PHYSICS

BOOKS - TARGET PHYSICS (MARATHI ENGLISH)

MAGNETIC EFFECT OF ELECTRIC CURRENT

Classical Thinking

1. The phenomenon in which magnetic field is produced in the space near a conductor carrying current is called _____

A. thermionic effect

B. photoelectric effect

C. heating effect

D. magnetic effect of electric current

Answer: D

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2. The magnitude of magnetic strength at any point in magnetic field is _____

A. electric flux

B. electric flux per unit area

C. magnetic flux

D. magnetic flux per unit area

Answer: D

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3. Which of the following is NOT the unit of magnetic induction?

A. gauses

B. weber/ m^2

C. maxwell

D. tesla

Answer: C

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4. The dimensions of magnetic induction are

A. $\left[M^{-1}L^{-2}T^{0}A^{1}\right]$

B. $\left[M^{1}L^{0}T^{-2}A^{-2}\right]$

C. $\left[M^{1}L^{0}T^{-2}A^{-1}\right]$

D. $\left[M^{1}L^{0}T^{-1}A^{-1}\right]$

Answer: C

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5. The value of magnetic induction wil be miniumum at a point due to a small current carrying conductor when angle between element and line joining point and centre of element is

A. directly proportional to current.

B. directly proprotional to square of distance of point from centre of element.

C. inversely proportional to the distance of point from centre of element.

D. inversely proportional to length of conductor.

Answer: A

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6. The value of magnetic induction wil be miniumum at a point due to a small current carrying conductor when angle between

element and line joining point and centre of element is

A. 90°

B. 180°

C. 0°

D. both B and C

Answer: D

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7. The magnitude of magnetic induction at a distance 4 cm due to straight conductor carrying a current of 10 A is

A. $5 \times 10^{-6} Wb/m^2$

B. 5×10^{-5} N/Am

C. 5×10^{-5} gauss

D. 5×10^{-6} tesla

Answer: B

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8. The magnetic field produced around a straight line wire when current flows through it is

A. parallel to the wire.

B. perpendicular to the wire.

C. in the form of concentric circle.

D. parabolic line.

Answer: C

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9. A tangent to a point on the magnetic lines of force gives us the direction of_____

A. magnetic flux density

B. magnetic induction

C. magnetic flux

D. magnetic dipole.

Answer: B

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10. The dimensional formula for permeability of free space, μ_0 is

A. $\left[M^1L^2T^2A^{-2}\right], Wb/Am^2$

B. $\left[M^1L^1T^2A^{-1}\right], Wb/Am$

C. $\left[M^1L^1T^2A^{-3}\right]$, Wb/A m

D. $\left[M^1L^1T^{-2}A^{-2}\right]$, Wb/A m

Answer: D

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11. In vector form the magnetic induction dB at a point of distance r from centre of element of length dl is given as

A. $\vec{dB} = \frac{\mu_0}{4\pi}\frac{idl\sin\theta}{r^2}$

B. $\vec{dB} = \frac{\mu_0}{4\pi}\frac{I\vec{d}\,l \times \vec{r}}{r^2}$

C. $\vec{dB} = \frac{\mu_0}{4\pi}\frac{I\vec{r} \times \vec{d}\,l}{r^3}$

D. $\vec{dB} = \frac{\mu_0}{4\pi}\frac{I\vec{d}\,l \times \vec{r}}{r^3}$

Answer: D

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12. The direction of magnetic field produced around a long straight conductor is given by

A. right hand thumb rule.

B. left hand thumb rule.

C. right hand screw rule.

D. both A and C

Answer: D

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13. According to right hand thumb rule, if current is directed in upward direction then the direction of magnetic induction is _____

A. anticlockwise

B. clockwise

C. same as current

D. opposite to that of current.

Answer: A

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14. A current carrying coil is equivalent to

A. electric dipole

B. magnetic dipole

C. magnetic moment.

D. both A and B

Answer: B

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15. If the current flowing in a circular loop is in anticlockwise direction then the magnetic induction will be

A. along the direction of current.

B. opposite to the direction of current.

C. directed outwards.

D. directed inwards.

Answer: D

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16. If the current flowing in a circular loop is in clockwise directions, then the magnetic induction will be

A. along the direction of current.

B. perpendicular to plane of coil

C. directed inwards.

D. both B and C.

Answer: D

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17. The magnetic induction at centre of loop due to current flowing through small element 'dl' is given as $dB = \frac{\mu_0}{4\pi}\frac{Idl\sin\theta}{r^2}$ where θ is

A. 0°

B. 180°

C. 90°

D. 60°

Answer: C

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18. The magnetic induction at the centre of a coil made from a wire of length 22 cm carrying a current of 0.5 A is

A. $8 \times 10^{-6} Wb/m^2$

B. $0.9 \times 10^{-6} Wb/m^2$

C. $9 \times 10^{-6} Wb/m$

D. $0.8 \times 10^{-6} Wb/m^2$

Answer: C

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19. A circular coil having 50 turns each of radius 0.05 m carries a current of 1 A. The magnitude of magnetic induction at a point 0.2 m from its centre on its axis is

A. 9×10^{-6} gauss

B. 9×10^{-5} N/A m

C. 9×10^{-4} T

D. $9 \times 10^{-6} Wb/m^2$

Answer: D

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20. A magnetic field

A. always exerts a force on a charged particle.

B. never exerts a force on a charged particles.

C. exerts a force, if the charged particle is moving across the magnetic field lines.

D. exerts a force, if the charged particle is moving along the magnetic field lines.

Answer: C

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21. A straight conductor carrying a current does not experience a force when it is

A. parallel to magnetic field.

B. perpendicular to magnetic field.

C. antiparallel to magnetic field.

D. both A and C.

Answer: D

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22. The C.G.S. units of magnetic inductions are

A. dyne $em\mu^{-1}cm^{-1}$

B. oersted

C. gauss

D. all of these

Answer: D

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23. The force acting on a particle of charge q moving in a uniform magnets field with velocity v is

A. parallel to both $\overrightarrow{v}$ and $\overrightarrow{B}$

B. perpendicular to both $\overrightarrow{v}$ and $\overrightarrow{B}$

C. parallel to $\overrightarrow{v}$ and perpendicular to $\overrightarrow{B}$

D. perpendicular to $\overrightarrow{v}$ and parallel to $\overrightarrow{B}$

Answer: B

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24. When a particle carrying a charge of 200 μ C moves at an angle 30° to a uniform magnetic field of induction $5 \times 10^{-5} Wb/m^2$ with a speed of $2 \times 10^5 m/s$. The force acting on the particle is

A. 5×10^{-3}N

B. 10^{-3} N

C. 2×10^{-3} N

D. 10^{-4} N

Answer: B

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25. A force of 1.732×10^{-2} N acts on a particleof charge q moving with a velocity $1/1000^{th}$ of the velocity of light in a magnetic

field of induction $\frac{2}{\sqrt{3}} \times 10^{-5} Wb/m^2$ and perpendicular to the field then q is

A. 5000 C

B. 5000 μ C

C. 500 μC

D. 500 C

Answer: B

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26. The magnetic force acting on a conductor of length l carrying a current I placed in field of strength B is given as

A. $\vec{F} = I\left(\vec{B} \times \vec{l}\right)$

B. $\vec{F} = I\left(\vec{I} \times \vec{B}\right)$

C. $\vec{F} = I\left(\vec{l} \cdot \vec{B}\right)$

D. $\vec{F} = I\left(\vec{B} \cdot \vec{l}\right)$

Answer: B

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27. A conductor of length 1m and carrying current of 1A is placed at an angle 45° to the magnetic field of 1 oersted. The force acting on the conductor is

A. $\frac{10^{-4}}{\sqrt{2}}$ N

B. $\frac{10^{-4}}{\sqrt{3}}$ N

C. $\frac{10^{-2}}{\sqrt{3}}$ N

D. $\frac{10^{-2}}{\sqrt{2}}$ N

Answer: A

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28. The maximum force acting on a straight conductor of length 15 cm, placed in a magnetic field of induction $5 \times 10^{-5} N/A$ m is 3×10^{-4} N then the current flowing in conductor is

A. 40 mA

B. 4×10^{-3} A

C. 400 mA

D. 40 A

Answer: D

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29. The force acting on a charge q in both electric and magnetic field, stimulateneously is

A. $\vec{F} = \left(q\vec{E}\right) + q\left(\vec{B} \times \vec{v}\right)$

B. $\vec{F} = \left(q\vec{E}\right) + q\left(\vec{v} \times \vec{B}\right)$

C. $\vec{F} = \left(q \times \vec{E}\right) + q\left(\vec{v} \cdot \vec{B}\right)$

D. $\vec{F} = \left(q\vec{E}\right) + q\left(\vec{v} \cdot \vec{B}\right)$

Answer: B

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30. In Fleming's left hand rule, the thumb points in the direction of _____

A. current

B. magnetic field

C. motion of conductor

D. force acting on conductor

Answer: D

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31. Two long straight conductors of length 1 m each separated by a distance of half metre and carrying currents of 200 A and 50 A respectively in opposite directions. Then the force of attraction is

A. 4×10^{-4} N

B. 4×10^{-3} N

C. 2×10^{-3} N

D. zero

Answer: D

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32. Two long and straight conductors, placed parallel to each other are separated by 10 cm, carrying current of 2A and 4 A respectively in opposite direction. The force per unit length exerted by each conductor on the other

A. 16×10^{-5} N/m

B. 1.6×10^{-5} N/m

C. 32×10^{-4} N/m

D. 3.2×10^{-5} N/m

Answer: B

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33. Two long parallel wires are at a distance of 4 cm. They carry currents I and 3I in same

direction. Where will the field produced by both wires be zero from current I?

A. 0.02 cm

B. 0.01 cm

C. 1 cm

D. 3 cm

Answer: C

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34. The quantity of charge that flows through a given cross section in one second, when there is a steady current of one ampere is

A. 1.6×10^{-9} coulomb

B. 6.023×10^{23} coulomb

C. 1 coulomb

D. zero

Answer: C

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35. The force of attraction between two long parallel conductors 1 metre apart carrying unit ampere current in same direction is

A. 2×10^{-7} N/m

B. 10^{-7} N/m

C. 10^{-5} N/m

D. 0.5×10^{-6} N/m

Answer: A

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36. A rectangular current carrying loop in a uniform magnetic field experiences_____

A. force

B. torque

C. both A and B

D. pressure

Answer: B

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37. If the net magnetic force acting on a loop is zero then

A. no torque acts on loop

B. loop performs translational motion.

C. both A and B

D. torque may or may not act on it

Answer: C

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38. A square coil of side 10 cm consists of 20 turns and carries a current of 12A. The coil is suspended vertically and the normal to the plane makes an angle of 30° with the direction of uniform magnetic field of 0.8 T. The torque acting on the coil is

A. 0.69 Nm

B. 0.96 Nm

C. 0.096 Nm

D. 0.069 Nm

Answer: B

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39. The magnetic moment of a square coil having 5 turns, each side measuring 4 cm and carrying a current of unit ampere is

A. $20 \times 10^{-3} Am^2$

B. $8 \times 10^{-3} Am^2$

C. $8\ Am^2$

D. $16 \times 10^{-3} Am^2$

Answer: B

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40. Which of the following relation is correct?

A. 1 tesla $=10^{-4}$ gauss

B. 1 gauss $= 10^4 Wb/m^2$

C. 1 gauss $= 10^4 N/Am$

D. 1 Wb/m^2 = 1N/A m

Answer: D

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41. The magnetic induction of the centre of circular coil carrying current of 1.4 A is 1.76×10^{-6} N/A m then the circumference of the loop is

A. 0.5 m

B. 3.14 m

C. 0.57 m

D. 6.28 m

Answer: B

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42. A long straight wire carries a current of 50 A. An electron moving at 10^7 m/s is 5 cm away from the wire. The force acting on electron if its velocity is directed towards the wire will be

A. 1.6×10^{-6} N

B. 3.2×10^{-16} N

C. 4.8×10^{-16} N

D. 1.8×10^{-16} N

Answer: B

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43. The magnitude of magnetic induction due to a straight long conductor at a distance 10 cm from conductor is $1.33 \times 10^{-4} Wb/m^2$. If electrons flow through the conductor, the number of particles flowing per second is

A. 3.9×10^{21}

B. 4.1×10^{20}

C. 4.4×10^{20}

D. 3.9×10^{20}

Answer: B

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Critical Thinking Introduction

1. A current carrying wire in the neighborhood produces

A. no field

B. electric field only.

C. magnetic field only.

D. electric and magnetic fields.

Answer: C

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2. The magnetic induction at a point P which is at a distance of 4 cm from a long current carrying wire is 10^{-8} T. The induction at a

distance 12 cm from same current carrying wire is

A. 1.11×10^{-7} T

B. 3.33×10^{-9} T

C. 3×10^{-3} T

D. 3.3×10^{-7} T

Answer: B

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3. A vertical straight conductor carries a current vertically upwards. A point P lies to the east of it at a small distance and another point Q lies to the west at the same distance. The magnetic field at P is

A. greater then at Q

B. same as at Q

C. less than at Q

D. greater or less than at Q depending upon the strength of the current.

Answer: B

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4. If a long hollow copper pipe carries a direct current, the magnetic field associated with the current will be

A. only inside the rod

B. only outside the rod

C. both inside and outside the rod

D. neither inside nor outside the rod

Answer: C

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5. If a long hollow copper pipe carriers a direct current, the magnetic field associated with the current will be:

A. only inside the pipe

B. only outside the pipe

C. neither inside not outside the pipe

D. both inside and outside the pipe.

Answer: B

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6. A helium nucleus makes a full rotation in a circle of radius 0.8 metre in two seconds. The value of the magnetic field B at the centre of the circle will be

A. $\frac{10^{-19}}{\mu_0}$

B. $10^{-19}\mu_0$

C. $2 \times 10^{-10}\mu_0$

D. $\frac{2 \times 10^{-19}}{\mu_0}$

Answer: B

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

A. $\sqrt{2}$

B. 2

C. 3

D. 1

Answer: A

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8. Two circular coils are made of two identical wires of same length and carry same current. If the number of turns of the two coils are 4 and

2, then the ratio of magnetic induction at the centres will be

A. $4:1$

B. $1:4$

C. $1:2$

D. $2:1$

Answer: A

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9. The magnetic induction at a point on the axis of a circular current carrying coil at a distance equal to the radius of coil carrying a current of 0.5 A is

A. $\pi a\sqrt{2} \times 10^{-2}$ T

B. $\frac{\pi a}{\sqrt{2}} \times 10^{-7}$ T

C. $\frac{\pi}{\sqrt{2}a} \times 10^{-7}$ T

D. $\frac{\pi\sqrt{2}}{a} \times 10^{-7}$ T

Answer: C

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10. The ratio of magnetic induction at a point along the axis of a circular coil of radius a at a distance x to a point where x tends to zero is $[x >> a]$

A. x^3/a^3

B. a^3/x^3

C. $2a^3/x^3$

D. $2x^3/a^3$

Answer: B

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11. A wire of length L carrying a current I is bent into a circle. The magnitude of the magnetic field at the centre of the circle is

A. $\frac{\pi\mu_0 I}{L}$

B. $\frac{\mu_0 I}{2L}$

C. $\frac{2\pi\mu_0 I}{L}$

D. $\frac{\mu_0 I}{2\pi L}$

Answer: A

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12. 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. 0.2

B. 0.4

C. 0.6

D. 0.8

Answer: D

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13. A circular coil of radius R carries a current i . The magnetic field at its centre is B. The distance from the centre on the axis of the coil where the magnetic field will be $B/8$ is

A. 3r

B. 2r

C. $\sqrt{3}$ r

D. $\sqrt{2}$ r

Answer: C

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14. Assertion: An electron and proton enters a magnetic field with equal velocities, then, the force experienced by the proton will be more

than electron.

The mass of proton is 1837 times more than electron.

A. Assertion is True, Reason is True, Reason is a correct explanation for Assertion.

B. Assertion is True, Reason is True, Reason is not a correct explanation for Assertion.

C. Assertion is True, Reason is False

D. Assertion is False, Reason is True.

Answer: D

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15. A very high magnetic field is applied to a stationary charge. Then the charge experiences

A. no force.

B. a force in the direction of magnetic field.

C. a force perpendicular to the magnetic field.

D. a force in an ordinary directions.

Answer: A

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16. An electron moving with a uniform velocity along the positive x-direction enters a magnetic field directed along the positive y-direction. The force on the electron is directed along

A. X-direction

B. Y-direction

C. Z-direction

D. negative Z-directions.

Answer:

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17. A particle with 10^{-11} coulomb of charge and $10^{-7}kg$ mass is moving wilth a velocity of $10^{8}m/s$ along the y-axis. A uniform static

magnetic field $B = 0.5$ Tesla is acting along the x-direction. The force on the particle is

A. 5×10^{-11} N along $\hat{i}$

B. 5×10^{-4} N along $-\hat{k}$

C. 5×10^{-11} N along $-\hat{j}$

D. 5×10^{-3} N along $\hat{k}$

Answer: B

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18. A current- carrying straight wire is kept along the axis of a circular loop carrying a current. The straight wire

A. will exert an inward force on the circular loop.

B. will exert on outward force on the circular loop.

C. will exert a force on the circular loop parallel to itself.

D. will not exert any force on the circular loop.

Answer: D

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19. A particle of charge -32×10^{-18} coulomb moving with velocity 20 ms^{-1} along the x-axis enters a region where a magnetic field of induction B is along the y-axis, and an electric field of magnitude 5×10^4 V/m is along the

negative z-axis. If the charged particle continues moving along the x-axis, the magnitude of B is

A. $10^3 Wb/m^2$

B. $10^5 Wb/m^2$

C. $10^6 Wb/m^2$

D. $10^7 Wb/m^2$

Answer: A

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20. A current carrying wire is placed along east and west in a magnetic field directed north wards. If the current in the wire is directed east wards, the direction of force on the wire is

A. Due west.

B. Due south.

C. Vertically upwards.

D. Vertically downwards.

Answer: C

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21. Two long parallel wires, separated by a distance R have equal current I flowing in each of them. The magnetic field of one exerts a force F on the other. The distance R is increased to 2R and the current in each wire is reduced from I to $I/2$. What is the force between them now?

A. 4F

B. F

C. $F/4$

D. $F/8$

Answer: D

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22. While defining value of one ampere of steady current, which of the following condition needs to be taken into consideration?

A. Dimensions of two conductors.

B. Distance between two conductors.

C. Amount of force produced between them.

D. All of the above.

Answer: D

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23. A horizontal conducting wire of length 0.1 m carries a current of 4A. If mass of the wire is 7.5×10^{-5} kg and $g = 10m/s^2$, the uniform magnetic induction required to support the weight of the wire is

A. 1.675×10^{-3} T

B. 1.775×10^{-3} T

C. 1.875×10^{-3} T

D. 1.975×10^{-3} T

Answer: C

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24. A rectangular loop is acted upon by two forces of same magnitude but opposite directions. The net force acting on the loop is

A. maximum

B. zero

C. equal to magnitude of torque

D. one

Answer: B

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25. A current carrying loop in a uniform magnetic field will experience

A. Force only

B. Torque only

C. Both torque and force

D. Neither torque nor force.

Answer: B

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

A. shape of loop

B. area of loop

C. number of turns

D. angle between normal of coil and magnetic field.

Answer: A

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27. choose the correct option

	Column I		Column II
i.	Fossils	a.	Paleontological evidence
ii.	Flipper of whale and forelimb of bat	b.	Morphological evidence
		c.	Anatomical evidence

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28. A circular loop of radius r having N number of turns carries current I is placed in a placed in a uniform magnetic field $\vec{B}$ parallel to the plane of the loop. The torque on the loop is :

A. (A) $NI\pi r^2 B$

B. (B) $N^2 I^2 \pi r^2 B$

C. (C) $NI^2 \pi r^2 B$

D. (D) $NI\pi r^2 B^2$

Answer: C

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

A. $2:\pi$

B. $\pi:2$

C. $\pi:4$

D. $4:\pi$

Answer: C

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30. A $2MeV$ proton is moving perpendicular to a uniform magnetic field 2.5 tesla. The force on the proton is

A. 8×10^{-10} N

B. 4×10^{-10} N

C. 1.2×10^{-10} N

D. 7.84×10^{-12} N

Answer: D

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31. A wire of length l carries a steady current. It is bent first to form a circular plane loop of one turn. The magnetic field at the centre of the loop is B. The same length is now bent more sharply to give a double loop of smaller radius. The magnetic field at the centre caused by the same is

A. B

B. 2B

C. 3B

D. 4B

Answer: D

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32. A homogeneous electric field E and a uniform magnetic field $\overrightarrow{B}$ are pointing in the same direction. A proton is projected with its velocity parallel to $\overrightarrow{E}$. It will

A. go on moving in the same direction with increasing velocity.

B. go on moving in the same direction with constant velocity.

C. turns to its right.

D. turn to its left.

Answer: A

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33. A wire carrying current I and other carrying $2I$ in the sam direction produce a magnetic field B at the midpoint. What will be the field when $2I$ wire is swiched off?

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

B. 2B

C. B

D. 4B

Answer: C

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

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

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

C. $\frac{v^2}{c^2}$

D. $\frac{c^2}{v^2}$

Answer: C

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35. A uniform conducting wire ABC has a mass of 10 g. A current of 2A flows through it. The wire is kept in a uniform magnetic field B= 2T. The acceleration of the wire will be

A. zero

B. $12m/s^2$ along Y-axis.

C. $1.2 \times 10^{-3} m/s^2$ along Y-axis

D. $0.6 \times 10^{-3} m/s^2$ along Y-axis.

Answer: B

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36. The work done by a magnetic field on moving charge is

A. zero because $\vec{F}$ acts parallel to $\vec{v}$.

B. positive because $\vec{F}$ acts perpendicular to $\vec{v}$.

C. zero because $\overrightarrow{F}$ acts perpendicular to $\overrightarrow{v}$.

D. negative because $\overrightarrow{F}$ acts parallel to $\overrightarrow{v}$.

Answer: C

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37. For a give perimeter in plane, following are some shpaes mentioned. Choose the shape for the loop such that which when placed inside

magnetic field will have maximum torque acting on it.

A. Square

B. Rectangle

C. Circle

D. Sphere

Answer: C

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38. Three long straight wires are connected parallel to each other across a battery of negligible internal resistance. The ratio of their resistances are $3:4:5$. What is the ratio of distances of middle wire from the others if the net forces experienced by it is zero.

A. $4:3$

B. $3:1$

C. $5:3$

D. $2:3$

Answer: C

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39. A horizontal rod of mass $10g$ and length $10cm$ is placed on a smooth plane inclined at an angle of 60° with the horizontal with the length of the rod parallel to the edge of the inclined plane. A uniform magnetic field induction B is applied vertically downwards. If the current through the rod is $1 \cdot 73ampere$,

the value of B for which the rod remains stationary on the inclined plane is

A. 1.73 T

B. $(1.73)^{-1}$ T

C. 1 T

D. $\sqrt{2}(1.73)$ T

Answer: C

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

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

b. What is the equivalent magnetic dipole moment?

A. 13.7 T

B. 1 T

C. 13.7 gauss

D. 13 gauss

Answer: A

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41. A horizontal wire carries $200amp$ current below which another wire of linear density $20 \times 10^{-5} kgm^{-1}$ carrying a current is kept at $2cm$ distance. If the wire kept below hangs in air. The current in this wire is

A. 100 A

B. 9.8 A

C. 98 A

D. 48 A

Answer: C

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Competitive Thinking Introduction

1. The region surrounding a stationary electric dipole has

A. electric field only

B. magnetic field only

C. both electric and magnetic fields

D. neither electric nor magnetic fields

Answer: A

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2. The magnetic field near a current carrying conductor is given by

A. Coulomb's law

B. Lenz' law

C. Biot-Savart's law

D. Kirchoff's law.

Answer: C

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3. The magnetic field due to current in a straight wire segment of length L at a point

on its perpendicular bisector at a distance $r(r > \ > L)$

A. decreases as $\frac{1}{r}$

B. decreases as $\frac{t}{r^2}$

C. decreases as $\frac{1}{r^3}$

D. approaches a finite limit as $r \to \infty$

Answer: B

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4. Two indentical long conducting wires AOB and COD are placed at right angles to each other, with one above other such that is their common point for the two. The wires carry I_1 and I_2 currents respectively. A point P is at a height d above the point O, with respect to the plane of the wires. the magnetic field at P is,

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

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

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

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

Answer: D

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5. A long straight wire carrying current of $30A$ is placed in an external unifrom magnetic field of induction $4\times10^{-4}T$. The magnetic field is acting parallel to the direction of current. The magnitude of the resultant magnetic

inuduction in tesla at a point $2.0cm$ away form the wire is

A. 10^{-4}

B. 3×10^{-4}

C. 5×10^{-4}

D. 6×10^{-4}

Answer: B

Watch Video Solution

6. A current carrying circular loop is freely suspended by a long thread. The plane of the loop will point in the direction

A. wherever left free

B. north-south

C. east-west

D. at 45° with the east-west direction

Answer: C

Watch Video Solution

7. 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. $4\pi \times 10^{-5}$ tesla

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

C. 4×10^{-5} tesla

D. 2×10^{-5} tesla

Answer: A

Watch Video Solution

8. A circular loop of radius 'r' of conducting wire connected with a Voltage source of zero internal resistance produces a magnetic field 'B' at its centre. If instead, a circular loop of radius '2r' made of same material, having the same cross section is connected to the same voltage source, what will be the magnetic field at its centre?

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

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

C. 2B

D. B

Answer: B

Watch Video Solution

9. A long wire carries a steady current . It is bent into a circle of one turn and the magnetic field at the centre of the coil is B. It

is then bent into a circular loop of n turns. The magnetic field at the centre of the coil will be

A. $2n^2B$

B. nB

C. n^2B

D. 2nB

Answer: C

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10. The dipole moment of a circular loop carrying a current I, is m and the magnetic field at the centre of the loop is B_1 . When the dipole moment is doubled by keeping the current constant, the magnetic field at the centre of the loop is B_2 . The ratio $\frac{B_1}{B_2}$ is:

A. $\sqrt{2}$

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

C. 2

D. $\sqrt{3}$

Answer: A

Watch Video Solution

11. Two concentric coils each of radius equal to $2\pi cm$ are placed at right angles to each other $3ampere$ and $4ampere$ are the currents flowing in each coil respectively. The magnetic induction in $weber/m^2$ at the centre of the coils will be

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

A. 5×10^{-5}

B. 7×10^{-5}

C. 12×10^{-5}

D. 10^{-5}

Answer: A

Watch Video Solution

12. 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. $\frac{a}{a^2x^2}$

B. $\frac{a^2}{(a^2+x^2)^{1/2}}$

C. $\frac{na^2}{(a^2+x^2)^{3/2}}$

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

Answer: C

Watch Video Solution

13. The magnetic field due to a current carrying circular loop of radius $3m$ at as point

on the axis at a distance of $4m$ from the centre is $54\mu T$. What will be its value at the centre of the loop/

A. 250 μT

B. $150\mu T$

C. $125\mu T$

D. $75\mu T$

Answer: A

Watch Video Solution

14. The magnetic induction at the centre of a current carrying circular coil of radius $10cm$ is $5\sqrt{5}$ times the magnetic induction at a point on its axis. The distance of the point from the centre of the coil in m is

A. 0.1 m

B. 0.2 m

C. 0.05 m

D. 0.25 m

Answer: B

Watch Video Solution

15. A circular coil of radius r carries a current I. The magnetic field at its centre is B. At what distance from the centre, on the axis of the coil the magnetic field wil be B/8 ?

A. $R\sqrt{2}$

B. $R\sqrt{3}$

C. 2R

D. 3R

Answer: B

 Watch Video Solution

16. Magnetic fields at two points on the axis of a circular coil at a distance of $0.05m$ and $0.2m$ from the centre are in the ratio $8:1$. The radius of the coil is

A. 1.0 m

B. 0.1 m

C. 0.15 m

D. 0.2 m

Answer: B

Watch Video Solution

17. If a proton is projected in a direction perpendicular to a uniform magnetic field with velocity v and and electron is projected along the line of force, what will happen to proton and electron?

A. the electron will travel along a circle with constant speed and the proton will move along a straight line.

B. proton will move in a circle with constant speed and there will be no effect on the motion of electron.

C. there will not be any effect on the motion of electron and proton.

D. the electron and proton both will follow the path of a parabola.

Answer: B

Watch Video Solution

18. A charged particle moving with velocity vis subjected to electric field E and magnetic field B. The particle will go undeflected if

A. E is perpendicular to B.

B. E is parallel to v and perpendicular to B.

C. E and B both are parallel to v.

D. E, B and v are mutually perpendicular

but $v = \frac{E}{B}$.

Answer: D

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19. A charged particle is moved along a magnetic field line. The magnetic force on the particle is

A. along its velocity

B. opposite to its velocity.

C. perpendicular to its velocity

D. zero

Answer: D

Watch Video Solution

20. A particle of mass 'm' and charge 'q' is incident on XZ plane with velocity 'v' in a direction making angle θ with a uniform magnetic field applied along X-axis. The

magnetic field applied along X-axis. The nature of motion performed by the particle is

A. circular

B. helical

C. parabola

D. straight line

Answer: B

 Watch Video Solution

21. A charged particle is released from rest in a region of steady and uniform electric and magnetic fields which are parallel to each other . The particle will move in a

A. straight line

B. circle

C. helix

D. cycloid

Answer: A

Watch Video Solution

Watch video solution

22. A positively charged particle projected towards east is deflected towards north by a magnetic field. The field may be

A. towards west

B. towards south

C. upward

D. downward

Answer: D

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23. A loop of flexible conducting wire lies in a magnetic field of 2.0 T with its plane perpendicular to the field. The length of the wire is 1 m. When a current of 1.1A is passed through the loop, it opens into a circle, then the tension developed in the wire is

A. 0.15 N

B. 0.25 N

C. 0.35 N

D. 0.45 N

Answer: C

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24. If a particle of charge 10^{-12} coulomb moving along the $\hat{x}$-direction with a velocity $10^5 m/s$ experiences a force of 10^{-10} newton in $\hat{y}$-direction due to magnetic field. Then the minimum magnetic field is

A. 6.25×10^3 tesla in $\hat{z}$- direction

B. 10^{-15} tesla in $\hat{z}$- direction

C. 6.25×10^{-3} tesla in $\hat{z}$- direction

D. 10^{-3} tesla in $\hat{z}$- direction

Answer: D

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25. A proton is moving perpendicular to a uniform magnetic field of 2.5 tesla with 2 MeV kinetic energy. The force on proton is _____N.

(Mass of proton= 1.6×10^{-27} kg, charge of proton $= 1.6 \times 10^{-19}$ C)

A. 8×10^{-12}

B. 8×10^{-11}

C. 3×10^{-11}

D. 3×10^{-10}

Answer: A

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26. A current of 5 ampere is flowing in a wire of length 1.5 metres. A force of $7.5N$ 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

Watch Video Solution

27. A conductor in the form of a right angle ABC with $AB = 3cm$ and $BC = 4cm$ carries a current of $10A$.There is a uniform magnetic field of $5T$ perpendicular to the palne of the conductor. The force on the conductor will be

A. 1.5 N

B. 2.0 N

C. 2.5 N

D. 3.5 N

Answer: C

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28. 1 Tesla =

A. 1 Wb/m

B. 1 J/A m

C. 1 N/A m

D. 1 A m/N

Answer: C

Watch Video Solution

29. A particle of charge q moves with a velocity $\vec{v} = a\hat{i}$ in a magnetic field of $\vec{B} = b\hat{j} + c\hat{k}$ where a ,b and c are constants. The magnetic of the force experienced by the particle is

A. 0

B. qa(b+c)

C. $qa\left(b^2 - c^2\right)^{1/2}$

D. $qa\left(b^2+c^2\right)^{1/2}$

Answer: D

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30. The electron in the beam of a television tube move horizontally from south to north. The vertical component of the earth's magnetic field points down. The electron is deflected towards.

A. west

B. no deflection

C. east

D. north to south

Answer: C

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31. A vertical wire carrying a current in the upward direction is placed in horizontal magnetic field directed towards north. The wire will experience a force directed towards

A. north

B. south

C. east

D. west

Answer: D

Watch Video Solution

32. An electron moving with a uniform velocity along the positive x-direction enters a magnetic field directed along the positive y-

direction. The force on the electron is directed along

A. positive y-direction

B. negative y-direction

C. positive z-direction

D. negative z-direction

Answer: D

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33. Two free paralell wires carrying currents in opposite direction

A. attract each other

B. repel each other

C. neither attract nor repel.

D. get rotated to be perpendicular to each other.

Answer: B

 Watch Video Solution

34. Equal currents are passing through two very long and straight parallel wires in the same direction. They will _____

A. repel each other

B. attract each other

C. lean towards each other

D. neither attract nor repel each other.

Answer: B

Watch Video Solution

35. Two parallel beams of electrons moving in the same direction produce a mutual force

A. of attraction in plane of paper.

B. of repulsion in plane of paper

C. upwards perpendicular to plane of paper

D. downwards perpendicular to plane of paper.

Answer: B

Watch Video Solution

36. Two long conductors, separated by a distance d carry current I_1 and I_2 in the same direction . They exert a force F on each other. Now the current in one of them is increased to two times and its direction is reversed . The distance is also increased to $3d$. The new value of the force between them is

A. $-2F$

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

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

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

Answer: C

Watch Video Solution

37. Two thin long paralel wires separated by a distance b are carrying a current 1 A each. The magnitude of the force 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

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

A. attract each other with a force of $\frac{\mu_0 I^2}{2\pi d^2}$

B. repel each other with a force of $\frac{\mu_0 I^2}{2\pi d^2}$

C. attract each other with a force of $\frac{\mu_0 I^2}{2\pi d}$

D. repel each other with a force of $\frac{\mu_0 I^2}{2\pi d}$

Answer: C

Watch Video Solution

39. Two long parallel wires carrying equal current separated by $1m$, exert a force of

`2xx10^(-7)N//m on one another. The current flowing through them is

A. 2.0 A

B. 2.0×10^{-1} A

C. 1.0 A

D. 1.0×10^{-7} A

Answer: C

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40. Two long parallel wires separated by 0.1 m carry currents of 1A and 2A respectively in opposite directions. A third current-carrying wire parallel to both of them is placed in the same plane such that it feels no net magnetic force. It is placed at a distance of

A. 0.5 m from the 1st wire, towards the 2nd wire.

B. 0.2 m from the 1st wire, towards the 2nd wire.

C. 0.1 m from the 1st wire, towards the 2nd wire.

D. 0.2 m from the 1st wire, away from the 2nd wire.

Answer: C

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41. Two very long straight wires are set parallel to each other. Each carries a current I in the same directions and the separation between

them is 2r. The intensity of magnetic field at point P as shown in figure is _____

A. $\frac{3\mu_0 I}{8\pi r}$

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

C. $\frac{2\mu_0 I}{3\pi r}$

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

Answer: C

Watch Video Solution

42. Two parallel very long straight wires carrying current of 5 A each are kept at a separation of 1 m. If the currents are in the same direction, the force per unit length between them is _____ N/m. $(\mu_0 = 4\pi \times 10^{-7}$ SI).

A. 5×10^{-5}, attractive

B. 5×10^{-6}, attractive

C. 5×10^{-5}, repulsive

D. 5×10^{-6} , repulsive

Answer: B

Watch Video Solution

43. Two long straight wires, each carrying current of 5.0 A, are kept parallel to each other at a separation of 2.5 cm. The magnitude by 5.0 cm of a wire is

A. 8.0×10^{-5} N

B. 4.0×10^{-5} N

C. 2.0×10^{-5} N

D. 1.0×10^{-5} N

Answer: D

Watch Video Solution

44. An arrangement of three parallel straight wires placed perpendicular to plate of paper carrying same currents i along the same direction is shown in figure. Magnitude of force per unit length on the middle wire B is

given by

A. $\frac{\mu_0 i^2}{2\pi d}$

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

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

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

Answer: D

Watch Video Solution

45. A rectangular loop carrying a current i is placed in a uniform magnetic field B. The area enclosed by the loop is A. If there are n turns in the loop, the torque acting on the loop is given by

A. $nI\vec{A} \times \vec{B}$

B. $nI\vec{A} . \vec{B}$

C. $\frac{1}{n}\left(1\vec{A} \times \vec{B}\right)$

D. $\frac{1}{n}\left(I\vec{A} . \vec{B}\right)$

Answer: A

Watch Video Solution

46. A triangular loop of side l carries a current I. It is placed in a magnetic field B such that the plane of the loop is in the direction of B. The torque on the loop is

A. zero because $\vec{F}$ acts parallel to $\vec{v}$.

B. Ibl

C. $\frac{\sqrt{3}}{2} 1 l^2 B^2$

D. $\frac{\sqrt{3}}{4} I B l^2$

Answer: D

Watch Video Solution

47. A current i flows in a circular coil of radius r. If the coil is placed in a uniform magnetic field B with its plane parallel to the field, magnitude of the torque that acts on the coil is

A. zero because $\overrightarrow{F}$ acts parallel to $\overrightarrow{v}$.

B. $2\pi rIB$

C. $\pi r^2 IB$

D. $2\pi r^2 IB$

Answer: C

Watch Video Solution

48. The magnetic moment of a current (i) carrying circular coil of radius (r) and number of turns (n) varies as

A. $1/r^2$

B. $1/r$

C. r

D. r^2

Answer: D

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49. A current loop in a magnetic field

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

orientation.

B. can be in equilibrium in one orientation.

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

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

Answer: D

 Watch Video Solution

50. Magnetic dipole moment $\vec{M}$ of the coil, placed in uniform magnetic field of induction $\vec{B}$ does not depend on

A. number of turns of coil.

B. current through coil.

C. area of the cross-section.

D. magnetic field of induction.

Answer: D

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51. A coil of 100 turns and area $2 \times 10^{-2} m^2$, pivoted about a vertical diameter in a uniform magnetic field carries a current of $5A$. When the coil is held with its plane in North-South direction, it experiences a torque of $0.3N/m$. When the plane is in East-West direction the torque is $0.4Nm$. The value of magnetic induction is (Neglect earth's magnetic field)

A. 0.2 T

B. 0.3 T

C. 0.4 T

D. 0.05 T

Answer: D

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52. A metallic rod of mass per unit length 0.5 kg m^{-1} is lying horizontally on a smooth inclined plane which makes an anlge of 30° with the horizontal. The rod is not allowed to

slide down by flowing a current through it when a magnetic field of induction 0.25 T is acting on it in the vertical direction. The current flowing in the rod to keep it stationary

A. 7.14 A

B. 5.98 A

C. 14.76 A

D. 11.32 A

Answer: A

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53. 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 acceleration $3a_0$ toward west. The electric and magnetic fields in the room are

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

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

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

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

Answer: B

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54. A uniform electric field and a uniform magnetic field are produced, pointed in the same direction. An electron is projected with its velocity pointing in the same direction. Then,

A. the electron will turn to its right

B. the electron will turn to its left

C. the electron velocity will increase in magnitude.

D. the electron velocity will decrease in magnitude.

Answer: D

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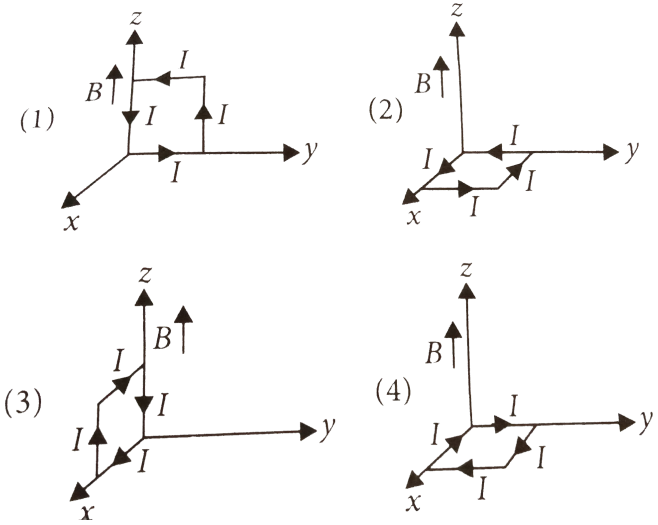
55. A rectangular loop of sides 10cm and 5cm carrying a current I of 12A is placed in different orienctations as shown in the figure



If there is a uniform magnetic field of 0.3 T in the positive z-direction, in which orientations the loop would be in (i) stable equilibrium and (ii) unstable equilibrium .

A. A and B, respectively

B. A and C respectively

C. B and D respectively

D. B and C, respectively

Answer:

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56. A conductor lies along the z-axis at $-1.5 \leq z < 1.5$ m and carries a fixed current of 10.0 A in $-\hat{a}_z$ direction (see figure). For a filed of $\overrightarrow{B} = 3.0 \times 10^{-4} e^{-0.2x} \hat{a}_y$ T, find the power required to move the conductor at constant speed to x=2.0 m, y=0 m in 5×10^{-3}

s. speed to x=2.0 m, y=0 m in 5×10^{-3} s. Assume parallel motion along the x-axis.

A. 1.57 W

B. 2.97 W

C. 14.58 W

D. 29.7 W

Answer: B

Watch Video Solution

57. Two current carrying coils have radii r and 2r and have same magnetic induction at their centres. The ratio of voltage applied across them is

A. $1:2$

B. $2:1$

C. $1:4$

D. $1:8$

Answer: B

 Watch Video Solution

58. A very long straight wire of radius 'r carries current 'I'. Intensity of magnetic field 'B' at a point, lying at a perpendicular distance 'a' from the axis is $\propto$ _____

A. a^2

B. $\frac{1}{a^2}$

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

D. a

Answer: D

Watch Video Solution

59. Magnetic induction produced at the centre of a circular loop carrying current is B . The magnetic moment of the loop of radius R is

A. $\frac{BR^3}{2\pi\mu_0}$

B. $\frac{2\pi BR^3}{\mu_0}$

C. $\frac{BR^3}{2\pi\mu_0}$

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

Answer: B

Watch Video Solution

60. The electron in the hydrogen atom circles around the proton with a speed of $2.18 \times 10^6 ms^{-1}$ in an orbit of radius $5.3 \times 10^{-11} m$. What magnetic field does it produce at the proton ?

A. 14.08 T

B. 13.08 T

C. 10.08 T

D. 12.41 T

Answer: A

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61. If two streams of proton move parallel to each other in the same direction, then they

A. do not exert any force on each other.

B. repel each other.

C. attract each other

D. get rotated to be perpendicular to each other.

Answer: B

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Evaluation Test

1. The magnetic field due to a current carrying circular loop of radius 6 cm at a point on the axis at a distance of 8 cm from the centre is

108 μT. What will be its value at the centre of the loop?

A. 250 μ T

B. 450μ T

C. 325μ T

D. 500μ T

Answer: D

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2. Two long conductors separated by a distance 50 cm 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 1.5 m. The new value of the force between them is

A. $-2F$

B. F/3

C. $-2F/3$

D. $-F/3$

Answer: C

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3. A particle of charge -32×10^{-18} coulomb moving with velocity 20 ms^{-1} along the x-axis enters a region where a magnetic field of induction B is along the y-axis, and an electric field of magnitude 5×10^4 V/m is along the negative z-axis. If the charged particle

continues moving along the x-axis, the magnitude of B is

A. $7 \times 10^3 Wb/m^2$

B. $2.5 \times 10^3 Wb/m^2$

C. $10^4 Wb/m^2$

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

Answer: B

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4. A magnetic needle lying parallel to a magnetic field requires $Wunits$ of work to turn it through 60°. The torque needed to maintain the needle in this position will be

A. $\sqrt{3}m$

B. W

C. 0

D. $\left(\sqrt{3}/2\right)$ W

Answer: A

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5. In a region, steady and uniform electric and magnetic fields are present . These two fields are parallel to each other. A charged particle is released from rest in this region . The path of the particle will be a

A. ellipse

B. helix

C. straight line

D. circle

Answer: C

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6. A magnet 10 cm and having a pole strength of 8 units is deflected through 45° from the magnetic meridian. If the earth's magnetic field is 0.32 oersted, value of the deflecting couple in dynes cm will be

A. 16

B. 18

C. 24

D. 12

Answer: B

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7. A particle of mass m and charge q is accelerated through a potential differece V to a velocity $\overrightarrow{v}$ towards south. The particle enters a region with both a magnetic field $\overrightarrow{B}$ (pointing eastwards) and electric field $\overrightarrow{E}$

(pointing downwards). The particle travels with a constant velocity through this region. The potential difference V through this region should be equal to

A. $mE^2/2qB^2$

B. $2mE/qB$

C. E/qB

D. E^2/qB

Answer: A

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8. The field normal to the plane of a wire of 15 turns and radius r which carries 1 A is measured on the axis of the coil at a small distance d from the centre of the coil. This is smaller than the field at the centre by the fraction

A. $\frac{3}{2}\frac{d^2}{r^2}$

B. $\frac{2}{3}\frac{d^2}{r^2}$

C. $\frac{3}{2}\frac{r^2}{d^2}$

D. $\frac{2}{3}\frac{r^2}{d^2}$

Answer: A

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9. The magnetic field on the axis of a circular current carrying conductor of radius r at a distance r from centre is B_a and the magnetic field at its centre is B_c. The value of $B_a : B_c$ is

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

B. $\sqrt{2} : 1$

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

D. $1:\sqrt{2}$

Answer: C

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10. An α- particle is moving field of $\left(4\hat{i}-\hat{j}\right)$ tesla with a velocity of $\left(6\times10^{5}\hat{i}\right)ms^{-1}$. What will be the magnetic force acting on the particle?

A. 3.2×10^{-13} N, towards negative X-axis

B. 1.92×10^{-13} N, towards positive Z-axis.

C. 3.2×10^{-13} N, towards positive Y-axis.

D. 1.92×10^{-13} N, towards negative Z-axis.

Answer: D

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11. A long straight conductor AB, carrying a current of 25 A is fixed horizontally. Another long conductor XY is kept parallel to AB at a distance of 4mm, in air. Conductor XY is free to

move and carries current 1. Then the magnitude and direction of current I forwhich the magnetic repulsion just balances the weight of conductor XY is (Mass per unit length for conductor XY is $5 \times 10^{-2} Kg/m$).

A. 32.67 A

B. 3.98 A

C. 392 A

D. 300 A

Answer: C

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12. When a current carrying wire is bent into a circular loop, magnetic field lines around it

A. vanish

B. are rarefield

C. are crowded.

D. are unaffected

Answer: C

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