CLASS 12 PHYSICS PREVIOUS YEAR QUESTIONS
CHAPTER 4: MOVING CHARGES AND MAGNETISM

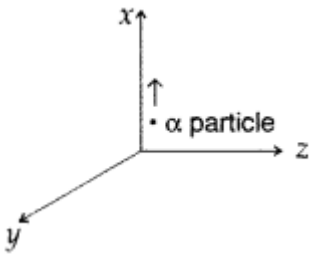
Question 1. What is the direction of the force acting on a charged particle q, moving with a velocity $v\longrightarrow$ in a uniform magnetic field B? (Delhi)

Question 2. Why should the spring/suspension wire in a moving coil galvanometer have low torsional constant? (All India 2008)

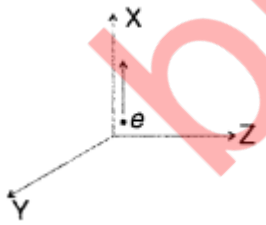
Question 3. Magnetic field lines can be entirely confined within the core of a toroid, but not within a straight solenoid. Why? (Delhi 2008).

Question 4. An electron does not suffer any deflection while passing through a region of uniform magnetic field. What is the direction of the magnetic field? (All India 2009)

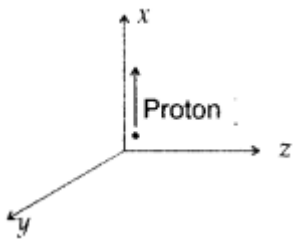
Question 5. A beam of a particles projected along +x-axis, experiences a force due to a magnetic field along the +y-axis. What is the direction of the magnetic field? (All India 2009)



Question 6. A beam of electrons projected along +x-axis, experiences a force due to a magnetic field along the +y/-axis. What is the direction of the magnetic field? (All India 2010)



Question 7. A beam of protons, projected along + x-axis, experiences a force due to a magnetic field along the – y-axis. What is the direction of the magnetic field? (All India 2010)



Question 8. Depict the trajectory of a charged particle moving with velocity v as it enters a uniform magnetic field perpendicular to the direction of its motion. (Comptt. All India 2012)

Question 9. Write the expression in vector form, for the magnetic force $F\rightarrow$ acting on a charged particle moving with velocity $V\rightarrow$ in the presence of a magnetic field B. (Comptt. All India 2012)

Question 10. An ammeter of resistance 0.6 Ω can measure current upto 1.0 A. Calculate
(i) The shunt resistance required to enable the ammeter to measure current upto 5.0 A
(ii) The combined resistance of the ammeter and the shunt. (Delhi 2013)

Question 11. Write the expression, in a vector form, for the Lorentz magnetic force $F\rightarrow$ due to a charge moving with velocity $V\rightarrow$ in a magnetic field $B\rightarrow$. What is the direction of the magnetic force? (Delhi 2013)

Question 12. Using the concept of force between two infinitely long parallel current carrying conductors, define one ampere of current. (All India 2013)

Question 13. Write the condition under which an electron will move undeflected in the presence of crossed electric and magnetic fields.(Comptt. All India 2013)

Question 14. Why do the electrostatic field lines not form closed loops? (All India 2015)

Question 15. A particle of mass 'm' and charge 'q' moving with velocity V enters the region of uniform magnetic field at right angle to the direction of its motion. How does its kinetic energy get affected? (Comptt. Delhi 2015)

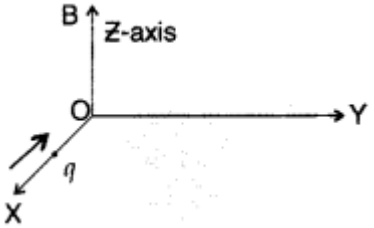
Question 16. Write the underlying principle of a moving coil galvanometer. (Delhi 2015)

Question 17. A coil, of area A, carrying a steady current I, has a magnetic moment, $\vec{m}$, associated with it. Write the relation between $\vec{m}$, I and A in vector form. (Comptt Delhi 2015)

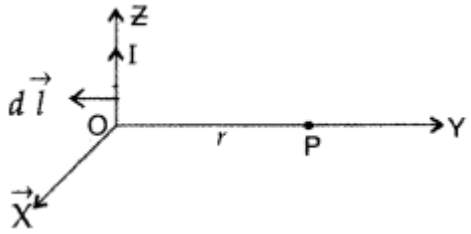
Short Answer Type SA II

Question 18. Using Ampere's circuital law, obtain an expression for the magnetic field along the axis of a current carrying solenoid of length l and having N number of turns. (All India 2008)

Question 19. A charge 'q' moving B along the X-axis with a velocity v is subjected to a uniform magnetic field B acting along the Z-axis as it crosses the origin O. (Delhi 2009)
(i) Trace its trajectory.
(ii) Does the charge gain kinetic energy as it enters the magnetic field? Justify your answer.



Question 20. State Biot-Savart law.
A current I flows in a conductor placed perpendicular to the plane of the paper. Indicate the direction of the magnetic field due to a small element $d\vec{l}\rightarrow$ at point P situated at a distance $\vec{r}$ from the element as shown in the figure.



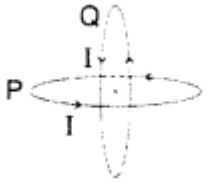
Question 21. (a) In what respect is a toroid different from a solenoid? Draw and compare the pattern of the magnetic field lines in the two cases.
(b) How is the magnetic field inside a given' solenoid made strong? (All India 2011)

Question 22. Write the expression for Lorentz magnetic force on a particle of charge 'q' moving with velocity $\vec{v}$ in a magnetic field $\vec{B}$. Show that no work is done by this force on the charged particle. (All India 2011)

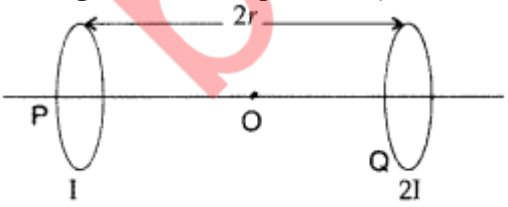
Question 23. A steady current (I_1) flows through a long straight wire. Another wire carrying steady current (I_2) in the same direction is kept close and parallel to the first wire. Show with the help of a diagram how the magnetic field due to the current I_1 exerts a magnetic force on the second wire. Write the expression for this force. (All India 2011)

Question 24. Using Ampere's circuital law, obtain the expression for the magnetic field due to a long solenoid at a point inside the solenoid on its axis. (All India 2011)

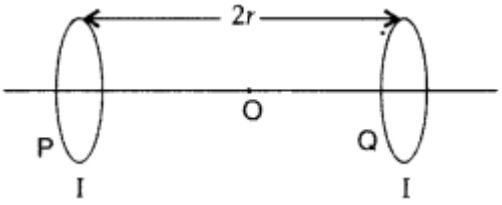
Question 25. Two identical circular wires P and Q each of radius R and carrying current 'I' are kept in perpendicular planes such that they have a common centre as shown in the figure. Find the magnitude and direction of the net magnetic field at the common centre of the two coils. (Delhi 2011)



Question 26. Two identical circular loops, P and Q, each of radius r and carrying current I and 21 respectively are lying in parallel planes such that they have a common axis. The direction of current in both the loops is clockwise as seen from O which is equidistant from both the loops. Find the magnitude of the net magnetic field at point O. (Delhi 2011)



Question 27. Two identical circular loops, P and Q, each of radius r and carrying equal currents are kept in the parallel planes having a common axis passing through O. The direction of current in P is clockwise and in Q is anti-clockwise as seen from O which is equidistant from the loops P and Q. Find the magnitude of the net magnetic field at O. (Delhi 2011)



Question 28. A circular coil of closely wound N turns and radius r carries a current I. Write the expressions for the following :

(i) the magnetic field at its centre
(ii) the magnetic moment of this coil (All India 2011)

Question 29. A proton and a deuteron, each moving with velocity $\vec{v}$ enter simultaneously in the region of magnetic field $\vec{B}$ acting normal to the direction of velocity. Trace their trajectories establishing the relationship between the two. (Comptt. Delhi 2011)

Question 30. A particle of mass 10^{-3} kg and charge 5 pC enters into a uniform electric field of 2×10^5 NC^{-1}, moving with a velocity of 20 ms^{-1} in a direction opposite to that of the field. Calculate the distance it would travel before coming to rest. (Comptt. Delhi 2011)

Question 31. A particle of mass 2 x 10^{-3} kg and charge 2 μC enters into a uniform electric field of 5×10^5 NC^{-1}, moving with a velocity of 10 ms^{-1} in a direction opposite to that of the field. Calculate the distance it would travel before coming to rest. (Comptt. Delhi 2011)

Question 32. A particle of mass 5×10^{-3} kg and charge 4 μC enters into a uniform electric field of 2×10^5 NC^{-1}, moving with a velocity of 30 ms^{-1} in a direction opposite to that of the field. Calculate the distance it would travel before coming to rest. (Comptt. Delhi 2011)

Question 33. An ammeter of resistance 0.80 Ω can measure current upto 1.0 A.
(i) What must be the value of shunt resistance to enable the ammeter to measure current upto 5.0A?
(ii) What is the combined resistance of the ammeter and the shunt? (Delhi 2013)

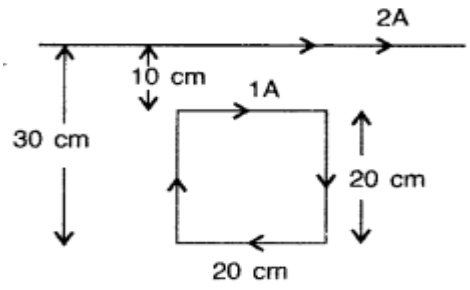
Question 34. (a) How is a toroid different from a solenoid?
(b) Use Ampere's circuital law to obtain the magnetic field inside a toroid.
(c) Show that in an ideal toroid, the magnetic field
(i) inside the toroid and
(ii) outside the toroid at any point in the open space is zero. (Comptt. All India 2014)

Question 35. Derive an expression for the magnetic moment ($\vec{\mu}$) of an electron revolving around the nucleus in terms of its angular momentum $(\vec{l})$. What is the direction of* the magnetic moment of the electron with respect to its angular momentum? (Comptt. All India 2014)

Question 36. Draw the magnetic field lines due to a current passing through a long solenoid. Use Ampere's circuital law, to obtain the expression for the magnetic field due to the current I in a long solenoid having n number of turns per unit length. (Comptt. Delhi 2014)

Question 37. A rectangular coil of sides 'V and 'b' carrying a current I is subjected to a uniform magnetic field $\vec{B}$ acting perpendicular to its plane. Obtain the expression for the torque acting on it.
(Comptt. Delhi 2014)

Question 38. A square loop of side 20 cm carrying current of 1A is kept near an infinite long straight wire carrying a current of 2A in the same plane as shown in the figure.



Calculate the magnitude and direction of the net force exerted on the loop due to the current carrying conductor. (Comptt. All India)

Question 39. A square shaped plane coil of area 100 cm^2 of 200 turns carries a steady current of 5A. It is placed in a uniform magnetic field of 0.2 T acting perpendicular to the plane of the coil. Calculate the torque on the coil when its plane makes an angle of 60° with the direction of the field. In which orientation will the coil be in stable equilibrium? (Comptt. All India 2014)

Question 40. Find the condition under which the charged particles moving with different speeds in the presence of electric and magnetic field vectors can be used to select charged particles of a particular speed. (All India 2015)

Question 41. A charge q of mass m is moving with a velocity of v, at right angles to a uniform magnetic field B. Deduce the expression for the radius of the circular path it describes. (Comptt. Delhi 2015)

Question 42. A proton and an alpha particle having the same kinetic energy are, in turn, passed through a region of uniform magnetic field, acting normal to the plane of the paper and travel in circular paths. Deduce the ratio of the radii of the circular paths described by them. (Comptt. Delhi 2015)

Short Answer Type SA III

Question 43. A circular coil of 200 turns and radius 10 cm is placed in a uniform magnetic field of 0.5 T, normal to the plane of the coil. If the current in the coil is 3.0 A, calculate the
(a) total torque on the coil.
(b) total force on the coil.
(c) average force on each electron in the coil, due to the magnetic field.
Assume the area of cross-section of the wire to be 10^{-5} m^2 and the free electron density is $10^{29}/m^3$. (All India 2015)

Question 45. Derive the expression for force per unit length between two long straight parallel current carrying conductors. Hence define one ampere. (Delhi 2015)

Question 46. Find the magnetic field at a point on the axis of a circular coil carrying current and hence find the magnetic field at the centre of the circular coil carrying current.

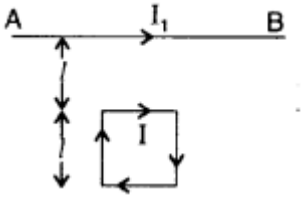
Question 47. Deduce the expression for the magnetic dipole moment of an electron orbiting around the central nucleus. (All India 2010)

Question 48. A long straight wire of a circular cross-section of radius ‘a’ carries a steady current ‘I’. The current is uniformly distributed across the cross-section. Apply Ampere’s circuital law to calculate the magnetic field at a point V in the region for
(i) r < a and (ii) r > a.

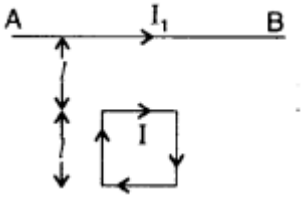
Question 49. State the underlying principle of working of a moving coil galvanometer. Write two reasons why a galvanometer can not be used as such to measure current in a given circuit. Name any two factors on which the current sensitivity of a galvanometer depends. (Delhi 2010)

Question 50. Write the expression for the magnetic moment ($\vec{M}$) due to a planar square loop of side ‘l’ carrying a steady current I in a vector form. In the given figure this loop is placed in a horizontal plane near a long straight conductor carrying a steady current I, at a distance l as shown. Give reasons to explain that the loop will experience a net force but no torque. Write the expression for this force acting on the loop.

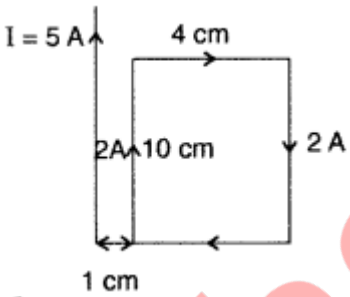
(Delhi 2010)



Question 51. Write the expression for the magnetic moment ($\overrightarrow{M}$) due to a planar square loop of side 'l' carrying a steady current I in a vector form. In the given figure this loop is placed in a horizontal plane near a long straight conductor carrying a steady current I, at a distance l as shown. Give reasons to explain that the loop will experience a net force but no torque. Write the expression for this force acting on the loop.
(Delhi 2010)

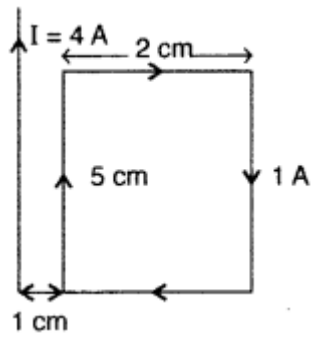


Question 52. A rectangular loop of wire of size 4 cm × 10 cm carries a steady current of 2 A. A straight long wire carrying 5 A current is kept near the loop as shown. If the loop and the wire are coplanar, find
(i) the torque acting on the loop and



(ii) the magnitude and direction of the force on the loop due to the current carrying wire. (Delhi 2012)

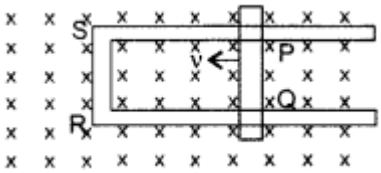
Question 53. A rectangular loop of wire of size 2 cm × 5 cm carries a steady current of 1 A. A straight long wire carrying 4 A current is kept near the loop as shown in the figure.
If the loop and the wire are coplanar, find
(i) the torque acting on the loop and
(ii) the magnitude and direction of the force on the loop due to the current carrying wire. (Delhi 2010)



Question 54. Two identical coils, each of radius 'R' and number of turns 'N' are lying in perpendicular planes such that their centres coincide. Find the magnitude and direction of the resultant magnetic field at the centre of the coils, if they are carrying currents 'I' and √3I respectively.
(Comptt. Delhi 2010)

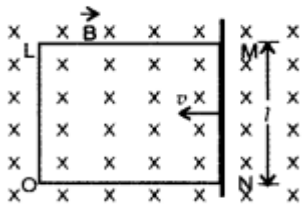
Question 55. Two identical coils, each of radius 'R' and number of turns 'N' are lying in perpendicular planes such that their centres coincide. Find the magnitude and direction of the resultant magnetic field at the centre of the coils, if they are carrying currents 'I' and $\sqrt{2}I$ respectively.
(Comptt. Delhi 2010)

Question 56. Figure shows a rectangular loop conducting PQRS in which the arm PQ is free to move. A uniform magnetic field acts in the direction perpendicular to the plane of the loop. Arm PQ is moved with a velocity v towards the arm RS. Assuming that the arms QR, RS and SP have negligible resistances and the moving arm PQ has the resistance r, obtain the expression for



(i) the current in the loop
(ii) the force and
(iii) the power required to move the arm PQ. (Delhi 2010)

Question 57. A rectangular conductor LMNO is placed in a uniform magnetic field of 0.5 T. The field is directed perpendicular to the plane of the conductor. When the arm MN of length of 20 cm is moved towards left with a velocity of 10 ms^{-1}, calculate the emf induced in the arm. Given the resistance of the arm to be 5Ω (assuming that other arms are of negligible resistance) find the value of the current in the arm.
(All India 2010)



Question 58. A wire AB is carrying a steady current of 12A and is lying on the table. Another wire CD carrying 5A is held directly above AB at a height of 1 mm. Find the mass per unit length of the wire CD so that it remains suspended at its position when left free. Give the direction of the current flowing in CD with respect to that in AB. [Take the value of g = 10 ms^{-2}] (All India 2010)

Question 59. A wire AB is carrying a steady current of 10 A and is lying on the table. Another wire CD carrying 6 A is held directly above AB at a height of 2 mm. Find the mass per unit length of the wire CD so that it remains suspended at its position when left free. Give the direction of the current flowing in CD with respect to that in AB. [Take the value of g = 10 ms^{-2}] (All India 2010)

Question 60. (a) Define the current sensitivity of a galvanometer.
(b) The coil area of a galvanometer is 16×10^{-4} m^2. It consists of 200 turns of a wire and is in a magnetic field of 0.2 T. The restoring torque constant of the suspension fibre is 10^{-6} Nm per degree. Assuming the magnetic field to be radial, calculate the maximum current that can be measured by the galva-nometer if the scale can accommodate 30° deflection. (Comptt. All India 2010)

Question 61. (a) State Ampere's circuital law, expressing it in the integral form.
(b) Two long coaxial insulated solenoids, S_1 and S_2 of equal lengths are wound one over the other as shown in the figure. A steady current "I" flows through the inner solenoid S_1 to the other end B, which is connected to the outer solenoid S_2 through which the same current "I" flows in the opposite direction so as to come out at end A. If n_1 and n_2 are the number of turns per unit length, find the magnitude and direction of the net magnetic field at a point
(i) inside on the axis and
(ii) outside the combined system. (Delhi 2014)

Question 62. Consider the motion of a charged particle of mass 'm' and charge 'q' moving with velocity $\vec{v}$ in a magnetic field $\vec{B}$.
(a) If $\vec{v}$ is perpendicular to $\vec{B}$, show that it describes a circular path having angular frequency $\omega = qB/m$.
(b) If the velocity $\vec{v}$ has a component parallel to the magnetic field $\vec{B}$, trace the path described by the particle. Justify your answer. (Comptt. Delhi 2014)

Question 63. (a) Draw a schematic sketch of a moving coil galvanometer and describe briefly its working.
(b) "Increasing the current sensitivity of a galvanometer does not necessarily increase the voltage sensitivity." Justify this statement. (Comptt. Delhi 2014)

Question 64. A uniform magnetic field $B\rightarrow$ is set up along the positive x-axis. A particle of charge 'q' and mass 'm' moving with a velocity v enters the field at the origin in X-Y plane such that it has velocity components both along and perpendicular to the magnetic field $B\rightarrow$. Trace, giving reason, the trajectory followed by the particle. Find out the expression for the distance moved by the particle along the magnetic field in one rotation. (All India 2014)

Question 65. Write the expression for the generalized form of Ampere's circuital law. Discuss its significance and describe briefly how the concept of displacement current is explained through charging/discharging of a capacitor in an electric circuit. (All India 2014)

Question 65. (a) Why is the magnetic field radial in a moving coil galvanometer? Explain how it is achieved.
(b) A galvanometer of resistance 'G' can be converted into a voltmeter of range (0 – V) volts by connecting a resistance 'R' in series with it. How much resistance will be required to change its range from 0 to V/2? (Comptt. All India 2014)

Question 66. A closely wound solenoid of 2000 turns and cross sectional area 1.6×10^{-4} m^2 carrying a current of 4.0 A is suspended through its centre allowing it to turn in a horizontal plane. Find
(i) the magnetic moment associated with the solenoid,
(ii) magnitude and direction of the torque on the solenoid if a horizontal magnetic field of 7.5×10^{-2} T is set up at an angle of 30° with the axis of the solenoid. (Comptt. All India 2014)

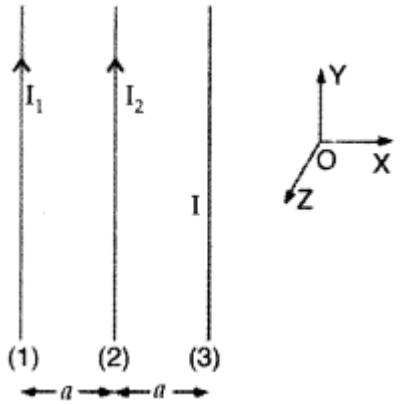
Question 67. (a) Write the expression for the magnetic force acting on a charged particle moving with velocity v in the presence of magnetic field B.
(b) A neutron, an electron and an alpha particle moving with equal velocities, enter a uniform magnetic field going into the plane of the paper as shown. Trace their paths in the field and justify your answer. (Delhi 2016)

Question 68. Two long straight parallel conductors carry steady current I_1 and I_2 separated by a distance d. If the currents are flowing in the same direction, show how the magnetic field set up in one produces an attractive force on the other. Obtain the expression for this force. Hence define one ampere. (Delhi 2014)

Question 69. Use Biot-Savart law to derive the expression for the magnetic field on the axis of a current carrying circular loop of radius R.

Draw the magnetic field lines due to a circular . wire carrying current I. (All India 2014)

Question 70. Three long straight parallel wires are kept as shown in the figure. The wire (3) carries a current I



(i) The direction of flow of current I in wire (3), is such that the net force, on wire (1), due to the other two wires, is zero.
(ii) By reversing the direction of I, the net force, on wire (2), due to the other two wires, becomes zero.
What will be the directions of current I, in the two cases? Also obtain the relation between the magnitudes of currents I_1 I_2 and I.

Question 71.A circular coil, having 100 turns of wire, of radius (nearly) 20 cm each, lies in the XY plane with its centre at the origin of co-ordinates. Find the magnetic field, at the point (0, 0, $20\sqrt{3}$ cm), when this coil carries a current of (Comptt. Delhi 2016)

Question 72. Write the expression for the magnetic force $F\rightarrow$ acting on a charged particle q moving with velocity $F\rightarrow$ in the presence of the magnetic field $B\rightarrow$ in a vector form. Show that no work is done and no change in the magnitude of the velocity of the particle is produced by this force. Hence define the unit of magnetic field. (Comptt. All India 2016)

Question 73. A long straight wire, of circular cross section (radius = a) carries a current I which is uniformly distributed across the cross section of the wire.
Use Ampere's circuital law to calculate the magnetic field B(r), due to this wire, at a point distance r < a and r > a from its axis. Draw a graph showing the dependence of B(r) on r. (Comptt. All India 2016)

Question 74. Derive the expression for the torque τ acting on a rectangular current loop of area A placed in a uniform magnetic field B. Show that $\vec{\tau} = \vec{m} \times B\rightarrow$ where $\vec{m}$ is the magnetic moment of the current loop given by $\vec{m} = I\rightarrow A\rightarrow$. (Comptt. All India)

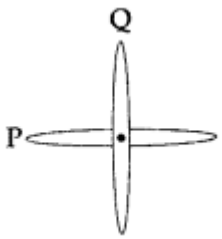
Question 75. Describe the working principle of a moving coil galvanometer. Why is it necessary to use
(i) a radial magnetic field and
(ii) a cylindrical soft iron core in a galvanometer? Write the expression for current sensitivity of the galvanometer.
Can a galvanometer as such be used for measuring the current? Explain. (Delhi 2017)

Question 76. An electron of mass m_e revolves around a nucleus of charge +Ze. Show that it behaves like a tiny magnetic dipole. Hence prove that the magnetic moment associated with it is expressed as $\vec{\mu} = -\frac{e}{2m_e}L\rightarrow$ where L is the orbital angular momentum of the electron. Give the significance of negative sign. (Delhi 2017)

Question 77. (a) Write the expression for the force $\vec{F}$ acting on a particle of mass m and charge q moving with velocity $\vec{v}$ in a magnetic field $\vec{B}$. Under what conditions will it move in
(i) a circular path and
(ii) a helical path?
(b) Show that the kinetic energy of the particle moving in magnetic field remains constant. (Delhi 2017)

Question 78. (a) State Biot-Savart law and express this law in vector form.
(b) Two identical circular coils, P and Q each of radius R, carrying currents 1 A and $\sqrt{3}$ A respectively, are placed concentrically and perpendicular to each other lying in the XY and YZ planes. Find the magnitude and direction of the net magnetic field at the centre of the coils. (All India 2017)

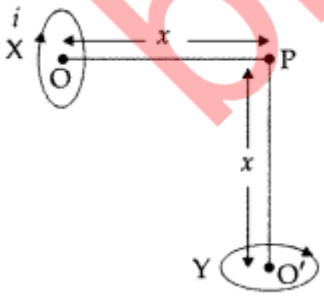
Question 79. Two identical loops P and Q each of radius 5 cm are lying in perpendicular planes such that they have a common centre as shown in the figure. Find the magnitude and direction of the net magnetic field at the common centre of the two coils, if they carry currents equal to 3 A and 4 A respectively. (All India 2017)



Question 80. State the Lorentz's force and express it in vector form. Which pair of vectors are always perpendicular to each other? Derive the expression for the force acting on a current carrying conductor of length L in a uniform magnetic field 'B'. (Comptt. Delhi 2017)

Question 81. Define the term magnetic moment of a current loop. Derive an expression for the magnetic field at any point along the axis of a solenoid of length 21, and radius «, and number of terms per unit length n. (Comptt. Delhi 2017)

Question 82. (a) Draw the pattern of magnetic field lines for a circular coil carrying current.
(b) Two identical circular loops X and Y of radius R and carrying the same current are kept in perpendicular planes such that they have a common centre at P as shown in the figure. Find the magnitude and direction of the net magnetic field at the point P due to the loops. (Comptt. All India 2017)

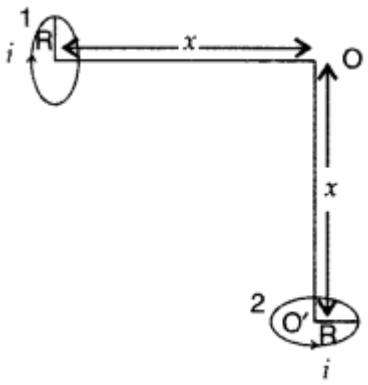


Question 83. Define the term current sensitivity of a galvanometer. Write its SI unit. (Comptt. All India 2017)

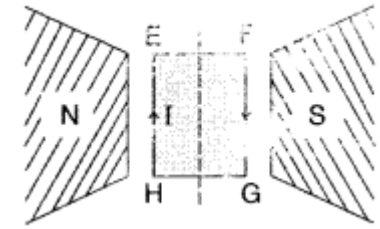
Long Answer Type

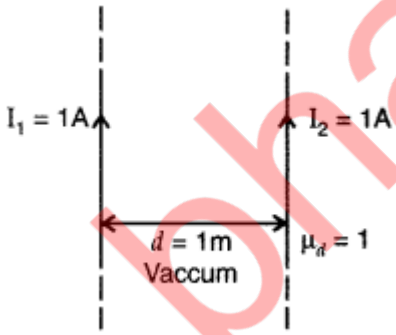
Question 84. (a) Using Biot-Savart's law, derive an expression for the magnetic field at the centre of a circular coil of radius R, number of turns N, carrying current i.
(b) Two small identical circular coils marked 1, 2 carry equal currents and are placed with their geometric axes perpendicular to each other as shown in the figure. Derive an expression for the resultant magnetic

field at O. (Delhi 2017)



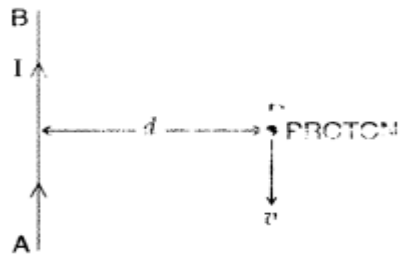
Question 85. (a) Two straight long parallel conductors carry currents I_1 and I_2 in the same direction. Deduce the expression for the force per unit length between them.
Depict the pattern of magnetic field lines around them.
(b) A rectangular current carrying loop EFGH is kept in a uniform magnetic field as shown in the figure.
(i) What is the direction of the magnetic moment of the current loop?
(ii) When is the torque acting on the loop
(A) maximum,
(B) zero? (All India 2017)





Question 86. (a) With the help of a diagram, explain the principle and working of a moving coil galvanometer.
(b) What is the importance of a radial magnetic field and how is it produced?
(c) Why is it that while using a moving coil galvanometer as a voltmeter a high resistance in series is required whereas in an ammeter a shunt is used? (All India)

Question 87. (a) Derive an expression for the force between two long parallel current carrying conductors.



(b) Use this expression to define S.I. unit of current.
(c) A long straight wire AB carries a current I. A proton P travels with a speed v, parallel to the wire, at a distance d from it in a direction opposite to the current as shown in the figure. What is the force experienced by the proton and what is its direction? (All India)

Question 88. State Biot-Savart law, giving the mathematical expression for it.
Use this law to derive the expression for the magnetic field due to a circular coil carrying current at a point along its axis.
How does a circular loop carrying current behave as a magnet? (Delhi 2011)

Question 89. (a) State the principle of the working of a moving coil galvanometer, giving its labelled diagram.
(b) "Increasing the current sensitivity of a galvanometer may not necessarily increase its voltage sensitivity." Justify this statement
(c) Outline the necessary steps to convert a galvanometer of resistance RG into an ammeter of a given range. (All India 2011)

Question 90. (a) Write the expression for the force, $F\rightarrow$, acting on a charged particle of charge 'q', moving with a velocity latex]\overrightarrow{\mathbf{v}}[/latex] in the presence of both electric field $E\rightarrow$ and magnetic field $B\rightarrow$. Obtain the condition under which the particle moves undeflected through the fields.
(b) A rectangular loop of size l × b carrying a steady current I is placed in a uniform magnetic field $B\rightarrow$. Prove that the torque $\vec{\tau}$ acting on the loop is given by $\vec{\tau}=\vec{m}\times B\rightarrow$, where $m\rightarrow$ is the magnetic moment of the loop. (All India 2011)

Question 91. (a) Explain, giving reasons, the basic difference in converting a galvanometer into
(i) a voltmeter and
(ii) an ammeter.
(b) Two long straight parallel conductors carrying steady currents I_1 and I_2 are separated by a distance'd' Explain briefly, with the help of a suitable diagram, how the magnetic field due to one conductor acts on the other. Hence deduce the expression for the force acting between the two conductors. Mention the nature of this force.

Question 92. (a) Explain briefly with the help of a labelled diagram, the principle and working of a moving coil galvanometer.
(b) Define the term 'current sensitivity' of a galvanometer. How is it that increasing current sensitivity may not necessarily increase its voltage sensitivity? Explain. (Comptt. All India 2011)

Question 93. (a) State Biot-Savart law. Deduce the expression for the magnetic field due to a circular current carrying loop at a point lying on its axis.
(b) Two long parallel wires carry currents I_1 and I_2 flowing in the same direction. When a third current carrying wire is placed parallel and coplanar in between the two, find the condition when the third wire would experience no force due to these two wires. (Comptt. All India 2011)

Question 94. (a) Derive the expression for the torque on a rectangular current carrying loop suspended in a uniform magnetic field.
(b) A proton and a deutron having equal momenta enter in a region of uniform magnetic field at right angle to the direction of the field. Depict their trajectories in the field. (Delhi 2013)

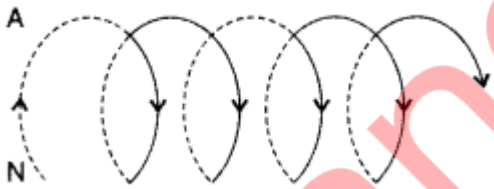
Question 95. (a) Using Biot-Savart's law, derive the expression for the magnetic field in the vector form at a point on the axis of a circular current loop.
(b) What does a toroid consist of? Find out the expression for the magnetic field inside a toroid for N turns of the coil having the average radius r and carrying a current I. Show that the magnetic field in the open space inside and exterior to the toroid is zero. (All India 2013)

Question 96. State Biot-Savart law, expressing it in the vector form. Use it to obtain the expression for the magnetic field at an axial point, distance 'd' from the centre of a circular coil of radius V carrying current T. Also find the ratio of the magnitudes of the magnetic field of this coil at the centre and at an axial point for which
$d = a\sqrt{3}$. (Comptt. Delhi 2013)

Question 97. (a) Draw the magnetic field lines due to a current carrying loop.
(b) State using a suitable diagram, the working principle of a moving coil galvanometer. What is the function of a radial magnetic field and the soft iron core used in it?
(c) For converting a galvanometer into an ammeter, a shunt resistance of small value is used in parallel, whereas in the case of a voltmeter a resistance of large value is used in series. Explain why. (Comptt. Delhi 2011)

Question 98. (a) Draw a labelled diagram of a moving coil galvanometer. Describe briefly its principle and working.
(b) Answer the following :
(i) Why is it necessary to introduce a cylindrical soft iron core inside the coil of a galvanometer?
(ii) Increasing the current sensitivity of a galvanometer may not necessarily increase its voltage sensitivity. Explain, giving reason. (All India 2011)

Question 99. (a) State Ampere's circuital law. Use this law to obtain the expression for the magnetic field inside an air cored toroid of average radius r, having 'n' turns per unit length and carrying a steady current I.



(b)
An observer to the left of a solenoid of N turns each of cross section area 'A' observes that a steady current I in it flows in the clockwise direction. Depict the magnetic field lines due to the solenoid specifying its polarity and show that it acts as a bar magnet of magnetic moment m = NIA. (Delhi 2011)

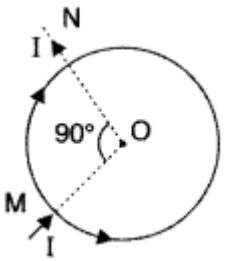
Question 100. Explain, using a labelled diagram, the principle and working of a moving coil galvanometer.
(a) What is the function of
(i) uniform radial magnetic field,
(ii) soft iron core?
(b)Define the terms
(i) current sensitivity and
(ii) voltage sensitivity of a galvanometer. Why does increasing the current sensitivity not necessarily increase voltage sensitivity? (All India 2011)

Question 101. (a) Write, using Biot-Savart law, the expression for the magnetic field $\vec{B}$ due to an element $d\vec{l}$ carrying current I at a distance r from it in a vector form.
Hence derive the expression for the magnetic field due to a current carrying loop of radius R at a point P distant x from its centre along the axis of the loop.
(b) Explain how Biot-Savart law enables one to express the Ampere's circuital law in the integral form, viz.,

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 I$$

...where [I is the total current passing through the surface. (All India 2011)

Question 102. (a) Use Biot-Savart law to derive the expression for the magnetic field due to a circular coil of radius R having N turns at a point on the axis at a distance V from its centre. Draw the magnetic field lines due to this coil.
(b) A current 'I' enters a uniform circular loop of radius 'R' at point M and flows out at N as shown in the figure.



Obtain the net magnetic field at the centre of the loop. (Comptt. Delhi 2011)

Question 103. (a) Show how Biot-Savart law can be alternatively expressed in the form of Ampere's circuital law. Use this law to obtain the expression for the magnetic field inside a solenoid of length 'l', cross-sectional area 'A' having 'N' closely wound turns and carrying a steady current 'I'.
Draw the magnetic field lines of a finite solenoid carrying current I.
(b) A straight horizontal conducting rod of length 0.45 m and mass 60 g is suspended by two vertical wires at its ends. A current of 5.0 A is set up in the rod through the wires.
Find the magnitude and direction of the magnetic field which should be set up in (Comptt. Delhi 2011)