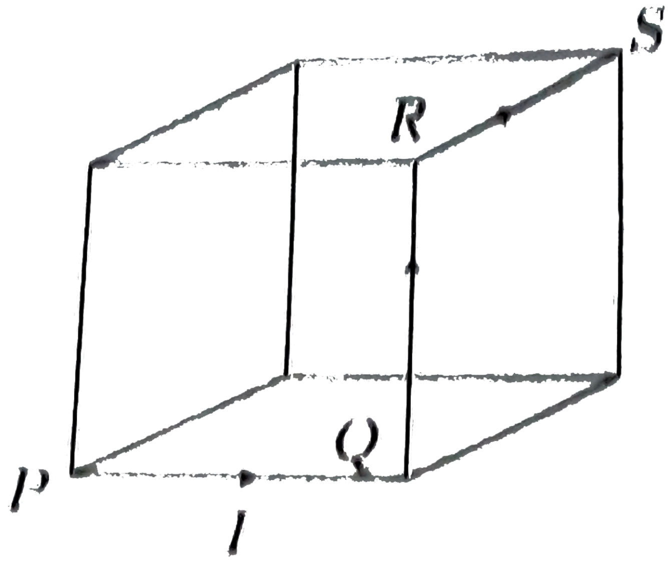
64. A wires PQRS carrying a current I runs along three edges of a cube of side l as shown in figure. There exists a uniform magnetic field of magnitude B along one of the sides of cube. The magnitude of the force acting on the wire is



A. zero

B. $\sqrt{3}IB$

C. $\sqrt{2}IlB$

D. $2Ilb$

Answer: C

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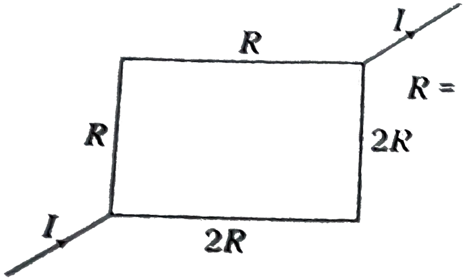
65. The magnetic field at the centre of square of side a is



A. $\dfrac{\sqrt{2}\mu_0}{\pi a}$

B. $\dfrac{\sqrt{2}\mu_0 I}{3\pi a}$

C. $\dfrac{2}{3}\dfrac{\mu_0 I}{a}$

D. zero

Answer: B

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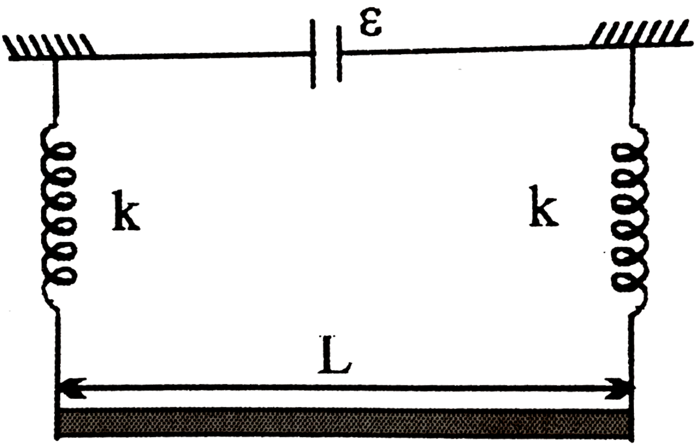
66. A straight rod of mass m and lenth L is suspended from the identical spring as shown in the figure The spring stretched by a distance of x_0 due to the weight of the wire The circuit has total resistance $R\omega$ When the magnetic field perpendicular to the plane of the paper is switched on, springs are observed to extend further by the same distance The magnetic field strength is



A. $\frac{2mgR}{LE}$

B. $\frac{mgR}{LE}$

C. $\frac{mgR}{2LE}$

D. $\frac{mgR}{E}$

Answer: B

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67. A particle of specific charge $q/m = (\pi)C/kg$ is projected from the origin towards positive x-axis with a velocity of $10m/s$ in a uniform magnetic field $\overrightarrow{B} = -2\widehat{K}$ Tesla. The velocity $\overrightarrow{V}$ of the particle after time $t = 1/6$ s will be

A. $\left(5\hat{i} + 5\sqrt{3}\hat{j}\right)m/s$

B. $10\hat{j}m/s$

C. $\left(5\sqrt{3}\hat{i} + 5\hat{j}\right)m/s$

D. $-10\hat{j}m/s$

Answer: A

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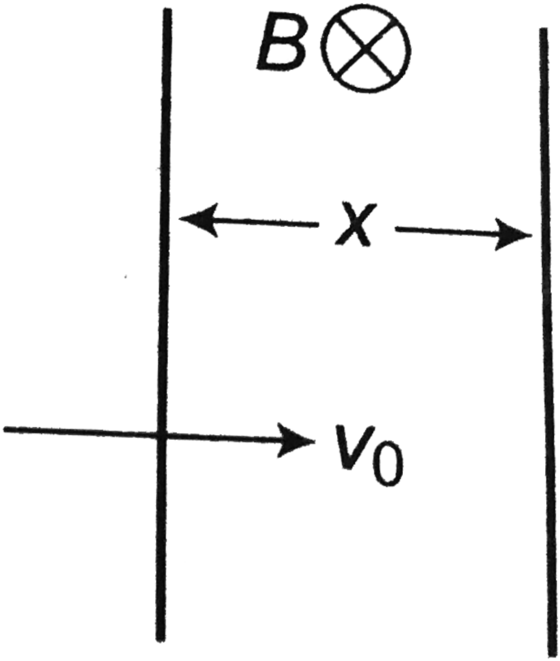
68. A charged particle enters into a uniform magnetic field with velocity v_0 perpendicular to it , the length of magnetic field is $x = \frac{\sqrt{3}}{2}R$, where R is the radius of the circular path of the particle in the field .The magnitude of charge in velocity of the particle when it comes out of the field is



A. $2v_0$

B. $\frac{v_0}{2}$

C. $\frac{\sqrt{3}v_0}{2}$

D. v_0

Answer: D

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69. 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 and are non zero, respectively. Then, this region of space may have

A. $E = 0, B = 0$

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

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

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

Answer: D

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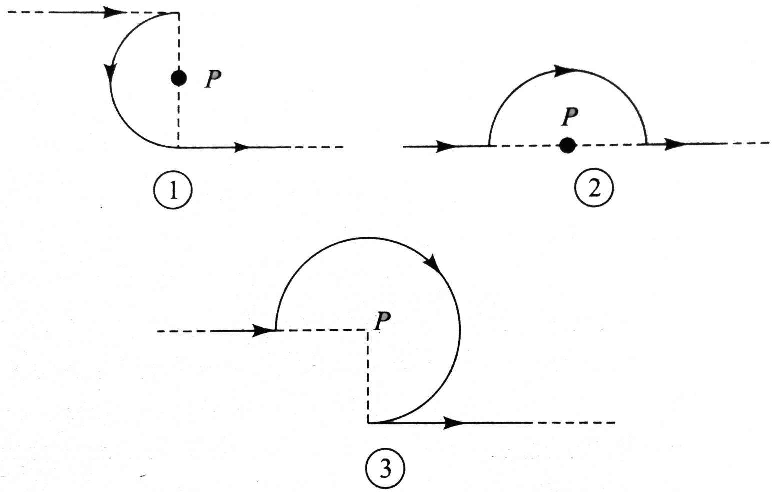
70. Figure shows three cases: in all case the circular part has radius r and straight ones are infinitely long. For the same current the ratio of field B

at centre P in the three case $B_1 : B_2 : B_3$ is



A. $\left(-\frac{\pi}{2}\right) : \left(\frac{\pi}{2}\right) : \left(\frac{3\pi}{4} - \frac{1}{2}\right)$

B. $\left(-\frac{\pi}{2} + 1\right) : \left(\frac{\pi}{2} + 1\right) : \left(\frac{3\pi}{4} - \frac{1}{2}\right)$

C. $-\frac{\pi}{2} : \frac{\pi}{2} : 3\frac{\pi}{4}$

D. `(-(pi)/(2)-1):((pi)/(2)-(1)/(4)):((3pi)/(4)+(1)/(2))

Answer: A

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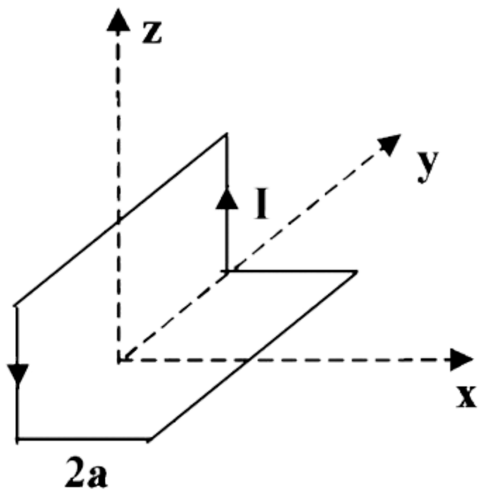
71. A non - popular loop of conducting wire carrying a current I is placed as shown in the figure . Each of the straighrt sections of the loop is of the length $2a$. The magnetic field due to this loop at the point $P(a, 0, a)$ points in the direction



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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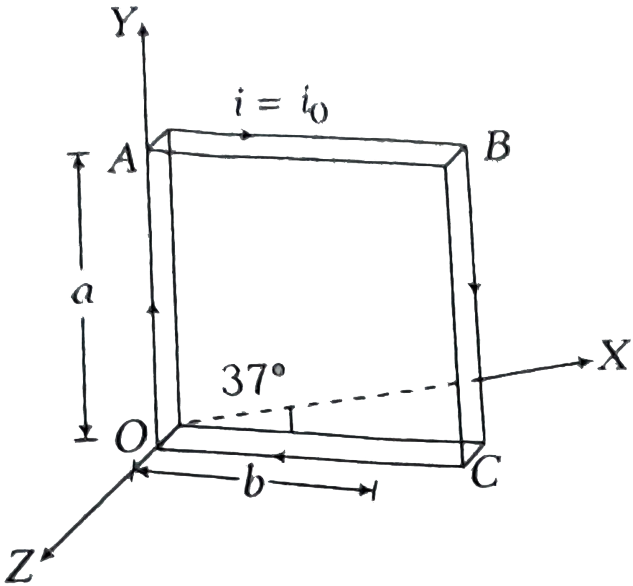
72. A rectangular loop consists of N closed wrapped turns and has dimendions $a \times b$. The loop is hinged along the Y-axis. What is the magnitude of the torque exerted on the loop by a uniform magnetic field $B = B_0$ directed along the X-axis when current $i = i_0$ in the direction shown. The torque acting on the loop is



A. $-\dfrac{4Ni_0abB_0\hat{j}}{5}$

B. $\dfrac{4Ni_0abB_0\hat{i}}{5}$

C. $-\dfrac{4Ni_0abB_0J}{3}\hat{j}$

D. $\frac{-2Ni_0abB_0\hat{j}}{5}$

Answer: A

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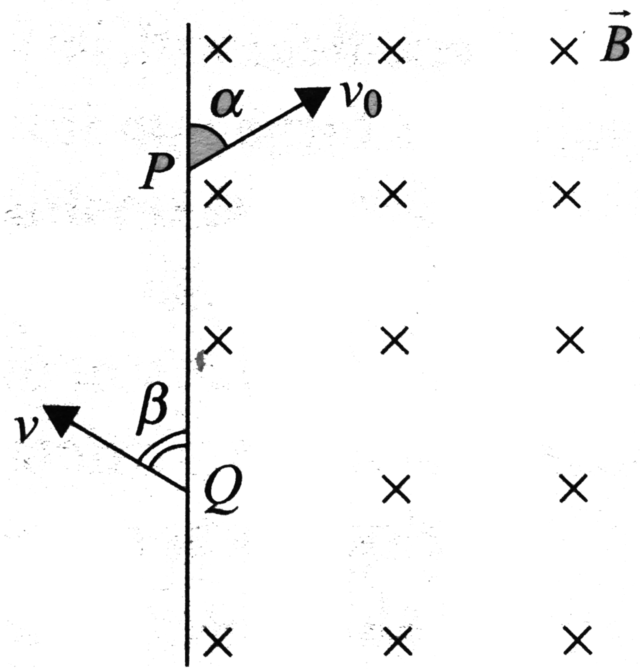
73. A particle of charge -q and mass m enters a uniform magnetic field $\vec{B}$ (perpendicular to paper inward) at P with a velocity v_0 at an angle α and leaves the field at Q with velocity v at angle β as shown in fig.



A. $\alpha = \beta$

B. $v = v_0$

C. $PQ = \dfrac{2mv_0 \sin \alpha}{Bq}$

D. particle remains in the field for time $t = \dfrac{2m(\pi - \alpha)}{Bq}$

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

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74. A square coil of edge L having n turns carries a current i. it is kept on a smooth horizontal plate. A uniform magnetic field B exists in a direction parallel to an edge the total mass of the coil is M. What should be the minimum value of B for which the coil will start tipping over?

A. $\dfrac{Mg}{niL}$

B. $\dfrac{Mg}{2niL}$

C. $\dfrac{Mg}{4niL}$

D. $\dfrac{2Mg}{niL}$

Answer: B

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

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

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

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

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

Answer: A

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Assertion And Reason

1. Assertion Two infinitely long wires A and B carry unequal currents both in inward direction.

Then, there is only point (excluding the ponts at infinity), where net magnetic field is zero.

Reason That point liews between points A abnd B.

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

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

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: b

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2. Assertion When a charged particle moves perpendicular to a uniform magnetic field then its momentum remains constant.

Reason Magnetic force acts perpendicular to the velocity of the particle.

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

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

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: d

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3. Assertion If a charged particle is pronected in a region, where B is perpendicular to velocity of projection, then the net force acting on the particle is independent orf its mass.

Reason The particle is performing uniform circular motion and force acting on it is $\frac{mv^2}{r}$.

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

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

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: c

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4. Assertion If a charged particle enters from outside in uniform magnetic field, then it will keep on rotating in a circular path.

Reson Magnetic force is always perpendicular to velocity vector.

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

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

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: d

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5. Assertion An $\alpha -$ particle and a deuteron having same kinetic energy enter in a uniform magnetic field perpendicular to the field. Then, radius of circular path of $\alpha -$ particle will be more.

Reason $\frac{q}{m}$ ratio of an $\alpha -$ particle is more than the $\frac{q}{m}$ ratio of a deuteron.

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

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

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: d

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6. Assertion A charged particle is rotating in a circular path in uniform magnetic field. Then, plane of circle is perpendicular to the magnetic field.

Reason Circular motion is a two-dimensional motion.

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

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

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: b

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7. Assertion In a uniform magnetic field $B = B_0\hat{k}$, if velocity of a charged particle is $v_0\hat{i}$ at t = 0, then it can have the velocity $v_0\hat{j}$ at some other instant.

Reason In uniform magnetic field, acceleration of a charged particle is always zero.

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

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

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: c

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8. Assertion If velocity of charged particle in a uniform magnetic field at some instant is $\left(a_1\hat{i} - a_2\hat{j}\right)$ and at some other instant is $\left(b_1\hat{i} + b_2\hat{j}\right)$, then

$a_1^2 + a_2^2 = b_1^2 + b_2^2$

Reason Magnetic force cannot change velocity of a charged particle.

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

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

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: c

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9. Assertion In non-uniform magnetic field speed of a charged particle varies.

Reason Work done by magnetic force on a charged particle is always zero.

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

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

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: d

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10. Assertion Path of a charged particle in uniform magnetic field cannot be a parabola, if no other forces (other than magnetic force) are acting on the particle.

Reason For parabolic path, a constant acceleration is required.

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

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

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: b

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11. Assertion A beam of electron can pass undeflected through a region of E and B.

Reason Force on moving charged particle due to magnetic field may be zero in some cases.

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12. Assertion If the path of a charged particle in a region of uniform electric and magnetic field is not a circle, then its kinetic energy may remain constant.

Reason In a combined electric and magnetic field region a moving charge experiences a net force

$F = qE + q(V \times B)$, where symbols have their usual meanings.

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13. Assertion Maganetic field (B) and electric field (E) are present in a this region. Net force on a charged particle in this region is zero , if

$E = B \times v$

Reason E/B has the dimensions of velocity.

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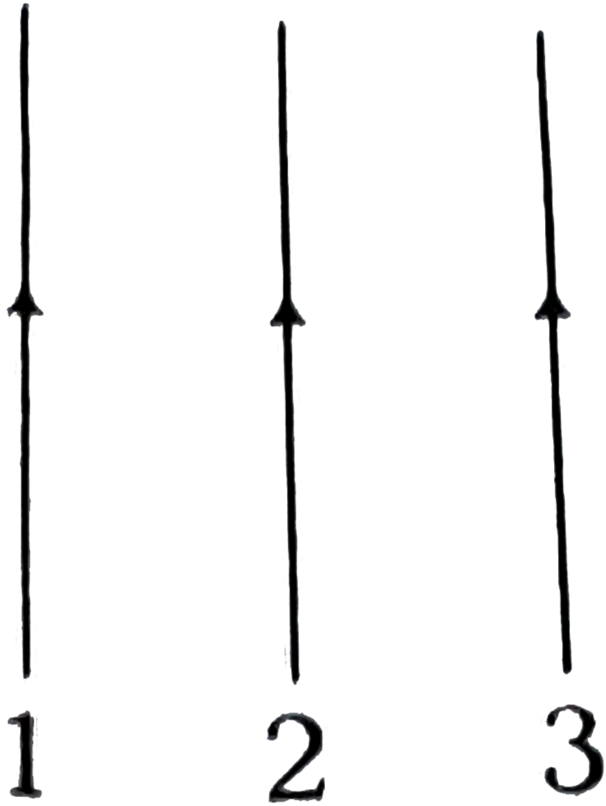
14. Assertion three infinitely long current carrying wires have equal currents and they are equally spaced. The magnitude of magnetic force on all three is same.



Reason Net force on wire-2 is zero.

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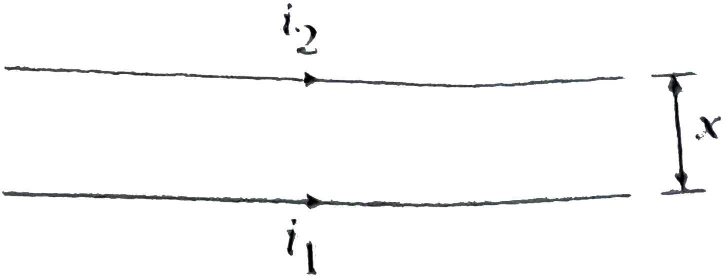
15. Assertion Upper wire shown in figure is fixed. At a certain distance x,lower wire can remain in equilibrium.



Reason The above equilibrium of lower wire is stable equilibrium.

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16. Assertion A flexeble wire loop of irregular shape carrying current when placed in a uniform external magnetic field acquires a circular shape.

Reason For a given perimeter circular shape is having the greatert area.

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17. Assertion At the centre of a circular current carrying loop (I_1), there is an infinitely long straight of the circle. Then magnetic force of attraction between two is zero.

Reason Magnetic field of I_1 at centre is inwards, parallel to I_2.

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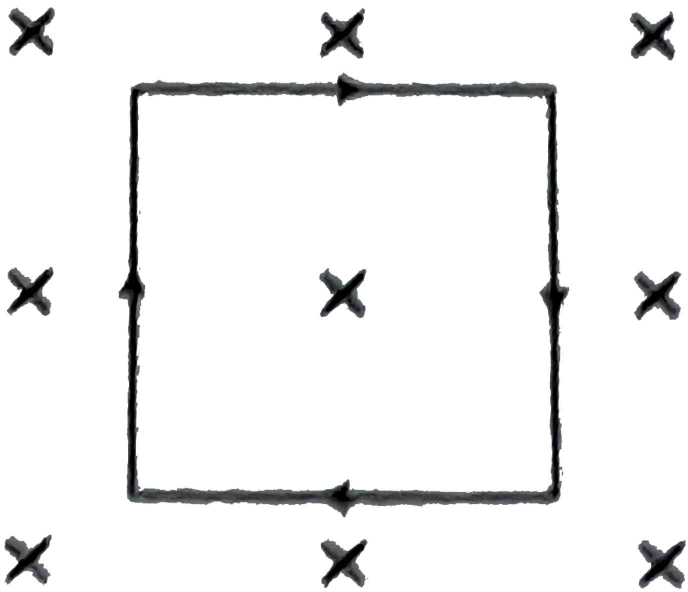
18. Assertion Net torque in the current carrying loop placed in a uniform magnetic field (pointing inwards) is zero.



Reasonl Magnetic moment (M) is inwards.

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

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

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: A

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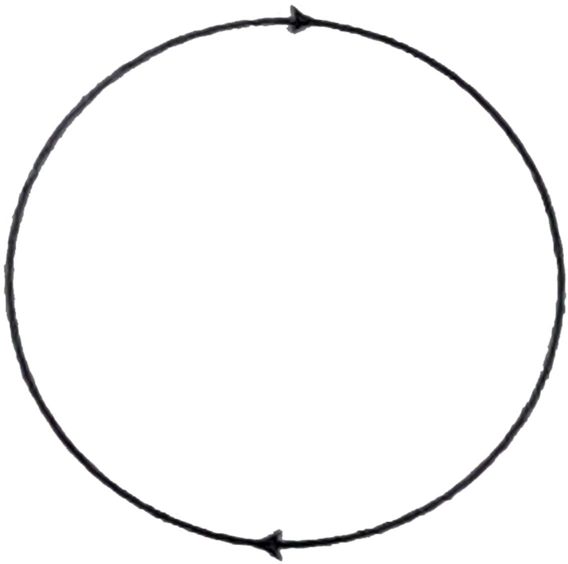
19. Assertion: A charged particle is rotating in a circle. Then magnetic field (B) at centre of circle and magnetic moment (M) produced by motion of charged particle are parallel to each other.



Reason: M and B are always parallel to each other.

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

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

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

Answer: A

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20. Assertion : current sensitivity of a galvanometer is directley proportionall to the current through the coil.

Reason : Voltage sensitivity is inversely proportional to voltage.

A. If both the assertion and reason are true and reason is a true explantion of the assertion.

B. If both the assertion and reason are true but the reason is not true the correct explantion of the assertion.

C. If the assertion is true but reason false

D. If the assertion is false but reason true

Answer: D

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Match The Following

1. A charged particle enters in a uniform magnetic field perpendicular to it. Now match the following two columns.

Column I		Column II	
(A)	Speed of the particle	(p)	is constant
(B)	Velocity of the particle	(q)	is not constant
(C)	Acceleration of the particle	(r)	is maximum
(D)	Force on the particle	(s)	is minimum

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2. Four particles α-particle, deuteron and electron and a CI^{-} ion enter in a transverse magnetic field perpendicular to it with same kinetic energy. Their paths are as shown in figure. Now match the following two columns.

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3. A charged particle is rotating in uniform circular motion in a uniform magnetic field . Let r= radius of circule, v= speed of particle k = kinetic energy, a= magnitude of acceleration , p= magnitude of linear momentum,

$\frac{q}{m} = \alpha$=specific charge and $\omega =$ angular speed. then match the following two columns.

	Column I		Column II
(A)	If v is doubled	(p)	r will become two times
(B)	If K is doubled	(q)	ω will become two times
(C)	If p is doubled	(r)	a will become two times
(D)	If α is doubled	(s)	None

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4. A square current carrying loop abcd is palced near an infinitely long another current carrying wire ef. Now, match the following two columns.

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Medical Entrance S Gallery

1. 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. nB

B. n^2B

C. $2nB$

D. $2n^2B$

Answer: B

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2. An electron is moving in a circular path under the influence fo a transerve magnetic field of $3.57 \times 10^{-2}T$. If the value of e/m is $1.76 \times 10^{141}C/kg$. The frequency of revolution of the electron is

A. $1GHz$

B. $100MHz$

C. $62.8MHz$

D. $6.28MHz$

Answer: a

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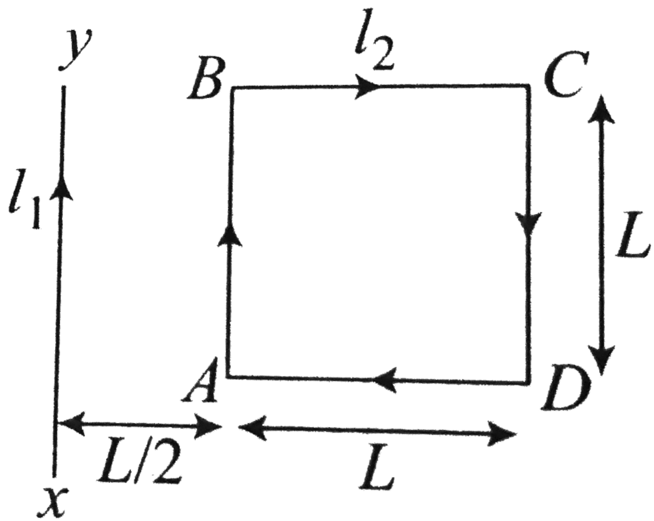
3. A sqaure loop $ABCD$, carrying a current I_2 is placed near and coplanar with a long straight conductor XY, carrying a current I_1 as shwon in Figure. The net force on the loop will be



A. $\frac{\mu_0 Ii}{2\pi}$

B. $\frac{2\mu_0 IiL}{3\pi}$

C. $\frac{\mu_0 IiL}{2\pi}$

D. $\frac{2\mu_0 I i}{3\pi}$

Answer: d

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4. A long staright wire of radius a carries a steady current I. The curent is unifromly distributed over its cross-section. The ratio of the magnetic fields B and B', at radial distances $\frac{a}{2}$ and $2a$ respectively from the axis of the wire is:

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

B. 1

C. 4

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

Answer: b

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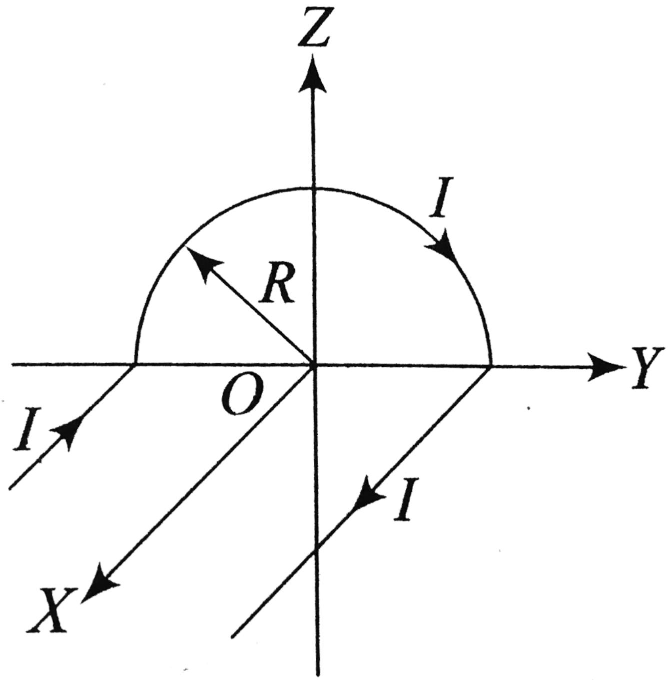
5. A wire carrying current I has the shape as shown in the adjoining figure. Linear parts of the wire are very long and parallel to X-axis while semicicular portion of radius R is lying in $Y-Z$ plane. Magnetic field at point O is



A. $B=\frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i}+2\hat{k}\right)$

B. $B=\frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i}-2\hat{k}\right)$

C. $B=\frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i}+2\hat{k}\right)$

D. $B=\frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i}-2\hat{k}\right)$

Answer: c

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6. An electron moving in a circular orbit of radius r makes n rotation per secound. The magnetic field produced at the centre has magnitude

A. $\frac{\mu_0 \text{ne}}{2\pi r}$

B. zero

C. $\frac{\mu_0 n^2 e}{r}$

D. $\frac{\mu_0 \text{ne}}{2r}$

Answer: d

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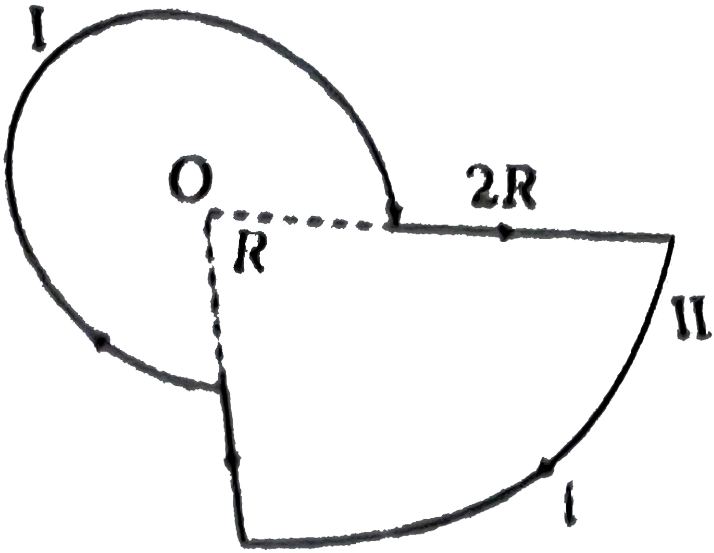
7. Consider the circular loop having current I and with central point O. the magnetic field at the central point O is



A. $\frac{2\mu_0 i}{3\pi R}$ acting downward

B. $\frac{5\mu_0 i}{12R}$ acting downward

C. $\frac{6\mu_0 i}{11R}$ acting downward

D. $\frac{3\mu_0 i}{7R}$ acting downward

Answer: B

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8. A proton is projected with a speed of $3X10^6ms^{-1}$ horizontally from est to west. A uniform magnetic field $\overrightarrow{B}$ of strength $2.0X10^{-3}$ T exists in the vertically upward direction(a) find the force on the proton just after it is projected. (b) what is the acceleration produced?

A. $11.6 \times 10^{11} m/s^2$

B. $17.4 \times 10^{11} m/s$

C. $5.8 \times 10^{11} m/s^2$

D. $2.9 \times 10^{11} m/s^2$

Answer: c

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9. The magnetic field at the centre of a circular coil carrying current I ampere is B. It the coil is bent into smaller circular coil of n turns then its magnetic field at the centre is B, the ratio between B' and B is

A. $1:1$

B. $n:1$

C. $n^2:1$

D. $(n+1):1$

Answer: C

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10. Two parallel wires are carrying electric currents of equal magnitude and in the same direction. They excert

A. attract each other

B. repel each other

C. lean towards each other

D. Neither attract nor repel each other

Answer: a

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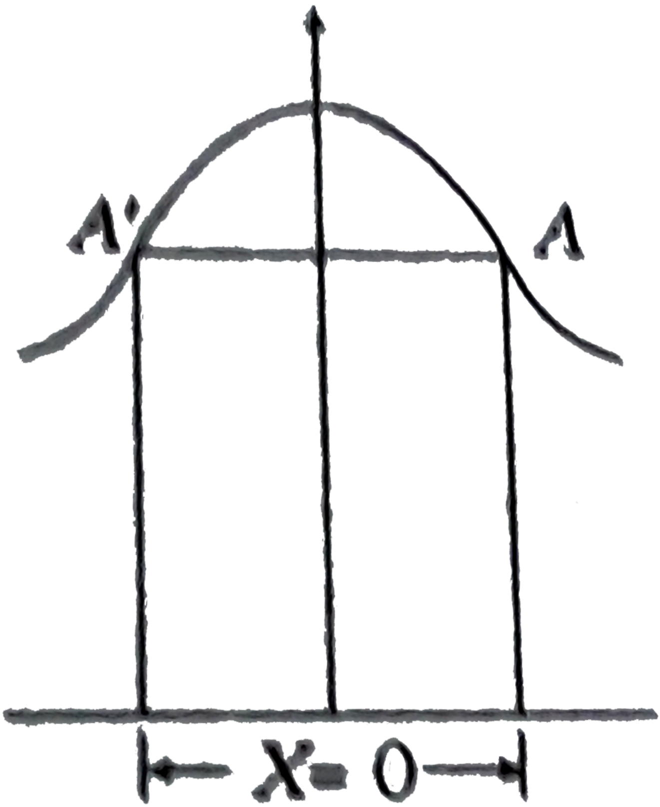
11. The variation of magnetic field (B) due to circular coil as the distance X varies is shown in the graph. Which of the following is false



A. Points A and A' are known as points of zero curvature

B. B varies linearly with X at points A and A'

C. $\frac{dB}{dt} = 0$ at points A and A'

D. $\frac{d^2B}{dt^2} = 0$ at points A and A'

Answer: c

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12. Two particles X and Y with equal charges, after being accelerated throuhg 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. $\sqrt{R_1 / R_2}$

B. R_1 / R_2

C. $(R_1 / R_2)^2$

D. $(R_2 / R_1)^2$

Answer: b

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13. There is a ring of radius r having linear charge density λ and rotating with a uniform angular velocity ω. the magnetic field produced by this ring at its own centre would be

A. $\frac{\lambda\omega^2}{2-\mu_0}$

B. $\frac{\mu_0\lambda^2\omega}{\sqrt{2}}$

C. $\frac{\mu_0\lambda\omega}{2}$

D. $\frac{\mu_0\lambda}{2\omega^2}$

Answer: c

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14. Two particles A and B having equal charges $+6C$, after being accelerated through the same potential differences, enter a region of uniform magnetic field and describe circular paths of radii $2cm$ and $3cm$ respectively. The ratio of mass of A to that of B is

A. $1/3$

B. $1/2$

C. $4/9$

D. $9/5$

Answer: c

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15. A proton beam enters magnetic field of $10^{-4} Wb/m^2$ normally. If the specific charge of the proton is $10^{11} C/kg$ and its velocity is $10^9 m/s$ then the radius of the circle described will be

A. 100 m

B. 0.1 m

C. 1 m

D. 10 m

Answer: A

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16. Cyclotron is used to accelerate

A. Only negatively charged particles

B. neutron

C. Both positively and negatively charged paticles

D. Only positively charged particles

Answer: d

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17. Two parallel beams of positrons moving in the same direction will

A. not interact with each other

B. repel each other

C. attract each other

D. bedeflected normal to the plane containing two beams

Answer: c

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18. 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. 5×10^{-5}

B. 12×10^{-5}

C. 7×10^{-5}

D. 10^{-5}

Answer: A

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19. A conducting loop is placed in a uniform magnetic field with its plane perpendicular to the field with its plane perpendicular to the field. An emf is induced in the loop if

(i) it is translated

(ii) it is rotated about its axis

(iii) it is rotated about a diameter

(iv) it is deformed

A. it is translated parallel to itself

B. it is rotated about one of its diameters

C. it is rotated about its own axis which is parallel to the field

D. the loop is deformed from the original shape

Answer: b

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20. A solenoid has length $0.4cm$, radius $1cm$ and 400 turns of wire. If a current of $5A$ is passed through this solenoid, then what is the magnetic field inside the solenoid?

A. $6.28 \times 10^{-4}T$

B. $6.28 \times 10^{-3}T$

C. $6.28 \times 10^{-7}T$

D. $6.28 \times 10^{-6}T$

Answer: B

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21. A toroid having 200 turns carries a current of 1A. The average radius of the toroid is 10 cm. the magnetic field at any point in the open space inside the toroid is

A. $4 \times 10^{-3} T$

B. zero

C. $0.5 \times 10^{-3} T$

D. $2 \times 10^{-3} T$

Answer: B

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22. When a proton is released from rest in a room, it starts with an initial acceleration a_0 towards west. When it is projected towards north with a speed v_0 it moves with an initial accelaration $3a_0$ towards west. The electric and the maximum possible magnetic field in the room

(i) $\frac{ma_0}{e}$, towards west

(ii) $\frac{2ma_0}{ev_0}$, downward

(iii) $\frac{ma_0}{e}$, towards east

(iv) $\frac{2ma_0}{ev_0}$, upward

A. $\frac{ma_0}{e}\text{west}\frac{2ma_0}{ev_0}\text{up}$

B. $\frac{ma_0}{e}\text{west}\frac{2ma_0}{ev_0}\text{down}$

C. $\frac{ma_0}{e}\text{east}\frac{3ma_0}{ev_0}\text{up}$

D. $\frac{ma_0}{e}\text{east}\frac{3ma_0}{ev_0}\text{down}$

Answer: b

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

A. $200\mu T$

B. $250\mu T$

C. $125 \mu T$

D. $75 \mu T$

Answer: b

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24. 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 a direction perpendicular to the plane of the wires AOB and COD, will be given by

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

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

C. $\frac{\mu_0}{2\pi d}(I_1^2 - I_2^2)$

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

Answer: D

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25. A proton of mass m and charge q is moving in a plane with kinetic energy E. if there exists a uniform magnetic field B, perpendicular to the plane motion. The proton will move in a circular path of radius

A. $\frac{3Em}{qB}$

B. $\frac{\sqrt{2Em}}{qB}$

C. $\frac{\sqrt{Em}}{2qB}$

D. $\frac{\sqrt{2Eq}}{qB}$

Answer: B

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26. If the velocity of charged particle has both perpendicular and parallel components while moving through a magnetic field ,then what is the path following by a charged particle?

A. Circular

B. Ellipatical

C. Linear

D. Helical

Answer: D

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27. A charged particle (charge q) is moving in a circle of radius R with unifrom speed v. The associated magnetic moment μ is given by

A. $\frac{1}{2}v^2R$

B. $\frac{1}{4}qvR$

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

D. $\frac{1}{2}q^2vR$

Answer: c

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28. 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. $\frac{2\mu mq}{B}$

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

C. $\frac{2\pi qB}{m}$

D. $\frac{2\pi m}{qB}$

Answer: d

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29. Due to the flow of current in a circular loop of radius R, the magnetic induction produced at the centre of the loop is B. The magnetic moment of the loop is (μ_0=permeability constant)

A. $\frac{BR^2}{2\pi\mu_0}$

B. $\frac{2\pi BR^2}{\mu_0}$

C. $\frac{BR^2}{2\pi\mu_0}$

D. $\frac{2\pi BR^2}{\mu_0}$

Answer: b

Watch Video Solution

30. In cyclotron for a given magnet radius of the semicircle traced by positive ion is directly proportional to (where v= velocity of positive ion)

A. v^{-2}

B. v^{-1}

C. v

D. v^2

Answer: c

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

A. remains stationary

B. spins about its own axis

C. moves in the direction of the field

D. moves perpendicular to the direction of the field

Answer: a

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32. An alectron in a circular orbit of radius 0.05 mn performs $10^{16}\text{rev}/s$. the magnetic moment due to this ratation of electron is $\left(\in A - m^2\right)$.

A. 2.16×10^{-23}

B. 3.21×10^{-22}

C. 3.21×10^{-24}

D. 1.26×10^{-23}

Answer: d

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33. A circular coil of radius $10 cm and 100$ turns carries a current 1A. What is the magnetic moment of the coil?

A. $3.142 \times 10^4 A - m^2$

B. $10^4 A - m^2$

C. $3, 142 A - m^2$

D. $3A - m^2$

Answer: c

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34. 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. $-2F$

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

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

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

Answer: c

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35. A charged particle experience magnetic force in the presence of magnetic field. Which of the following statement is correct?

A. the particle is moving and magnetic field is perpendicular to the velocity

B. The particle is moving and magnetic fiels is parallel to the velocity

C. The particle is stationary and magnetic field is perpendicular to the velocity

D. The particle is stationary and magnetic field is parallel to the velocity

Answer: a

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36. The rartio $(\text{in} S1 units)$ of magnetic dipole moment to that of the angular momentum of an electron of mass $m kg$ and charge e coulomb in Bohr's orbit of hydrogen atom is

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

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

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

D. $\frac{e}{2m}$

Answer: d

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37. 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 .... $MKS units$.

A. $\frac{L^2 I^2}{4\pi}$

B. $\frac{LI}{4\pi}$

C. $\frac{L^2 I}{4\pi}$

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

Answer: c

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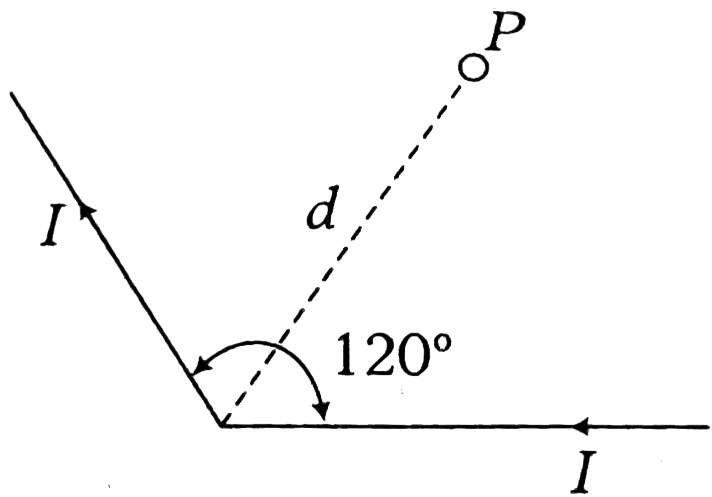
38. A long conducting wire carrying a current I is bent at 120°(see figure). The magnetic field B at a point P on the right bisector of bending angle at a distance d from the bend is

(μ_0 is the permeability of free space)



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

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

C. $\frac{\mu_0 I}{\sqrt{3}\pi d}$

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

Answer: D

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39. A current loop in a magnetic field

A. experiences a torque whether the field is uniform or non-uniform in all orientations

B. can be in equilibrium in one orientations

C. can be equilibrium in two orientations, both the equilibrium states are unstable

D. can be in equilibrium in two orientations one stable while the other is unstable

Answer: d

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40. A proton and helium nucleus are shot into a magnetic field at right angles to the field with same kinetic energy. Then the ratio of their radii is

A. $1:1$

B. $1:2$

C. $2:1$

D. $1:4$

Answer: a

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41. Two charged particles have charges and masses in the ratio $2:3$ and $1:4$ respectively. If they enter a uniform magnetic field and move with the same velocity then the ratio of their respective time periods of revolutions is

A. $3:8$

B. $1:4$

C. $3:5$

D. $1:6$

Answer: A

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42. A metal rod of length l cuts across a uniform magnetic field B with a velocity v. If the resistance of the circuit of which the rod forms a part is r, then the force required to move the rod is

A. $\frac{B^2l^2v}{r}$

B. $\frac{Blv}{r}$

C. $\frac{B^2lv}{r}$

D. $\frac{Blv^2}{r}$

Answer: A

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43. A current of 2 A is made to flow through a coil which has only one turn. The magnetic field produced at the centre is $4\pi \times 10^{-6}\mathrm{Wb}/m^2$. the radius of the coil is

A. $0.0001m$

B. $0.01m$

C. $0.1m$

D. $0.001m$

Answer: c

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44. A long straight wire is carrying a current of 12 A . The magnetic field at a distance of 8 cm is

$(\mu_0 = 4\pi \times 10^{-7} NA^2)$

A. $2 \times 10^{-4} wb/m^2$

B. $3 \times 10^{-5} Wb/m^2$

C. $4 \times 10^{-4} Wb/m^2$

D. $4 \times 10^{-5} Wb/m^2$

Answer: b

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45. The magnetic field at a point on the axis of a long solenoid having 5 turns per cm length when a current of 0.8 A flows through it is

A. $5.024 \times 10^{-8} Wb/m^2$

B. $6.024 \times 10^{-8} Wb/m^2$

C. $7.024 \times 10^{-8} Wb/m^2$

D. $8.024 \times 10^{-8} Wb/m^2$

Answer: a

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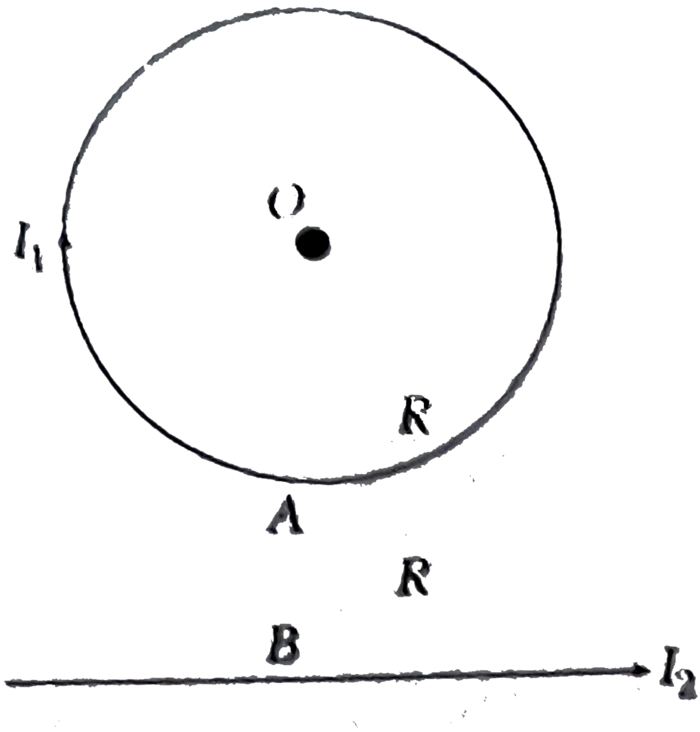
46. In the diagram I_1, I_2 are the strength of the currents in the loop and straight conductors respectively $OA = AB = R.$ the net magnetic field at the centre O is zero . Then the ratio of the currents in the loop and the straight conductor is



A. π

B. 2π

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

D. $\frac{1}{2\pi}$

Answer: D

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47. The adjacent figure shows, the cross-section of a long rod with its length perpendicular to the plane of the paper. It carries constant current flowing along its length. $B_1, B_2, B_3 \text{and} B_4$ respectively respresent the magnetic fields due to the current in the rod at points $1, 2, 3 \text{and} 4$ lying at different separations from the centre O as shown in the figure. which of the following shall hold true?

A. $B_1 > B_2 \neq 0$

B. $B_2 > B_3 \neq 0$

C. $B_1 = B_2 = B_3 \neq 0$

D. $B_2 > B_4 \neq 0$

Answer: d

View Text Solution

48. Two straight wires each 10 cm long are parallel to one another and separated by 2 cm. when the current flowing in them is 30 A and 40 A respectively then the force experienced by either of the wires is

A. $1.2 \times 10^{-3} N$

B. $12 \times 10^{-3} N$

C. $11.2 \times 10^{-3} N$

D. $10.2x10^{-3} N$

Answer: a

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49. A conductor of length 5 cm is moved paralllel to itself with a speed of $2m/s$, perpendicular to a uniform magnetic field of $10^{-3} Wb/m^2$. the induced emf generated is

A. $2 \times 10^{-3} V$

B. $1 \times 10^{-3} V$

C. $1 \times 10^{-4} V$

D. $2 \times 10^{-4} V$

Answer: c

Watch Video Solution

50. On meter length of wires carriers a constant current. The wire is bent to from a circular loop. The magnetic field at the centre of this loop is B. The same is now bent to form a circular loop of smaller radius to have four turns in the loop. The magnetic field at the centre of this loop B. The same is now bent to form a circular loop of smaller radius of have four turns in the loop. The magnetic field at the centre of this new loop is

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

B. $4B$

C. $\frac{B}{4}$

D. $16B$

Answer: d

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51. A proton is moving in a uniform magnetic field B in a circular path of radius a in a direction perpendicular to Z- axis along which field B exists. Calculate the angular momentum. If the radius is a and charge on proton is e.

A. $\frac{Be}{a^2}$

B. eB^2a

C. a^2eB

D. aeB

Answer: c

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52. The magnetic field in a certain region of space is given by $B = 8.35 \times 10^{-2} \hat{i} T$. A proton is shot into the field with velocity $v = \left(2 \times 10^5 \hat{i} + 4 \times 10^5 \hat{j}\right) m/s$. the proton follows a helical path in the field. The distance moved by proton in the x-direction during the period of one revolution in the yz-plane will be (mass of proton $= 1.67 \times 10^{-27} kg)$

A. $0.053m$

B. $0.136m$

C. $0.157m$

D. $0.236m$

Answer: C

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53. A planar coil having 12 turns carries 15 A current. The coil is oriented with respect to the uniform magnetic field $B = 0.2\hat{i}T$ such that its directed area is $A = 0.04\hat{i}m^2$. the potential energy of the coil in the given orientation is

A. 0

B. $+0.72J$

C. $+1.44J$

D. $-1.44J$

Answer: D

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54. A current i ampere flows along the inner conductor of a coaxial cable and returns along the outer conductor fo the cable, then the magnetic induction at any point outside the conductor at a distance r metre from the axis is

A. ∞

B. zero

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

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

Answer: b

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55. Two parallel long wires carry currents $i_1 \text{and} i_2$ with $i_1 > i_2$.When the currents are in the same direction then the magnetic field midway between the wires is $10 \mu T$. when the direction of i_2 is reversed ,then it becomes $40 \mu T$. then ratio of i_1 / i_2 is

A. $3:4$

B. $5:3$

C. $7:11$

D. $11:7$

Answer: b

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56. A charged particle with a velocity $2 \times 10^3 ms^{-1}$ passes undeflected through electric field and magnetic fields in mutually perpendicular directions. The magnetic field is `1.5 t. the magnitude of electric field will be

A. $1.5 \times 10^3 NC^{-1}$

B. $2 \times 10^3 NC^{-1}$

C. $3 \times 10^3 NC^{-1}$

D. $1.33 \times 10^3 NC^{-1}$

Answer: c

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57. Two similar coils of radius R are lying concentriclaly with their planes at right angels to each other. The currents flowing in them are I and $2I$ respectively. The resulant magntic field induction at the centre will be

A. $\frac{\sqrt{5\mu_0 I}}{2R}$

B. $\frac{3\mu_0 I}{2R}$

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

D. $\frac{\mu_0 i}{R}$

Answer: a

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58. When an electronl beam passes through and electric field they gain kinetic energy. If the same electron beam passes through a magnetic field then their

A. energy and momentum both ramain unchanged

B. potential energy increases

C. momentum increases

D. kinetic energy increases

Answer: a

View Text Solution

59. A steel wire of length l has a magnetic moment M. It is bent into a semicircular arc. What is the new magnetic moment?

A. $m \times l$

B. $\frac{M}{l}$

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

D. M

Answer: a

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