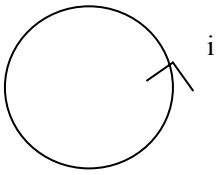
1. An electron beam projected along +X axis, experiences a force due to a magnetic field along +Y axis. What is the direction of the magnetic field?

2. An electron and a proton moving parallel to each other in the same direction with equal momenta, enter into a uniform magnetic field which is at right angles to their velocities. Trace their trajectories in the magnetic field.

3. The force $\vec{F}$ experienced by a particle of charge q moving with velocity $\vec{v}$ in a magnetic field $\vec{B}$ is given by $\vec{F} = q(\vec{v} \times \vec{B})$. Of these, name the pairs of vectors which are always at right angles to each other.

4. How does the magnetic moment of an electron in a circular orbit of radius r and moving with a speed v change, when the frequency of revolution is doubled?

5. In the diagram shown below is a circular loop carrying current I. Show the direction of the magnetic field with the help of lines of force

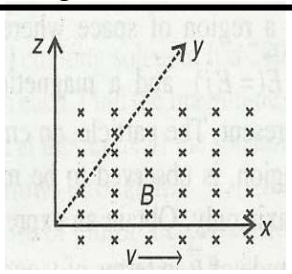


6. Which one of the following will experience maximum force when projected with the same velocity v perpendicular to the magnetic field B(i) $\alpha particles$
$(ii)\,\beta particles$

7. A ammeter and a milliammeter are converted from the same galvanometer. Out of the two which current measuring instrument has higher resistance?

8. A 20 μC charge is placed in a uniform magnetic field of 2 tesla. How much force does the charge experience?

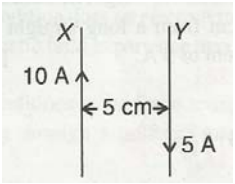
9. If the magnetic field is parallel to the +ve y axis and the charged particle is moving along +ve x axis, which way would the Lorentz force be for (a) an electron (negative charge) (b) a proton (positive charge)



10. State the principle of working of a cyclotron. Write two uses of this machine.

11. Which one of the two, an ammeter or a milliammeter has a higher resistance and why?

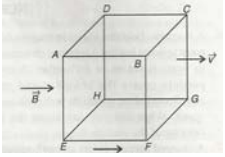
12. Two long parallel straight wires X and Y separated by a distance of 5 cm in air carry currents of 10 A and 5 A respectively in opposite direction. Calculate the magnitude and direction of the force on a 20 cm length of the wire Y.



13. A charged particles having a charge q is moving with a speed v along x- axis. It enter a region of space where an electric field $\vec{E}\,(=E\hat{j})$ and a magnetic field $\vec{B}$ are both present. The particles on emerging fro this region is observed to be moving along the x axis only. Obtain an expression for the magnitude of $\vec{B}$ in terms of v and E. Give the direction of $\vec{B}$.

14. A stream of electrons travelling with speed v m/s at right angles to a uniform magnetic field B is deflected in a circular path of radius r. Prove that $\frac{e}{m} = \frac{v}{rB}$

15. Twelve wires of equal length are connected in the terms of a skeleton cube which is moving with velocity $\vec{v}$ in the direction of a magnetic field $\vec{B}$. Find the e.m.f in each arm of the cube.

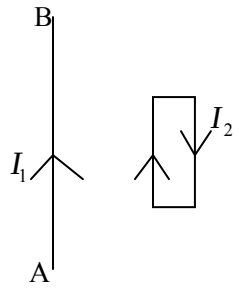


16. If the current sensitivity of a moving coil galvanometer is increased by 20% its resistance also increases by 1.5 times. How will the voltage sensitivity of galvanometer be affected? **[Ans: 80% original value]**

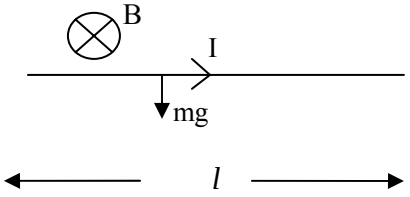
17. An electron in an atom revolves around the nucleus in an orbit of radius 0.53Å. Calculate the equivalent magnetic moment if the frequency of revolution of electron is $0.8\times10^{9}\,MHz$ **[Ans: $9.6\times10^{-24}\,Am^2$]**

18. An electron of kinetic energy 25keV moves perpendicular to the direction of a uniform magnetic field of 0.2 miletesla. Calculate the time period of rotation of the electron in the magnetic field. **[Ans: $1.79\times10^{-7}\,s$]**

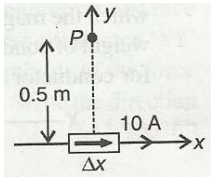
19. In the figure , the straight line wire AB is fixed while the loop is free to move under the influence of the electric currents flowing in then. In which direction does the loop begin to move? Give reason for your answer.



20. A straight wire of mass 200 g and length 1.5 m carries a current of 2A. It is suspended in mid- air by a uniform horizontal magnetic field B. What is the magnitude of the magnetic field?



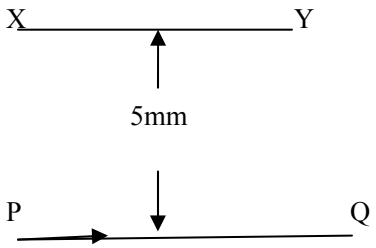
21. An element $\Delta L = \Delta x\hat{i}$ is placed at the origin and carries a large current I = 10A. What is the magnetic field on the y axis at a distance of 0.5m? Δx = 1m



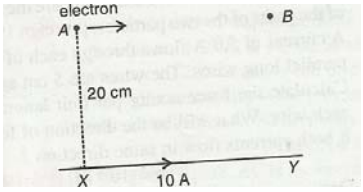
22. A galvanometer with a coil of resistance 12Ω shows a full scale deflection for a current of 2.5mA. Calculate the value of the resistance required to convert it into (a) an ammeter of range 0 to 7.5 A and (b) a voltmeter of range 0 to 10 V. Draw the diagrams to show how you will connect this resistance to the galvanometer in each case.

23. A straight wire of length $\frac{\pi}{2}$ meter is bent into circular shape. If the wire were to carry a current of 5A, calculate the magnetic field due to it, before bending at a point distant 0.01 times the radius of the circle formed from it. Also calculate the magnetic field at the center of the circular loop formed for the same value of current.

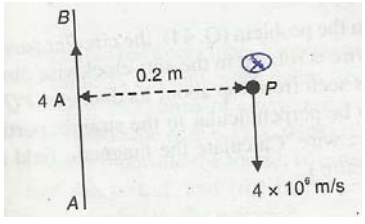
24. A long straight conductor PQ carrying a current 75A is fixed horizontally. Another long conductor XY is kept parallel to PQ at a distance of 5mm in air. Conductor XY is free to move and carries a current I. Calculate the magnitude and direction of current I for which XY (Mass per unit length for conductor XY is $10^{-2}\,kg/m$



25. An infinitely long straight conductor XY is carrying a current of 10A. An electron is moving with a speed of $10^{5}\,m/s$ parallel to the conductor in air from the point A to B as shown in figure. The perpendicular distance between the electron and the conductor XY is 20 cm. Calculate the magnitude of the force experienced by the electrons. Write the directions of this force.



26. A long straight wire AB carries of 4A. A proton P travels at $4\times10^{6}\,m/s$ parallel to the wire 0.2 m from it and in a direction opposite to the current as shown in the figure. Calculate the force which the magnetic field of current exerts on the proton. Also specify the direction of the force [**Ans:** $25.6\times10^{-19}\,N$ **away from the wire]**



27. A current carrying conductor PQ of length 1 m , mass $4.4\times10^{-3}\,Kg$ and resistance 50 milli- ohm is kept in a uniform magnetic field of 1.8 m T as shown in figure.

(i) State the rate for finding the direction of the force experienced by the conductor in the magnetic field. Indicate the direction of the force PQ.

(ii) Calculate the potential differences V that must be applied to the conductor PQ so that it remains in equilibrium in the magnetic field. **[Ans: V = 1.2 volt]**

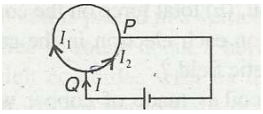
28. A voltmeter reads 5.0V at full scale deflection and is graded according to its resistance per volt at full scale deflection as 2000 Ω/V. How will you convert it into a voltmeter that reads 15 V at full scale deflection?

[Ans: By using R = 2 $\times 10^4$ Ω in series]

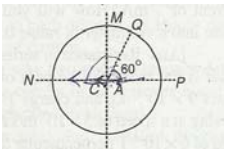
29. A charged particle of mass m , charge q moving at a uniform velocity v enters a uniform magnetic field B acting normal to the plane of the paper. Deduce expressions for the (i) radius of the circular path in which it travels (ii) kinetic energy of the particle
(assuming v<<c). Why does the kinetic energy of the charge not change when moving through the magnetic field?

30. A proton and an alpha particle of the same kinetic energy in turn move through a uniform magnetic field B in a plane normal to the field. Compare the radii of the paths of the two particles.

31. Show that no magnetic field is there at center of circular coil as shown



32. In the given figure AC is a current element of strength 0.4Am placed at the center of a circle of radius 10 cm. Calculate magnetic field induction P, Q, M and N



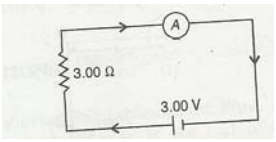
[**Ans:** At point M, B = 4 $\times 10^{-5} T, at P and N, B = 0T$]

33. A galvanometer with a coil of resistance 12.0 Ω shows full scale deflection for a current of 2.5mA. How will you convert the galvanometer into (i) an ammeter of range 0 to 7.5 A. (b) a voltmeter of range 0 to 10.0V? Determine the net resistance of the meter in each case. When an ammeter is put in a circuit does it read slightly less or more than the actual current in the original circuit? When a voltmeter is put across a part of the circuit, does it read (slightly0 less or more than the original voltage drop? Explain.

[Ans: (a) S= 4.00 $\times$ 10 $^{-3}$ Ω, Net resistance = 4.0 $\times$ 10 $^{-3}$ Ω, (d) series resistance = 3988 Ω, Net resistance = 4000 Ω,]

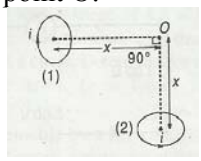
34. A voltameter reads 5.0V at full scale deflection and is graded according to its resistance per volt at full scale deflection as 5000 Ω/V? How will you convert it into voltmeter that reads 20V at full scale deflection? Will you prefer this voltmeter to one graded as 2000 Ω/V?
[Ans: Put in series R = 75000 Ω; This is more accurate than one graded as 2000 Ω/V?

35.In the circuit shown below the current is to be measured . What is the value of the current if the ammeter shown (i) is a galvanometer with resistance R_G = 60.00 Ω; (ii) is a galvanometer described in (i) but covered to an ammeter by a shunt resistance r_s = 0.02 Ω (iii) is an ideal ammeter with zero resistance .



36.(a) With the help of a labeled diagram explain the principle and working of a moving galvanometer.
(b) two parallel coaxial circular coils of equal radius R and equal numbers of turns N carrying equal currents I in the same direction and are separated by distance 2R. Find the magnitude and direction of the net magnetic field produced at the mid- point of the line joining their centers.

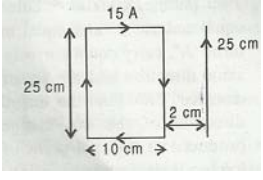
37. (a) State Biot- Savart law. Using this law, derive the expression for the magnetic field due to a current carrying circular loop of radius R at a point which is at distance x from its center along the axis of the loop.
(b) Two small identical circular loops marked 1 and 2 carrying equal currents are placed with the geo- metrical axes perpendicular to each other as shown in figure. Find the magnitude and direction of the net magnetic field produced at the point O.



38. An electron revolves around a proton in a H atom at a speed of 2.18 $\times 10^{-6} ms^{-1}$ in an orbit of radius 0.53 Å. what magnetic field does it produce at the center of its circular orbit? **[Ans: 12.42T]**

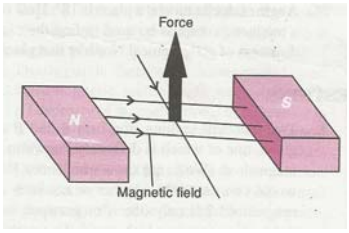
39. Depict the magnetic field lines due to two straight long, parallel conductors carrying currents $I_1 and I_2$ in the same direction. Hence deduce an expression for the force acting per unit length on one conductor due to other, Is this force attractive or repulsive?

Figure shows a rectangular current carrying loop placed 2 cm away from a long straight current carrying conductor. What is the direction and magnitude of the net force acting on the loop?



40. Steel is preferred for making permanent magnets whereas a soft iron is preferred for making electromagnets. Give one reason.

41. As shown in the figure a enters a uniform magnetic field and experiences an upward force as indicated. What is the charge sign on the particle?



42. What is the value of the angle of dip at a place on the earth's surface , where the ratio of the vertical component to the horizontal component of the earth's magnetic field is $\frac{1}{\sqrt{3}}$?

43. The angle of dip at a location in southern India is about 18 degree. Would you except a greater or smaller dip angle in Britain?

44. Distinguish between diamagnetic and ferromagnetic materials in respect of their (i) intensity of magnetization (ii) behavior in a non uniform magnetic field and (iii) susceptibility.

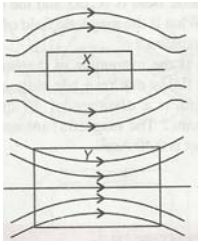
45. A magnetic compass needle of magnetic moment 60 Am^2 is placed at a place. The needle points towards the geographical north. Using the data given below, find the value of declination at that place. Horizontal component of earth's magnetic field = $40 \times 10^{-6} Wbm^{-2}$ and torque experienced by the needle = $1.2 \times 10^{-3} Nm$

[Ans: 30 degree]

46. Three identical specimens of magnetic materials nickel, Antimony, Aluminum are kept in non- uniform magnetic field. Draw the modification in the field lines in each case. Justify your answer.

47. Bars, A , B and C made from three different types of materials, are put one by one in a non uniform magnetic filed. While bars B and C tend to move from the weak to the strong field region. The effect observed in bar C is much stronger than that observed in bar B. Identify the class of material to which the three bars belongs.
Show with the help of diagrams, the behavior of field lines due to external magnetic field near bars A , B and C

49. A uniform magnetic field gets modified as shown below when two specimens X and Y are placed in it.



(i) Identify the two specimens X and Y
(ii) State the reason for the behavior of the field lines X and Y

50.. A short bar magnet of magnetic movement M = 0.32 JT^{-1} is placed in a uniform external magnetic field of 0.15 T. If the bar is free to rotate in the plane of the field, which orientation would correspond to its (i) stable and (ii) unstable equilibrium? What is the potential energy of the magnet in each case?

[Ans: (i) U = $-4.8 \times 10^{-2} J$ **Stable**
(ii) $V = +4.8 \times 10^{-2} J$ **; Unstable]**