PHYSICS

BOOKS - NCERT PHYSICS (ENGLISH)

MAGNETISM AND MATTER

Others

1. A toroid of n turns, mean radius R and cross-sectional radius a carries current I. It is placed on a horizontal table taken as x-y plane. Its magnetic moment $\overrightarrow{M}$

A. is non-zero and points in the z-direction by symmetry

B. points along the axis of the toroid (m=m ϕ)

C. is zero, otherwise there would be a field falling as $\frac{1}{r^3}$ at large distances outside the toroid

D. is pointing radially outwards.

Answer: C

Watch Video Solution

2. The magnetic field of the 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° with the axis of the earth. At mumbai, declination is nearlyzero, then.

A. the declination varies between $11.3^{\circ} CW$ to $11.3^{\circ} E$

B. the least declination is 0°

C. the plane defined by dipole axis the earth axis passes through Greenwich

D. declination averaged over the earth must be always negative

Answer:

Watch Video Solution

3. In a permanent magnet at room temperature.

A. magnetic moment of each molecule is zero

B. the individual molecules have non-zero magnetic moment which are all perfectly aligned

C. domains are partially aligned

D. domains are all perfectly aligned

Answer:

Watch Video Solution

4. Consider the two idealized systems: (i) a parallel plate capacitor with large plates and small separation and (ii) a long solenoid of length $L > > R$, radius of cross-section. In (i) $\vec{E}$ is ideally treated as a constant between plates and zero outside. In (ii) magnetic field is constant inside the solenoid and zero outside.

These idealised assumptions, however, contradict fundamental law as below:

A. case i contradicts Gauss law for electrostatic fields

B. case ii contradicts Gauss' law for magnetic fields

C. case i agrees with $\oint E$. Dil=0.

D. case ii contradicts $\oint H$,dil=I_{en}

Answer:

Watch Video Solution

5. A paramagnetic sample shows a net magnetisation of $8Am^{-1}$ when placed in an external magnetic field of $0 \cdot 6T$ at a temperature of $4K$. When the same sample is placed in an external magnetic field of $0 \cdot 2T$ at a temperature of $16K$, the magnetisation will be

A. $\frac{32}{3}Am^{-1}$

B. $\frac{2}{3}Am^{-1}$

C. $6Am^{-1}$

D. $2.4Am^{-1}$

Answer:

Watch Video Solution

6. S is the surface of a lump of magnetic material.

A. Lines of B are necessarily continous across S

B. Some lines of B must be discontinous across S

C. Lines of H are necessarily continous across S

D. Lines of H cannot all be continous across S

Answer:

Watch Video Solution

7. The primary origin(s) of magnetism lies in

A. atomic currents

B. pauli exlucison principle

C. polar nature of molecules

D. intrinsic spin of electrons

Answer:

Watch Video Solution

8. A long solenoid has 1000 turns per metre and carries a current of $1A$. It has a soft iron core of $\mu_r = 1000$. The core is heated beyond the Curie temperature, T_c.

A. The H field in the solenoid is (nearly) unchanged but the B field decreases drastically

B. The H and B fields in the solenoid are nearly unchanged

C. The magnetisation in the core reverses direction.

D. The magnetisation in the core diminishes by a factor of about 10^8

Answer:

Watch Video Solution

9. Essential difference between electrostatic shielding by a conducting shell and magnetostatic shielding is due to

A. electrostatic field lines can end on charges and conductors have free charges

B. lines of B can also end but conductors cannot end them

C. lines of B cannot end on any material and perfect shieldin g is not possible

D. shells of high permeability can be used to divert lines of B from the interior region.

Answer:

Watch Video Solution

10. 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. can b e positive or negative

D. is bounded.

Answer:

Watch Video Solution

11. A proton has spin and magnetic moment just like an electron. Why then its effect is neglected in magnetism of materials?

Watch Video Solution

12. A permanent magnet in the shape of a thin cylinder of length 10 cm has $M = 10^6 A/m$. Calculate the magnetisation current I_M.

Watch Video Solution

13. Explain quantitatively the order of magnitude difference between the diamagnetic susceptibility of $N_2(-5 \times 10^{-9})$ (at STP) and $Cu(-10^{-5})$.

Watch Video Solution

14. From molecular view point, discus the temperature dependence of susceptibility for diamagnetism, paramagnetism and ferromagnetism.

Watch Video Solution

15. A ball of superconducting material is dipped in liquid nitrogen and placed near a bar magnet. (i) In which direction will it move?

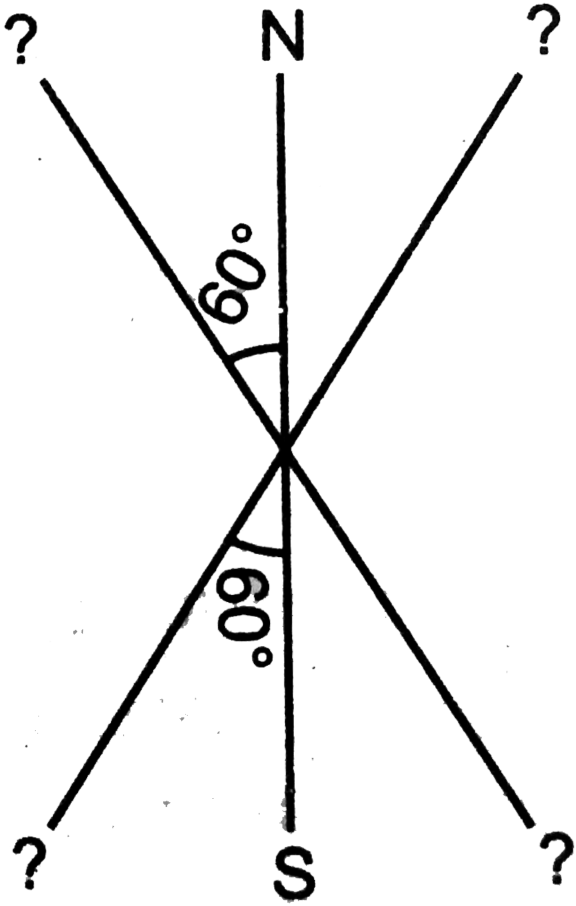
(ii) What will be the direction of it's magnetic moment?

Watch Video Solution

16. Verify the Gauss's law for magnetic field of a point dipole of dipole moment M at the origin for the surface which is a sphere of radius R.

Watch Video Solution

17. Three identical bar magnets are rivetted together at centre in the same place as shown in figure. This system is placed at rest in a slowly varying magnetic field. It is found that the system of magnets does not show any motion. The north-south poles of one magnet are shown in figure. Determine the poles of the remaining two.



Watch Video Solution

18. Suppose we want to verify the analogy between electrostatic and magnetostatic by an explicit experiment. Consider the motion of (i) electric dipole $\overrightarrow{p}$ in an electrostatic field $\overrightarrow{E}$ and (ii) magnetic dipole $\overrightarrow{M}$ in a magnetic field $\overrightarrow{B}$. Write down a set of conditions on $\overrightarrow{E}$, $\overrightarrow{B}$, $\overrightarrow{p}$, $\overrightarrow{M}$ so that the two motions are verified to be identical. (Assume identical initial conditions).

Watch Video Solution

19. A bar magnet of magnetic moment M and moment of inertia I (about centre, perpendicular to length) is cut into two equal pieces, perpendicular to length. Let T be the period of oscillation of the original magnet about an axis through the mid point, perpendicular to length, in a magnetic field $\overrightarrow{B}$. What would be the similar period T' for each piece?

Watch Video Solution

20. Use i the Ampere's law for H and ii continuity of lines of B, to conclude that inside a bar magnet, (a) lines of H run from the N-pole to S-pole while (b) lies of B must run from the S-pole to N -pole.

Watch Video Solution

21. Verify the Ampere's law for magnetic field of a point dipole moment $\overrightarrow{M} = M\hat{k}$. Take C as the closed curve running clockwise along (i) z-axis from $z = a > 0$ to $z = R$, (ii) along the quarter circle of radius R and centre at the origin, in the first quadrant of x-z plane, (iii) along the x-axis from $x = R$ to $x = a$, and (iv) along the quarter circle of radius a and centre at the origin in the first quadrant of x-y plane.

View Text Solution

22. What are the dimensions of χ, the magnetic susceptibility? Consider an H-atom. Guess an expression for χ upto a constant by constructing a quantity of dimensions of χ, out of parameters of the atom: e, m, v, R and μ_0. Here, m is the electronic mass, v is electronic velocity, R is Bohr radius. Estimate the number so obtained and compare with the value of $|\chi\lceil 10^{-5}$ for any solid material.

Watch Video Solution

23. Assume the dipole model of earth's magnetic field B which is given by B_V= vertical component of magnetic field $= \frac{\mu_0}{4\pi}\frac{2M\cos\theta}{r^3}$, B_H=Horizontal component of magnetic field

$= \frac{\mu_0}{4\pi} \frac{\sin \theta M}{r^3}, \theta = 90^\circ$ -latitude as measured from magnetic equator.

Find loci of points for which (i) $\left| \vec{B} \right|$ is minimum, (ii) dip angle is zero, and (iii) dip angle is $\pm 45^\circ$.

Watch Video Solution

24. Consider the plane S formed by the dipole axis and the axis of earth. Let P be point on the magnetic equator and in S. Let Q be the point of intersection of the geographical and magnetic equators Obtain the declination and dip angles at P and Q.

Watch Video Solution

25. There are two current carrying planar coils made each from identical wires of length L. C_1 is the circular (radius R) and C_2 is square (side a). They are so constructed that they have same frequency of oscillation when they are placed in the same uniform $\vec{B}$ and carry the same current i. Find a in terms of R.

Watch Video Solution