

**SAINIK SCHOOL GOPALGANJ**  
**CLASS – XII**  
**ASSIGNMENT – MAGNETISM AND MATTER**

**SECTION A : MULTIPLE CHOICE QUESTIONS (TOTAL 05 QUESTIONS)**

1. It is considered that the earth consists of a huge bar magnet of magnetic moment  $8.0 \times 10^{22} \text{ Am}^2$ . What is the magnitude of the earth's magnetization? (Radius of earth = 6400 km)
- (a)  $100 \text{ Am}^{-1}$
  - (b)  $80.2 \text{ Am}$
  - (c)  $72.8 \text{ Am}^{-1}$
  - (d)  $30 \text{ Am}$
2. A magnetic needle free to rotate in a vertical plane parallel to the magnetic meridian has its north tip pointing down at  $22^\circ$  with the horizontal. The horizontal component of the earth's magnetic field at the place is 0.35 G. The earth's magnetic field at the place is: (Given  $\cos 22^\circ = 0.97$ )
- (a) 0.91 G
  - (b) 0.64 G
  - (c) 0.38 G
  - (d) 0.12 G
3. The magnetic field of Earth can be modelled by that of a point dipole placed at the centre of the Earth. The dipole axis makes an angle of  $11.3^\circ$  with the axis of Earth. At Mumbai, 'declination is nearly zero. Then,
- (a) the declination varies between  $11.3^\circ \text{ W}$  to  $11.3^\circ \text{ E}$ .
  - (b) the least declination is  $0^\circ$ .
  - (c) the plane defined by dipole axis and Earth axis passes through Greenwich.
  - (d) declination averaged over Earth must be always negative.
4. The primary origin(s) of magnetism lies in
- (a) Pauli exclusion principle.
  - (b) polar nature of molecules.
  - (c) intrinsic spin of electron.
  - (d) None of these.
5. Let the magnetic field on earth be modelled by that of a point magnetic dipole at the centre of earth. The angle of dip at a point on the geographical equator
- (a) is always zero.
  - (b) can be zero at specific points.
  - (c) cannot be positive or negative.
  - (d) is not bounded.

**SECTION B : SHORT ANSWER QUESTIONS (TOTAL 05 QUESTIONS)**

6. At a place, the horizontal component of earth's magnetic field is  $B$  and angle of dip is  $60^\circ$ . What is the value of the earth's magnetic field at equator?
7. The hysteresis loop of a soft iron piece has a much smaller area than that of a carbon steel piece. If the material is to go through repeated cycles of magnetization, which piece will dissipate greater heat energy?
8. If the solenoid is free to turn about the vertical direction and a uniform horizontal magnetic field of  $0.25 \text{ T}$  is applied, what is the magnitude of torque on the solenoid when its axis makes an angle of  $30^\circ$  with the direction of applied field?
9. Explain with the help of diagram the terms
- magnetic declination and
  - Angle of dip at a given place.
10. Define the following:-
- Neutral points
  - Magnetic meridian
  - Geographical Meridian

**SECTION C : LONG ANSWER QUESTIONS (TOTAL 05 QUESTIONS)**

11. A short bar magnet of magnetic moment  $5.25 \times 10^{-2} \text{ J T}^{-1}$  is placed with its axis perpendicular to the earth's field direction. At what distance from the centre of the magnet, the resultant field is inclined at  $45^\circ$  with earth's field on s.(a) its normal bisector and (b) its axis. Magnitude of the earth's field at the place is given to be  $0.42 \text{ G}$ . Ignore the length of the magnet in comparison to the distances involved.

12. Answer the following questions:

(a) The earth's magnetic field varies from point to point in space.

Does it also change with time? If so, on what time scale does it change appreciably?

(b) The earth's core is known to contain iron. Yet geologists do not regard this as a source of the earth's magnetism. Why?

(c) The charged currents in the outer conducting regions of the earth's core are thought to be responsible for earth's magnetism. What might be the 'battery' (i.e., the source of energy) to sustain these currents?

(d) The earth may have even reversed the direction of its field several times during its history of 4 to 5 billion years. How can geologists know about the earth's field in such distant past?

(e) The earth's field departs from its dipole shape substantially at large distances (greater than about 30,000 km). What agencies may be responsible for this distortion?

13. (a) A small compass needle of magnetic moment ' $m$ ' is free to turn about an axis perpendicular to the direction of uniform magnetic field ' $B$ '. The moment of inertia of the needle about the axis is ' $I$ '. The needle is slightly disturbed from its stable position and then released. Prove that it executes simple harmonic motion. Hence deduce the expression for its time period.

(b) A compass needle, free to turn in a vertical plane orients itself with its axis vertical at a certain place on the earth. Find out the values of

- i. horizontal component of earth's magnetic field and
- ii. angle of dip at the place.

14. Explain hysteresis and its applications?

15. Write the properties of paramagnetic, Diamagnetic, Ferromagnetic Substances?