PHYSICS

BOOKS - NCERT FINGERTIPS PHYSICS (HINGLISH)

MOVING CHARGES AND MAGNETISM

Magnetic Force

1. When a magnetic compass needle is carried nearby to a straight wire carrying current, then

I. the straight wire cause a noticeable deflection in the compass needle.

II. the alignment of the needle is tangential to an imaginary circle with straight wire as its centre and has a plane perpendicular to the wire

A. (I) is correct

B. (II) is correct

C. both (I) and (II) are correct

D. neither (I) nor (II) is correct

Answer: C

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2. Which one of the following is not correct about Lorentz Force?

A. In presence of electric field $\overrightarrow{E}(r)$ ang magnetic field $\overrightarrow{B}(r)$ the force on a moving electric charge is $\overrightarrow{F}=q\left[\overrightarrow{E}(r)+\overrightarrow{v}\times\overrightarrow{B}(r)\right]$

B. The force, due to magnetic field on a negative charge is opposite to that on a positive charge.

C. The force due to magnetic field becomes zero if velocity and magnetic field are parallel or anti- parallel.

D. For a static charge the magnetic force is maximum.

Answer: D

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

A. moves in the direction of the field.

B. remained stationary.

C. moves perpendicular to the direction of the field.

D. moves opposite to the direction of the field.

Answer: B

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4. In an inertial frame of reference, the magnetic force on a moving charged particle is F. Its value in another inertial frame of reference will be

A. remained same

B. changed due to change in the amount of charge

C. changed due to change in velocity of charged particle

D. changed due to change in field direction

Answer: C

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5. The magnetic force $\overrightarrow{F}$ on a current carrying conductor of length I in an external magnetic field $\overrightarrow{B}$ is given by

A. $\dfrac{I \times \overrightarrow{B}}{\overrightarrow{l}}$

B. $\dfrac{\overrightarrow{l} \times \overrightarrow{B}}{I}$

C. $I\left(\overrightarrow{l} \times \overrightarrow{B}\right)$

D. $l^2 \overrightarrow{l} \times \overrightarrow{B}$

Answer: C

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6. A straight wire having mass of 1.2 kg and length of 1m carries a current of 5 A. If the wire is suspended in mid-air by a uniform horizontal magnetic field, then the magnitude of field is

A. 0.65T

B. 1.53T

C. 2.4T

D. 3.2T

Answer: C

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7. A conducting circular loop of radius r carries a constant current i. It is placed in a uniform magnetic field B such that B is perpendicular to the plane of loop. What is the magnetic force acting on the loop?

A. $2\pi RIB$

B. $2\pi Rl^2 B^3$

C. $\pi R^2 IB$

D. zero

Answer: D

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8. A 2.5 m long straight wire having mass of 500 g is suspended in mid air by a uniform horizontal magnetic field B. If a current of 4 A is passing through the wire then the magnitude of the field is $\left(\text{Take g } 10ms^{-2}\right)$

A. 0.5T

B. 0.6T

C. 0.25T

D. 0.8T

Answer: A

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9. 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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10. The horizontal component of earth's magnetic field at a certain place is $3.0 \times 10^{-5}T$ and having a direction from the geographic south to geographic north. The force per unit length on a very long straight conductor carrying a 12 A in east to west direction is

A. $3.0 \times 10^{-5} Nm^{-1}$

B. $3.2 \times 10^{-5} Nm^{-1}$

C. $3.6 \times 10^{-5} Nm^{-1}$

D. $3.8 \times 10^{-5} Nm^{-1}$

Answer: C

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11. An 8 cm long wire carrying a current of 10 A is placed inside a solenoid perpendicular to its axis. If the magnetic field inside the solenoid is 0.3 T, then magnetic force on the wire is

A. 0.14N

B. 0.24N

C. 0.34N

D. 0.44N

Answer: B

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12. The magnetic force per unit length on a wire carrying a current of 10 A and making an angle of 45° with the direction of a uniform magnetic field of 0.20 T is

A. $2\sqrt{2}Nm^{-1}$

B. $\frac{2}{\sqrt{2}}Nm^{-1}$

C. $\frac{\sqrt{2}}{2}Nm^{-1}$

D. $4\sqrt{2}Nm^{-1}$

Answer: B

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13. A ciruclar coil of 20 turns and radius $10cm$ is placed in a uniform magnetic field of $0.1T$ normal to the plane of the coil . If the current in the coil is $5.0A$ what is the average force on each electron in the coil due to the magnetic field (The coil is made of copper wire of cross – sectional area $10^{-5}m^2$ and the free electron density in copper is given to be about $10^{29}m^{-3}$).

A. $2.5 \times 10^{-25}N$

B. $5 \times 10^{-25}N$

C. $4 \times 10^{-25}N$

D. $3 \times 10^{-25}N$

Answer: B

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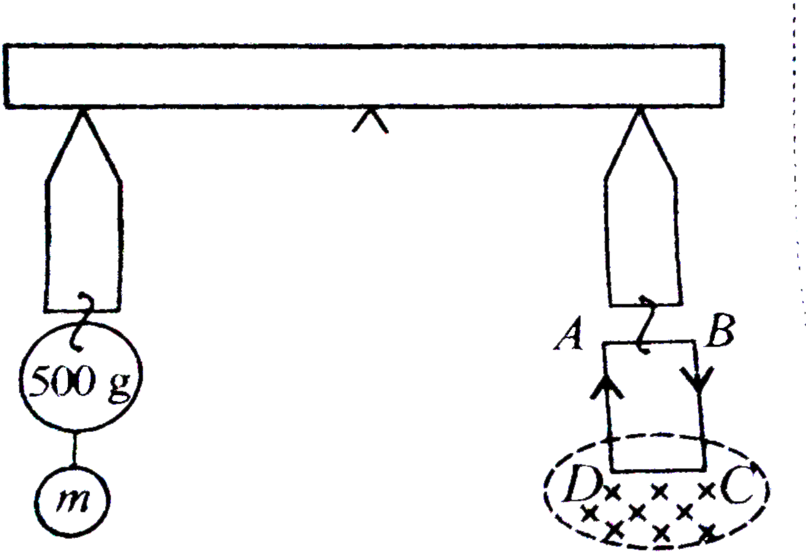
14. A rectangular coil ABCD is hung from one side of a balance as shown in figure. A 500 g mass is added to the other arm to balance the weight of the coil. A current of 9.8 A is passed through the coil and a constant magnetic field of 0.4 T acting inward (in xz plane) is switched on such that only arm CD of length 1.5 cm lies in the field. The additional mass m must be added to regain the balance is



A. 4g

B. 5g

C. 6g

D. 7g

Answer: C

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15. Which one of the following is correct statement about magnetic forces?

A. Magnetic forces always obey Newton's third law

B. Magnetic forces do not obey Newton's third law

C. For very high current, magnetic forces obey Newton's third law

D. Inside low magnetic field, magnetic forces obey Newton's third law

Answer: B

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Motion In Magnetic Field

1. A charged particle is moving on circular path with velocity v in a uniform magnetic field B, if the velocity of the charged particle is doubled and strength of magnetic field is halved, then radius becomes

A. 8 times

B. 4 times

C. 2 times

D. 16 times

Answer: B

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2. An electron of energy 1800 eV describes a circular path in magnetic field of flux density 0.4 T. The radius of path is $(q = 1.6 \times 10^{-19} C, m_e = 9.1 \times 10^{-31} kg)$

A. $2.58 \times 10^{-4} m$

B. $3.58 \times 10^{-4} m$

C. $2.58 \times 10^{-3} m$

D. $3.58 \times 10^{-3} m$

Answer: B

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3. Two α-particles have the ratio of their velocities as 3:2 on entering the field. If they move in different circular paths, then the ratio of the radii of their paths is

A. $2:3$

B. $3:2$

C. $9:4$

D. $4:9$

Answer: B

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4. When a positively charged particle enters a uniform magnetic field with uniform velocity, its trajectory can be

$a)$ a straight line $b)$ a circle $c)$ a helix

A. (i) only

B. (i) or (ii)

C. (i) or (iii)

D. any one of (i),(ii) and (iii)

Answer: D

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5. 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. R_1 / R_2

B. $(R_1 / R_2)^2$

C. (R_2 / R_1)

D. $(R_2 / R_2)^2$

Answer: B

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6. An electron having momentum 2.4×10^{-23} kg m s^{-1} enters a region of uniform magnetic field of 0.15 T. The field vector makes an angle of 30° with the initial velocity vector of the electron. The radius of the helical path of the electron in the field shall be

A. 2mm

B. 1mm

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

D. 0.5mm

Answer: D

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Motion In Combined Electric And Magnetic Fields

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

A. $\overrightarrow{v} = \overrightarrow{B} \times \overrightarrow{E} / E^2$

B. $\overrightarrow{v} = \overrightarrow{E} \times \overrightarrow{B} / B^2$

C. $\overrightarrow{v} = \overrightarrow{B} \times \overrightarrow{E} / B^2$

D. $\overrightarrow{v} = \overrightarrow{E} \times \overrightarrow{B} / E^2$

Answer: B

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2. A charged particle would continue to move with a constant velocity in a region wherein, which of the following conditions is not correct?

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

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

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

D. $E = 0, B = 0$

Answer: C

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3. The cyclotron frequency v_c is given by

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

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

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

D. $\frac{2\pi B}{qm}$

Answer: A

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4. A charged particle is moving in a cyclotron, what effect on the radius of path of this charged particle will occur when the frequency of the radio frequency field is doubled?

A. It will also be doubled.

B. It will be halved.

C. It will be increased by four times.

D. It will remain unchanged.

Answer: D

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5. A cubical region of space is filled with some uniform electric and magnetic field. An electron enters the cube across one of its faces with velocity v and a positron enters via opposite face with velocity $-v$. At this instant, which one of the following is not correct?

A. The electric forces on both the particles cause identical acceleration.

B. The magnetic forces on both the particles cause equal acceleration.

C. Both particles gain or loose energy at the same rate.

D. The motion of the centre of mass is determined by B alone.

Answer: A

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6. A cyclotron is operated at an oscillator frequency of 12 MHz and has a dee radius R 50 cm. What is the magnitude of the magnetic field needed for a proton to be accelerated in the cyclotron?

A. 0.78 T

B. 0.65 T

C. 0.39 T

D. 0.12 T

Answer: A

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7. If an electron is moving in a magnetic field of $5.4 \times 10^{-4} T$ on a circular path of radius 32 cm having a frequency of 2.5 MHz, then its speed will be

A. $8.56 \times 10^{6} ms^{-1}$

B. $5.024 \times 10^{6} ms^{-1}$

C. $8.56 \times 10^{4} ms^{-1}$

D. $5.024 \times 10^{4} ms^{-1}$

Answer: B

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8. A proton and an a-particle enter in a uniform magnetic field perpendicularly with same speed. The will b ratio of time periods of both particle $\left(\frac{T_p}{T_\alpha}\right.$ will be

A. $1:2$

B. $1:3$

C. $2:1$

D. $3:1$

Answer: A

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9. A proton, a deutron and α-particle, whose kinetic energies are same, enter perpendicularly a uniform magnetic field. Compare the radii of their circualr paths.

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

B. $\sqrt{2}:1:1$

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

D. $1:2:\sqrt{2}$

Answer: C

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10. An electron enters with a velocity $\overrightarrow{v} = v_0\hat{i}$ into a cubical region (faces parallel to coordinate planes) in which there are uniform electric and magnetic fields. The orbit of the electron is found to spiral down inside the cube in plane parallel to the x-y plane. Suggest a configuration of fields $\overrightarrow{E}$ and $\overrightarrow{B}$ that can lead to it.

A. $\overrightarrow{E} = E_0\hat{j}, \overrightarrow{B} = B_0\hat{k}$

B. $\overrightarrow{E} = E_0\hat{i}, \overrightarrow{B} = B_0\hat{k}$

C. $\overrightarrow{E} = E_0\hat{i}, \overrightarrow{B} = B_0\hat{j}$

D. $\overrightarrow{E} = E_0\hat{j}, \overrightarrow{B} = B_0\hat{j}$

Answer: B

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11. 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 $= 1 \cdot 67 \times 10^{-27} kg$.

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12. Which of the following is not correct about cyclotron?

A. It is a machine to accelerate charged particles or ions to high energies.

B. Cyclotron uses both electric and magnetic fields in combination to increase the energy of charged particles.

C. The operation of the cyclotron is based on the fact that the time for one revolution of an ion is independent of its speed or radius of its orbit.

D. The charged particles and ions in cyclotron can move on any arbitrary path.

Answer: D

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13. The operating magnetic field for accelerating protons in a cyclotron oscillator having frequency of 12 MHz is $\left(q = 1.6 \times 10^{-19} C, m_p = 1.67 \times 10^{-27} kg \text{ and } 1MeV = 1.6 \times 10^{-13J}\right)$

A. 0.69T

B. 0.79T

C. 0.59T

D. 0.49T

Answer: B

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14. In the question number 34, the kinetic energy (in MeV) of the proton beam produced by the accelerator is (radius of dees =60 cm)

A. 5

B. 6.5

C. 10.6

D. 12.6

Answer: C

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15. An electron is moving in a cyclotron at a speed of $3.2 \times 10^7 ms^{-1}$ in a magnetic field of $5 \times 10^{-4} T$ perpendicular to it. What is the frequency of this electron? $(q = 1.6 \times 10^{-19} C, m_c = 9.1 \times 10^{-31} kg)$

A. $1.4 \times 10^5 Hz$

B. $1.4 \times 10^7 Hz$

C. $1.4 \times 10^6 Hz$

D. $1.4 \times 10^9 Hz$

Answer: B

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16. A proton is accelerating on a cyclotron having oscillating frequency of 11 MHz in external magnetic field of 1 T. If the radius of its dees is 55 cm, then its kinetic energy (in MeV) is is $(m_p = 1.67 \times 10^{-27} kg, e = 1.6 \times 10^{-19} C)$`

A. 13.36

B. 12.52

C. 14.89

D. 14.49

Answer: D

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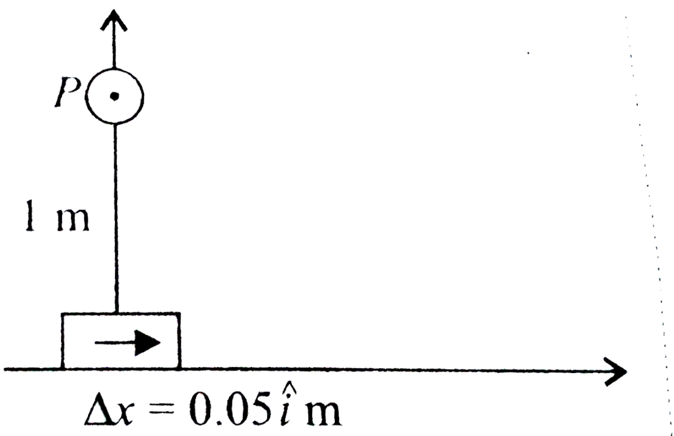
Magnetic Field Due To A Current Element Biot Savart Law

1. An element of $0.05\hat{i}m$ is placed at the origin as shown in figure which carries a large current of 10 A. The magnetic field at a distance of 1 m in perpendicular direction is



A. $4.5 \times 10^{-8}T$

B. $5.5 \times 10^{-8} T$

C. $5.0 \times 10^{-8} T$

D. $7.5 \times 10^{-8} T$

Answer: C

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2. If an electron is moving with velocity v produces a magnetic field $\overrightarrow{B}$, then

A. the direction of field $\overrightarrow{B}$ will be same as the direction of velocity $\overrightarrow{v}$.

B. the direction of field $\overrightarrow{B}$ will be opposite to the direction of velocity $\overrightarrow{v}$.

C. the direction of field $\overrightarrow{B}$ will be perpendicular to the direction of velocity $\overrightarrow{v}$.

D. the direction of field $\vec{B}$ does not depend upon the direction of velocity $\vec{v}$.

Answer: C

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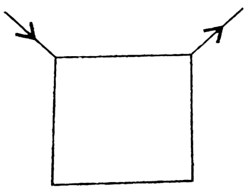
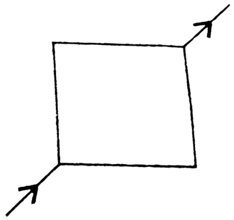
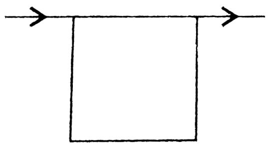
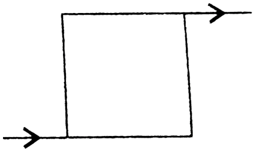
3. Current flows through uniform square frames as shown. In which case is the magnetic field at the centre of the frame not zero ?

A. 

B. 

C. 

D. 

Answer: C

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4. Five long wires A, B, C, D and E, each carrying current I are arranged to form edges of a pentagonal prism as shown in figure. Each carries current out of the plane of paper.

(a) What will be magnetic induction at a point on the axis O? Axis is at a distance R from each wire.

(b) What will be the field if current in one of the wires (say A) is switched off?

(c) What if current in one of the wire (say) A is reversed?

A. equal to zero

B. less than zero

C. more than zero

D. infinite

Answer: A

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Magnetic Field On The Axis Of A Circular Current Loop

1. A circular loop of radius 3 cm is having a current of 12.5 A. The magnitude of magnetic field at a distance of 4 cm on its axis is

A. $5.65 \times 10^{-5} T$

B. $5.27 \times 10^{-5} T$

C. $6.54 \times 10^{-5} T$

D. $9.20 \times 10^{-5} T$

Answer: A

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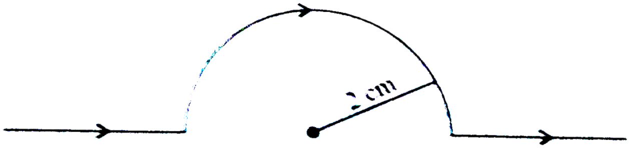
2. A straight wire carrying a current of 13 A is bent into a semi-circular arc of radius 2 cm as shown in figure. The magnetic field is $1.5 \times 10^{-4} T$ at the centre of arc, then the magnetic field due to straight segment is



A. $1.5 \times 10^{-4} T$

B. $2.5 \times 10^{-4} T$

C. zero

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

Answer: C

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3. A circular coil of wire consisting of 100 turns each of radius 9 cm carries a current of 0.4 A. The magnitude of the magnetic field at the centre of coil is $\left[\mu_0 = 1256 \times 10^{-7}\right.$ SI unit]

A. $2.4 \times 10^{-4} T$

B. $3.5 \times 10^{-4} T$

C. $2.79 \times 10^{-4} T$

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

Answer: C

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4. The magnitude of the magnetic field at the centre of the tightly wound 150 turn coil of radius 12 cm carrying a current of 2 A is

A. 18G

B. 19.7G

C. 15.7G

D. 17.7G

Answer: C

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5. A tightly wound 90 turn coil of radius 15 cm has a magnetic field of $4 \times 10^{-4} T$ at its centre. The current flowing through it is

A. 1.06A

B. 2.44A

C. 3.44A

D. 4.44A

Answer: A

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6. A 4 A current carrying loop consists of three identical quarter circles of radius 5 cm lying in the positive quadrants of the x-y, y-z and z-x planes with their centres at the origin joined together, value of B at the origin is

A. $\frac{\mu_0}{10}\left(\hat{i}+\hat{j}-\hat{k}\right)T$

B. $\frac{\mu_0}{10}\left(-\hat{i}+\hat{j}+\hat{k}\right)T$

C. $\frac{\mu_0}{5}\left(\hat{i}+\hat{j}+\hat{k}\right)T$

D. $10\mu_0\left(\hat{i}+\hat{j}+\hat{k}\right)T$

Answer: D

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7. The electric current in a circular coil of two turns produced a magnetic induction of 0.2 T at its centre. The coil is unwound and then rewound into a circular coil of four turns. If same current flows in the coil, the magnetic induction at the centre of the coil now is

A. 0.2T

B. 0.4T

C. 0.6T

D. 0.8T

Answer: D

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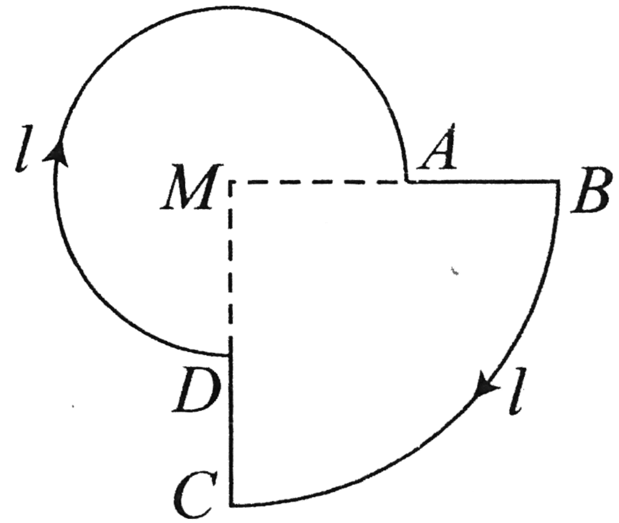
8. A current I is flowing thorugh the loop. The direction of the current and the shpae of the loop are as the shown in the figure. The magnetic fild at the centre of the loop is $\frac{\mu_0 I}{R}$ times

$(MA = R, MB = 2R, \angle DMA = 90^\circ)$



A. $\frac{5}{16}$, out of the plane of the paper.

B. $\frac{5}{16}$, into the plane of the paper.

C. $\frac{7}{16}$, out of the plane of the paper.

D. $\frac{7}{16}$, out the plane of the paper.

Answer: D

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1. A solenoid of length 0.6 m has a radius of 2 cm and is made up of 600 turns If it carries a current of 4 A, then the magnitude of the magnetic field inside the solenoid is

A. $6.024 \times 10^{-3} T$

B. $8.024 \times 10^{-3} T$

C. $5.024 \times 10^{-3} T$

D. $7.024 \times 10^{-3} T$

Answer: C

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2. A solenoid of length $50 cm$, having 100 turns carries a current of $2 \cdot 5 A$. Find the magnetic field, (a) in the interior of the solenoid, (b) at one end of the solenoid.

Given $\mu_0 = 4\pi \times 10^{-7} WbA^{-1}m^{-1}$.

A. $3.14 \times 10^{-4} T$

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

C. $1.57 \times 10^{-4} T$

D. $9.42 \times 10^{-4} T$

Answer: A

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3. A 90 cm long solenoid has six layers of windings of 450 turns each. If the diameter of solenoid is 2.2 cm and current carried is 6 A, then the magnitude of magnetic field inside the solenoid, near its centre is

A. $50\pi G$

B. $60\pi G$

C. $72\pi G$

D. $80\pi G$

Answer: C

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4. Which of the following statement is correct?

A. The magnetic field in the open space inside the toroid is constant.

B. The magnetic field in the open space exterior to the toroid is constant.

C. The magnetic field inside the core of toroid is constant.

D. The magnetic field inside the core of toroid is zero.

Answer: C

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5. The inner and outer radius of a toroid core are 28 cm and 29 cm respectively and around the core 3700 turns of a wire are wounded. If the current in the wire is 10 A, then the magnetic field inside the core of the toroid is

A. $2.60 \times 10^{-2} T$

B. $2.60 \times 10^{-3} T$

C. $4.52 \times 10^{-2} T$

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

Answer: A

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Force Between The Parallel Currents The Ampere

1. The nature of parallel and anti-parallel currents are

A. parallel currents repel and antiparallel currents attract.

B. parallel currents attract and antiparallel currents repel.

C. both currents attract.

D. both currents repel.

Answer: B

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2. Two parallel wires 2 m apart carry currents of 2 A and 5 A respectively in same direction, the force per unit length acting between these two wires is

A. $2 \times 10^{-6} Nm^{-1}$

B. $3 \times 10^{-6} Nm^{-1}$

C. $1 \times 10^{-6} Nm^{-1}$

D. $4 \times 10^{-6} Nm^{-1}$

Answer: C

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3. Two long and parallel straight wires A and B are carrying currents of 4A and 7A in the same directions are separated by a distance of 5cm. The force acting on a 8cm section of wire A is

A. $3 \times 10^{-6} N$

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

C. $9 \times 10^{-6} N$

D. $12 \times 10^{-6} N$

Answer: C

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4. A conductor of length 2 m carrying current 2 A is held parallel to an infinitely long conductor carrying current of 12 A at a distance of 100 mm, the force on small conductor is

A. $8.6 \times 10^{-5} N$

B. $6.6 \times 10^{-5} N$

C. $7.6 \times 10^{-5} N$

D. $9.6 \times 10^{-5} N$

Answer: D

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5. Two straight wires A and B of lengths 10 m and 12 m carrying currents of 4.0 A and 6.0 A respectively in opposite direction, lie parallel to each other at a distance of 3.0 cm. The force on a 15 cm section of the wire B near its centre is

A. $2.4 \times 10^{-5} N$, attractive

B. $2.4 \times 10^{-5} N$, repulsive

C. $1.2 \times 10^{-5} N$, attractive

D. $1.2 \times 10^{-5} N$, attractive

Answer: B

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6. A long straight wire carrying current of 30 A rests on a table. Another wire AB of length 1 m, mass 3 g carries the same current but in the opposite direction, the wire AB is free to slide up and down. The height upto which AB will rise is

A. 0.6 cm

B. 0.7 cm

C. 0.4 cm

D. 0.5 cm

Answer: A

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Torque On Current Loop Magnetic Dipole

1. The magnetic moment of a current I carrying circular coil of radius r and number of turns N varies as

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

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

C. r

D. r^2

Answer: D

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2. A 200 turn closely wound circular coil of radius 15 cm carries a current of 4 A. The magnetic moment of this coil is

A. $36.5Am^2$

B. $56.5Am^2$

C. $66.5Am^2$

D. $108Am^2$

Answer: B

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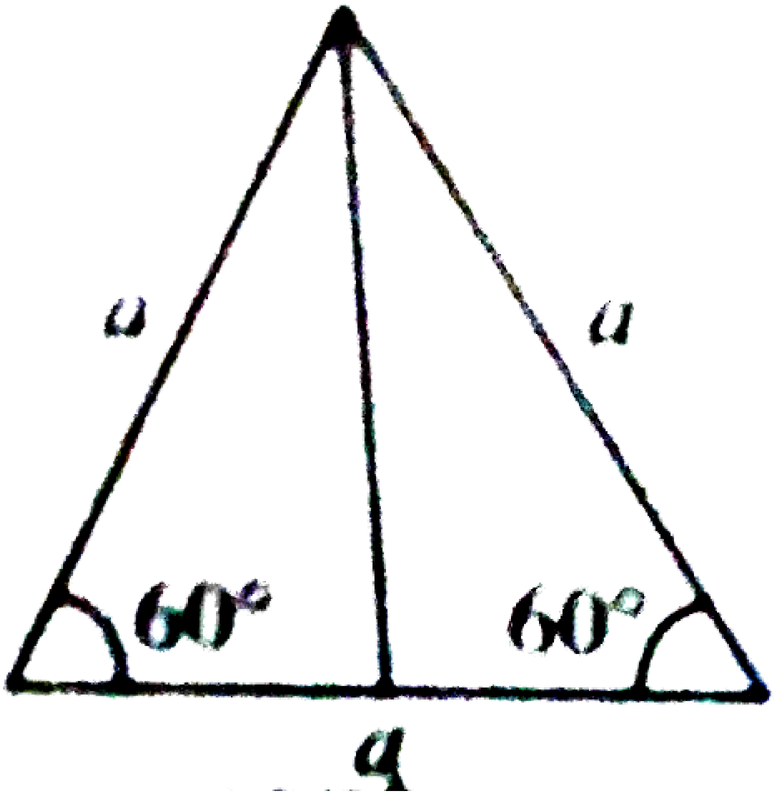
3. A uniform conducting wire of length length 10a and resistance R is wound up into four turn as a current carrying coil in the shape of equilateral triangle of side a. If current I is flowing 4 through the coil then the magnetic moment of the coil is



A. $\frac{\sqrt{3}}{2}a^2 I$

B. $\frac{a^2 I}{\sqrt{3}}$

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

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

Answer: C

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4. The magnetic moment associated with a circular coil of 35 turns and radius 25 cm, if it carries a current of

A. $72.2Am^2$

B. $70.5Am^2$

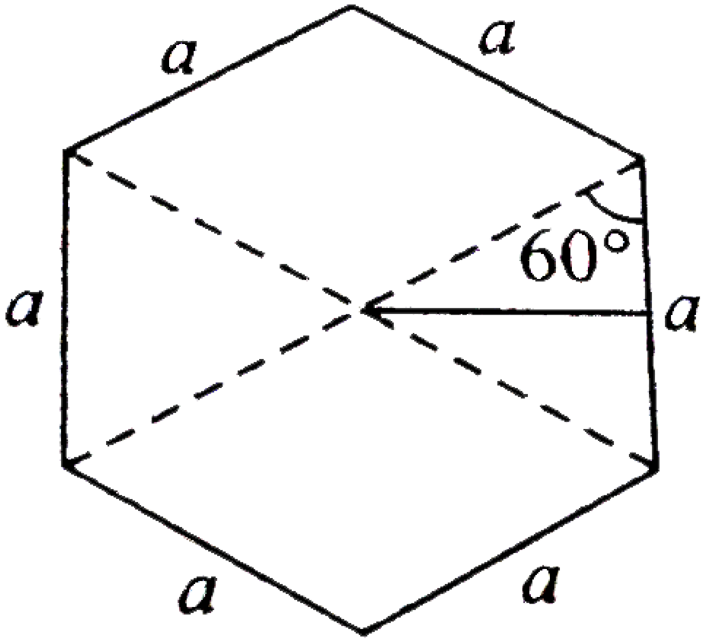
C. $74.56Am^2$

D. $75.56Am^2$

Answer: D

View Text Solution

5. A uniform conducting wire of length 18a and resistance R is wound up as current carrying coil in the shape of a regular a hexagon of sides a. If the coil is connected to a voltage source V_0, then the magnetic moment



of coil is

A. $6\sqrt{3}\frac{V_0}{R}a^2 Am^2$

B. $\frac{9\sqrt{3}}{2}\frac{V_0 a^2}{R}Am^2$

C. $\frac{7\sqrt{3}}{2}\frac{V_0 a^2}{R}Am^2$

D. $\frac{11\sqrt{3}}{2}\frac{V_0 a^2}{R}Am^2$

Answer: B

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6. Magnetic field at the centre of a circualr loop of area A carrying current I is B. What is the magnetic moment of this loop?

A. $\frac{(BA)^2}{\mu_0 \pi}$

B. $\frac{BA\sqrt{A}}{\mu_0}$

C. $\frac{BA\sqrt{A}}{\mu_0 \pi}$

D. $\frac{2BA\sqrt{A}}{\mu_0 \sqrt{\pi}}$

Answer: D

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7. A short bar magnet has a magnetic moment of $0.65TJ^{-1}$, then the magnitude and direction of the magnetic field produced by the magnet at a distance 8 cm from the centre of magnet on the axis is

A. $2.5 \times 10^{-4}T$, along NS direction

B. $2.5 \times 10^{-4} T$, along SN direction

C. $4.5 \times 10^{-4} T$, along NS direction

D. $4.5 \times 10^{-4} T$, along NS direction

Answer: B

Watch Video Solution

8. A circular coil of radius 10 cm having 100 turns carries a current of 3.2 A. The magnetic field at the center of the coil is

A. $2.01 \times 10^{-3} T$

B. $5.64 \times 10^{-3} T$

C. $2.64 \times 10^{-3} T$

D. $5.64 \times 10^{-3} T$

Answer: A

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9. In the question number 73, for the coil given the magnetic moment is

A. $12.95 Am^2$

B. $25.79 Am^2$

C. $10.05 Am^2$

D. $24.79 Am^2$

Answer: C

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10. In the question number 73, the given coil is placed in a vertical plane and is free to rotate about a horizontal axis which coincides with its diameter. A uniform magnetic field of 5T in the horizontal direction exists such that initially the axis of the coil is in direction of the field. The coil rotates through an angle of 60° under the influence of magnetic field. The magnitude of torque on the coil in the final position is

A. 25 N m

B. $25\sqrt{3}Nm$

C. 40 N m

D. $40\sqrt{3}Nm$

Answer: B

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

A. area of loop

B. value of current

C. magnetic field

D. None of these

Answer: D

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12. A circular coil of 70 turns and radius 5 cm carrying a current of 8 A is suspended vertically in a uniform horizontal magnetic field of magnitude 1.5 T. The field lines make an angle of 30° with the normal of the coil then the magnitude of the counter torque that must be applied to prevent the coil from turning is

A. 33 Nm

B. 3.3 Nm

C. $3.3 \times 10^{-2} Nm$

D. $3.3 \times 10^{-4} Nm$

Answer: B

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13. A circular coil of 25 turns and radius 12 cm is placed in a uniform magnetic field of 0.5 T normal to the plane of the coil. If the current in the coil is 6 A then total torque acting on the coil is

A. zero

B. 3.4 Nm

C. 3.8 Nm

D. 4.4 Nm

Answer: A

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14. The final torque on a coil having magnetic moment 25 A m2 in a 5 T uniform external magnetic field, if the coil rotates through an angle of 60° under the influence of the magnetic field is

A. 216.5Nm

B. 108.25Nm

C. 102.5Nm

D. 258.1Nm

Answer: B

Watch Video Solution

15. A square coil of side $10cm$ consists of 20 turns and carries a current of 12A. The coil is suspended vertically and normal to the plane of the coil makes an angle of 30° with the direction of a uniform horizontal magnetic field of magnitude $0 \cdot 80T$. What is the magnitude of torque experienced by the coil?

A. 1.6 N m

B. 1.2 N m

C. 1.4 N m

D. 1.8 N m

Answer: A

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16. A coil having magnetic moment 15 A m^2 placed in a uniform magnetic field of 4 T in the horizontal direction exists such that initially the axis of coil is in the direction of the field. If the coil is rotated by 45° and the moment of inertia of the coil is 0.5 kg m^2 then the angular speed acquired by the coil is

A. 20rad s^{-1}

B. 10rad s^{-1}

C. 8.34rad s^{-1}

D. 4.5rad s^{-1}

Answer: C

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17. The gyromagnetic ratio of an electron in sodium atom is

A. depending upon the atomic number of the atom

B. depending upon the shell number of the atom

C. independent of that orbit it is in

D. having positive value

Answer: C

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18. Gyromagnetic ratio is the ratio of magnetic moment (μ_l) to the orbital angular momentum (l). Its numerical value for an electron is given by

A. $8.8 \times 10^{-12} C \text{ kg}^{-1}$

B. $8.8 \times 10^{10} C \text{ kg}^{-1}$

C. $1.6 \times 10^{-19} C \text{ kg}^{-1}$

D. $6.67 \times 10^{11} C \text{ kg}^{-1}$

Answer: B

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19. What is the correct value of Bohr magneton?

A. $8.89 \times 10^{-24} Am^2$

B. $9.27 \times 10^{-24} Am^2$

C. $5.56 \times 10^{-24} Am^2$

D. $9.27 \times 10^{-28} Am^2$

Answer: B

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The Moving Coil Galvanometer

1. In a moving coil galvanometer the deflection (ϕ) on the scale by a pointer attached to the spring is

A. $\left(\frac{NA}{kB}\right)I$

B. $\left(\frac{N}{kAB}\right)I$

C. $\left(\frac{NAB}{k}\right)I$

D. $\left(\frac{NAB}{kI}\right)$

Answer: C

Watch Video Solution

2. Two moving coil metres M_1 and M_2 have the following particular

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

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

The spring constants are identical for the two metres. What is the ratio of current sensitivity and voltage sensitivity of $M_2 \text{ to} M_1$?

A. 1.4, 1

B. 1.4, 0

C. 2.8, 2

D. 2.8, 0

Answer: A

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3. If the current sensitivity of a galvanometer is doubled, then its voltage sensitivity will be

A. doubled

B. halved

C. unchanged

D. four times

Answer: C

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4. A galvanometer can be converted into an ammeter by connecting

A. introducing a shunt resistance of large value in series.

B. introducing a shunt resistance of small value in parallel.

C. introducing a resistance of small value in series.

D. introducing a resistance of large value in parallel.

Answer: B

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5. A galvanometer of resistance 70Ω, is converted to an ammeter by a shunt resistance $r_3 = 0.03\Omega$. The value of its resistance will become

A. 0.025Ω

B. 0.022Ω

C. 0.035Ω

D. 0.030Ω

Answer: D

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6. If the galvanometer current is 10 mA, resistance of the galvanometer is 40Ω and shunt of 2Ω is connected to the galvanometer, the maximum current which can be measured by this ammeter is

A. 0.21A

B. 2.1A

C. 210A

D. 21A

Answer: A

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7. A galvanometer of resistance 40Ω gives a deflection of 5 divisions per mA. There are 50 divisions on the scale. The maximum current that can pass through it when a shunt resistance of 2Ω is connected is

A. 210mA

B. 155 Ma

C. 420mA

D. 75 Ma

Answer: A

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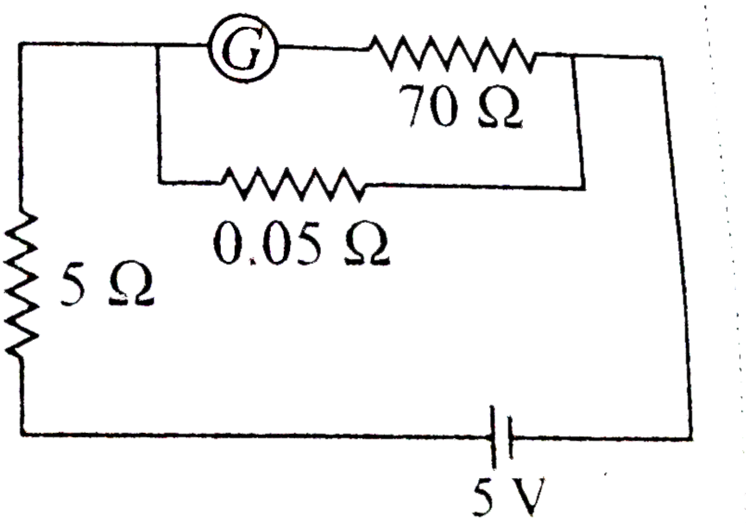
8. In the given circuit, a galvanometer with a resistance of 70Ω is converted to an ammeter 0.05Ω by a shunt resistance of 0.05 2, total current measured by this device



A. 0.88A

B. 0.77A

C. 0.55A

D. 0.99A

Answer: D

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9. A galvanometer having a resistance of 50Ω, gives a full scale deflection for a current of 0.05 A. The length (in metres) of a resistance wire of area of cross section $3 \times 10^{-2} cm$ that can be used to convert the galvanometer into an ammeter which can read a maximum of 5 A current is $(\text{Specific resistance of the wire } = 5 \times 10^{-7} \Omega m)$

A. 9

B. 6

C. 3

D. 1.5

Answer: C

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10. The conversion of a moving coil galvanometer into a voltmeter is done by

A. introducing a resistance of large value in series

B. introducing a resistance of small value in parallel

C. introducing a resistance of large value in parallel

D. introducing a resistance of small value in series

Answer: A

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11. The resistance of a galvanometer is 10Ω. It gives full-scale deflections when $1mA$ current is passed. The resistance connected in series for converting it into a voltmeter of $2.5V$ will be

A. 24.9Ω

B. 249Ω

C. 2490Ω

D. 24900Ω

Answer: C

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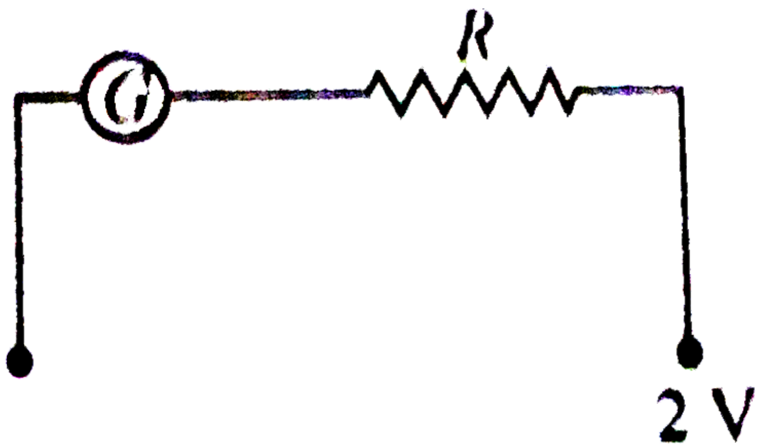
12. A voltmeter which can measure 2 V isconstructed by using a galvanometer of resistance 12Ω and that produces maximum deflection for the current of 2mA. Then the resistance R is



A. 888Ω

B. 988Ω

C. 898Ω

D. 999Ω

Answer: B

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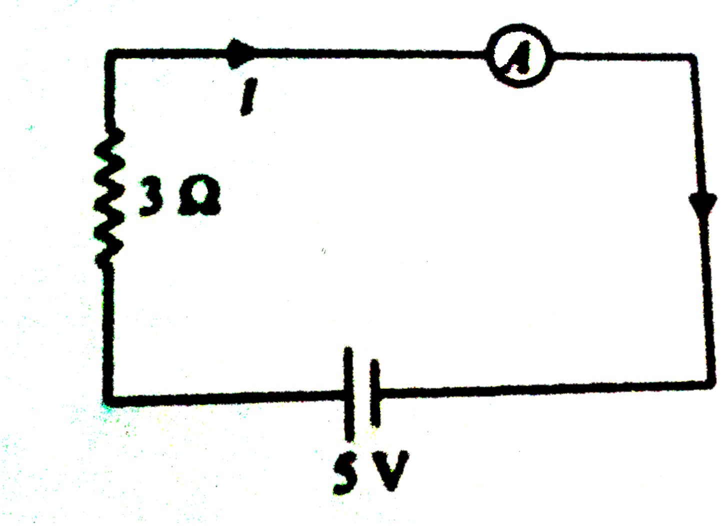
13. The value of current in the given circuit if the ammeter is a galvanometer with a resistance $R_G = 50\Omega$ is



A. 0.048 A

B. 0.023 A

C. 0.061 A

D. 0.094 A

Answer: D

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14. A galvanometer coil has a resistance of 15Ω and the metre shows full scale deflection for a current of 4 mA. To convert the meter into a voltmeter of range 0 to 18 V, the required resistance is

A. 5885Ωin series

B. 4485Ωin series

C. 5885Ωin series

D. 4485Ωin series

Answer: B

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15. A galvanometer of resistance 50Ω is connected to a battery of $3V$ along with resistance of 2950Ω in series. A full scale deflection of 30 divisions is obtained in the galvanometer. In order to reduce this deflection to 20 division the above series resistance should be

A. 6050Ω

B. 4450Ω

C. 5050Ω

D. 5550Ω

Answer: B

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16. The range of voltmeter of resistance 300Ω is 5 V. The resistance to be connected to convert it into an ammeter of range 5 A is

A. 1Ωin series

B. 1Ωin parallel

C. 0.1Ωin series

D. 0.1Ωin parallel

Answer: B

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Higher Order Thinking Skills

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

A. 1

B. 5

C. 10

D. 7

Answer: D

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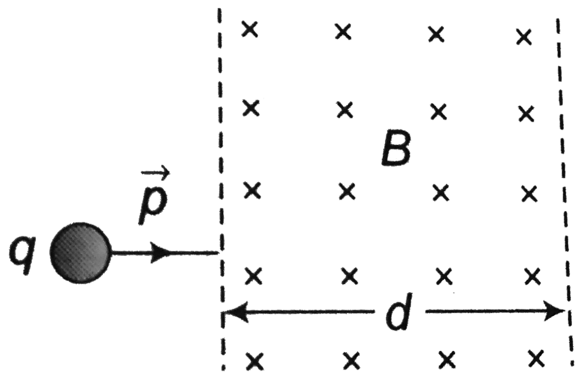
2. A particle with charge q, moving with a momentum p, enters a uniform magnetic field normally. The magnetic field has magnitude B and is confined to a region of width d, where $d < \frac{p}{Bq}$. If the particle is deflected by an angle θ in crosing the field then



A. $\sin\theta = \frac{BQd}{p}$

B. $\sin\theta = \frac{P}{BQd}$

C. $\sin\theta = \frac{Bp}{Qd}$

D. $\sin\theta = \frac{pd}{BQ}$

Answer: A

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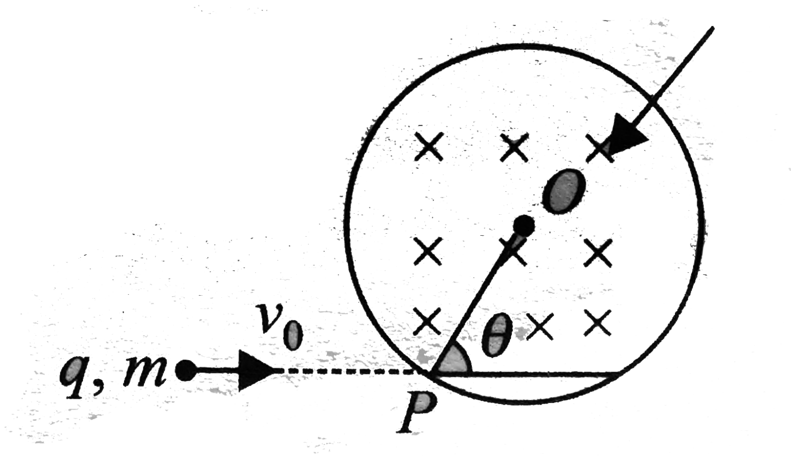
3. A particle of charge q and mass m is projected with a velocity v_0 toward a circular region having uniform magnetic field B perpendicular and into the plane of paper from point P as shown in Fig. 1.136. R is the radius and O is the center of the circular region. If the line OP makes an angle θ with the direction of v_0 then the value of v_0 so that particle passes through O is



A. $\frac{qBR}{m\sin\theta}$

B. $\frac{qBR}{2m\sin\theta}$

C. $\frac{2qBR}{m\sin\theta}$

D. $\frac{3qBR}{2m\sin\theta}$

Answer: B

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4. A current I flows in a rectangularly shaped wire whose centre lies at $(x_0, 0, 0)$ and whose vertices are located at the points A $(x_0 + d, \ - a, \ - b)$, $B(x_0 - d, a, \ - b)$, $C(x_0 - d, a, \ + b)$ and $D(x_0 + d,$ respectively. Assume that a,b,dltltx_0. Find the magnitude of magnetic dipole moment vector of the rectangular wire frame in J/T. (Given, b=10 m,I=0.01A, d=4m,a=3m).

A. $2JT^{-1}$

B. $4JT^{-1}$

C. $3JT^{-1}$

D. $9JT^{-1}$

Answer: A

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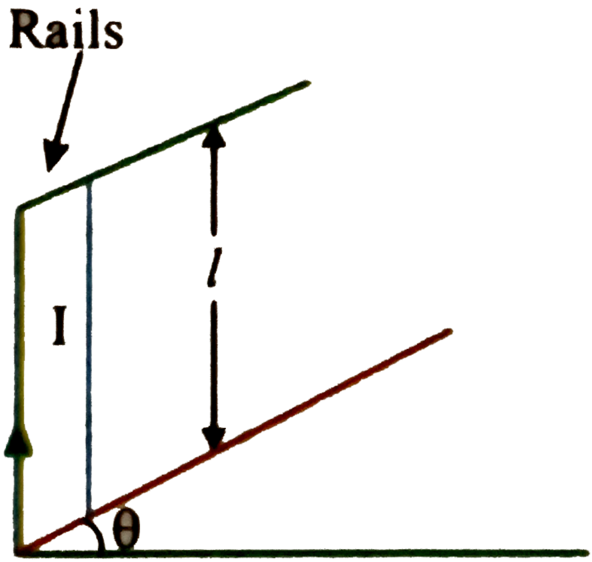
5. A conducting wire of length l and mass m is placed on two inclined rails as shown in figure. A current I is flowig in the wire in the direction shown When no magnetic field is present in the region, the wire is just on the verge of sliding. When a vertically upward magnetic field is switched on, the wire starts moving up the incline. The distance travelled by the wire as a function of time t will be



A. $\frac{1}{2}\left[\frac{IBl}{m} - 2g\right]t^2$

B. $\frac{1}{2}\left[\frac{IBl}{m} \times \frac{1}{\cos\theta} - 2g\sin\theta\right]t^2$

C. $\frac{1}{2}\left[\frac{IBl}{m} - 2g\sin\theta\right]t^2$

D. $\frac{1}{2}\left[\frac{IBl}{m}\frac{\cos 2\theta}{\cos\theta} - 2g\sin\theta\right]t^2$

Answer: D

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6. A current I=10A flows in a ring of radius $r_0 = 15cm$ made of a very thin wire. The tensile strength of the wire is equal to T=1.5N. The ring is placed in a magnetic field, which is perpendicular to the plane of th ering so that the forces tend to break the ring. Find B (in T) at which the ring is broken.

A. 0.5 T

B. 1 T

C. 2 T

D. 2.5 T

Answer: B

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7. Inside a long straight uniform wire of round cross-section, there is a long round cylindrical cavity whose axis is parallel to the axis of the wire and displaced from the latter by a distance l. A direct current of density j flows along the wire. Find the magnetic induction inside the cavity. Consider, in particular, the case $l = 0$.

A. 0

B. $\frac{1}{2}\mu_0 \overrightarrow{J} \times \overrightarrow{d}$

C. $\mu_0 \overrightarrow{J} \times \overrightarrow{d}$

D. $\frac{3}{2}\mu_0 \overrightarrow{J} \times \overrightarrow{d}$

Answer: B

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8. A galvanometer has a current sensitivity of 1 mA per division. A variable shunt is connected across the galvanometer and the combination is put in series with a resistance of 500Ω and cell of internal resistance 1Ω. It gives a deflection of 5 division for shunt of 5 ohm and 20 division for shunt of 25 ohm. The emf of cell is

A. 47.1 V

B. 57.1 V

C. 67.1 V

D. 77.1 V

Answer: A

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Ncert Exemplar

1. 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 momenta.

B. They must have equal charges.

C. They necessarily represent a particle-antiparticle pair.

D. The charge to mass ratio satisfy:

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

Answer: D

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

A. $\overrightarrow{B} \perp \overrightarrow{v}$

B. $\overrightarrow{B} \mid \mid \overrightarrow{v}$

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

A. The magnitude of magnetic moment now diminishes.

B. The magnetic moment does not change.

C. The magnitude of $\overrightarrow{B}$ at $(0, 0, z), z > \ > R$ increases.

D. The magnitude of $\overrightarrow{B}$ at $(0, 0, z), z > \ > R$ is unchanged.

Answer: A

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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 contnue to move with uniform velocity along the axis of the solenoid.

Answer: D

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5. In a cyclotron, a charged particle

A. undergoes acceleration all the time.

B. speeds up between the dees because of the magnetic field.

C. speeds up in a dee.

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

Answer: A

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6. A circular current loop of magnetic moment M is in an arbitrary orientation in an external magnetic field $\overrightarrow{B}$. The work done to rotate the loop by 30° about an axis perpendicular to its plane is :

A. MB

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

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

D. zero.

Answer: D

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Assertion And Reason

1. Assertion : Electron revolves around a positvely charged nucleus like a planet revolves around the sun.

Reason : The force acting in both the cases is of same kind.

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 the correct explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: C

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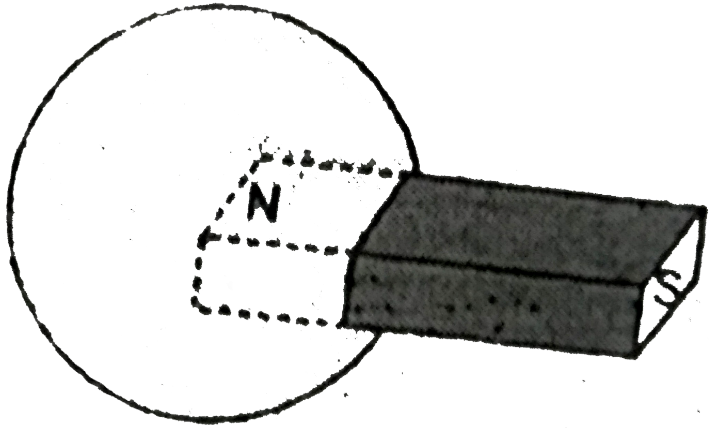
2. Statement-1 The net magnetic flux through a spherical surface enclosing north pole of a bar magnet as zero



Statement-2 Magnetic field lines always form closed loops

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 the correct explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

Watch Video Solution

3. Assertion : Magnetic field interacts with a moving charge and not with a stationary charge.

Reason : A moving charge produces a magnetic field.

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 the correct explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

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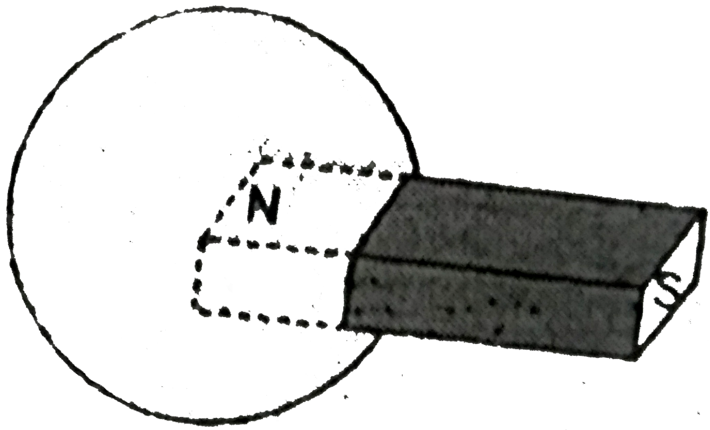
4. Statement-1 The net magnetic flux through a spherical surface enclosing north pole of a bar magnet as zero



Statement-2 Magnetic field lines always form closed loops

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 the correct explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

5. Assertion: The energy of charged particle moving in uniform magnetic field does not change.

Reason: Work done by magnetic field on the charge is 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 the correct explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

Watch Video Solution

6. Assertion: Cyclotron does not accelerate.

Reason: Mass of the electron is very small.

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 the correct explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

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7. AMPERE'S CIRCUITAL LAW

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 the correct explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

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8. MAGNETIC FIELD DUE TO CURRENT CARRYING SOLENOID

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 the correct explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

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9. Statement1: The magnetic filed at the ends of very long current carrying solenoid is half of that at the centre.

Statement2: If the solenoid is sufficiently long, the field within it is uniform.

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 the correct explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

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10. The two linear parallel conductors carrying currents in the opposite direction....................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 the correct explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: D

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11. Assertion: When a magnetic dipole is placed in a non-uniform magnetic field, only a torque acts on the dipole.

Reason: Force would also acts on dipole if magnetic field were uniform.

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 the correct explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: D

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12. Assertion : The net magnetic force on a current loop in a uniform magnetic field is zero but torque may or may not be zero.

Reason : Torque on a current carrying coil in a magnetic field is given by $\overrightarrow{\tau} = nI\left(\overrightarrow{A} Xx\tau(B)\right)$.

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 the correct explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: B

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13. $Assertion$: current sensitivity of a galvanometer is directly proportional to the current through the coil.

$Reason$: Voltage sensitivity is inversely proportional to voltage.

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 the correct explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: D

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14. Write two reasons, why a galvanometer cannot be used as such to measure current in a given circuit.

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 the correct explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

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15. A galvanometer can be used as a voltmeter by connecting

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 the correct explanation of assertion.

C. If assertion is true but reason is false

D. If both assertion and reason are false.

Answer: A

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Others

1. Ampere's circuital law is given by

A. $\oint \vec{H} . \vec{d} l = \mu_0 I_{\text{enc}}$

B. $\oint \vec{B} . \vec{d} l = \mu_0 I_{\text{enc}}$

C. $\oint \vec{B} . \vec{d} l = \mu_0 J$

D. $\oint \vec{H} . \vec{d} l = \mu_0 J$

Answer: B

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2. Two identical current carrying coaxial loops, carry current I in an opposite sense. A simple amperian loop passes through both of them once. Calling the loop as C,

A. $\oint_c \vec{B} . \vec{d} l = \pm 2\mu_0 J$

B. the value of $\oint \vec{B} . \vec{d} l$ is independent of sense of C.

C. there may be a point on C where B and dl are parallel.

D. none of these

Answer: B

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3. A long straight wire in the horizontal plane carries a current of 75 A in north to south direction, magnitude and direction of field B at a point 3 m east of the wire is

A. $4 \times 10^{-6} T$, vertical up

B. $5 \times 10^{-6} T$, vertical down

C. $5 \times 10^{-6} T$, vertical up

D. $4 \times 10^{-6} T$, vertical down

Answer: C

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4. If a long straight wire carries a current of 40 A, then the magnitude of the field B at a point 15 cm away from the wire is

A. $5.34 \times 10^{-5} T$

B. $8.34 \times 10^{-5} T$

C. $9.6 \times 10^{-5} T$

D. $10.2 \times 10^{-5} T$

Answer: A

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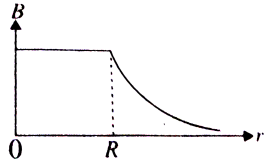
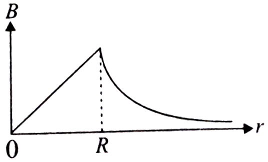
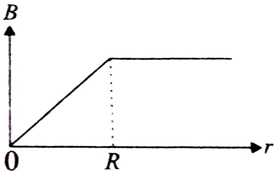
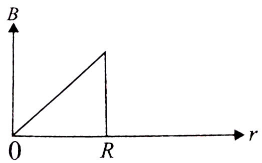
5. The correct plot of the magnitude of magnetic field $\vec{B}$ vs distance r from centre of the wire is, if the radius of wire is R

A. 

B. 



C.



D.

Answer: B

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