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CLASS 12 PHYSICS · NCERT CHAPTER 5 · IMU CET PRACTICE

Magnetism and Matter

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Questions: 45 MCQs

Each question has exactly one correct option. Attempt all questions first, then check the Answer Key and Solutions at the end.

- 1 The SI unit of magnetic dipole moment is
(A) Wb/m^2 (B) T m
(C) A/m (D) A m^2
- 2 Magnetic monopoles
(A) exist in bar magnets (B) do not exist (as far as known)
(C) exist in the Earth's core (D) exist in electromagnets
- 3 Gauss's law for magnetism states that
(A) the net magnetic flux through any closed surface is zero
(B) magnetic field lines start from north poles
(C) $\oint \mathbf{B} \cdot d\mathbf{l} = \mu_0 I$
(D) the net magnetic flux equals μ_0 times enclosed pole strength
- 4 Magnetic field lines of a bar magnet
(A) form closed loops, going from N to S outside and S to N inside
(B) start at S and end at N everywhere
(C) start at N and end at S
(D) are open curves
- 5 A bar magnet is cut into two equal halves perpendicular to its length. The magnetic moment of each half is
(A) zero (B) same as original
(C) double the original (D) half the original
- 6 A bar magnet is cut into two equal halves along its length. The pole strength of each half is
(A) same as original (B) half the original
(C) zero (D) double the original
- 7 The magnetic field on the axial line of a short bar magnet at distance r is
(A) $\mu_0(2m)/(4\pi r^2)$ (B) $\mu_0 m/(4\pi r^2)$
(C) $\mu_0 m/(4\pi r^3)$ (D) $\mu_0(2m)/(4\pi r^3)$

- 8 The magnetic field on the equatorial line of a short bar magnet at distance r is
(A) $\mu_0 m / (4\pi r^3)$, opposite to m (B) zero
(C) $\mu_0 (2m) / (4\pi r^3)$, along m (D) $\mu_0 m / (4\pi r^2)$
- 9 The torque on a bar magnet of moment m in a uniform field B at angle θ is
(A) $mB \cos \theta$ (B) zero
(C) $mB \sin \theta$ (D) mB
- 10 A bar magnet of moment 2 A m^2 is placed at 30° to a field of 0.4 T . The torque is
(A) 0.8 N m (B) 0.2 N m
(C) 0.69 N m (D) 0.4 N m
- 11 The work done in turning a magnet of moment m from parallel to antiparallel position in field B is
(A) mB (B) $-2mB$
(C) zero (D) $2mB$
- 12 A magnet freely suspended in a uniform field oscillates with period $T = 2\pi\sqrt{I/mB}$. If B is made four times, the period becomes
(A) $4T$ (B) $T/2$
(C) $T/4$ (D) $2T$
- 13 Magnetisation M of a material is defined as
(A) magnetic field per unit current (B) magnetic moment per unit mass
(C) net magnetic moment per unit volume (D) magnetic flux per unit area
- 14 Magnetic susceptibility χ is defined by
(A) $M = \chi H$ (B) $H = \chi M$
(C) $B = \chi H$ (D) $B = \chi M$
- 15 The relation between relative permeability μ_r and susceptibility χ is
(A) $\mu_r = 1 + \chi$ (B) $\mu_r = \chi$
(C) $\mu_r = 1/\chi$ (D) $\mu_r = 1 - \chi$
- 16 Diamagnetic substances have susceptibility
(A) zero (B) small and negative
(C) large and positive (D) small and positive
- 17 Paramagnetic substances have susceptibility
(A) -1 (B) large and positive
(C) small and positive (D) small and negative
- 18 Ferromagnetic substances have susceptibility
(A) large and positive (B) small and positive
(C) zero (D) small and negative
- 19 A superconductor is a perfect diamagnet with susceptibility
(A) $+1$ (B) ∞
(C) -1 (D) 0



- 20** Which of the following is diamagnetic?
(A) Aluminium (B) Iron
(C) Nickel (D) Bismuth
- 21** Which of the following is paramagnetic?
(A) Copper (B) Aluminium
(C) Bismuth (D) Water
- 22** A diamagnetic material placed in a non-uniform magnetic field tends to move
(A) not at all (B) perpendicular to the field
(C) from stronger to weaker field regions (D) from weaker to stronger field regions
- 23** When a diamagnetic liquid is placed in a U-tube with one arm between the poles of a magnet, the level in that arm
(A) rises (B) falls
(C) remains the same (D) oscillates
- 24** Curie's law for paramagnetic substances states that susceptibility is
(A) proportional to T^2
(B) inversely proportional to absolute temperature
(C) proportional to absolute temperature
(D) independent of temperature
- 25** Above the Curie temperature, a ferromagnetic substance becomes
(A) paramagnetic (B) diamagnetic
(C) a superconductor (D) more strongly ferromagnetic
- 26** Ferromagnetism is explained by
(A) free electron theory (B) band theory of insulators
(C) Bohr's theory (D) domain theory
- 27** Diamagnetism is present in
(A) all materials (B) only metals
(C) only ferromagnetic materials (D) only paramagnetic materials
- 28** The material suitable for making permanent magnets should have
(A) high retentivity and high coercivity (B) high retentivity and low coercivity
(C) low retentivity and low coercivity (D) low retentivity and high coercivity
- 29** The material suitable for electromagnet and transformer cores should have
(A) high coercivity
(B) high retentivity and high coercivity
(C) low permeability
(D) high permeability and low coercivity (low hysteresis loss)
- 30** The magnetic field intensity H has SI unit
(A) A/m (B) Wb
(C) A m² (D) T



- 31** A solenoid with 1000 turns/m carries 2 A. The magnetic intensity H inside it is
(A) 2.5×10^{-3} A/m (B) 1000 A/m
(C) 2000 A/m (D) 500 A/m
- 32** An iron core of relative permeability 500 is inserted into a solenoid producing $H = 1000$ A/m. The field B inside is about
(A) 0.063 T (B) 1.26×10^{-3} T
(C) 0.63 T (D) 6.3 T
- 33** The magnetic potential energy of a dipole is minimum when the angle between m and B is
(A) 180° (B) 0°
(C) 90° (D) 45°
- 34** A current loop behaves like
(A) a capacitor (B) a magnetic monopole
(C) a magnetic dipole (D) an electric dipole
- 35** The magnetic moment of a revolving electron in the first Bohr orbit is the
(A) 1 A m^2 (B) zero
(C) nuclear magneton (D) Bohr magneton ($\approx 9.27 \times 10^{-24} \text{ A m}^2$)
- 36** The dimensional formula of magnetic flux is
(A) $[ML^2T^{-1}A^{-1}]$ (B) $[MLT^{-2}A^{-1}]$
(C) $[ML^2T^{-2}A^{-1}]$ (D) $[MT^{-2}A^{-1}]$
- 37** The magnetic field of the Earth can be approximately represented by
(A) a uniform field everywhere
(B) a monopole at the North Pole
(C) a current along the equator only
(D) a magnetic dipole located near its centre
- 38** The angle between the geographic meridian and the magnetic meridian at a place is called
(A) dip (inclination) (B) latitude
(C) declination (D) azimuth
- 39** At the magnetic poles of the Earth, the angle of dip is
(A) 45° (B) 0°
(C) 180° (D) 90°
- 40** The ratio of the magnetic field at a point on the axis to that at the same distance on the equatorial line of a short bar magnet is
(A) 4 : 1 (B) 2 : 1
(C) 1 : 2 (D) 1 : 1
- 41** Relative permeability of a diamagnetic material is
(A) slightly less than 1 (B) zero
(C) much greater than 1 (D) slightly greater than 1

- 42 The net magnetic moment of a paramagnetic sample increases when
- (A) the sample is heated above Curie point
 - (B) the applied field decreases
 - (C) the applied field increases and temperature decreases
 - (D) temperature increases
-
- 43 Two identical bar magnets are placed one above the other with like poles together. The time period of oscillation compared to a single magnet in the same field is
- (A) $\sqrt{2}$ times
 - (B) unchanged
 - (C) doubled
 - (D) halved
-
- 44 A magnetic needle in a uniform field experiences
- (A) a net force only
 - (B) a torque but no net force
 - (C) both force and torque
 - (D) neither
-
- 45 The SI unit of magnetic pole strength is
- (A) A m
 - (B) A/m
 - (C) A m²
 - (D) T
-

Answer Key

1	2	3	4	5	6	7	8	9	10
D	B	A	A	D	B	D	A	C	D
11	12	13	14	15	16	17	18	19	20
D	B	C	A	A	B	C	A	C	D
21	22	23	24	25	26	27	28	29	30
B	C	B	B	A	D	A	A	D	A
31	32	33	34	35	36	37	38	39	40
C	C	B	C	D	C	D	C	D	B
41	42	43	44	45					
A	C	B	B	A					

Hints & Solutions

- (D)** $m = IA \rightarrow A \text{ m}^2$ (also J/T).
- (B)** Magnetic poles always occur in pairs; isolated monopoles have not been found.
- (A)** $\oint \mathbf{B} \cdot d\mathbf{A} = 0$, since there are no magnetic monopoles.
- (A)** Field lines are continuous closed loops.
- (D)** Pole strength is unchanged, length halves $\rightarrow m/2$.
- (B)** Cutting lengthwise halves the cross-section, so the pole strength halves; length is unchanged.
- (D)** $B_{\text{axial}} = (\mu_0/4\pi)(2m/r^3)$.
- (A)** $B_{\text{eq}} = (\mu_0/4\pi)(m/r^3)$, directed opposite to m .
- (C)** $\tau = m \times B$.
- (D)** $\tau = 2 \times 0.4 \times 0.5 = 0.4 \text{ N m}$.
- (D)** $W = mB(\cos 0^\circ - \cos 180^\circ) = 2mB$.
- (B)** $T \propto 1/\sqrt{B} \rightarrow T/2$.
- (C)** $M = m_{\text{net}}/V$, unit A/m.
- (A)** $\chi = M/H$, dimensionless.
- (A)** $B = \mu_0(H + M) = \mu_0(1 + \chi)H$.
- (B)** Diamagnets are weakly repelled; χ is small negative (e.g., -10^{-5}).
- (C)** Paramagnets are weakly attracted; χ is small positive.
- (A)** Ferromagnets (Fe, Co, Ni) are strongly magnetised; $\chi \gg 1$.
- (C)** Meissner effect: $B = 0$ inside $\rightarrow \mu_r = 0 \rightarrow \chi = -1$.
- (D)** Bismuth, copper, water and silver are diamagnetic. Al is paramagnetic; Fe and Ni are ferromagnetic.
- (B)** Aluminium, sodium, oxygen are paramagnetic.
- (C)** Diamagnets are repelled from regions of strong field.
- (B)** The liquid is pushed out of the strong-field region.



24. (B) $\chi = C/T$.
25. (A) Thermal agitation destroys domain alignment above T_c .
26. (D) Ferromagnets contain domains of aligned moments which align further in external fields.
27. (A) Diamagnetism arises from orbital motion of electrons and is universal, though often masked.
28. (A) Permanent magnets must retain magnetism and resist demagnetisation (e.g., steel, alnico).
29. (D) Soft iron magnetises and demagnetises easily with small energy loss.
30. (A) $H = B/\mu_0 - M$, unit A/m.
31. (C) $H = nI = 1000 \times 2 = 2000$ A/m.
32. (C) $B = \mu_0 \mu_r H = 4\pi \times 10^{-7} \times 500 \times 1000 \approx 0.628$ T.
33. (B) $U = -mB \cos \theta$ is minimum ($-mB$) at $\theta = 0^\circ$ — stable equilibrium.
34. (C) Its field at large distances is identical to that of a bar magnet with $m = IA$.
35. (D) $\mu_B = e\hbar/(2m_e) \approx 9.27 \times 10^{-24}$ J/T.
36. (C) $\Phi = BA$; $B = F/(Il) = [MT^{-2}A^{-1}] \rightarrow \Phi = [ML^2T^{-2}A^{-1}]$.
37. (D) The Earth's field resembles that of a giant bar magnet (dipole) at the centre, tilted to the rotation axis.
38. (C) Magnetic declination.
39. (D) The field is vertical at the magnetic poles.
40. (B) $(2m/r^3) : (m/r^3) = 2 : 1$.
41. (A) $\mu_r = 1 + \chi$ with χ small negative.
42. (C) $M = C B/T$: stronger field aligns more dipoles, lower T reduces thermal disorder.
43. (B) m and l both double: $T = 2\pi\sqrt{l/mB}$ unchanged.
44. (B) Equal and opposite pole forces cancel but form a couple unless aligned.
45. (A) $m = q_m \times 2l \rightarrow q_m = m/(2l) \rightarrow A$ m.

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