ABHINAV ACADEMY

UDUPI

CET25P5 MAGNETISM AND MATTER

Class 12 - Physics

Time Allowed: 1 hour and 30 minutes **Maximum Marks: 52**

1. How does the magnetic susceptibility χ of a paramagnetic material change with absolute temperature T? **[1]**

   a) $\chi \propto e^T$ b) $\chi \propto T$

   c) χ = constant d) $\chi \propto T^{-1}$

2. A bar-magnet of the pole-strength 2 Amp-m is kept in a magnetic field of induction 4×10^{-5} Wb/m^2 such that the axis of the magnet makes an angle 30° with the direction of the field. If the couple acting on the magnet is found to be 80×10^{-7} Nm, then the distance between the poles of the magnet is: **[1]**

   a) 20 cm b) 4 m

   c) 2 m d) 8 m

3. The susceptibility of a paramagnetic material is χ at 27° C. At what temperature will its susceptibility be $\frac{\chi}{2}$? **[1]**

   a) 54° C b) 327° C

   c) 237° C d) 1600° C

4. Which one of the following has relative magnetic permeability between 0 and 1? **[1]**

   a) Sodium b) Aluminium

   c) Alnico d) Water

5. Two similar magnets of magnetic moments M_1 and M_2 are taken and vibrate in a vibration magnetometer with their **[1]**

   i. like poles together

   ii. unlike poles together. If the ratio of the time periods is $\frac{1}{2}$, then the ratio of M_1 and M_2 $\left(\text{i.e., } \frac{M_1}{M_2}\right)$ is

   a) 0.5 b) $\frac{5}{3}$

   c) 2 d) $\frac{1}{3}$

6. An aeroplane having a wingspan of 35m files due north with the speed of 90 m/s, given B = 4×10^{-5} T. The potential difference between the tips of the wings will be **[1]**

   a) 0.126 V b) 1.26 V

   c) 0.013 V d) 12.6 V

7. Tesla is the unit of **[1]**

   a) magnetic induction b) electric field

   c) electric flux d) magnetic flux

8. A bar magnet of pole strength (m) and magnetic moment (M) is cut perpendicular to its axis in two equal halves. **[1]**

The new pole strength (m') and magnetic moment (M') of each part are respectively:

a) 2m and $\frac{M}{2}$

b) m and $\frac{M}{2}$

c) $\frac{m}{2}$ and 2M

d) m and M

9. The arrangement fo two magnetic poles of equal and opposite strengths separated by a finite distance is called: **[1]**

a) Magnetic dipole

b) Magnetic current

c) Magnetic field

d) Magnetic pole

10. Which of the following has its permeability less than that of free space? **[1]**

a) Copper

b) Nickel

c) Copper chloride

d) Aluminium

11. The intensity of magnetic field is H and the moment of a magnet is M Maximum potential energy is: **[1]**

a) 4 MH

b) 3 MH

c) MH

d) 2 MH

12. A paramagnetic sample shows a net magnetisation of 8 Am^{-1} when placed in an external magnetic field of 0.6T at a temperature of 4K. When the same sample is placed in an external magnetic field of 0.2 T at a temperature of 16K, the magnetisation will be **[1]**

a) 6 Am^{-1}

b) $\frac{2}{3}\mathrm{Am}^{-1}$

c) 2.4 Am^{-1}

d) $\frac{32}{3}\mathrm{Am}^{-1}$

13. According to Gauss's law for magnetism, **[1]**

a) $\oint \vec{B}.\overrightarrow{ds} = 0$

b) $\int \vec{B}.\overrightarrow{ds} = 0$

c) $\oint \vec{B}.\overrightarrow{ds} = \mu_0$

d) $\int \vec{B}.\overrightarrow{ds} = \mu_0$

14. The susceptibility of ferromagnetic material is: **[1]**

a) inversely proportional to square of temperature

b) inversely proportional to temperature

c) independent of temperature

d) directly proportional to temperature

15. Time period of oscillation of a magnetic needle is **[1]**

a) $T = \sqrt{\frac{I}{MB}}$

b) $T = \pi\sqrt{\frac{MB}{I}}$

c) $T = 2\pi\sqrt{\frac{MB}{I}}$

d) $T = 2\pi\sqrt{\frac{I}{MB}}$

16. Points A and B are situated perpendicular to the axis of a 2 cm long bar magnet at large distances x and 3x from its centre on opposite sides. The ratio of the magnetic fields at A and B will be approximately equal to **[1]**

a) 2 : 9

b) 1 : 9

c) 9 : 1

d) 27 : 1

17. A closely wound solenoid of 800 turns and area of cross section $2.5 \times 10^{-4}\mathrm{m}^2$ carries a current of 3.0 A. What is its associated magnetic moment? **[1]**

a) 0.4 J/T

b) 0.8 J/T

c) 0.6 J/T

d) 0.5 J/T

18. A bar magnet is cut into two equal halves parallel to its magnetic axis. The physical quantity that remains unchanged is: **[1]**

a) moment of inertia

b) pole strength

c) magnetic moment

d) magnitude of magnetisation

19. Which one of the following has negative value of susceptibility? **[1]**

a) Lead

b) Nickel

c) Iron

d) Aluminium

20. A sensitive magnetic instrument can be shielded very effectively from outside fields by placing it inside a box of **[1]**

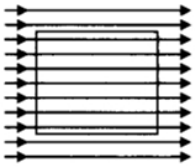
a) plastic material

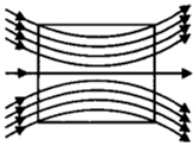
b) teak wood

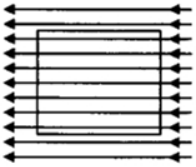
c) soft iron of high permeability

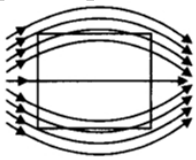
d) a metal of high conductivity

21. A uniform magnetic field exists in space in the plane of paper and is initially directed from left to right. When a bar of soft iron is placed in the field parallel to it, the lines of force passing through it will be represented by **[1]**

a) 

b) 

c) 

d) 

22. A Rowland ring of mean radius 15 cm has 3500 turns of wire wound on a ferromagnetic core of relative permeability 800. What is the magnetic field B in the core for a magnetising current of 1.2A? **[1]**

a) 3.48 T

b) 5.48 T

c) 4.08 T

d) 4.48 T

23. A toroid wound with 60 turns/m of wire carries a current of 5.00 A. The torus is iron, which has a magnetic permeability of $\mu_{\mathrm{m}} = 5000\mu_0$ under the given conditions. H and B inside the iron are **[1]**

a) 380A/m,1.98T

b) 340A/m,1.88T

c) 300A/m, 1.88T

d) 340A/m, 2.88T

24. At a point on the right bisector of a magnetic dipole, the magnetic: **[1]**

a) field varies as r^3

b) potential is zero at all points on the right bisector

c) field is perpendicular to the axis of dipole

d) potential varies as $\frac{1}{r^2}$

25. Magnetism in substances is caused by **[1]**

a) hidden magnets

b) orbital motion of electrons only

c) due to spin and orbital motions of electrons both

d) spin motion of electrons only

26. Consider the two idealised 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), 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 laws as below: **[1]**

a) case (ii) contradicts Gauss's law for magnetic fields.

b) case (i) contradicts Gauss's law for electrostatic fields.

c) case (ii) contradicts en $\oint H.d1 = I_{en}$

d) case (i) agrees with $\oint E.d1 = 0$

27. A small bar, when placed near a magnet is repelled by it. This is because the bar is made of: **[1]**

a) Copper

b) Iron

c) Aluminium

d) Nickel

28. A magnet is cut in three equal parts by cutting it perpendicular to its length. The time period of original magnet is T0 in a uniform magnetic field B. Then, the time period of each part in the same magnetic field is **[1]**

a) None of these

b) $\frac{T_o}{4}$

c) $\frac{T_o}{3}$

d) $\frac{T_o}{2}$

29. A closely wound solenoid of 800 turns and area of cross section $2.5 \times 10^{-4} \text{m}^2$ carries a current of 3.0 A. It is free to turn about the vertical direction and a uniform horizontal magnetic field of 0.25 T is applied. Magnitude of torque on the solenoid when its axis makes an angle of 30° with the direction of applied field is **[1]**

a) 0.075 J

b) 0.09 J

c) 0.065 J

d) 0.06 J

30. The magnetic moment (μ) of a revolving electron around the nucleus varies with principal quantum number n as **[1]**

a) $\mu \propto n$

b) $\mu \propto \frac{1}{n}$

c) $\mu \propto \frac{1}{n^2}$

d) $\mu \propto n^2$

31. The magnetic moment of a revolving electron around the nucleus varies with principal quantum number n as **[1]**

a) $\mu \propto n$

b) $\mu \propto \frac{1}{n^2}$

c) $\mu \propto n^2$

d) $\mu \propto \frac{1}{n}$

32. A bar magnet has magnetic dipole moment $\vec{M}$. Its initial position is parallel to the direction of uniform magnetic field $\vec{B}$. In this position, the magnitudes of torque and force acting on it respectively are **[1]**

a) 0 and MB

b) $|\vec{\text{M}} \times \vec{\text{B}}|$ and 0

c) 0 and 0

d) MB and MB

33. The universal property among all substances is **[1]**

a) ferromagnetism

b) non-magnetism

c) diamagnetism

d) paramagnetism

34. A magnet of magnetic moment M is suspended in a uniform magnetic field B. The maximum value of torque acting on the magnet is **[1]**

a) zero

b) MB

c) 2MB

d) $\frac{1}{2}MB$

35. The force between two magnetic poles is F. If the distance between the poles and pole strengths of each pole are doubled, then the force experienced is: **[1]**

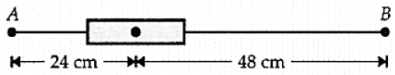
a) F

b) $\frac{F}{4}$

c) 2F

d) $\frac{F}{2}$

36. A bar magnet of length 3 cm has points A and B along its axis at distances of 24 cm and 48 cm on the opposite sides. Ratio of magnetic fields at these points will be **[1]**



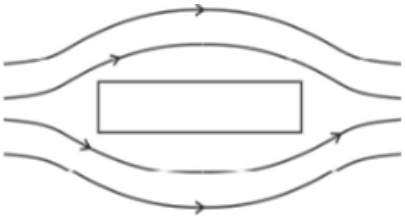
a) $\frac{1}{2\sqrt{2}}$

b) 4

c) 3

d) 8

37. The magnetic field lines near a substance are as shown in the figure. The substance is: **[1]**



a) Iron

b) Aluminium

c) Copper

d) Sodium

38. A closely wound solenoid of 2000 turns and area of cross-section $1.6 \times 10^{-4} m^2$, carrying a current of 4.0 A, is suspended through its centre allowing it to turn in a horizontal plane. What is the magnetic moment associated with the solenoid? **[1]**

a) 3.18 Am^2

b) 2.08 Am^2

c) 1.28 Am^2

d) 4.38 Am^2

39. Which of the following statements is not correct about the magnetic field? **[1]**

a) inside the magnet, the lines go from north to south pole of the magnet

b) the magnet lines form a closed loop

c) tangents to the magnetic lines give the direction of the magnetic field.

d) magnetic lines of force do not cut each other

40. The magnetic moment has dimensions of **[1]**

a) $[L^2A]$

b) $[L^2T^{-1}A]$

c) $[LT^{-1}A]$

d) [LA]

41. The value of 1 Bohr magneton is: [Given h = 6.62 $\times$ 10^{-34} Js, e = 1.6 $\times$ 10^{-19} C and m_e = 9.1 $\times$ 10^{-31} kg] **[1]**

a) 7.27 $\times$ 10^{-24} Am^2

b) 9.27 $\times$ 10^{-24} Am^2

c) 10.57 $\times$ 10^{-24} Am^2

d) 8.57 $\times$ 10^{-24} Am^2

42. Two bar magnets having same geometry with magnetic moments M and 2M are firstly placed in such a way that their similar poles are on the same side and its period of oscillation is T_1. Now the polarity of one of the magnets is reversed and its time period becomes T_2. Then, **[1]**

a) $T_1 = T_2$

b) $T_2 = \infty$

c) $T_1 > T_2$

d) $T_1 < T_2$

43. Two tangent galvanometers having coils of the same radius are connected in series. A current flowing in them produces a deflection of 60° and 45° respectively. The ratio of the number of turns in the coils is: **[1]**

a) $\frac{\sqrt{3}}{1}$

b) $\frac{\sqrt{3+1}}{1}$

c) $\frac{(\sqrt{3+1})}{(\sqrt{3}-1)}$

d) $\frac{4}{3}$

44. The susceptibility of a magnetic substance is found to depend on temperature and the strength of the magnetising field. The material is a: **[1]**

a) diamagnet

b) superconductor

c) ferromagnet

d) paramagnet

45. The ratio of magnetic fields due to a small bar magnet in the end on position to the broad side on position is **[1]**

a) 1 : 1

b) 1 : 4

c) 2 : 1

d) 1 : 2

46. A bar magnet having a magnetic moment of 2×10^4 JT^{-1} is free to rotate in a horizontal plane. A horizontal magnetic field B = 6×10^{-4} T exists in the space. The work done in taking the magnet slowly from a direction parallel to the field to a direction 60° from the field is **[1]**

a) 0.6 J

b) 12 J

c) 2 J

d) 6 J

47. A frog can be levitated in a magnetic field produced by a current in a vertical solenoid placed below the frog. This is possible, because the body of the frog behaves as **[1]**

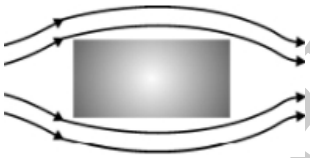
a) paramagnetic

b) ferromagnetic

c) anti-ferromagnetic

d) diamagnetic

48. Which of the following cannot modify an external magnetic field as shown in the figure? **[1]**



a) Silicon

b) Sodium Chloride

c) Copper

d) Nickel

49. The major contribution of magnetism in substances is due to **[1]**

a) hidden magnets.

b) spin motion of electrons

c) orbital motion of electrons

d) equally due to orbital and spin motions of electrons

50. The radius of the coil of a Tangent Galvanometer which has 10 turns is 0.1 m. The current required to produce a deflection of 60° $\left(B_H = 4 \times 10^{-5} T\right)$ is **[1]**

a) 5.6 A

b) 2.6 A

c) 2.1 A

d) 1.1 A

51. The main use of studying a hysteresis curve for a given material is to estimate the **[1]**

a) voltage loss

b) hysteresis loss

c) current loss

d) power loss

52. The μ_0 is also known as : **[1]**

a) magnetic dipole

b) Absolute Permittivity

c) Magnetic dipole moment

d) Magnetic flux