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Class: 12
Subject: Physics
Topic: Magnetism And Matter
No. of Questions: 10

1. .Answer the following question:
   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?
   The earth's core is known to contain iron. Yet geologists do not regard this as a source of the earth's magnetism. Why?
   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?
   The earth's field departs from its dipole shape substantially at large distance (greater that about 30, 000 km). What agencies may be responsible for this distortion?

2. A short bar magnet of magnetic moment m $= 0.32\ J\ T^{-1}$ is placed in a uniform 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 (a) stable, and (b) unstable equilibrium? What is the potential energy of the magnet ineach case?

3. A closely wound solenoid of 800 turns and area of cross section $2.5 \times 10^{-4} m^2$carries a current of 3.0 A. Explain the sense in which the solenoid acts like a bar magnet. What is its associated magnetic moment?

4. A bar magnet of magnetic moment 1.5 J T^{-1} lies aligned with the direction of a uniform magnetic field of 0.22 T.
   What is the amount of work required by an external torque to turn the magnet so as to align its magnetic moment: (i) normal to the field direction, (ii) opposite to the field direction? What is the torque on the magnet in cases (i) and (ii)?

5. A magnetic needle free to rotate in a vertical plane parallel to the magnetic meridian has its north tip pointing down at 22^o with horizontal. The horizontal component of the earth's magnetic field at the place is known to be 0.35 G. Determine the magnitude of the earth's magnetic field at the place.

6. At a certain location in Africa, a compass points 12^o west of the geographic north. The north tip of the magnetic needle of a dip circle placed in the plane of magnetic meridian points 60^o above the horizontal. The horizontal component of the earth's field is measured to be 0.16 G. Specify the direction and magnitude of the earth's field at the location.

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7. Answer the following questions:
   Why does a paramagnetic sample display greater magnetization (for the same magnetizing field) when cooled?
   Why is diamagnetism, in contrast, almost independent of temperature?
   If a toroid uses bismuth for its core, will the field in the core be (slightly) greater or (slightly) less than when the core is empty?
   Is the permeability of a ferromagnetic material independent of the magnetic field? If not, is it more for lower or higher fields?
   Magnetic field lines are always nearly normal to the surface of a ferromagnet at every point. (This fact is analogous to the static electric field lines being normal to the surface of a conductor at every point.) Why?
   (f) Would the maximum possible magnetization of a paramagnetic sample be of the same order of magnitude as the magnetization of a ferromagnet?

8. Answer the following questions:
   Explain qualitatively on the basis of domain picture the irreversibility in the magnetization curve of a ferromagnet. 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?

9. 'A system displaying a hysteresis loop such as a ferromagnet, is a device for storing memory?' Explain the meaning of this statement. What kind of ferromagnetic material is used for coating magnetic tapes in a cassette player, or for building 'memory stores' in a modern computer?

10. A certain region of space is to be shielded from magnetic field. Suggest a method.
    Sol.
    A certain region of space can be shielded from magnetic field if it is surrounded by soft iron rings. In such arrangements, the magnetic lines are drawn out of the region.