PHYSICS

BOOKS - MHTCET PREVIOUS YEAR PAPERS AND PRACTICE PAPERS

MAGNETIC EFFECT OF ELECTRIC CURRENT

Examlpe

1. A current path shaped as shown in figure produces a magnetic field at P the centre fo the arc. If the arc subtends an angle of 30° and the radius of the arc is 0.6 m. What is the magnitude of the field at P, if the current is 3.0 A?

A. $26 \times 10^{-7} T$

B. 4T

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

D. 2.6T

Answer: A

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

A. $10A$

B. $60A$

C. $50A$

D. $20A$

Answer: C

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Exercise 1 Topical Problems

1. Magnetic effects of electric were discovered by

A. Faraday

B. Oersted

C. Ampere

D. Joule

Answer: B

2. Which of the following gives the value of magnetic field according to, Biot-Savart's law

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

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

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

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

Answer: C

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3. Magnetic field at a distance r from an infinitely long straight conductor carrying steady varies as

A. $1/r^2$

B. $1/r$

C. $1/r^2$

D. $1/\sqrt{r}$

Answer: B

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

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

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

C. 2B

D. 4B

Answer: C

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5. Two parallel wires carrying equal currents i_1 and i_2 with $i_1 > i_2$. When the current are in the same direction, the $10mT$. If the direction of i_2

is reversed, the field becomes $30mT$. The ratio i_1 / i_2 is

A. 4

B. 3

C. 2

D. 1

Answer: C

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

A. south

B. east

C. north

D. west

Answer: D

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

A. y=x

B. y=-x

C. y=x-1

D. y=-x+1

Answer: A

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

A. directly proportional to r

B. inversely proportional to r

C. directly proportional to r^2

D. inversely proportional to r^2

Answer: B

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

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

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

C. $\frac{\mu_0 i}{4R}$

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

Answer: B

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

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

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

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

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

Answer: B

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

A. $\frac{\mu_0 i}{4}(r_1 + r_3)$

B. $\frac{\mu_0 i}{4}(r_1 - r_3)$

C. $\frac{\mu_0 i}{4}\left[\frac{r_1 + r_3}{r_1 r_2}\right]$

D. $\frac{\mu_0 i}{4}\left[\frac{r_1 - r_3}{r_1 r_2}\right]$

Answer: C

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

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

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

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

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

Answer: C

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13. A current i flow through a closed loop as shown in figure. The magnetic field at the centre

O is

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

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

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

D. None of these

Answer: A

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14. A current I ampere flows in circular arc of wire whose radius is R, which subtends and $3\pi/2$ radian at its centre. The magnetic induction B at the centre is

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

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

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

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

Answer: D

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

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

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

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

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

Answer: C

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

A. moves in the direction of the field

B. moves in an opposite direction of the field

C. remains stationary

D. starts spinning

Answer: C

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

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

B. $\frac{B}{rv}$

C. Bvr

D. $\frac{vr}{B}$

Answer: A

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

A. remains constant

B. increases

C. decreases

D. becomes zero

Answer: A

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

A. contract

B. expand

C. move towards +ve X-axis

D. move towards -ve X-axis

Answer: B

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20. Two proton beams going in the same direction repel each other whereas two wires carrying currents in the same direction attract each other. Explain.

A. potential difference between them

B. mutual inductance between them

C. electric force between them

D. magnetic force between them

Answer: D

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

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

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

C. A will attract B but will repel A

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

Answer: A

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

A. $\mu_0 i / 2\pi d^2$

B. $\mu_0 i^2 / 2\pi d^2$

C. $\mu_0 i^2 / 2\pi d$

D. $\mu_0 i / 2\pi d$

Answer: C

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23. Two long conductors, separated by a distance d carry current I_1 and I_2 in the same direction . They exert a force F on each other. Now the current in one of them is increased to

two times and its direction is reversed . The distance is also increased to $3d$. The new value of the force between them is

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

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

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

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

Answer: D

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

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

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

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

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

Answer: A

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

A. $5A$

B. $50A$

C. $10A$

D. $100A$

Answer: C

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

Mark the correct option from the codes given below.

A.

A	B	C	D
p	q,s	q,s	q,s

B.

A	B	C	D
q	p	s	r

C.

A	B	C	D
p	q	p	q

D.

A	B	C	D
p	q	q	q,r

Answer: A

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27. A metallic loop is placed in a nonuiform magnetic field. Will an emf be induced in the loop?

A. the loop will feel a force of attraction

B. the loop will a force of repulsion

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

D. None of the above

Answer: D

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

A. shape of the loop

B. area of the loop

C. number of turns in the loop

D. strength of the current

Answer: A

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

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

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

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

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

Answer: C

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

A. 31.4 Nm

B. 3.14 Nm

C. 0.314 Nm

D. zero

Answer: D

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Exercise 2 Miscellaneous Problems

1. A line wire is hidden in a wall its position can be located with the help of

A. watt-meter

B. moving coil galvanometer

C. magnetic needle

D. the position of the line wire cannot be located without breaking the wall

Answer: C

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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. B is perpendicular to v

B. B is parallel to v

C. it obeys inverse cube law

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

Answer: A

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3. A current flows in a conductor from east to west. The direction of the magnetic field at a

points above the conductor is

A. towards north

B. towards south

C. towards east

D. towards west

Answer: A

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4. An equilateral triangle of side length l is formed from a piece of wire of uniform

resistance. The current i is fed as shown in the figure. The the megnitude of the magnetic field at its centre O is

A. $\frac{\sqrt{3}\mu_0 i}{2\pi l}$

B. $\frac{3\sqrt{3}\mu_0 i}{2\pi l}$

C. $\frac{\mu_0 i}{2\pi l}$

D. zero

Answer: D

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

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

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

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

D. zero

Answer: A

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6. Magnetic field produced at the point O due to current flowing in as infinite wire shaped as show in the figure is

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

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

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

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

Answer: D

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7. Two long thin wires ABC and DEF are arranged as shown in the figure. The magnitude of the magnetic field at O is

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

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

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

D. zero

Answer: D

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8. Three long, straight and parallel wires carrying currents are arranged as shown in figure. The force experienced by 10 cm length of wire Q is

A. $14 \times 10^{-4} N$ towards the right

B. $14 \times 10^{-4} N$ towards the left

C. $2.6 \times 10^{-4} N$ towards the right

D. $2.6 \times 10^{-4} N$ towards the left

Answer: C

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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. Two infinitely long conductors carruying equal currents are shaped as shown in fiugre. The point P is located symmetrically with respect to the two conductors. The magnetic field at P due to any one conductor is B. The total field at P is

A. zore

B. B

C. $\sqrt{2}B$

D. 2B

Answer: A

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

A. 0.32N-m

B. 32-Nm

C. 0.0032 N-m

D. 0.032 N-m

Answer: A

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

will be

A. BIR $\tan\alpha$

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

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

D. None of the above

Answer: C

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

A. 3

B. 4

C. 6

D. 2

Answer: B

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14. Some current i=2A is figure. The frame is a combination of two equilateral triangles ACD and CDE of side 1 m. It is placed in uniform magnetic field B=4T acting perpendicular to the plane of frame. The magnitude of magnetic force acting on the frame is

A. 24 N

B. zero

C. 16 N

D. 8 N

Answer: A

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15. A conducting stick of length 2L and maas m is moving down a smooth inclined plane of inclination 60° with conductor perpendicular to the paper inwards. A vertically upward magnetic field B exists in space there. The magnitude of

magnetic field B is

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

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

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

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

Answer: C

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16. A charge q is moving with a velocity $v_1 = 1\hat{i}$ m/s at a point in a magentic field and experiences a force $F = q\left[-\hat{j} + 1\hat{k}\right]$ N. If the charge is moving with a voloctiy $v_2 = 2\hat{j}$ m/s at the same point then it experiences a force $F_2 = q\left(1\hat{i} - 1\hat{k}\right)$ N. The magnetic induction B at that point is

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

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

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

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

Answer: A

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

A. $2B_0li$

B. zero

C. $B_0 li$

D. $4B_0 li$

Answer: C

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18. A straight rod of mass m and length L is suspended from the identical springs as shown in figure. The spring is stretched a distance x_0 due to the weight ot the wire.

The circuit has total resistance R. When the magnetic field parpendicular to the plane of paper is switched on, then springs are observed to extend further by the same distance. The magnetic field strenght is

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

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

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

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

Answer: B

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19. Figure here shows three cases, in all cases the circular path has radius r and straight ones are infinitely long. For same current the magnetic field at the center P in cases 1, 2 and 3 have the ratio

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

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

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

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

Answer: A

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

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

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

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

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

Answer: B

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Example

1. A striaight wire carries a current of 3 A calculate the magnitude of the magentic field at a point 15 cm away from the wire

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

B. $4 \times 10^{-6} T$

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

D. $8 \times 10^{-6} T$

Answer:

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2. A solenoid of 1.5 metre length and 4.0 cm diameter posses 10 turn per cm. A current of 5 ampere is flowing through it. The magnetic induction at axis inside the solenoid is

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

B. $2OI \times 10^{-5}t$

C. $2PI \times 10^{-3}g$

D. $2PI \times 10^{-5}g$

Answer:

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3. A solenoid of length $0 \cdot 5m$ has a radius of $1cm$ and is made up of 500 turns. It carries a current of $5A$. What is the magnitude of the magnetic field inside the solenoid?

A. $4.39 \times 10^{-5}T$

B. $3.28 \times 10^{-3}T$

C. $2.39 \times 10^{-5}T$

D. $6.28 \times 10^{-2}T$

Answer:

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4. A moving coil galvanometer has 10 turns each of length 12 cm and breadth 8 cm the coil of MCG carries a current of 125 μ A The coil is kept perpendicular to uniform magnetic field of induction 10^{-2} T the twis t constant of phosphor bronz fibre is 12×10^{-9} Nm/degree calculate the defection produced

A. 10°

B. 20°

C. 30°

D. 60°

Answer:

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5. A rectangular coil having 100 turns each of length 1.0 cm and breadth 0.5 cm is suspended in radial magnetic field of induction 0.02 T the torisional constant of suspension fibre is

2×10^{-8} Nm / degreee calculate current sensitivity of MCG

A. 500 div /A

B. 600div /A

C. 400 div / A

D. none of these

Answer:

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6. A current of 5.0 A is passed through the coil of a galvanometer having 500 turns and each turns has an average area of $3 \times 10^{-4} m^2$ if a torque of 1.5 N-m is required for this coil carrying same current to set it parallel to a magnetic field calculate the strength of the magnetic field

A. 20T

B. 25T

C. 23T

D. 21T

Answer:

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7. A galvanometer of resistance 15Ω gives full scale deflection for a current of 2mA. Calculate the shunt resistance needed to convert it into an ammeter of range 0 to 5A.

A. $0.09\ \Omega$

B. 0.08Ω

C. 23Ω

D. 0.006Ω

Answer:

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8. A moving coil galvanometer hs a resistance of 25 ω and gives a full scale deflection for a current of 10 mA how will you convert it in to voltemeter having range 0-100 V ?

A. $9.975k\Omega$ in series

B. $8.965k\Omega$ in series

C. $10.343k\Omega$ in series

D. $6.638k\Omega$ in series

Answer:

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9. A moving coil galvanometer has 100 turns and each turn has an area $2.0cm^2$. The magnetic field produced by the magnet is $0.01T$. The deflection in the coil is 0.05 radian when a

current of $10mA$ is passed through it. Find the torsional constant of the suspension wire.

A. $3.0 \times 10^{-4} Nmrad^{-1}$

B. $4 \times x10^{-5} Nmrad^{-1}$

C. $5 \times 10^{-6} Nmrad^{-1}$

D. $7 \times 10^{-7} Nmrad^{-1}$

Answer:

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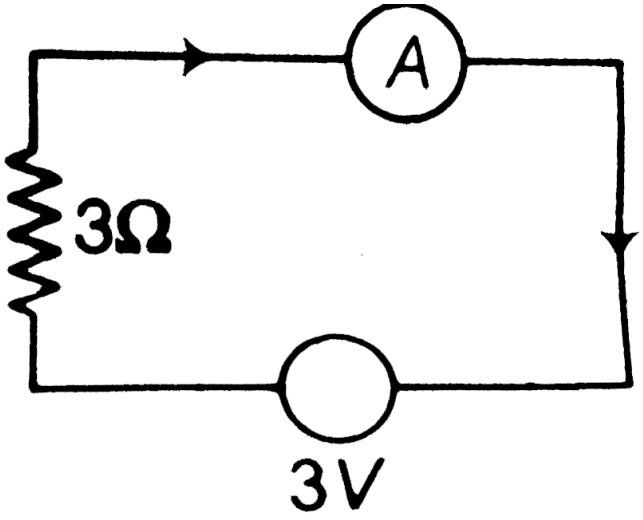
10. In the given circuit the current is to be measured the value of the current if the ammeter shown is a galvanometer with a resistance $R_g = 60\omega$ is



A. 0.99 A

B. 0.048 A

C. 0.02 A

D. 0.06 A

Answer:

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11. In a cyclotron, a magnetic field of $2 \cdot 4T$ is used to accelerate protons. How rapidly should the electric field between the dees be reversed? The mass and the charge of protons are

$1 \cdot 67 \times 10^{-27} kg$ and $1 \cdot 6 \times 10^{-19} C$

respectively.

A. 1.342×10^{-69}

B. 2.342×10^{-8}

C. 2.3645×10^{-10}

D. none of these

Answer:

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

A. $50\mu s$

B. $25\mu s$

C. $10\mu s$

D. $5\mu s$

Answer:

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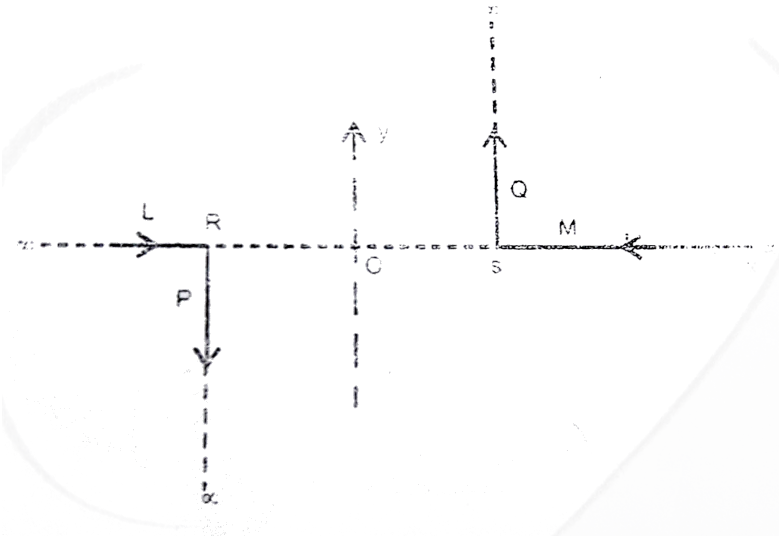
Exercise 1

1. A pair of stationary and infinitely long bent wires is placed in the $X-Y$ plane as shown in figure.The wires carry currents of $10A$ each as shown.The segments L and M are along the x-axis.The segments P and Q are pallel to the Y-axis such that $OS=OR=0.02m$.Find the magnitude and direction of the magnetic

induction at the origin O.



A. $10^{-3}T$

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

C. $2 \times 10^{-6}T$

D. $10^{-4}T$

Answer: D

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2. A closely wound solenoid $80cm$ long has layers of windings of $400turns$ each. The diameter of the solenoid is $1 \cdot 8cm$. If the current carried is $8 \cdot 0A$ estimate the magnitude of $\overrightarrow{B}$ inside the solenoid near its centre.

A. $1.5 \times 10^{-2}T$ opposite to the axis of solenoid

B. $2.5 \times 10^{-2}T$ along the axis of solenoid

C. $3.5 \times 10^{-2} T$ along the axis fo solenoid

D. $1.5 \times 10^{-2} T$ opposite to the axis of solenoid

Answer: B

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3. A solenoid of length 50 cm and a radius of cros section 1 cm has 1000 turns of wire wound over it if the current carried is 5A the magnetic field on its axis near the centre of the solenoid

is approximately (Given permeability of free space $\mu_0 = 4\pi \times 10^{-7} T - mA^{-1}$)

A. $0.63 \times 10^{-2} T$

B. $1.26 \times 10^{-2} T$

C. $2.51 \times 10^{-2} T$

D. $6.3T$

Answer: B

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4. A current I ampere flows along an infinitely long straight thin walled tube, then the magnetic induction at any point inside the tube is .

A. infinite

B. zero

C. $\frac{\mu_0 22i}{4\pi r}T$

D. $\frac{\mu_0 iT}{2r}$

Answer: D

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5. The magnetic induction at apoint P which is at the distance 4 cm from a long current carrying wire is $10^{-3}T$. The field of induction at a distance 12 cm from the current will be

A. 3.33×10^{-9}tesla

B. 1.11×10^{-4} tesla

C. 3×10^{-3} tesla

D. 9×10^{-2} tesla

Answer: A

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

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

B. 4

C. 1

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

Answer: C

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7. A horizontal overhead power lines 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 $1 \cdot 5m$ below the line?

A. 1.2×10^{-5}T perpendicularly outward to the plane of paper

B. $1.9 \times 10^{-5} T$ perpendicularly outward to the plne of paper

C. $2.6 \times 10^{-5} T$ perpendicularly inward to the plane of paper

D. $2.6 \times 10^{-5} T$ perpendicularly inward to the plane of paper

Answer: A

Watch Video Solution

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

A. decreasing its radius

B. decreasing the current throught it

C. increasing its area of cross section

D. introducing a medium of higher permeability

Answer: D

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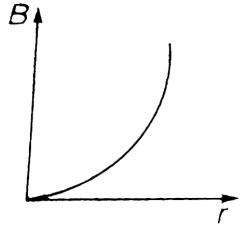
9. The magnetic flux denisty B at a distance r from a long stright rod carrying a steady current varies with r as show in the

A.



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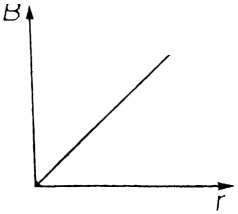
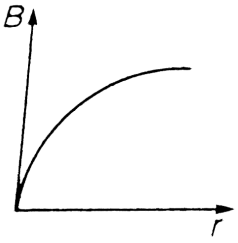
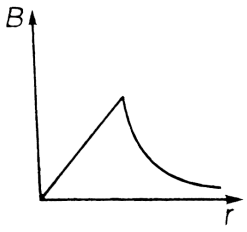


C.



D. 

Answer: D

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

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

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

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

D. $628 \times 10^{-6} T$

Answer: B

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11. There are 50 turns of a wire in every cm langth of a long solenoid. If 4 ampere current is flowing in the solenoid, the approximate value

of magnetic field along its axis at an internal point and at one end will be respectively

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

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

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

D. zero

Answer: D

Watch Video Solution

12. There are 50 turns of a wire in every cm langth of a long solenoid. If 4 ampere current is flowing in the solenoid, the approximate value of magnetic field along its axis at an internal point and at one end will be respectively

A. $12.6 \times 10^{-7} wbm^{-2}, 6.3 \times 10^{-3} wbm^{-2}$

B. $12.6 \times 10^{-3} wbm^{-2}, 252 \times m^{-2} 10^{-3} wbm^{-2}$

C. $25.1 \times 10^{-5} wbm^{-2}, 6.3 \times 10^{-3} wbm^{-2}$

D. $25.1 \times 10^{-5} wbm^{-2}, 6.3 \times 10^{-3} wbm^{-2}$

Answer: C

Watch Video Solution

13. A direct current I flow along the length of an infinitely long striaght thin walled pipe then the magnetic field is

A. uniform throughout the pipe but not zero

B. zero only along the axis of the pipe

C. zero at any point inside the pipe

D. maximum at the center and minimum at the edge

Answer: C

 Watch Video Solution

14. A moving coil galvanometer gives full scale defection when a current of 0.05 A is passed through its coil it is converted in to a voltmeter reading up to 5V by using an external resistance

of 975 ω what is the resistance of the galvanometer coil ?

A. 30Ω

B. 25Ω

C. 50Ω

D. 40Ω

Answer: B

Watch Video Solution

15. A voltmeter has resistance of 2000 ohms and it can measure upto $2V$. If we want ot increase its range to $10V$ then the, required resistance in series will be

A. 4000ω

B. 6000ω

C. 7000ω

D. 8000ω

Answer: D

Watch Video Solution

16. An ammeter has resistance R_0 and range I what resistance should be connected in parallel with it to increase its range by nI ?

A. $\frac{R_0}{n-1}$

B. $\frac{R_0}{n+1}$

C. $\frac{R_0}{n}$

D. none of these

Answer: C

Watch Video Solution

17. The deflection in a moving coil galvanometer is

A. directly proportional to the torsioonal constant

B. directly proportional to the number of turns in the coil

C. inversely proportional to the area of the coil

D. inversely proportional to the current flowing

Answer: B

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18. A narrow beam of protons and deutrons, each having the same momentum, enters a region of uniform magnetic field directed perpendicular to their direction of momentum.

The ratio of the radii of the circular paths described by them is

A. $1:2$

B. $1:1$

C. $2:1$

D. $1:3$

Answer: B

Watch Video Solution

19. A proton, a deuteron and an α-particle with the same KE enter a region of uniform magnetic field, moving at right angles to B. What is the ratio of the radii of their circular paths ?

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

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

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

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

Answer: A

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20. Magnetic field

A. can increase the speed of charge particle

B. can accelerate a charge particle

C. both a and b are correct

D. both a and b are incorrect

Answer: B

Watch Video Solution

21. What uniform magnetic enter a magnetic field applied perpendicular to a beam of electrons moving at $1.3 \times 10^{6} ms^{-1}$ is required to make the electrons travel in a circular arc of radius 0.35 m

A. $21 \times 10^{-5} T$

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

C. $2.1 \times 10^{-5} T$

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

Answer: C

Watch Video Solution

22. A charged particle enters a magnetic field H with its initial velocity making an angle of 45° with H. The path of the particle will be

A. straight line

B. a circle

C. an ellipse

D. a hellix

Answer: D

Watch Video Solution

23. A charged particle moves along a circle under the action of passible constant electric and magnetic fields. Which of the following are possible?

A. E=0, B=0

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

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

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

Answer: B

Watch Video Solution

24. An electric field of 1500 V/m and a magnetic field of 0.40 Wb/m^2 act on a moving electron. The minimum uniform speed along a straight line, the electron could have is

A. $16 \times 10^{15} ms^{-1}$

B. $6 \times 10^{-16} ms^{-1}$

C. $3.75 \times 10^{3} ms^{-1}$

D. $3.75 \times 10^2 ms^{-1}$

Answer: C

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25. Identify the correct statement from the following

A. cyclotron frequencty is independent particle in cyclotron does charge particle

B. kinetic energy of charged particle in cycoltron does not depend on its mass

C. cyclotron frequency does not depend on speed of charged particle

D. kinetic energy of charged particle in cyclotron is independent of its charge

Answer: C

 Watch Video Solution

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

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

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

C. $2\pi^2 m v^2 r^2$

D. $\pi^2 m v^2 r^2$

Answer: C

Watch Video Solution

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

A. circular

B. elliptical

C. linear

D. helical

Answer: D

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28. A uniform magnetic field $\overline{B} = B_0\hat{j}$ exists in a space. A particle of mass m and charge q is projected towards negative x-axis with speed v from the a point $(d, 0, 0)$ The maximum value v for which the particle does not hit $y - z$ plane is .

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

B. $\frac{Bqa}{2m}$

C. $\frac{Bq}{am}$

D. $\frac{Bq}{2am}$

Answer: A

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29. An electron and a proton enter a magnetic field perpendicularly. Both have same kinetic energy. Which of the following is true

A. trajectory of electron is less curved

B. trajectroy of proton is less curved

C. both trajectroy ar equally curved

D. both move in strainght line path

Answer: C

Watch Video Solution

30. 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 antiaritcl pair

D. the charge to masss ratio satisfy

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

Answer: D

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31. A proton and an α particle accelerated through the same potential difference enter a region of uniform magnetic field normally if the

radius of the proton orbit is 10 cm ten radius of α particle is

A. $10cm$

B. $10\sqrt{2}cm$

C. $20cm$

D. $5\sqrt{2}cm$

Answer: B

Watch Video Solution

32. Electrons move at right angles to a magnetic field of 1.5×10^{-2} Tesla with a speed of $6 \times 10^{7} m/s$. If the specific charge of the electron is $1.7 \times 10^{11} C/kg$. The radius of the circular path will be

A. 2.9 cm

B. 3.9 cm

C. 2.35 cm

D. 2cm

Answer: C

Watch Video Solution

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

A. $\frac{mv^2}{R}2\pi R$

B. zero

C. $BQR\pi R$

D. $BQv2\pi R$

Answer: B

Watch Video Solution

34. A particle of mass m, charge q and kinetic energy T enters in a transverse uniform magnetic field of induction B. After the 3 s, the kinetic energy of the particle will be

A. 3T

B. 2T

C. T

D. 4T

Answer: C

Watch Video Solution

35. The magnetic force on a charge particle moving in the field does no work because

A. kinetic energy of the charged particle does not change

B. the charge of the particle remains same

C. the magnetic force is perpendicular to velocity of the particle

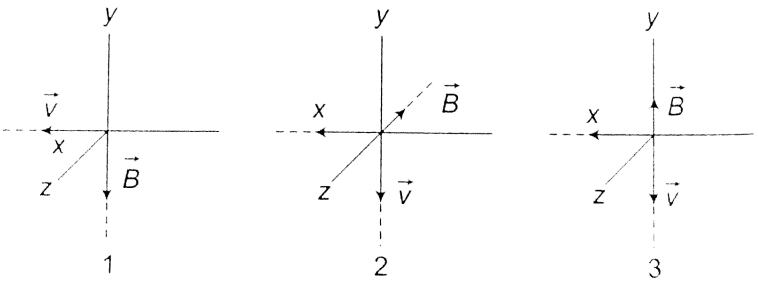
D. the magentic force is parallel to magnetic field

Answer: C

Watch Video Solution

36. The figure shows three situations when an electron moves with velocity $\overrightarrow{v}$ travels through

a uniform magnetic field $\overrightarrow{B}$. In each case, what is the direction of magnetic force on the electron



A. positive z axis negative x axis positive y axis

B. negative z axis negative x axis and zero

C. positive z axis positive y axis and zero

D. negative z axis positive x axis and zero

Answer: B

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Exercise 2

1. Same current i is flowing in the three infinitely long wires along positive x-,y- and z-directions. The magnetic filed at a point (0,0,-a) would be

A. $\frac{\mu_0 i}{2\pi a}\left(\hat{j}-\hat{i}\right)$

B. $\frac{\mu_0 i}{2\pi a}\left(\hat{j}+\hat{i}\right)$

C. $\frac{\mu_0 i}{\pi a}\left(\hat{j}-\hat{i}\right)$

D. $\frac{\mu_0 i}{2\pi a}\left(\hat{I}+\hat{j}+\hat{k}\right)$

Answer: A

Watch Video Solution

2. A tangent galvanometer is connected directly to an ideal battery. If the number of turns in the coil is doubled, the deflection will

A. increase

B. decrease

C. remain unchanged

D. either increase or decrease

Answer: A

Watch Video Solution

3. Two parallel long wires carry currents $i_1 \text{and} i_2$ with $i_1 > i_2$.When the currents are in the same direction then the magnetic field midway between the wires is $10\mu T$. when the direction

of i_2 is reversed ,then it becomes $40\mu T$. then ratio of i_1 / i_2 is

A. 1

B. 3

C. 2

D. 4

Answer: C

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

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

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

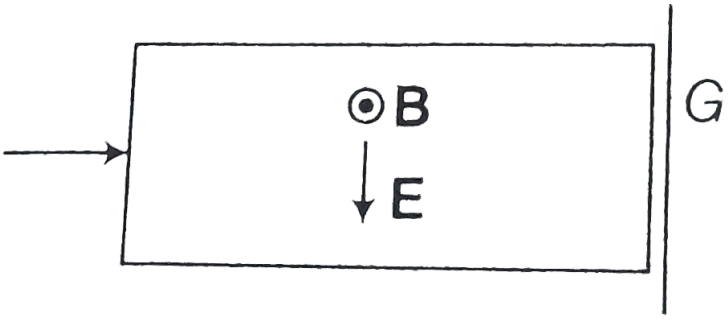
C. $\frac{\sqrt{Em}}{2qB}$

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

Answer: A

Watch Video Solution

5. A stream of electron and protons are directed towards a narrow slit in a screen the intervening region has a uniform electric field E vertically downwards and a unifrom magnetic field B out of the plane of the as shown then



A. electron and protons with speed $\frac{|E|}{|B|}$ will pass through the slit

B. protons with speed $\frac{|E|}{B|}$ will pass through the slit electrons of the same speed will not

C. neither electron nor protons will go through the slit irrespective of their speed

D. electron will always be deflected upwards irrespective of their speed

Answer: C, D

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

A. $\mu_0 ni$

B. $\mu_0 n^2 i$

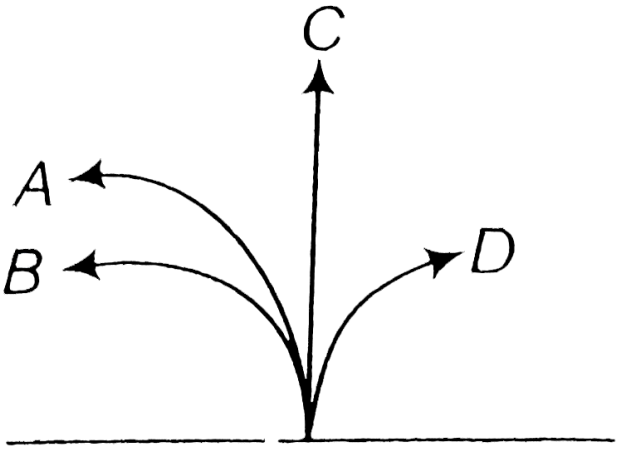
C. $\mu_0 ni^2$

D. none of these

Answer: A

Watch Video Solution

7. A neutorn a proton an electron and an α particle enter a region of uniform magnetic field with the same velocities the magnetic field is perpendicular and directed into the plane of the paper the tracks of the palrticles are labelled in the the electron follows the track



A. D

B. C

C. B

D. A

Answer: A

View Text Solution

8. The radius of the path of an electron moving at a speed of $3 \times 10^{7} ms^{-1}$ perpendiuclar to a magnetic field 5×10^{-4} T is nearly

A. 15 cm

B. 45 cm

C. 27 cm

D. 34 cm

Answer: D

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9. An electron having charge $1.6 \times 10^{-19} C$ and mass 9×10^{-31} kg is moving with $4 \times 10^{6} ms^{-1}$ speed in a magnetic field

2×10^{-1} tesla in circular orbit. The force acting on electron and the radius of the circular orbit will be

A. $18.8 \times 10^{-13} N, 1.1 \times 10^{-4} m$

B. $12.8 \times 10^{-14} N, 1.1 \times 10^{-3} m$

C. $12.8 \times 10^{-13} N, 1.1 \times 10^{-3} m$

D. $1.28 \times 10^{-13} N 1.1 \times 10^{-4} m$

Answer: D

 Watch Video Solution

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

A. 4.8 cm

B. 8.1 cm

C. 9.9 c

D. 10.6 cm

Answer: A

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

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

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

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

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

Answer: B

Watch Video Solution

12. If a current is passed through a spring then the spring will

A. gets compressed

B. gets expanded

C. oscillates

D. remains unchanged

Answer: A

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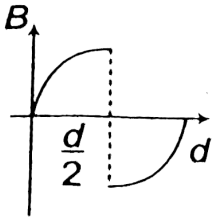
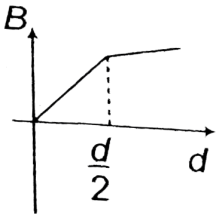
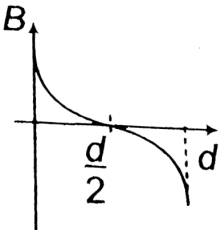
13. An uniform beam of positively charged particles is moving with a constant velocity parallel to another beam of negatively charged particles, velocity in opposite direction separated by a distance d the variation of magnetic field B along a perpendicular line draw between the two beams is best represented by

A. 

B. 

C.

D. 

Answer: D

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14. A long horizontally fiexed wire carries a current of 100 A directely above and parallel to it is a fine wire that carries a current of 20 A and weight 0.04 N/m The distance between the two wires for which the upper wire is just supported by magnetic repulsion is

A. $10^{-2}mm$

B. $10^{-2}cm$

C. $10^{-2}m$

D. $10^{-2}km$

Answer: C

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15. A proton and a deuteron both having the same kinetic energy enter perpendicularly in to uniform magnetic field B for motion of proton and deuteron on ciruclar path of radius R_p and R_d respectively the correct statement is

A. $R_d = \sqrt{R_p}$

B. $R_d = R_p / \sqrt{2}$

C. $R_d = R_p$

D. $R_d = 2R_p$

Answer: A

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16. A n electrically charged particle enters into a uniform magnetic induction field in a direction perpendicular to the field with a velocity v then it travels

A. ina straight line without acceleration

B. with force in the direction of the field

C. in a circular path with a radius directly proportional to

D. in a circular path with a radius directly proportional to its velocity

Answer: D

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17. A magnetic field 4×10^{-3} kT exerts a force $\left(4\hat{I} + 3\hat{j}\right) \times 10^{10}$ N on a particle having a

charge 10^{-9} C and going on the XY plane The velocity of the particle is

A. $-75\hat{I} + 100\hat{j}$

B. $-100\hat{I} + 75\hat{j}$

C. $25\hat{I} + 2\hat{j}$

D. $2\hat{I} + 25\hat{i}$

Answer: A

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

A. 8×10^{-7}N

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

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

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

Answer: B

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19. An electron having charge $1.6 \times 10^{-19} C$ and mass 9×10^{-31} kg is moving with $4 \times 10^{6} ms^{-1}$ speed in a magnetic field 2×10^{-1} tesla in circular orbit. The force acting on electron and the radius of the circular orbit will be

A. $12.8 \times 10^{-13} B, 11 \times 10^{-3} m$

B. $1.28 \times 10^{-14} N, 11 \times 10^{-3} m$

C. $12.8 \times 10^{-13} N, 11 \times 10^{-3} m$

D. $1.28 \times 10^{-13} N, 11 \times 10^{-4} m$

Answer: D

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

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

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

B. they will come out travelling along parallel paths

C. they will come out at the same time

D. none of the above

Answer: B

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21. The maximum velocity to which a proton can be accelerated in a cyclotron of 10 MHZ frequency and radius 50 cm is

A. $6.28 \times 10^8 ms^{-1}$

B. $3.14 \times 10^8 ms^{-1}$

C. $6.28 \times 10^7 ms^{-1}$

D. $3.14 \times 10^7 ms^{-1}$

Answer: D

Watch Video Solution

22. An electron is accelerated by a potential difference of 12000 volts. It then enters a uniform magnetic field of $10^{-3}T$ applied perpendicular to the path of electron. Find the radius of path. Given mass of electron $= 9 \times 10^{-31}kg$ and charge on electron $= 1.6 \times 10^{-19}C$

A. 36.7 m

B. 36.7 cm

C. 3.67 m

D. 3.67 cm

Answer: A

Watch Video Solution

23. A current I ampere flows along an infinitely long straight thin walled tube, then the magnetic induction at any point inside the tube is .

A. 0

B. ∞

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

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

Answer: A

Watch Video Solution

24. The current in the windings on a toroid is $2.0A$. There are 400 turns and the mean circumferential length is $40cm$. If the inside magnetic field is $1.0T$, the relative permeability is near to

A. 100

B. 200

C. 300

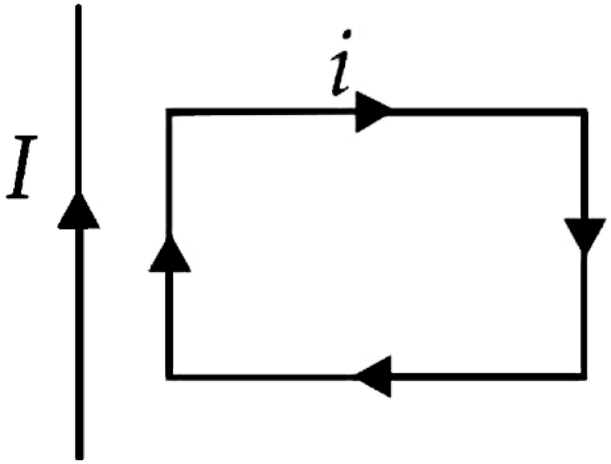
D. 400

Answer: D

Watch Video Solution

25. A rectangular loop carrying a current i is situated near a long straight wire such that the wire is parallel to one of the sides of the loop

and is in the plane of the loop . If steady current I is established in the wire as shown in the figure ,



A. rotate about an axis parallel to the wire

B. move away from the wire

C. move towards the wire

D. remain statioinary

Answer: C

Watch Video Solution

Mht Cet Corner

1. The charge on a particle Y is double the charge on particle X.These two particles X and Y after being accelerated through the same potential difference enter a region of uniform magnetic field and describe circular paths of

radii R_1 and R_2 respectively. The ratio of the mass of X to that of Y is

A. $\frac{r_1}{r_2}$

B. $\frac{\sqrt{r_1}}{r_2}$

C. $\left[\frac{r_2}{r_1}\right]^2$

D. $\left[\frac{r_1}{r_2}\right]^2$

Answer: A

Watch Video Solution

2. A galvanometer of resistance 30Ω is connected to a battery of emf 2 V with 1970Ω resistance in series. A full scale deflection of 20 divisions is obtained in the galvanometer. To reduce the deflection to 10 divisions, the resistance in series required is

A. 4030 ω

B. 4000ω

C. 3970ω

D. 2000ω

Answer: C

3. Sensitivity of a moving coil galvanometer can be increased by

A. decreasing the number of turns of coil

B. increasing the number of turns of coil

C. decreasing the area of a coil

D. by using a weak magnet

Answer: B

Watch Video Solution

4. A range of galvanometer is V, when 50Ω resistance is connected in series. Its range gets doubled when 500Ω resistance is connected in series. Galvanometer resistance is

A. 100ω

B. 200ω

C. 300ω

D. 400ω

Answer: D

Watch Video Solution

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

A. v^{-2}

B. v^{-1}

C. v

D. v^2

Answer: C

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

the maximum possible magnetic field in the room

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

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

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

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

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

B. $\frac{ma_0}{e}$ west $\frac{2\mathrm{ma}_0}{ev_0}$ down

C. $\frac{ma_0}{e}$ East $\frac{3\mathrm{ma}_0}{\mathrm{ev}_0}$ up

D. $\frac{ma_0}{e}$ East $\frac{3ma_0}{\mathrm{ev}_0}$ down

Answer: B

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7. A current loop in a magnetic field

A. experience a troque whether the field is uniform or non unifrom in all orientations

B. can be in equilibrium in one orientatin

C. can be equilbrium in two orientations both the equilibrium states are unsatable

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

Answer: D

Watch Video Solution

8. Which of the following while in motion cannot be deflected by magnetic field?

A. protons

B. cathode rays

C. alpha particles

D. neutrons

Answer: D

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9. Fleming 's left and right handle rule are used in

A. DC motor and AC generator

B. DC generator and AC motor

C. DC generator and DC motor

D. both rules are same any one can be used

Answer: C

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10. Tangent galvanometer mearusre

A. capacitance

B. current

C. resistance

D. potential difference

Answer: B

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11. An electron is travelling along the x-direction. It encounters magnetic field in the y-direction. Its subsequent motion will be

A. straight line along the x direction

B. a circle in the XZ plane

C. a circle in the YZ plane

D. a circle in the XY plane

Answer: D

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12. To decrease the range of an ammeter its resistance need to be incrased an ammeter has resistacne R_0 and range / which of the following resistance can be connected in series with it to drecease its range to l/n

A. $\frac{R_0}{n}$

B. $\frac{R_0}{n-1}$

C. $\frac{R_0}{n+1}$

D. none of these

Answer: D

13. A galvanometer has a resistance of 3663Ω. A shunt Sis connected across it such that (1/34) of the total current passes through the galvanometer. Then the value of the shunt is :

A. 3663 ω

B. 111ω

C. 107.7ω

D. 3555.3ω

Answer: B

14. In an ammeter 10% of main current is passing through the galvanometer. If the resistance of the galvanometer is G, then the shunt resistance, in ohms is

A. 60ω

B. 240ω

C. 120ω

D. 480ω

Answer: C

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15. Three moving coil galvanometer A,B and C are made of coils of three different material having torsional constrant $1.8 \times 10^{-8}, 2.8 \times 10^{-8}$ and 3.8×10^{-8} respectively if the three galvanometer are

identical in all other respect then in which of the above cases sensitivity maximum

A. A

B. C

C. B

D. same in each case

Answer: A

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16. A galvanometer has a resistance of G ohm and range of V volt. Calculate the resistance to be used in seres with it to extend its range its renge to nV volt.

A. nG

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

C. $(n-1)G$

D. $\frac{G}{n-1}$

Answer: C

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17. Two tangent galvanometers having coils of the same radius are connected in series. A current flowing in them produces deflections of 60° and 45° respectively. The ratio of the number of turns in the coils is

A. $\frac{4}{\sqrt{3}}$

B. $\frac{\sqrt{3+1}}{1}$

C. $\frac{\sqrt{3}+1}{\sqrt{3-1}}$

D. $\frac{\sqrt{3}}{1}$

Answer: D

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18. We have a galvanometer of resistance 25Ω. It is shunted by a 2.5Ω wire. The part of total current that flows through the galvanometer is given as

A. $\frac{l_g}{l} = \frac{4}{11}$

B. $\frac{l_g}{l} = \frac{3}{11}$

C. $\frac{l_g}{l} = \frac{2}{11}$

D. $\frac{l_g}{l} = -\frac{1}{11}$

Answer: D

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

A. path of both will be straight line

B. both are equally curved

C. the path of proton shall be less curved than that of electron

D. the path of proton shall be less curved than that of electron

Answer: B

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20. The radius of circular path of an electron when subjected to a perpendicular magnetic field is

A. $\frac{mV}{be}$

B. $\frac{me}{Be}$

C. $\frac{mE}{Be}$

D. $\frac{Be}{Mv}$

Answer: A

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