CLASS XII

CHAPTER4 and 5 Magnetic Effects of Electric current and Magnetism

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SECTION A CONCEPTUAL AND APPLICATION TYPE QUESTIONS

1 Is it necessary for every magnetic field configuration to have a north and south pole? Justify. 1

2 State one qualitative difference between electric field lines and magnetic field lines. 1

3 Why a cyclotron cannot accelerate i) a neutron ii) an electron? 1

4 A moving charged particle enters a magnetic field and emerges out from it .Will it kinetic energy i)increase ii)decrease or iii) remain unchanged ? (sample paper)

5 Why the kinetic energy of a charged particle in a magnetic field is unchanged? 1

6 A charged particle of charge q enters a uniform magnetic field **B**, with a velocity **v** experiences a force **F**, identify a minimum of two pair of perpendicular vectors among the parameters mentioned. (repeated question)

7 A circular loop carries a current of I in clockwise direction, draw a diagram to show the coil and magnetic field lines associated with it.

8 Mention two factors by which the current sensitivity of a moving coil galvanometer can be increased? (2001)

9 An electron beam projected along + x-axis, experiences a force due to a magnetic field along +y axis.what is the direction of magnetic field?

10 What is the path of a charged particle moving in a magnetic field in a direction i) parallel ii) at an acute angle iii) perpendicular to the magnetic field?

11 An α particle and a proton enter a uniform magnetic field with same speed in the perpendicular direction, compare the radii of their circular paths.

12 An α particle and a proton enter a uniform magnetic field with same speed in the perpendicular direction, compare the ratio of their time periods. 1(repeated)

13 A charge of 8μC moving with a velocity of (2**i** +3**j**)m/s enters in a magnetic field of (6**i** +9**j**)**T.**Find the force acting on the charge. 2

14 Three identical specimens of nickel ,aluminium, and antimony are placed in a uniform magnetic field. Draw the modifications in the field lines in each case. 1

15 You are given two identical looking bars A and B. One of them is a bar magnet ,while the other is an iron bar.How will you distinguish them without using any other material?

16 What happens to the pole strength and magnetic dipole moment of a bar magnet if it is cut into two pieces i) along its length ii) transverse to its length? 2

17 What is the effect on the magnetization of Antimony when it is cooled? 1(2006 S)

18 What should be the orientation of a magnetic dipole in a uniform magnetic field so that its potential energy is i) maximum ii) minimum? 2

19 Which among the following i) nickel ii) aluminium iii) antimony can become a super conductor when cooled to a very low temperature ? 1

20 State the principle of working of a galvanometer. (2015)
A galvanometer of resistance G is converted into a voltmeter to measure upto V volts by connecting a resistance R1 in series with the coil. If a resistance R2 is connected in series with it, then it can measure upto V/2 volts. Find the resistance, in terms of R1 and R2, required to be connected to convert it into a voltmeter that can read upto 2 V. Also find the resistance G of the galvanometer in terms of R1 and R2.

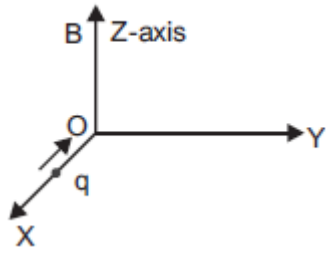
21 a)State Ampere's circuital law. Use this law to obtain the expression for the magnetic field inside an air cored toroid of average radius 'r', having 'n' turns per unit length and carrying a steady current I. 5(2015)
b)An observer to the left of a solenoid of N turns each of cross section area 'A' 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.

22 A charge 'q' moving along the X-axis with a velocity $\vec{v}$ is subjected to a uniform magnetic field B acting along the Z-axis as it crosses the origin O. 1

(i) Trace its trajectory.

(ii) Does the charge gain kinetic energy as it enters the magnetic field? Justify your anwer.



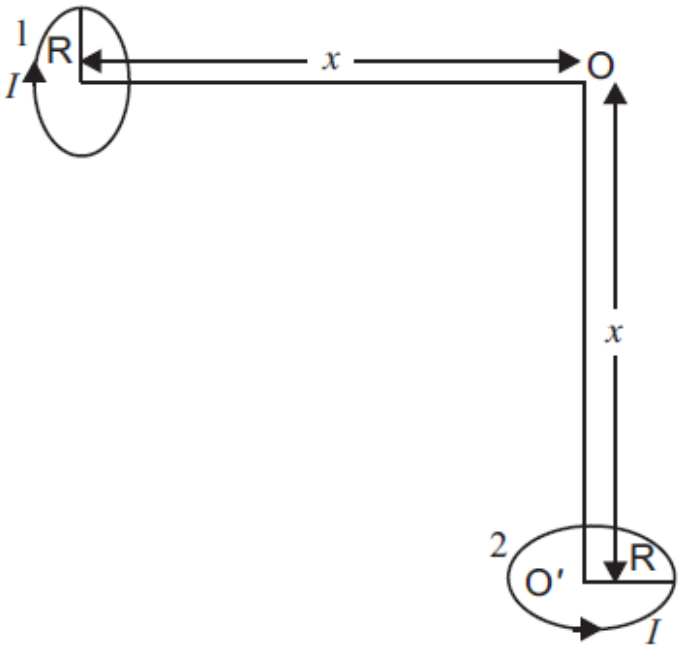
23 Explain how Biot – Savart law enables one to express the Ampere's circuital law in the integral form, viz.,

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

where I is the total current passing through the surface.

SECTION B NUMERICAL PROBLEMS

1 Two small identical circular coils marked 1 and 2 carryequal currents and are placed with their geometric axesperpendicular to each other as shown in the figure. Derive an expression for the resultant magnetic field at O 3(2008)



2 A moving coil galvanometer has a resistance of 10Ω , and produces full scale deflection for a current of 25mA. How can the instrument be adopted to measure
i) voltages upto120V ii)currents upto 20A? 3

3 A voltmeter can measure upto 25V and its resistance is 1000Ω. What has to be done to make it measure upto 250 V? 2)

4 A solenoid is 2m long and 3cm in diameter.It has 5 layers of windings of 1000 turns each and carries a current of 5A.What is the magnetic field at its centre? How will the magnetic induction change when a core of i) antimony ii) soft iron is introduced inside the solenoid?

5 A 0.5 m long solenoid has 500turns and has a magnetic field of 2.52×10^{-3} T at its centre. Find the i) current in the solenoid ii) magnetic field at one end of the solenoid. 2

6 A straight wire carries a current of 3A in the upward direction. Calculate the magnitude of magnetic field at a point 15cm away from the wire. Draw a diagram to show the direction of magnetic field and current. 3

7 In a chamber a uniform magnetic field of 6.5G ($1G = 10^{-4}T$) is maintained .An electron is shot into the field with a speed of 4.8×10^{6}m/s ,normal to the field. State whether the path of the electron would be circle or helix ? What would be the radius of the path? 3

8 What is the magnitude of force per unit length on a wire carrying a current of 8A and making an angle of 30° with the direction of a uniform magnetic field of 0.15T ? 2

9	A charge q moving in a straight line is accelerated by a pd of V. It enters a uniform magnetic field normal to it .Deduce the expression for the radius of circular path in terms of V	2 (2010)
10	Calculate the force per unit length of a long straight wire carrying a current of 4A due to a parallel wire carrying a current of 6A in same direction, if the distance between the wires is 3cm find the nature of force also.	2
11	An electron in an atom revolves around the nucleus in an orbit of radius 0.53angstrom.Calculate the equivalent magnetic moment if the frequency of revolution of electron is 6.8×10^9 MHz	2(1992,1998, 2001)
12	A magnetic field of 2×10^3 A/m produces a magnetic induction of 4π Wb/m^2 in a bar of iron. Calculate the relative permeability and susceptibility of iron.	2
13	Two magnetic poles , one of which is twice stronger than the other, repel one another with a force of 2×10^{-5} N, when kept at a separation of 20cm in air. Calculate the pole strengths of the two poles.	2
14	Calculate the intensity of magnetization of earth ,assume the earth to be a giant bar magnet of magnetic moment 8.0×10^{22} Am^2 , take the earth's radius to be 6400km	3
15	A bar magnet made of steel has a magnetic moment of 2.5Am^2 and a mass of 6.0×10^{-3} kg. If the density of steel is 7.9×10^3kg/m^3, find the intensity of magnetization of the magnet	2
16	A circular coil of 100 turns and radius 10cm carries a current of 5A. It is suspended vertically in a uniform horizontal magnetic field of 0.5T, the field lines making an angle of 60◦ with the plane of the coil .Calculate the magnitude of the torque that must be applied on it to prevent it from turning.	3
17	Two concentric circular coils X and Y of radii 16cm and 10cm respectively, lie in the same vertical plane containing north to south direction. Coil X has 20 turns and coil Y 25 turns ; they carry currents of 16A and 18A respectively. In coil X ,the current direction is anti clock wise and in coil Y ,the current direction is clock wise ,with respect to an observer looking at the coils facing west. Find the magnitude and direction of the net magnetic field with respect to the observer.	3
18	A short bar magnet of magnetic moment 0.5 J/T is placed with its axis is 30° to a uniform magnetic of 0.1 T. Calculate (i) the magnitude of the torque experienced and (ii) the direction onwhich it acts.	2(2012)
19	A magnetised needle of magnetic moment 4.8 × 10–2 J T–1 is placed at 30° with the direction of uniform magnetic field of magnitude 3 × 10–2 T. Calculate the torque acting on the needle.	2(2012)

20 A beam of proton passes undeflected with a horizontal velocity v, through a region of electric andmagnetic fields, mutually perpendicular to each other and perpendicular to the direction of thebeam. If the magnitudes of the electric and magnetic fields are 100 kV/m, 50 mT respectively,calculate (2008)

(i) velocity of the beam v.

(ii) force exerted by the beam on a target on the screen, if the proton beam carries a current of 0.80 mA.