PHYSICS

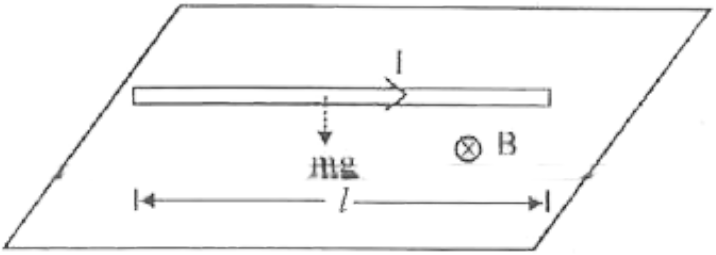
BOOKS - NEW JYOTHI PHYSICS (TAMIL ENGLISH)

MOVING CHARGES AND MAGNETISM

Solved Problems

1. A straight wire of mass 200 g and length 1.5 m carries a current of 2 A. It is suspend in mid-air by a uniform horizontal magnetic field B (Figure). What is the

magnitude of the magnetic field ?



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2. If the magnetic field is parallel to the positive y-axis and the charged particle is moving along the positive x-axis (figure), which way would the Lorentz force be for (a) and electron (negative charge), (b) a proton (positive charge)

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3. What is the radius of the path of an electron (mass 9×10^{-31} kg and charge $1.6 \times 10^{19} C$) moving at a speed of 3×10^{7} m/s in magnetic field of 6×10^{-4} T perpendicular to it ? What is its frequency ? Calculate its energy in keV. $\left(1eV = 1.6 \times 10^{-19} J\right)$

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

$\left(e = 1.60 \times 10^{-19} C, m_p = 1.67 \times 10^{-13} kg\right)$

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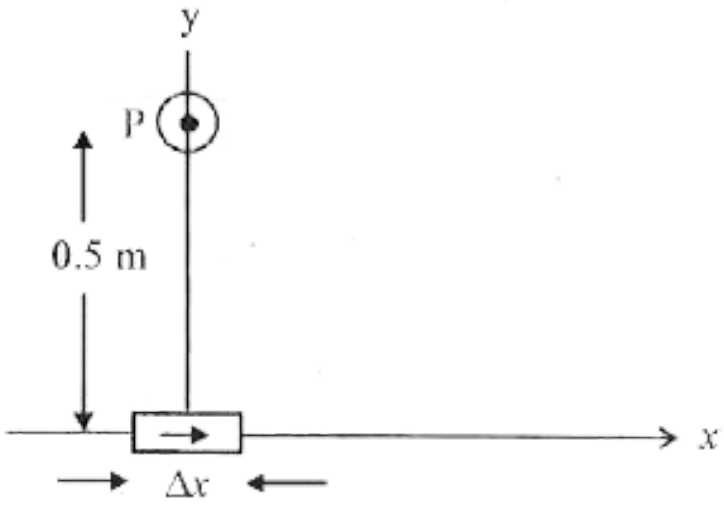
5. An element $\Delta l = \Delta x \hat{i}$ is placed at the origin and carries a large current I= 10 A(figure). What is the magnetic field on the y - axis at a distance of 0.5 m. $\Delta x = 1$ cm



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6. 6.A straight wire carrying a current of 12 A is bent into a semi-circular arc of radius 2.0 cm as shown in Fig. (a). Consider the magnetic field B at the centre of the arc.

a . What is the magnetic field due to the straight segments?

b. In what way the contribution to B from the semicircle differs from that of a circular loop and in what way does it resemble?

c. Would your answer be different if the wire were bent into a semi-circular arc of the same radius but in the opposite way as shown in Fig. (b)?

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7. Consider a tightly wound 100 turn coil of radius 10 cm, carrying a current of 1 A. What is the magnitude of the magnetic field at the centre of the coil?

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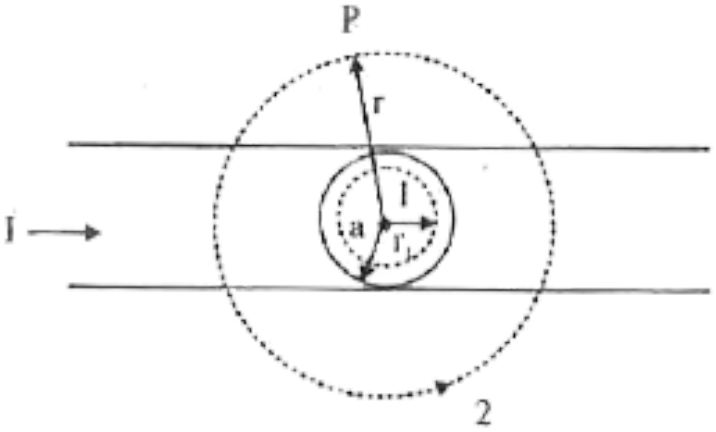
8. Figure shows a long straight wire of a circular cross - section (radius a) carrying steady current I. The current I is uniformly distributed across this cross - section . Calculate the magnetic field in the region $r < a$ and

$r > a$



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9. A solenoid of length 0.5 m has a radius of 1 cm and is made up of 500 turns. It carries a current of 5 A. What is the magnitude of magnetic field inside the solenoid ?

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10. The horizontal component of the earth's magnetic field at a certain place is 3.0×10^{-5} T and the direction of the field is form the geographic south to the georgraphic north . A very long straihgt conductor is carrying a steady current of 1 . What is the force par unit length on it when it is placed on horizontal table and the direction of the current is (a) east to west , (b) south to north ?

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11. A 100 turn closely wound circular coil of radius 10 cm carries a current of 3.2 A.

a. What is the field at the centre of the coil ?

b. What is the magnetic moment of this coil ?

The coil is placed in a vertical plane and is free to rotate about a horizontal axis which coincides with its diameter. A unifrom magnetic field of 2 T in the horizontal direction exists such that initially the axis of the coil is in the direction of the field. The coil rotates through an angle of 90° under the influence of the magnetic field .

c. What are the magnitudes of the torques on the coil in the initial and final position ?

d. What is the angular speed acqired by the coil when it has rotated by 90° ? The moment of inertia of the coil is 0.1 kg m^2

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12. A current -carrying circular loop lies on a smooth horizonatal plane. Can a unifrom magnetic field be set up in such a manner that the loop turns around itself (i.e, turns about the vertical axis) ?

b. A current -carrying circular loop is located in a uniform external magnetic field. If the loop is free to turn , what is its orientation of stable equilibrium ? Show that in this orientation , the flux of the total field (external field + field produced by the loop) is maximum .

c. A loop irregular shape carrying current is located in an external magnetic field. If the wire is flexible, why does it chage to a cirucalr shape ?

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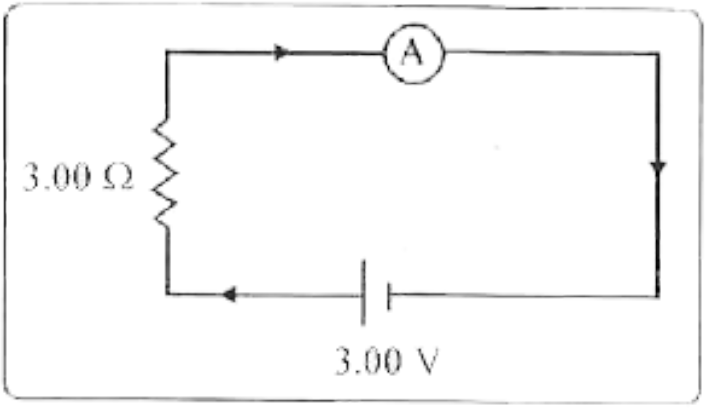
13. In the circuit (Figure) , the current it to be measured. What is the value of the current if the ammeter shown (a) is galvanometer with a resitance $R_G = 60, 00\Omega$, (b) is a galvanometer by a shunt resitance $r_s = 0.02\omega$ (c) is an ideal ammter with zero resitance ?



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Solutions To Exercises From Ncert Text

1. A cirular coil of wire cansiting of 100 turns ,each of readius 8.0 cm carries a current of 0.40 A. What is the magnitude of the magnetic field $\overline{B}$ at the centre of the coil ?

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2. A long straight wire carries a current of 35 A . What is the magnitude of the field B at a point 20 cm from the wire ?

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3. A long straight wire in the horizontal plane carries a current of 50 A in north to south direction . Give the magnitude and direction of B at a point 2.5 m east of the wire .

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4. A horizontal overhead power line carries a current of 90 A in east to west direction. What is the magnitude and direction of the magnetic field due to the current 1.5 m below the line ?

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5. What is the magnanitude of magnetic force per unit length on a wire carrying a current of 8 A and making an angle of 30° with the direction of a uniform magnetic field of 0.15 T ?

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6. A 3.0 cm wire carrying a current of 10 A is placed inside a solenoid perpendicular to its axis. The magnetic field inside the solenoid is given to be 0.27 T.What is the magnetic force on the wire ?

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7. Two long and parallel straight wires A and B carrying currents of 8.0 A and 5.0 A in the same direction are seperated by a distance of 4.0 cm . Estimate the force on a 10 cm section of wire A.

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8. A closely wound solenoid 80 cm long has 5 layers of windings of 400 turns each. The diameter of the solenoid is 1.8 cm .If the current carried is 8.0 A, estimate the magnitude of B inside the solenoid near its centre.

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9. A square coil of side 10 cm consists of 20 turns and carries a current of 12 A. The coil is suspended vertically and the normal to the plane of the coil makes an angle of 30° with the direction of a uniform horizontal magnetic field of magnitude 0.8 T. What is the magnitude of the torque experienced by the coil?

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10. Two moving coil meters M_1 and M_2 have the following particulars

$R_1 = 10\omega, N_1 = 30, \quad A_1 = 3.6 \times 10^{-3} m^2, B_1 = 0.25T$

$R_2 = 14\omega, N_2 = 42 A_2 = 1.8 \times 10^{-3} m^2, B_2 = 0.50T$

(The spering constants are identical for the two meters)

Determine the ratio of (a) current sensitivity and (b) voltage sensitivity of $M_2 \text{and} \quad M_1$

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11. In a chamber, a uniform magnetic field of 6.5G ($1G = 10^{-4}T$) is . Maintained . An electron is shot into field witha speed of $4.8 \times 10^6 ms^{-1}$ normal to the field . Explain why the path of the electron is a circle. Determine the radius of the circular orbit.

$\left(e = 1.6 \times 10^{-19}C, m = 9.1 \times 10^{-31}kg\right)$

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12. In Exercise. 11 obtain the frequency of revolution of the electron in tis circular orbit. Does the answer depend on the speed of the electron ? Explain .

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13. A circular coil of 30 turns and radius 8.0 cm carrying a current or 6.0 A is suspend vertically in a uniform horizontal magnetic field of lines make an angle of 60° with the normal of the coil. Calculate the magnitude of the counter torque that must be applied to prevent the coil from turning.

b. Whould your answer change, if the circular coil in (a) were replaced by a plannar coil of some irregular shape

that encloses the same area ? (All other particulars are also unaltered.)

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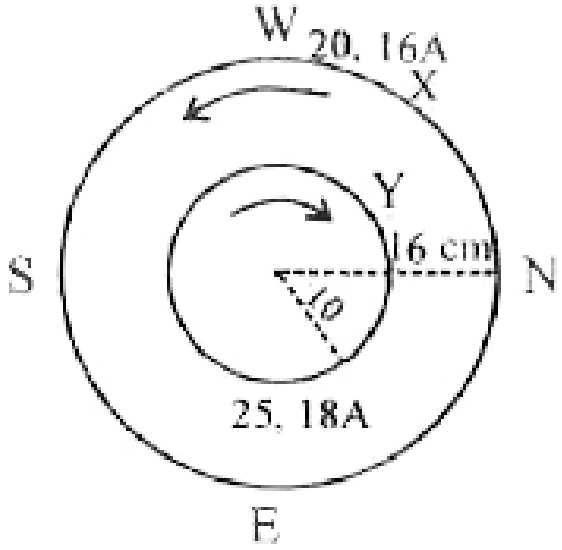
14. Two concentric circular coils X and Y of radii 16 cm and 10 cm , respectively, lie in the same vertical plane conatining the north to south direction. Coil X has 20 turns and carries a current of 16 A, coil Y has 25 turns and carries a current of 18 A . The sense of the current in X is anticlockwise, and clockwise in Y, for an observe looking at the coils facing west. Give the magnitude and direction of the net magnetic field due to the coils at

their centre.



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15. For a circular coil of radias R and N turns carrying current I, the magnitude of the magnetic field at a point on its at a distance x from its centre is given by

$$B = \frac{\mu_0 I R^2 N}{2(x^2 + R^2)^{\frac{1}{2}}}$$

a. Show that this reduces to the familar result for field the centre of the coil .]

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16. A toroid has core (non-ferromagnetic) of inner radius 25 cm and outer radius 26 cm, around which 3500 turns of a wire are wound. If the current in the wire is 11 A, what is the magnetic field (i) outside the toroid , (ii) inside the core of the toroid, and (iii)in the empty space surrounded by the toroid.

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17. A magnetic field that varies in magnitude from point to point but has a constant direction (east to west) is set up in a chamber. A charged particle enters the chamber and travels undeflected along a straight path with constant speed. What can you say about the initial velocity of the particle?

A charged particle enters an environment of a strong and non-uniform magnetic field varying from point to point both in magnitude and direction, and comes out of It following a complicated trajectory. Would its final speed equal the initial speed if it suffered no collisions with the environment? An electron travelling west to east enters a chamber baving a uniform electrostatic field in north to south direction. Specify the direction in

which a uniform magnetic field should be set up to prevent the electron from deflecting from its straight line path.

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18. An electron emitted by a heated cathode and accelerated through a potential difference of 2.0 Kv, enters a region with uniform magnetic field of 0.15 T. Determine the trajectory of the electron if the field (a) is transverse to its initial velocity , (b) makes an angle of 30° with the intial velocity .

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19. A magnetic field set up using Helmholtz coils is uniform in a small region in a direction perpendicular to both the axis of the coils and the elctrostatic field. If the beam remains undeflected when the eletrostatic field is $9.0 \times 10^{+5} Vm^{-1}$ make a simple guess as to what the beam contains . Why is the answer not unique ?

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20. A straight horizontal conducing rod of lenght 0.45 m and mass 60 g is suspend by two vetical wires at its ends. A current of 5.0 A is set up in the rod through the wires.

a. What magnetic field should be set up normal to the conductor in order that the tension in the wires is zero ?

b. What will be the total tension in the wires if the

direction of current is reversed keeping the magnetic field same as before ? (Ignore the mass of the wires.) g= 9.8 ms^{-2}

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21. The wires which connect the battery of an automobile to its starting motor carry current of 300 A (for a short time). What is the force per unit lenght between the wire if they are 70 cm long and 1.5 cm a part ? Is the force attractive or repulsive ?

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Practice Problems For Self Assessment

1. A vertical wire carries a current of 17 A. If the neutral point is observed at a distance of 10 cm from the wire, calculate the horizontal compoinent of earth's magnetic field .

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2. A long straiht telephone cable contains six wires , each carrying a current of 0.5 A. The distance between the wires can be neglected.

a. If the current in all six wires are in the same direction, what is the magnitude of the magnetic field 10 cm from the cable ?

b. If four wires carry current in one direction and the

other two in opposite directions, what is the field magnitude at 10 cm from the cable ?

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3. A straight wire of lenght L carries a current i. Show that the magnetic field B at a point distant R from the wire along a perpendicular bisector is

$$B = \frac{\mu_0 I}{2\pi R}, \frac{L}{\sqrt{L^2 = 4R^2}}$$

If $Lrar\infty$ then five the expression for B.

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4. A square loop of wire of side a carries a current i . Calculate the magnetic field at the centre of the loop

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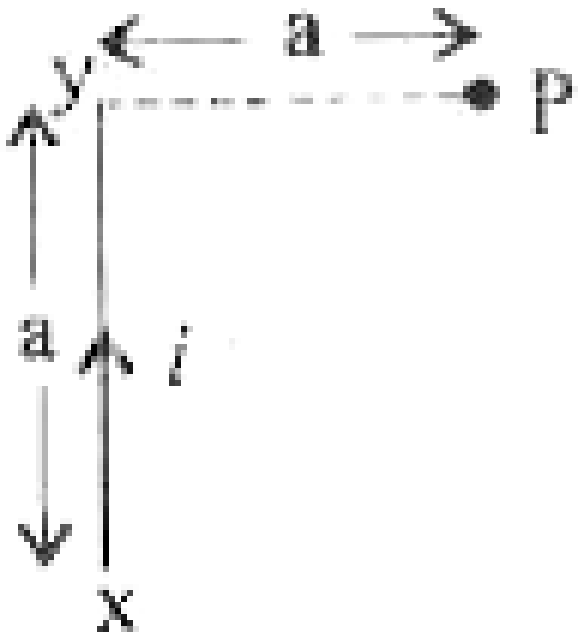
5. Calculate the magnetic field at the point p (Refer figure) due to straight wire XY carrying a current i.



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6. Two wires both of length are formed into (1) a circle and (2) a square . Each one carries a current i,Show that the magnetic field at the centre produced by the square is greater that that produced by the circle.

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7. A surveyer is using a magnetic compas 3m below a power line in which there is a steady current of 75 A . What is the magnetic field t this point due to the power line ?

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8. A student makes a short electromagnet by winding 200 turns of wire around a non conducting cylinder of diameter, d= 4 cm . A current of 5 A is passed through the wire . Find the magnetic dipole moment of the device

$x, x > \ > d$, on its axis the magnetic field of the dipole is $4\mu T$?

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9. The battery of an automobile is connected to a starting motor by straight wires 70 cm long and 1.5 cm apart. If, at the time of starting, the current in the wire is 300 A, estimate the force between the wires . Is the force attractive or repulsive?

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10. A short conductor of length 4 cm placed parallel to a long conductor of length 2 m near its centre. The conductors carry current of 2 and 5A respectively in opposite directions. What is the total force experienced by the long conductor when they are 2cm apart?

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11. A cyclotron's oscillating frequency is 5 MHz

i. What should be the operating magnetic field for accelerating deutrons?

ii What is the kinetic energy of the deutrons if the radius of the dees is 56 cm? Mass of deutrons $= 3.3 \times 10^{-27}$ kg. Charge of deutron $= 1.6 \times 10^{-19} C$

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12. An electron moves with a velocity $\overrightarrow{=}\left(3 \times 10^{6} \hat{i}+4 \times 10^{+6} \hat{j}\right)$ m/s through a magnetic field of strength $B=\left(0.03 \hat{i}+0.15 \hat{j}\right)$ T. Calculate the force on the electron.

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13. A square coil of side 10 cm consists of 20 turns and carries a current of 12 A. The coil is suspended vertically and the normal to the plane of the coil makes an angle of 30^{o} with the direction of a uniform horizontal magnetic

field of magnitude 0.8 T. What is the magnitude of the torque experienced by the coil?

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14. The coil of moving coil galvanometer twists through 90° when a current of one micro ampere is passed through it. If the area of the coil is $10^{-4}m^2$ and its has 100 turns ,calculate the magnetic field of the magnet of the galvanometer, [Given $C = 10^{-8}Nm/$ degree]

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15. Compare (a) current sensitivity and (b) voltage sensitivity in the following moving coil galvanometers.

Meter A : N = 30 $A = 1.5 \times 10^{-3} m^2$ B = 0.25 T R= 20 Ω

Meter , B :N = 35 $A = 2 \times 10^{-3} m^2$ B=0.25 T R= 30 Ω

You are given that the springs in the two meters have the same torsional constant .

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16. A galvanometer of resistance $50 ohm$ shows full scale deflection when 1.5 mA current flows. how can you convert it into (a). Voltmeter that reads 1 volt at full scale deflection (b) Ammeter that reads 30 mA at full scale deflection .

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17. It is desired to measure a maximum current of 30 A with an ammeter of range 3.0 Ampere and resistance 0.09 Ohm`. How will you do this ?

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18. A galvanometer F having 50 divisions has a current sensitivity of 1 m A/ division. Its resistance is $30 ohm$. How will you convert it in to

a. an ammeter of range 10 A

b. a voltmeter of range 10 V

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19. An electron and proton moving with same speed enter a uniform magnetic field perpendicularly. Which particle will have a larger radius of its circular path ? Find the ratio of the radius of thier paths.

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20. Match the following

A	B	C
i. γ ray	Sun burn	Photon emission by fast moving electrons
ii. X-ray	Remote sensing	Electronic de-excitation
iii. UV ray	Diagnosis	Oscillating current
iv. Microwave	Radioactivity	Nucleus

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Evaluation Questions And Answers

1. When current is passed through the conductor, the compass needle deflects. Why?

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2. Is the magnetic field same at all points which are at the same distance from the element?

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3. Is the magnetic field influenced by the medium in which the conductor is placed?

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4. What is the field at any point outside the core of the solenoid?

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5. What is the field inside the core of the solenoid?

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6. What is the nature of field around a moving charge?

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7. Can a charge move in a magnetic field without experiencing a force?

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8. What is the nature of motion of charge entered inclined to a magnetic field?

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9. If the path is circular, which force provides necessary centripetal force?

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10. What is the work done by magnetic force during this motion?

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11. How can we confine the motion in a comparatively small space?

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12. What is the electric field inside the 'dees?

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13. What is the nature of the path inside the 'dee'?

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14. The polarity of 'dees' should be changed, when the charge completes one half circle. Why?

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15. Torque is experienced by a current carrying rectangular coil placed in a magnetic field." Can this principle be used to detect feeble current?

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16. What is the difference between a galvanometer and an ammeter?

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17. Is it possible to measure high current using a galvanometer?

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18. How can you measure a high current using a galvanometer?

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19. How will you connect a voltmeter in a circuit?

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20. To measure p.d between two points in a circuit, minimum current should pass through the voltmeter. Why?

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21. How can you convert a galvanometer into an voltmeter? Can you use Voltmeter to measure current in a circuit?

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22. What is the magnetic field at a point on the axial line on a current carrying circular loop?

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23. How can you rewrite the above equation in terms of area of the loop?

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24. An electric charge will experience a force in uniform electric field. Similarly a moving charge experiences a

magnetic force (Lorentz) in magnetic field. The SI unit of magnetic field intensity is defined in terms of Lorentz force.

a. Write the expression for magnetic Lorentz force.

b. Mention any two differences between electric and magnetic field.

c. Give an account of work done by Lorentz force on a moving charge and corre sponding change in K.E.

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25. Two infinitely long wires carry current as shown in Figure. Find the magnetic field inten sity at the points P, P and P*

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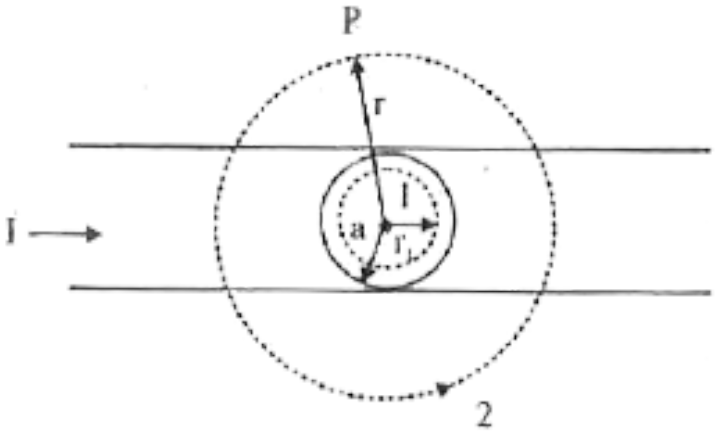
26. Figure shows a long straight wire of a circular cross - section (radius a) carrying steady current I. The current I is uniformly distributed across this cross - section . Calculate the magnetic field in the region $r < a$ and $r > a$



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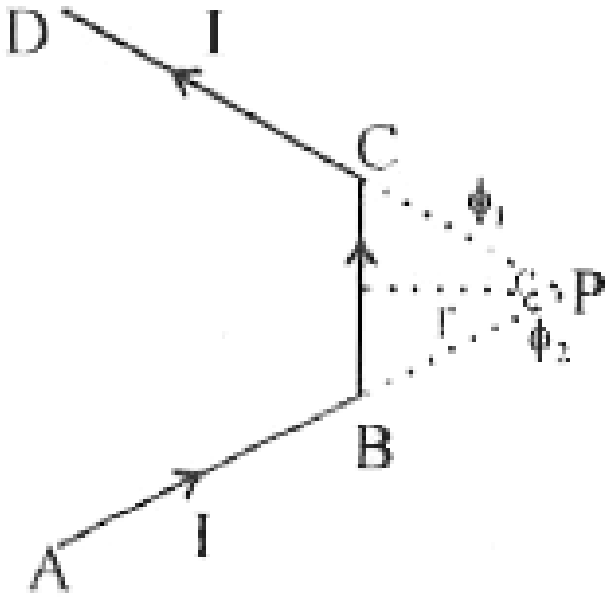
27. A straiht wire ABCD is bend as shown in figure. Find an expression for the magnetic field at the point P.



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28. P and Q are two infinitely long straight pärallel conductors placed in air 'r' distance apart. Let I_1 and I_2

be the current on P and Q respectively flowing in the same direction. Then

a. What is the magnetic field on Q due to I_1?

b. What is the force experienced by Q?

C. Is there any attraction or repulsion between P and Q?

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29. Describe qualitatively the path of a charged particle moving in a uniform magnetic field with initial velocity

a. Parallel to the field

b. Perpendicular to the field and

C. At an arbitrary angle with the field direction.

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30. When a charged particle moves in a magnetic field, does its KE always remain constant?

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31. A long copper wire of diameter 2 mm carries a current of 1.5 A.

a. What is the magnetic field (B) at a perpendicular distance 1 m from the middle of the wire?

b. What is the field (B) on the surface of the conductor?

c. At a distance 1 mm from the axis, what is the value of the magnetic field?

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32. An electron does not suffer any deflection while passing through a region. Are you sure that there is no magnetic field ?

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33. On looking downward, an electron appears moving anti-clockwise in a horizontal circle under a magnetic field. What is the direaction of the field ?

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34. What is the magnetic field along the axis and equatorial line of a bar magnet ?

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35. A current carrying circular loop lies on a smooth horizontal plane. Can a uniform magnetic field be set up in such a manner that the loop turns around itself (i.e. turns about vertical axis)

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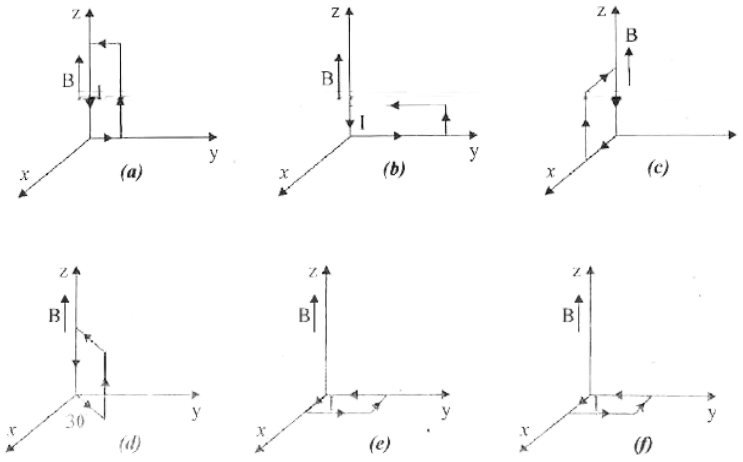
36. A uniform magnetic field of 3000G is established along the positive z-direction. A rect angular loop of sides 10 cm and 5 cm carries a current of 12A. What is the torque on the loop in different cases shown in the figure? What is the force on each case? Which case

corresponds to stable equilibrium?



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37. Describe qualitatively the path of a charged particle moving in a uniform magnetic field with initial velocity

a. Parallel to the field

b. Perpendicular to the field and

C. At an arbitrary angle with the field direction.

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38. A uniform magnetic field of 1.5 T exists in a cylindrical region of radius 10.0 cm, its direction parallel to the axis is along east to west. A wire carrying current of 7.0 A in the north to south direction passes through this region. What is the magnitude and direction of the force on the wire if,

a. the wire intersects the axis,

the wire is turned from N S to north east-south west direction.

c. the wire in the N-S direction is lowered from the axis by a distance 6.0 cm.

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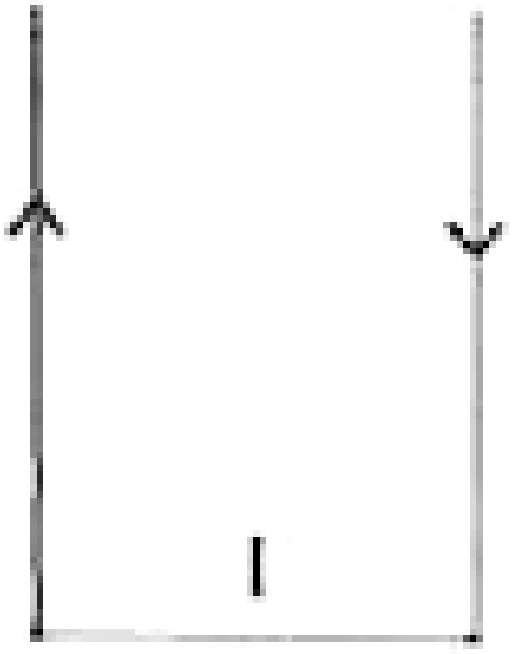
39. A straight horizontal conducting rod of length 0.45 m and mass 60 g is suspended by two vertical wires at its ends. A current of 5.0 A is set up in the rod through the wires.

a. What magnetic field should be set up normal to the conductor in order that the tension in the wires is zero?

b. What will be the total tension in the wires if the direction of current is reversed keeping the magnetic field same as before? (Ignore the mass of the wires.)

$g = 9.8ms^2$?



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40. A current carrying loop of irregular shape is located in an external magnetic field. If the wire is flexible , why

does it become circular?

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41. Starting from the expression for the force on a current carrying conductor in a magnetic field, arrive at the expression for Lorentz magnetic force.

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42. a. What type of particles can be accelerated in a cyclotron?

b. Why cyclotron is not used to accelerate electrons and neutrons?

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43. In a moving coil galvanometer,

a. why is horse-shoe magnet used?

b. why is phosphor bronze fibre used?

c. why is a soft iron cylinder used?

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44. Expression for voltage sensitivity is $\frac{\theta}{v} = \frac{NAB}{CR}$

a. What are the factors on which voltage sensitivity depends on ?

b. Why is it independent of number of turns ?

c. How will you increase the voltage sensitivity ?

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45. A moving coil galvanometer can be converted into an ammeter.

a. Is the statement true or false?

b. Is it possible? Explain

c. What is the effective resistance?

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46. No net force acts on a rectangular loop carrying a steady current when suspended freely in a uniform magnetic field. Is the statement correct or wrong? Justify your an swer.

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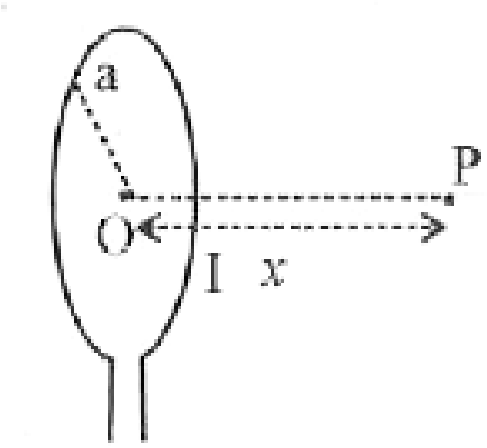
47. A student records the following data for the magnitudes (B) of the magnetic field at axial points at different distances x from the centre of a circular coil of radius 'a' carrying a current I. Verify (for any two) that these observations are in good agreement with the expected theoretical variation of B with x.



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48. What is the magnitude of the induced current in the circular loop KLMN of radius 'r' if the straight wire PQ carries a steady current of magnitude 'i' ampere?

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49. A short bar magnet placed with its axis at 30° to a uniform magnetic field of 0.2 T experiences a torque of 0.060 Nm.

i. Calculate magnetic moment of the magnet

ii. Find out what orientation of the magnet corresponds to its stable equilibrium in the magnetic field.

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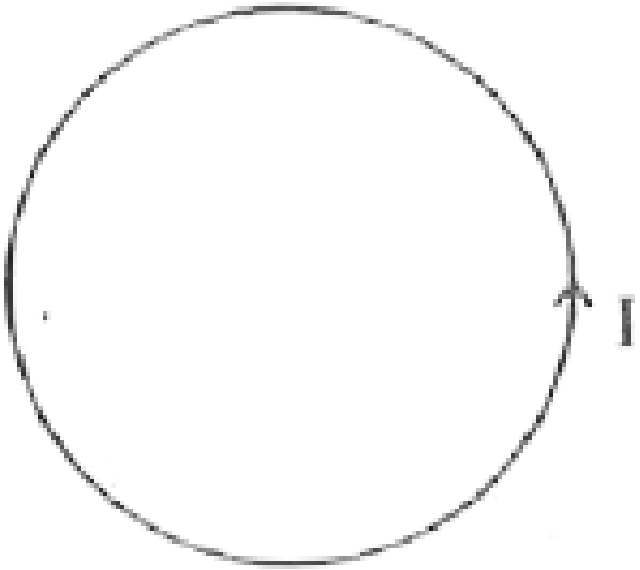
50. In the diagram shown is ciruclar loop carrying current I. show the direction of the magnetic field with the help of lines of force.



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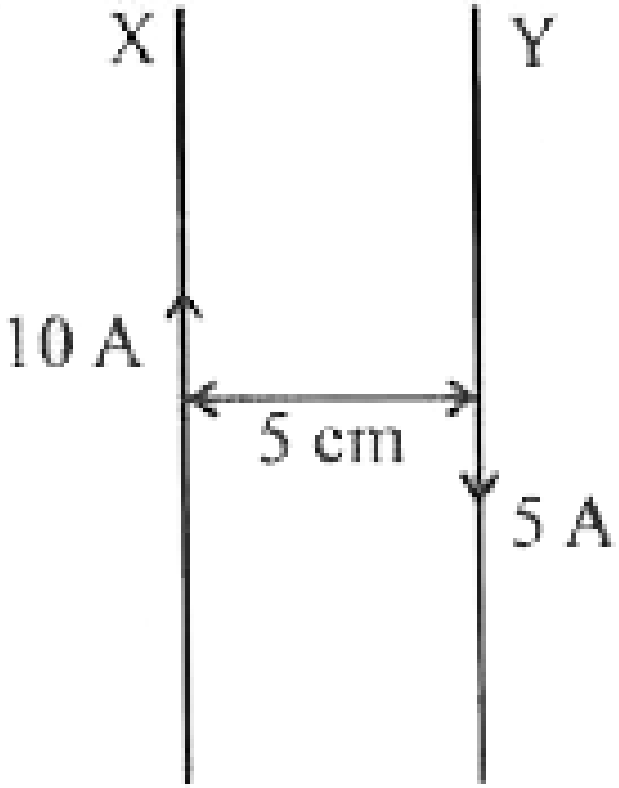
51. Two long parallel straight wires X and Y separated by a distance of 5 cm in air carry currents of 10A and 5A respectively in opposite directions. Calculate the magnitude and direction of the force on a 20 cm length of the wire Y.



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52. A galvanometer with a coil of resistance 120 ohm shows full-scale deflection for a current of 2.5 mA. How will you convert the galvanometer into an ammeter of range 0 to 7.5A? Determine the net resistance of the ammeter. When the ammeter is put in a circuit, does it read slightly less or more than the actual current in the original circuit? Justify your answer

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53. Two wires of equal lengths are bent in the form of two loops. One of the loops is square shaped whereas

the other loop is circular. These are suspended in a uniform magnetic field and the same current is passed through them. Which loop will experience greater torque? Give reason.

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Continuous Evaluation

1. Construction of a voltmeter to read required voltage and an ammeter to read required current, by converting a Galvanometer

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Continuous Evaluation Assignment

1. Outline the Oersted's experiment.

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2. Compare the relative strength of electrostatic force and magnetic force.

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3. Various laws to find the direction of magnetic field in a conductor.

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4. Mention how the Ampere's current balance apparatus used to measure electric current strength.

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Previous Year Questions

1. The relation between magnetic field and current is given by Biot-Savart law.

a. Illustrate Biot-Savart law with necessary figure.

b. Compare Biot-Savart law with Coloumb's law for electrostatic field.

c. Give an expression for magnetic field on the axis of a circular current loop.

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Competitive Exam Corner

1. A solenoid has core of a material with relative permeability 500 and its windings carry a current of 1 A. The number of turns of the solenoid is 500 per metre. The magnetization of the material is nearly

A. $2.5 \times 10^3 Am^{-1}$

B. $2.5 \times 10^5 Am^{-1}$

C. $2.0 \times 10^3 Am^{-1}$

D. $2.0 \times 10^5 Am^{-1}$

Answer:

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2. A $2\mu C$ charge moving around a circle with a frequency of 6.25×10^{12} Hz produces a mganetic field 6.28 tesla at the centre of the circle. The radius of the circle is

A. a. 2.25 m

B. b. 0.25 m

C. c. 13.0 m

D. d. 1.25 m

Answer:

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3. A galvanometer of resistance 100Ω is converted to a voltmeter of range 10 V by connecting a resistance of $10k\Omega$. The resistance required to convert the same galvanometer to an ammeter of range 1 A is

A. a. 0.4Ω

B. b. 0.3Ω

C. c. 0.1Ω

D. d. 0.2Ω

Answer:

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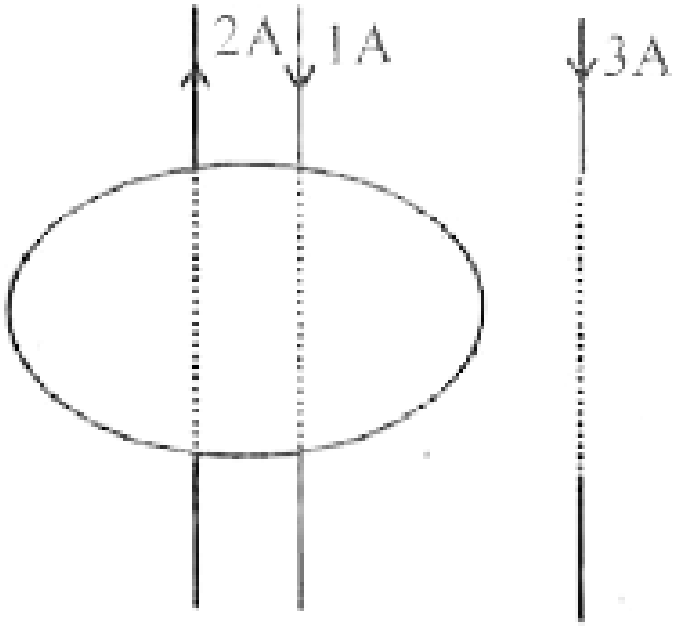
4. Two wires with currents 2 A and 1 A are enclosed in a circular in circular loop. Another wire with current 3 A is situated outside the loop as shown. The $\oint \vec{B} . \vec{dl}$ around

the loop is



A. a. μ_0

B. b. $3\mu_0$

C. c. $6\mu_0$

D. d. $2\mu_0$

Answer:

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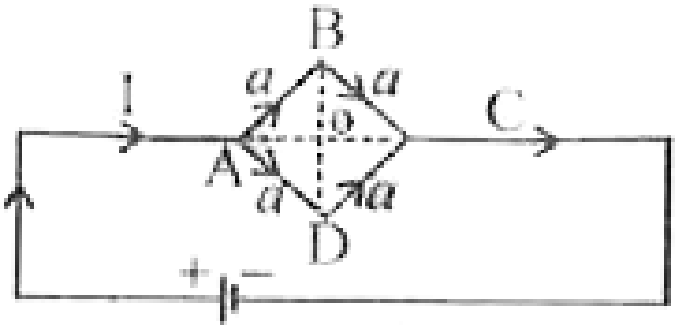
5. Magnetic field induction at athe cetre O of a square loop of side a carrying current I as shown in figure is



A. a. $\frac{\mu_{01}}{\sqrt{2}\pi a}$

B. b. $2\sqrt{2}\frac{\mu_0 1}{\pi a}$

C. c. $\frac{2\mu_{01}}{\pi a}$

D. d. zero

Answer:

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6. The force between two parallel current carrying wires is independent of

A. a. their distance of separation

B. b.the length of the wires

C. c. the magnitude of currents

D. d. the radiis of the wires

Answer:

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7. A metal conductor of length 1 m rotates vertically about one of its ends at angular velocity 5 rad. s^{-1} . If the horizontal component of earth's magnetic field is 0.2×10^4 T, then the emf developed between the ends of the conductor is

A. a. $5\mu V$

B. b. 5 m V

C. c. $50\mu V$

D. d. $50mV$

Answer:

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8. Choose the correct statement.

A. Current sensitivity of a moving coil galvanometer is inversely proportional to the magnetic induction,

B. To convert a galvanometer into an ammeter, a high resistance is connected in series.

C. To convert a galvanometer into a voltmeter, a low resistance is connected in parallel.

D. The voltage sensitivity of a moving coil galvanometer is directly proportional to the magnetic induction

Answer:

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9. Ampere's circuits law can be derived from

A. a. Ohm's law

B. b. Biot-Savart law

C. c. Gauss's law

D. d. Coulomb's law

Answer:

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10. The shunt resistance required to allow 4% of the main current through the galvanometer of resistance 48Ω is

A. 1Ω

B. 2Ω

C. 3Ω

D. 4Ω

Answer: (Kerala MEE 2011)

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11. The magnetic flux linked with a coil of N turns of area of cross section A held with its plane parallel to the field

B is

A. a. $\frac{NAB}{2}$

B. b, NAB

C. c. $\frac{NAB}{4}$

D. d. 0

Answer:

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12. Biot-Savart law can be expressed alternatively as

A. Coulomb's law

B. Ampere's circuital law

C. Ohm's law

D. Kirchhoff's law

Answer:

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13. The magnetic field at a point midway between two parallel long wires carrying currents in the same direction is 10μ T. If the direction of the smaller current among them is reversed, the field becomes $30\mu T$. The ratio of the larger to the smaller current in them is

A. a) $3:1$

B. b) $2:1$

C. c) $4:1$

D. d) $3:2$

Answer:

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14. A 100 turns coil of area of cross section $200cm^2$ having 2Ω resistance is held perpendicular to a magnetic field of 0.1 T. it its is removed from the magnetic field in one second , the induced charge produced in it is

A. a. $0.2C$

B. b. $2C$

C. c. $0.1C$

D. d. $20C$

Answer:

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15. Two charged particles have charges and masses in the ration 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 revolution is

A. a) $3:8$

B. b) $1:4$

C. c) $3:5$

D. d) $1:6$

Answer:

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16. A metal rod of length l cuts across a unifrom 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. a. $\frac{B^2l^2}{r}$

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

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

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

Answer:

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17. The magnitude of the magnetic field inside a long solenoid is increased by

A. a. decreasing its radius

B. b. decreasing the current through it

C. c. increasing its area of cross section

D. d. introducing a medium of higher permeability

Answer:

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18. If the radius of the dees of cyclotron is r, then the kinetic energy of proton of mass m accelerated by the cyclotron at an oscillating frequency v is

A. a) $4\pi^2 m^2 v^2 r^2$

B. b) $4\pi^2 m v^2 r^2$

C. c) $2\pi^2 m \nu^2 r^2$

D. d) $\pi^2 m^2 \nu^2 r^2$

Answer:

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

A. a. 4×10^{-3}T

B. b. $zero$

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

D. d. $3 \times 10^{3} T$

Answer: 2×10^{-3}T

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20. The deflection in a moving coil galvanometer is

A. a. directly proportional to the torsional constant of the spring

B. b. inversely proportional to the number of turns in the coil

C. c. inversely proportional to the area of the coil

D. d. directly proportional to the current flowing through it

Answer:

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21. When a magnetic field is applied on a stationary electron, it

A. a. remains stationary

B. b. spins about its own axis

C. c. moves in the direction of the field.

D. d. moves perpendicular to the direction of the field

Answer:

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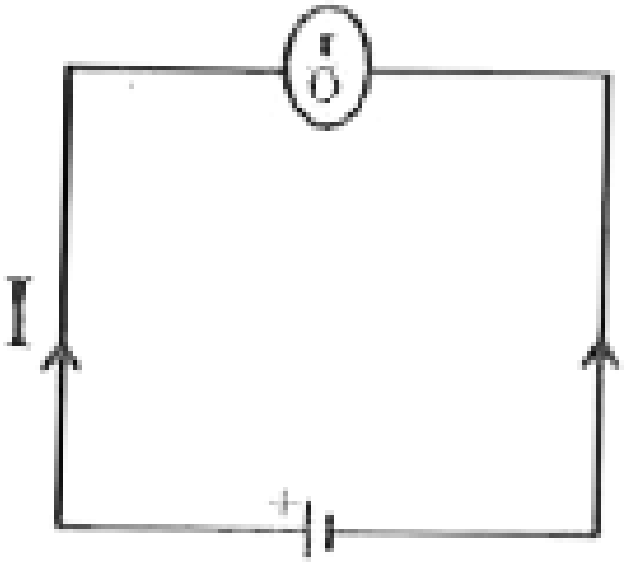
22. A single turn cirular coil is connected to a cell as shown. Magnetic field at the centre O of the coil is



A. a. $\frac{2\pi d}{r}$

B. b. $2\pi l$

C. c. zero

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

Answer: $\frac{1}{\pi r}$

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23. Identify the wrong statement

A. a) Current loop is equivalent to a magnetic dipole

B. b) Magnetic dipole moment of planar loop of area A carrying current I is I^2 A

C. c) Particles like proton, electron carry an intrinsic magnetic moment .

D. d) The current loop (magnetic moment $\vec{m}$) placed in uniform magnetic field.

$\vec{B}$ experiences a torque $\vec{\tau} = \vec{m} \times \vec{B}$

Answer:

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24. A proton is traveling along the X - direction with velocity $5 \times 10^6 \quad ms^{-1}$. The magnitude of force experienced by the proton in a magnetic field. $\overrightarrow{B} = \left(0.2\hat{i} + 0.4\hat{k}\right)$ telsa is

A. a. 3.2×10^{-13} N

B. b. 5.3×10^{-13} N

C. c. $3.2 \times 10^{13} N$

D. d. 6.3×10^{-12} N

Answer:

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25. The shunt required to send 10 % of the main current through a moving coil galvanometer of resistance 99Ω is

A. a. 99Ω

B. b. 9.9Ω

C. c. 10Ω

D. d. 11Ω

Answer:

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26. Two idential coil of 5 turns each carry 1 A and 2 A current respectively. Assume they have common centre

with their planes to each other. If their radius is 1 m each and direction of flow of current in the coils are in opposite directions, then the magnetic field produced on its axial line at a distance of $\sqrt{3}$ m from the common centre is (in tesla)

A. a. 0

B. b. $\frac{15}{16}\mu_0$

C. c. $\frac{8}{16}\mu_0$

D. d. $\frac{5}{16}\mu_0$

Answer: $\frac{16}{5}\mu_0$

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27. The ratio of the magnetic fields produced at the centre of a solenoid for a flow of current 1 A to that produced inside toroid for the flow of current 2A both having same number of turns per unit lenght is

A. a. $1:1$

B. b. $1:2$

C. c. $2:1$

D. d. $1:4$

Answer:

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28. Two long parallel wires carrying equal currents which are 8 cm apart produce a magnetic field $200\mu T$ mid way between them. The magnitude of the current in each wire is

A. a. $10A$

B. b. $20A$

C. c. $30A$

D. d. $40A$

Answer:

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