PHYSICS

BOOKS - MHTCET PREVIOUS YEAR PAPERS AND PRACTICE PAPERS

MAGNETIC EFFECT OF ELECTRIC CURRENT -I

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

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

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 $\overrightarrow{B}=B_0\left(1+\frac{x}{l}\right)\overrightarrow{k}$. 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_0li

D. $4B_0li$

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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