PHYSICS PAPER

(Magnetic Field due to Current & Earth's Magnetism)

(Section-A)

1. The magnetic field at the origin due to a current element I $\vec{dl}$ placed at a position $\vec{r}$ is –

(A) $\frac{\mu o\, i}{4\pi}\frac{dl\times r}{r3}$ (B) $-\frac{\mu o\, i}{4\pi}\frac{r\times dl}{r3}$

(C) $\frac{\mu o\, i}{4\pi}\frac{r\times dl}{r3}$ (D) $-\frac{\mu o\, i}{4\pi}\frac{dl\times r}{r3}$

2. 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

3. A moving charge produces –
(A) Electric field (B) Magnetic field (C) both of them (D) none of these

4. Let r be the distance of a point on the axis of a bar magnet from its center. The magnetic field at such a point is proportional to –

(A) $\frac{1}{r}$ (B) $\frac{1}{r2}$ (C) $\frac{1}{r3}$ (D) none of these

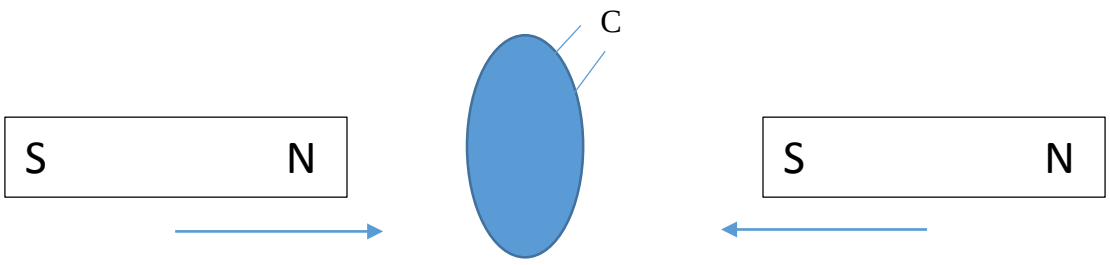
5. Let r be the distance of a point on the axis of a magnetic dipole from its center. The magnetic field at such a point is proportional to –

(A) $\frac{1}{r}$ (B) $\frac{1}{r2}$ (C) $\frac{1}{r3}$ (D) none of these

6. An electron is moving along +ve X-axis in the presence of uniform magnetic field along +ve Y-axis. What is the direction of the force acting on it? (1)

7. Where on the surface of Earth is the· angle of dip 90°? (1)

8. Two bar magnets are quickly moved towards a metallic loop connected across a capacitor 'C' as shown in the figure. Predict the polarity of the capacitor. (1)

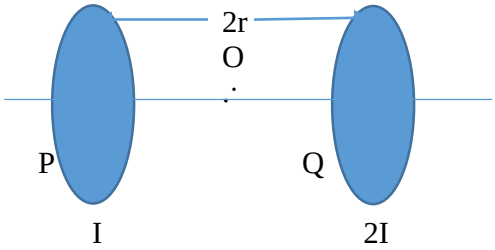


9. The horizontal component of the earth's magnetic field at a place is B and angle of dip is 60°. What is the value of vertical component of earth's magnetic field at equator? (1)

(Section-B)

10. The susceptibility of a magnetic material is 2.6×10^{-5}. Identify the type of magnetic material and state its two properties. (2)

11. Two identical circular loop, P and Q, each of radius r and carrying currents I and 2I 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 the both loops. Find the magnitude of the net magnetic field at point O. (2)

(Section-C)

Attempt any three:-

12. Distinguish the magnetic properties of dia-, para- and ferro-magnetic substances in terms of (i) susceptibility, (ii) magnetic permeability. Give one example of each of these materials.
Draw the field lines due to an external magnetic field near a (i) diamagnetic, (ii) paramagnetic substance. (5)

13. Derive a mathematical expression for the magnetic field strength at the center of the circular coil carrying electric current. (5)

14. A current carrying conductor is placed at an angle of 30^0 to a uniform magnetic field of strength $2*10^3$ T. The length of the conductor inside the magnetic field is 2m and the current flowing through it is 1.6A. Calculate the magnitude of the force experienced by it? (5)

15. (A) 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.
(B) In what respect is a toroid different from a solenoid? Draw and compare the pattern of the magnetic field lines in the two cases.
(C) How is the magnetic field inside a given solenoid made strong? (5)