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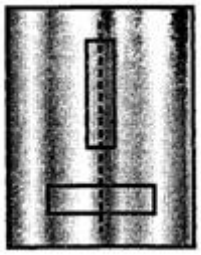
Date : 28.03.2025
Time : 03:00:00
Marks : 200

TEST ID: 57
PHYSICS

11.MAGNETISM MATTERIALS,6.MAGNETISM

Single Correct Answer Type

1. Magnetic dipole moment of a current-carrying coil is independent of
   a) Current in the coil
   b) Number of turns of the coil
   c) Strength of the magnetic field
   d) Area of the coil
2. The magnetic potential at any point due to a short magnetic dipole is
   a) $V = \frac{\mu_0}{4\pi}\frac{M}{r}$ b) $V = \frac{\mu_0}{4\pi}\frac{M}{r^2}$
   c) $V = \frac{\mu_0}{4\pi}\frac{M\cos\theta}{r^2}$ d) V=0
3. The magnetic moment of atom of diamagnetic substance is
   a) Equal to zero b) Less than zero
   c) Greater than 1 d) None of these
4. If a diamagnetic substance is brought near north or south pole of a bar magnet, it is
   a) Attracted by the poles
   b) Repelled by the poles
   c) Repelled by the north pole and attracted by the south pole
   d) Attracted by the north pole and repelled by the south pole
5. When a ferromagnetic material is placed in a strong external magnetic field, its domain size
   a) Increases
   b) Decreases
   c) Remain same
   d) Does not depend upon the strength of field
6. Magnetization of a sample is
   a) Volume of sample per unit magnetic moment
   b) Net magnetic moment per unit volume
   c) Ratio of magnetic moment and pole strength
   d) Ratio of pole strength to magnetic moment
7. The short bar magnet is placed horizontally in N\S direction with its north pole pointing to the south of earth. In these case the null point on its axis is obtained if
   a) $B_{eq}=B_H$ b) $B_{axis}=B_H$
   c) $B_{eq}=2B_H$ d) $B_{axis}=2B_H$
8. If the angular momentum of an electron is $\vec{J}$ then the magnitude of the magnetic moment will be
   a) $\frac{eJ}{m}$ b) $\frac{eJ}{2m}$ c) eJ 2m d) $\frac{2m}{eJ}$
9. A solenoid has core of a material with relative permeability 500 and its windings carry a current of 1A. The number of turns of the solenoid is 500 per metre. The magnetization of the material is nearly
   a) 2.5×10^3 Am^{-1} b) 2.5×10^5 Am^{-1}
   c) 2.0×10^3 Am^{-1} d) 2.0×10^5 Am^{-1}
10. The S.I unit of pole strength is
    a) Am^2 b) A^2m c) Am d) $A^{-1}m^{-1}$
11. Ferromagnetic substances have
    a) Very high permeability and very high susceptibility
    b) Very high permeability and very low susceptibility
    c) Very low permeability and very low susceptibility
    d) Very low permeability and very high susceptibility
12. A magnetic needle is kept in a non uniform magnetic field. It experience
    a) A force and torque
    b) A torque but not a force
    c) A force but not a torque
    d) Neither a torque nor a force
13. The perpendicular drawn to a magnet axis and passing through center of magnetic dipole is called as
    a) Magnetic length
    b) Magnetic equator
    c) Magnetic dipole moment
    d) None of these
14. Two short magnets are placed on a piece of cork which floats on water. The magnets are so placed that the axis of one produced bisects the axis of other at right angle then the cork



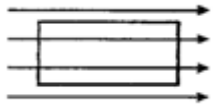
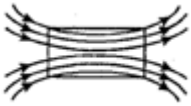
a) Rotates only
b) Moves along a straight line only
c) Has rotational as well as translational motion
d) Has neither translational nor rotational motion

15. The substances which are repelled by the magnet is called as
a) Diamagnetic b) Paramagnetic
c) Electromagnetic d) Ferromagnetic

16. A permanent magnet can be made by which of the following substance?
a) Soft iron b) Diamagnetic
c) Paramagnetic d) Ferromagnetic

17. A neutral point in the magnetic field is a point, where
a) Magnetic moment of the magnet is balanced by the magnetic field of the earth
b) Magnetic field due to the magnet is zero
c) Magnetism is strongest
d) Earth's magnetic field is exactly neutralised by the field due to the magnet

18. There is a uniform magnetic field of induction B parallel to the plane of paper and directed from left to right. A soft iron is placed in the field. The magnetic field near about the iron piece is correctly represented by the figure

a)  b) 

c)  d) 

19. The perpendicular drawn to magnetic axis and passing through centre of magnetic dipole is called as
a) Magnetic length
b) Magnetic dipole moment
c) Magnetic equator
d) Magnetic moment

20. A small piece of un magnetized substance gets repelled, when it is brought near a powerful magnet. The substances can be
a) Diamagnetic b) Nonmagnetic
c) Ferromagnetic d) Paramagnetic

21. Earths magnetisms is due to a
a) Large solid mass of magnetic material
b) Strong bar magnet placed inside the earth
c) Large mass of molten iron at the earths core
d) Molten change magnetic fluid given rise ro current inside the core of the earth

22. The substances which are slightly attracted by the magnet are
a) Diamagnetic b) Paramagnetic
c) Ferromagnetic d) Electromagnetic

23. 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. What is its associated magnetic moment?
a) $6\ JT^{-1}$ b) $0.9\ JT^{-1}$
c) $9\ JT^{-1}$ d) $0.6\ JT^{-1}$

24. The magnetic potential at a point due to a pole of strength m at a distance r is
a) $V = \frac{\mu_0}{4\pi}\frac{m}{r}$ b) $V = \frac{\mu_0}{4\pi}\frac{m}{r^2}$
c) $V = \frac{\mu_0}{4\pi}\frac{m}{r^3}$ d) $V = \frac{\mu_0}{4\pi}\frac{2m}{r}$

25. A small piece of unmagnetised substance gets repelled, when it is brought near a powerful magnet. The substance can be _____
a) Diamagnetic b) Ferromagnetic
c) Non-magnetic d) Paramagnetic

26. The SI unit of magnetic permeability is
a) Am^{-1} b) Am
c) Henry m^{-1} d) No unit, it is a dimensionless number

27. the substances which are strongly attracted by the magnets are
a) Diamagnetic b) Paramagnetic
c) Ferromagnetic d) Electromagnetic

28. The magnetic potential at any point due to a short magnetic dipole is inversely proportional to
a) Distance b) Square of distance
c) Cube of distance d) None of these

29. The electric intensity at any point due to a point is given by, Intensity = electric force/charge.
In analogy of this, what will be the magnetic induction at any point due to magnetic charge?
a) F/m b) F/M c) m/F d) M/F

30. When a magnetic substance is heated, then
a) It becomes a strong magnet

b) It losses its magnetism
c) It does not affect the magnetism
d) Its susceptibility increases

31. For diamagnetic materials, magnetic susceptibility is
a) Small and negative b) Small and positive
c) Large and negative d) Large and positive

32. Which of the following statements are true about the magnetic susceptibility χ_m of paramagnetic substance?
a) Value of χ_m is directly proportional to the absolute temperature of the sample
b) χ_m is positive at all temperatures
c) χ_m is negative at all temperatures
d) χ_m does not depend on the temperature of the sample

33. There are four light-weight-rod samples, A, B, C, D separately suspended by thread. A bar magnet is slowly brought near each sample and the following observations are noted
i. A is feebly repelled
ii. B is feebly attracted
iii. C is strongly attracted
iv. D remains unaffected
Which one of the following is true?
a) A is of a non-magnetic material
b) B is of a paramagnetic material
c) C is of a diamagnetic material
d) D is of a ferromagnetic material

34. A bar of diamagnetic substance is placed in a magnetic field with its length making angle θ with the direction of the magnetic field. How will be bar behave?
a) It will align itself parallel to the magnetic field
b) It will align itself perpendicular to the magnetic field
c) It will not show any change
d) Its behavior cannot be predicted

35. Permeabilities of diamagnetic materials are
a) Zero b) Less than unity
c) Equal to unity d) Greater than unity

36. An example of diamagnetic substance is
a) Aluminum b) Cobalt
c) Copper d) Oxygen

37. If a paramagnetic substance is placed in a non-uniform magnetic field, then it will move from
a) Weaker to stronger part
b) Remains stable
c) Stronger to weaker field
d) Perpendicular to field

38. The magnetic induction due to a bar magnet at an a equatorial point is directed along the axis
a) From S pole to N pole
b) From N pole to S pole
c) Perpendicular to the length of dipole
d) None of these

39. Ferromagnetic have their properties due to
a) Filled inner sub/shell
b) Vacant inner sub/shell
c) Partially filled inner sub/shell
d) All the sub/shell equally field

40. The maximum magnetization of a paramagnetic and ferromagnetic sample is
a) Of the same order
b) Smaller for Para and large for Ferro
c) Small can be predict
d) Nothing can be predict

41. What is the magnetization of a bar magnet having length 6 cm and area of cross section 5 cm^2? ($M = 1\ Am^2$)
a) 1.2×10^{-4} A/m b) 3.3×10^{4} A/m
c) 1.25×10^{-4} A/m d) 3.3×10^{-4} A/m

42. A ferromagnetic material is heated above its curie temperature. Which one is a correct statement?
a) Ferromagnetic domains are perfectly arranged
b) Ferromagnetic domains become random
c) Ferromagnetic domains are not influenced
d) Ferromagnetic material changes itself into diamagnetic material

43. Core of electromagnets are made of ferromagnetic material which has
a) Low permeability and high retentivity
b) High permeability and low retentivity
c) Low permeability and low retentivity
d) High permeability and high retentivity

44. A magnet of magnetic moment 3 Am^2 weighs 75 g. The density of the material of the magnet is 7500 kg/m^3. What is the magnetization?
a) 4×10^5 A/m b) 3×10^5 A/m
c) 6×10^6 A/m d) 2.5×10^5 A/m

45. The magnetic induction at any point due to a short magnetic dipole is
a) $\frac{\mu_0}{4\pi}\frac{M}{r^3}\sqrt{3\cos^2\theta+1}$ b) $\frac{\mu_0}{4\pi}\frac{2M}{r^2}\sqrt{3\cos^2\theta+1}$
c) $\frac{\mu_0}{4\pi}\frac{M}{r^2}\sqrt{3\cos^2\theta+1}$ d) $\frac{\mu_0}{4\pi}\frac{2M}{r^3}\sqrt{3\cos^2\theta+1}$

46. The thermal energy of atom of paramagnetic substance
a) Helps magnetization due to collision
b) Oppose magnetization due to collision

c) Helps magnetization due to rotation
d) oppose magnetization due to rotation

47. If a diamagnetic liquid is placed in a watch glass on a pole pieces of a magnet then the liquid will accumulate at
a) Centre b) Ends
c) At some place d) None of these

48. The magnetic flux near the axis and inside the air core solenoid of length 60 cm carrying current i is157×10^{-6} Wb. Its magnetic moment will be (cross-sectional area of a solenoid is very small as compared to its length, $\mu_0 = 4\pi \times 10^{-7}$SI unit)
a) 0.25Am^2 b) 0.50Am^2
c) 0.75Am^2 d) 1Am^2

49. A particle of charge q and mass m moves in a circular orbit of radius r with angular speed ω. The ratio of the magnitude of its magnetic moment to that of its angular momentum is
a) $\frac{q}{2m}$ b) $\frac{q\omega r^2}{2}$
c) $\frac{q\omega}{2mr^2}$ d) $\frac{q\omega r^2}{2m}$

50. The magnetic susceptibility of a material of a rod is 299 and permeability of vacuum μ_0 is $4\pi \times 10^{-7}\text{Hm}^{-1}$. Absolute permeability of the material of the rod is
a) $3771 \times 10^{-7}\text{Hm}^{-1}$ b) $3771 \times 10^{-5}\text{Hm}^{-1}$
c) $3770 \times 10^{-6}\text{Hm}^{-1}$ d) $3771 \times 10^{-8}\text{Hm}^{-1}$

51. The group of the atomic magnets formed due to interaction are called as
a) Domain b) Resistance
c) Inductance d) None of these

52. A current i flows in a conducting wire of length L. If we bent it in a circular form, then calculate its magnetic dipole moment.
a) $\frac{iL^2}{4\pi}\text{Am}^2$ b) $\frac{i^2L}{4\pi}\text{Am}^2$
c) $\frac{iL^2}{2\pi}Am^2$ d) $\frac{i^2L}{2\pi}\text{Am}^2$

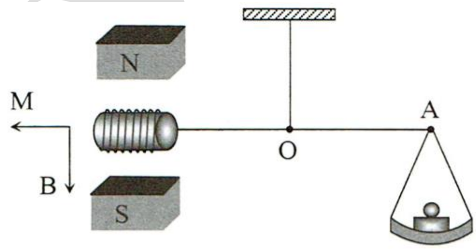
53. The magnetic moment of electron due to orbital motion is proportional to (where, n = principal quantum number)
a) $\frac{1}{n^2}$ b) $\frac{1}{n}$
c) n^2 d) n

54. Which of the following is paramagnetic?
a) Gold b) Water
c) Nickel d) Aluminum

55. Which of the following is of ferromagnetic material:
a) Alnico b) Brass c) Gold d) Lead

56. A toroid has 1500 turns and the inner and outer radii of its core 6 cm and 8 cm respectively. The magnetic field in the core for a current of 0.5 A is 2 T. The relative permeability of core is
a) 156.3 b) 662.2 c) 931.5 d) 1863

57. A small coil C with N = 100 turns is mounted on one end of a balance beam and introduced between the poles of an electromagnet as shown in the figure. The cross-sectional area of coil is A = 1.0 cm^2, length of arm OA of the balance beam is l = 20 cm. When there is no current in the coil the balance is in equilibrium. On passing a current i = 18 mA through the coil the equilibrium is restored by putting the additional counter weight of mass Δm = 40 mg on the balance pan. Find the magnetic induction at the spot where coil is located



a) 0.11 T b) 0.22 T c) 0.44 T d) 0.54 T

58. Curie temperature is a particular temperature at which ferromagnetic material changes to
a) Diamagnetic b) Paramagnetic
c) Non-magnetic d) Anti-magnetic

59. The magnetic dipole moment is a vector directed form
a) S pole to N pole
b) N pole to S pole
c) Perpendicular to dipole
d) None of these

60. The unit of permeability is:
a) Weber/metre
b) Weber/ampere metre
c) Weber
d) Weber/(metre)^2

61. A coil carrying current 'I' has radius 'r' and number of turns 'n'. It is rewound so that radius of new coil is $\frac{r}{4}$ and it carries current 'I'. The ratio of magnetic moment of new coil to that of origin coil is
a) 1 b) $\frac{1}{2}$ c) $\frac{1}{4}$ d) $\frac{1}{8}$

62. Magnetic meridian is a

a) Point b) Line along N-S
c) Vertical plane d) Horizontal plane

63. The magnetic susceptibility for magnetic material is
a) Small and negative b) Small and positive
c) Large and positive d) Large and negative

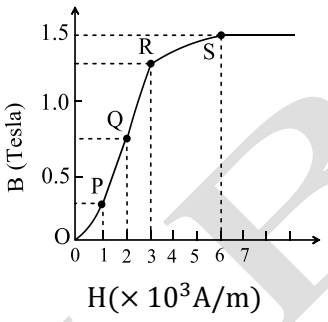
64. Magnetic flux linked with an area dA held at an angle θ between area vector and direction of B is given by:
a) B dA $\sin\theta$ b) B dA
c) B dA $\tan\theta$ d) B dA $\cos\theta$

65. A domain in a ferromagnetic substance is in the form of a cube of side 1μm. If it contains 8×10^{10} atoms and each atomic dipole has a dipole moment of $9 \times 10^{-24}\text{Am}^2$, then the magnetisation of the domain is
a) $7.2 \times 10^{5}\text{Am}^{-1}$ b) $7.2 \times 10^{3}\text{Am}^{-1}$
c) $7.2 \times 10^{9}\text{Am}^{-1}$ d) $7.2 \times 10^{12}\text{Am}^{-1}$

66. The magnetic moment of the atoms of the paramagnetic substances is greater than
a) Zero b) One c) Two d) Three

67. Which of the following is ferromagnetic?
a) Quartz b) Nickel
c) Bismuth d) Aluminum

68. The basic magnetization curve for a ferromagnetic material is shown in figure. Then, the value of relative permeability is highest for the point



a) P b) Q c) R d) S

69. The S.I unit of magnetic dipole is
a) Am^2 b) A^2m c) Am d) $\text{A}^{-1}\text{m}^{-1}$

70. Which of the following is ferromagnetic?
a) Quartz b) Bismuth
c) Nickel d) Aluminium

71. The ratio of magnetization I to the magnetic field intensity H is
a) Susceptibility b) Permeability
c) Permittivity d) All of these

72. A permanent magnet can be made from which one of the following substances?
a) Soft iron b) Paramagnetic
c) Diamagnetic d) Ferromagnetic

73. The magnetic moment produced in a substance of 1 g is $6 \times 10^{-7}\text{Am}^2$. If its density is 5 g cm^{-3}, then the intensity of magnetisation (in Am^{-1}) will be
a) 8.3×10^{6} b) 3.0
c) 1.2×10^{-7} d) 3×10^{-6}

74. When a ferromagnetic material is heated above its Curie temperature, it
a) Gets demagnetised
b) Becomes diamagnetic
c) Behaves like a paramagnetic substance
d) Remain unaffected

75. The ratio of the intensity of magnetization to strength of a magnetizing field is called
a) Magnetic flux density
b) Magnetic susceptibility
c) Magnetic permeability
d) None of these

76. The process of conversion of iron and its alloys into a magnet is
a) Magnetisms b) Magnetization
c) Magnetic dipole d) All of these

77. The intensity of magnetisation of a bar magnet is $5.0 \times 10^{4}\text{Am}^{-1}$. The magnetic length and the area of cross-section of the magnet are 12 cm and 1 cm^2, respectively. The magnitude of magnetic moment of this bar magnet is (in SI unit)
a) 0.6 b) 1.3
c) 1.24 d) 2.4

78. The S.I. unit of gyromagnetic ratio is
a) Cm b) C kg c) C kg^{-1} d) kg C^{-1}

79. Magnetic permeability of ferromagnetic substance is
a) Always zero
b) Minimum
c) Maximum
d) Less than paramagnetic substance and more than diamagnetic substance

80. The magnetic induction on a point on axis of a short magnetic dipole is
a) $\frac{\mu_0}{4\pi}\frac{2M}{r^3}$ b) $\frac{\mu_0}{4\pi}\frac{3M}{r^3}$ c) $\frac{\mu_0}{4\pi}\frac{M}{r^3}$ d) $\frac{\mu_0}{4\pi}\frac{2M^2}{r^3}$

81. A paramagnetic liquid is filled in a glass U tube of which one limb is placed between the pole pieces of an electromagnet. When the field is switched on, the liquid in the limb, which is in the field, will
a) Rise
b) Fall
c) Remain stationary

d) Initially rise and then fall

82. A steel wire of length 'l' has a magnetic moment 'M'. It is bent in 'L' shape having equal size of arm. The new magnetic moment is
a) $\frac{M}{2}$ b) $\frac{M}{\sqrt{2}}$ c) M d) 2M

83. The magnetic susceptibility of a paramagnetic material is 1.0×10^{-5} at 27 ℃ temperature. Then, at what temperature its magnetic susceptibility would be 1.5×10^{-5}?
a) 18℃ b) 200℃ c) −73℃ d) −18℃

84. In the unmagnetised state of a ferromagnetic substance, all the domains in it are
a) Parallel to each other
b) Perpendicular to each other
c) Randomly oriented in all directions
d) Anti parallel to each other

85. The amount of work done in carrying a unit N-pole from infinity to a point against a magnetic field is
a) Magnetic induction b) Magnetic potential
c) Magnetic moment d) Magnetic torque

86. The magnetic dipole moment per unit volume of substance is known as
a) Magnetic induction
b) Magnetic flux density
c) Intensity of magnetization
d) Magnetic permeability

87. The relation between magnetic induction (B),magnetizing field (H),and the magnetization (I) is
a) B=μ_0(H+I) b) B=(H+I)
c) B=μ_0(H-I) d) B=μ_0/(H+I)

88. Domain formation is necessary future of
a) Non magnetic b) Diamagnetic
c) Paramagnetic d) Ferromagnetic

89. A magnet with moment m is given. If it is bent into a semi-circular form, its new magnetic moment will be
a) $\frac{m}{\pi}$ b) $\frac{m}{2}$
c) m d) $\frac{2m}{\pi}$

90. Magnetic lines of induction in external space and inside the
a) S-pole to N-pole and N-pole to S-pole
b) N-pole to S-pole and S-pole to N-pole
c) S-pole to N-pole and S-pole to N pole
d) N-pole to S-pole and N-pole to S-pole

91. The magnetic induction due to a bar magnet at an axial point is directed along the axis
a) From S pole to N pole
b) From N pole to S pole
c) Perpendicular to the length of dipole
d) None of these

92. Relative permeability of iron is 5500, then its magnetic susceptibility will be
a) 5500×10^7 b) 5500×10^{-7}
c) 5501 d) 5499

93. A bar magnet has length 3 cm, cross-sectional area 2 cm^2 and magnetic moment 3Am^2. The intensity of magnetisation of bar magnet is
a) 2×10^5 A/m b) 3×10^5 A/m
c) 4×10^5 A/m d) 5×10^5 A/m

94. The magnetic dipole moment of a short magnetic dipole at a distant point along the equator of magnet has a magnitude of X in SI units. If the distance between the point and the magnet is halved, then the magnitude of dipole moment will be
a) $2X$ b) $\frac{1}{2}x$
c) X d) $\frac{1}{8}x$

95. A rod of diamagnetic substance is placed in a uniform magnetic field then it will come to rest with its length
a) Perpendicular to magnetic field
b) Parallel to magnetic field
c) Inclined at an angle to the magnetic field
d) None of these

96. Susceptibility is positive and small for a
a) Paramagnetic substance
b) Ferromagnetic substance
c) Non magnetic substance
d) Diamagnetic substance

97. _____substance have the highest permeability
a) Paramagnetic b) Diamagnetic
c) Ferromagnetic d) Nonmagnetic

98. Curie temperature is particular temperature at which ferromagnetic material changes to
a) Diamagnetic b) Nonmagnetic
c) Paramagnetic d) Antimagnetic

99. Gyromagnetic ratio of the electron revolving in a circular orbit of hydrogen atom is 8.8×10^{10}C kg^{-1}. What is the mass of the electron? (Given charge of the electron = 1.6×10^{-19} C)
a) 1×10^{-29}kg b) 0.1×10^{-29}kg
c) 1.1×10^{-29}kg d) $\frac{1}{11} \times 10^{-29}$kg

100. A magnetic dipole of moment M is placed in uniform magnetic field B so that angle between

direction of M and B is θ , the torque acting on the magnetic dipole is

a) MB $\sin\theta$ b) MB $\tan\theta$
c) MB $\cos\theta$ d) MB

101. In the unmagnitised of ferromagnetic substance all the domain in it are
a) Parallel to each other
b) Perpendicular to each other
c) Randomly oriented in all direction
d) Anti parallel to each other

102. Relative permittivity and permeability of a material are ε_r and μ_r, respectively. Which of the following values of these quantities are allowed for a diamagnetic material?
a) $\varepsilon_r = 1.5, \mu_r = 0.5$ b) $\varepsilon_r = 0.5, \mu_r = 0.5$
c) $\varepsilon_r = 1.5, \mu_r = 1.5$ d) $\varepsilon_r = 0.5, \mu_r = 1.5$

103. The relative permeability is represented by μ_r and the susceptibility is denoted by χ for a magnetic substance. Then for a paramagnetic substance,
a) $\mu_r < 1, \chi < 0$ b) $\mu_r < 1, \chi > 0$
c) $\mu_r > 1, \chi < 0$ d) $\mu_r > 1, \chi > 0$

104. The susceptibility of a magnetic material is χ at 127 ℃. At what temperature will its susceptibility be reduced to half of its original value?
a) 327℃ b) 427℃ c) 527℃ d) 627℃

105. The magnetic dipole moment of the earth is 6.4×10^{21} Am^2. If we assume it to be due to a current loop wound round the magnetic equator of the earth, then what should be the magnetic of the current, if the equatorial radius $= 6.4 \times 10^6$ m?
a) 5×10^7 A b) 25×10^6 A
c) 5×10^6 A d) 8×10^7 A

106. The product of the magnitude of the pole strength and the magnetic length is
a) A pole strength b) Magnetic moment
c) Magnetic dipole d) Neither 'a' nor 'b'

107. For an isotropic medium, B, μ, H and M_z are related as (where B, μ_0, H and M_z have their usual meaning in the context of magnetic material)
a) $(B - M_z) = \mu_0 H$ b) $M = \mu_0(H + M_z)$
c) $H = \mu_0(H + M_z)$ d) $B = \mu_0(H + M_z)$

108. The material of permanent magnet has
a) High retentivity, low coercivity
b) Low retentivity, high coercivity
c) Low retentivity, low coercivity
d) High retentivity, high coercivity

109. If a diamagnetic liquid is placed in a watch glass on the pole pieces of a magnet, then the liquid will accumulate at
a) Centre
b) At some places between end and centre
c) Ends
d) One third of its end

110. A bar magnet produces a field which is similar to a field produced by current flowing through
a) A circular coil b) Straight conductor
c) A rectangular coil d) A solenoid

111. The short bar magnet is placed horizontally in N\S direction with its north pole pointing to the north of earth. In these case the natural point is obtained on its equator when
a) B_{eq}=B_H b) B_{eq}=B_{axis}
c) B_{eq}=B_V d) B_{eq}=$2B_H$

112. A natural bar magnet
a) is always suspended in North-South direction
b) always has two poles
c) is made of iron and its alloys
d) All of the above

113. Maximum magnetization of a paramagnetic and ferromagnetic sample
a) Is of the same order
b) Is smaller for para and larger for ferro
c) Is smaller for ferro and larger for para
d) Cannot be predicted

114. If M_0 and L_0 denote the orbital angular moment and the angular momentum of the electron due to its orbital motion, then the gyromagnetic ratio is given by

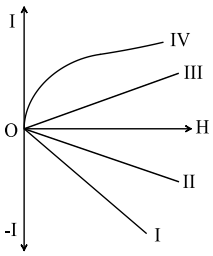
a) $\frac{L_0}{M_0}$ b) $\frac{M_0}{L_0}$ c) $L_0 M_0$ d) $\sqrt{\frac{M_0}{L_0}}$

115. An iron rod of volume 10^{-4} m^3 and relative permeability 900 is placed inside a long solenoid wound with 6 turns/cm. If a current of 0.4 A is passed through the solenoid, the magnetic moment of the rod is
a) 0.216 Am^2 b) 2.16 Am^2
c) 21.6 Am^2 d) 216×10^{-2} Am^2

116. A charge q is circulating with constant speed v in a semicircular loop of wire of radius R. The magnetic moment of this loop is

a) qvR b) $\frac{\pi Rqv}{2(\pi + 2)}$ c) $\frac{qvR}{3}$ d) $\frac{qv\pi R}{\pi + 2}$

117. The most appropriate I-H curve for a paramagnetic substance is



a) I b) II c) III d) IV

118. An iron rod is placed parallel to magnetic field of intensity 2000 A/m. The magnetic flux through the rod is 6×10^{-4} Wb and its cross-sectional area is 3 cm^2. The magnetic permeability of the rod (in $\frac{\text{Wb}}{\text{Am}}$) is

a) 10^{-1} b) 10^{-2}
c) 10^{-4} d) 10^{-3}

119. The length of a magnetised steel wire is l and the magnetic moment is m. It is bent into the shape of L with two equal sides. The magnetic moment now will be

a) $m/2$ b) $2m$
c) $\sqrt{2}m$ d) $m/\sqrt{2}$

120. Earth's magnetic field always has a horizontal component except at:

a) Equator b) Magnetic pole
c) A latitude of 50° d) A latitude of 60°

121. The magnetic susceptibility for diamagnetic materials is

a) Small and negative b) Large and negative
c) Small and positive d) Large and positive

122. The magnetic susceptibility is

a) $x = \frac{1}{\text{H}}$ b) $x = \frac{\text{B}}{\text{H}}$ c) $x = \frac{\text{M}}{\text{V}}$ d) $x = \frac{\text{M}}{\text{H}}$

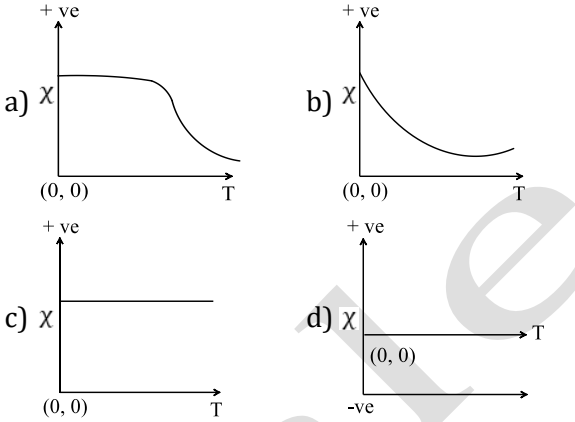
123. The magnetic field (B) inside a long solenoid having n turns per unit length and carrying current i when iron core is kept in it is (μ_0 = permeability of vacuum, χ = magnetic susceptibility)

a) $\mu_0 ni(1-x)$ b) $\mu_0 ni\chi$
c) $\mu_0 ni^2(1+\chi)$ d) $\mu_0 n^i(1+\chi)$

124. Magnetic moment of a bar magnet is equal to the magnet of the couple which is required to keep it

a) Parallel to uniform magnetic field of unit induction
b) Perpendicular to uniform magnetic field of unit induction
c) Parallel to uniform magnetic field of any induction
d) Perpendicular to uniform magnetic field of any induction

125. The variation of magnetic susceptibility (χ) with absolute temperature T for a ferromagnetic substance is represented by which graph



126. The direction of resultant magnetic induction at any point due to a short magnetic dipole is inclined to the axis of the dipole at an angle

a) $\tan^{-1}(\frac{1}{2}\tan\theta)$ b) $\frac{1}{2}\tan\theta$
c) $\tan^{-1}(\tan\frac{\theta}{2})$ d) $\tan^{-1}(2\tan\theta)$

127. When a material produces a magnetic field, which helps the applies magnetic field, then it is called

a) Diamagnetic b) Paramagnetic
c) Electromagnetic d) None of these

128. The vertical component of earth's magnetic field is zero at:

a) Geographical poles b) Magnetic equator
c) Magnetic poles d) Every pole

129. A bar magnet of length 10 cm and having the pole strength equal to 10^3 weber is kept in a magnetic field having magnetic induction (B) equal to $4\pi \times 10^{-3}$ tesla. It makes an angle of 30° with the direction of magnetic induction. The value of the torque acting on the magnet is ($\mu_0 = 4\pi \times 10^{-7}$ weber/ampere × m)

a) $2\pi \times 10^{-7}$ N × m b) $2\pi \times 10^{-5}$ N × m
c) 0.5N × m d) 0.5×10^2 N × m

130. The magnetic induction B and the force F on a pole m are related by

a) B = m F b) $\text{F} = \frac{\text{m}}{\text{B}}$
c) F = m B d) None of these

131. The space within a current carrying toroid is filled with tungsten of susceptibility 4.6×10^{-5}. The percentage increase in the magnetic field is

a) 2.3×10^{-3} b) 4.6×10^{-3}
c) 6.9×10^{-3} d) 9.2×10^{-3}

132. The space within a current carrying toroid is

filled with tungsten of susceptibility 6.8×10^{-5}. The percentage increase in the magnetic field B is

a) 6.8×10^{-3} b) 68×10^{-3}
c) 6.08×10^{-4} d) 68×10^{5}

133. The magnetic moment of atomic neon is

a) Zero b) $2\mu B$ c) μB d) $\frac{3\mu B}{2}$

134. A bar magnet of magnetic moment M_1 is axially cut into two equal parts. If these two pieces are arranged perpendicular to each other, the resultant magnetic moment is M_2, then the value of M_1/M_2 is

a) $\frac{1}{2\sqrt{2}}$ b) 1
c) $\frac{1}{\sqrt{2}}$ d) $\sqrt{2}$

135. Magnetic permeability is maximum for

a) Diamagnetic substance
b) Paramagnetic substance
c) Ferromagnetic substance
d) All of these

136. Magnetic field do not interact with:

a) Moving electric charge
b) Moving permanent magnet
c) Stationary electric charge
d) Stationary permanent magnet

137. A charge 2Q is circulating with constant speed 2X in a semicircular loop of wire of radius r. The magnetic moment of this loop is

a) 4QXr b) $\frac{2\pi rQX}{(\pi+2)}$ c) $\frac{4QXr}{3}$ d) $\frac{4QXr}{\pi+2}$

138. A paramagnetic substance in the form of a cube with sides 1 cm has a magnetic dipole moment of 20×10^{-6} J/T when a magnetic intensity of 60×10^{3} A/m is applied. Its magnetic susceptibility is

a) 3.3×10^{-4} b) 3.3×10^{-2}
c) 4.3×10^{-2} d) 2.3×10^{-2}

139. Magnets cannot be made from which of the following substances?

a) Iron b) Nickel c) Copper d) Cobalt

140. Which of the following is most suitable for the core for electromagnets?

a) Soft iron b) Steel
c) Copper-nickel alloy d) Air

141. If a diamagnetic substance is broad near north south pole of a bar magnet ,it is

a) Attracted by pole
b) Repelled by pole
c) Repelled by north pole only
d) Repelled by south pole only

142. If the magnetic dipole moment of an atom of diamagnetic material, paramagnetic material and ferromagnetic material are denoted by μ_d, μ_p and μ_f respectively, then

a) $\mu_d \neq 0$ and $\mu_f \neq 0$ b) $\mu_p \neq 0$ and $\mu_f \neq 0$
c) $\mu_d \neq 0$ and $\mu_p \neq 0$ d) $\mu_d \neq 0$ and $\mu_p \neq 0$

143. The direction of resultant magnetic induction at any point due to a short magnetic dipole is inclined to the axis of dipole (∅ angle between B and line and θ angle between line and axis)

a) $\theta + \tan^{-1}(\tan\theta)$ b) $\theta + \tan^{-1}(2\tan\theta)$
c) $\theta + \tan^{-1}(\tan\theta/2)$ d) $\theta + \tan^{-1}\left(\tan(\frac{\theta}{2})\right)$

144. An iron rod of length L and magnetic moment M is bent in the form of a semicircle. Now, its magnetic moment will be

a) M b) $\frac{2M}{\pi}$ c) $\frac{M}{\pi}$ d) $M\pi$

145. Telsa is a unit of measuring:

a) Intensity of magnetization
b) Magnetic field strength
c) Magnetic induction
d) Magnetic moment

146. If the magnetic lines of induction will move away from the substance, then the substance is

a) Ferromagnetic b) Electromagnetic
c) Paramagnetic d) Diamagnetic

147. A solenoid has core of a material with relative permeability 400. The windings of the solenoid are insulated from the core and carry a current of 2A. If the number of turns is 1000 per metre, calculate H and M.

a) $2 \times 10^{3}\text{Am}^{-1}, 8 \times 10^{5}\text{Am}^{-1}$ b) $1.0\ \text{Am}^{-1}, 1.5 \times 10^{5}\text{Am}^{-1}$
c) $6.8 \times 10^{-5}\text{Am}^{-1}, 1.2 \times 10^{-5}\text{Am}^{-1}$ d) $2.1 \times 10^{-4}\text{Am}^{-1}, -2.6 \times 10^{5}\text{Am}^{-1}$

148. The relation connecting B, H and l in SI system is

a) $B = H + I$ b) B = H − I
c) $B = \mu_0(H + I)$ d) $B = \mu_0(H - I)$

149. Unit of magnetic potential is

a) Wb/Am b) JA/m c) J/A-m d) Volt

150. The causes of Paramagnetism is

a) Unpaired electrons
b) Electron excess and spin motion of electron
c) Paired electron
d) Obtain motion of electron

151. Magnetic induction in magnetic field is:

a) Magnetic flux
b) Magnetic flux density
c) Force per unit pole strength
d) Magnetic moment per unit volume

152. The only property possessed by ferromagnetic substance is _____
a) Hysteresis b) Susceptibility
c) Directional property d) Compressibility

153. The angle made by orbital angular momentum of moment is
a) 120° b) 60°
c) 180° d) 90°

154. Which of the following represents correct formula for circulating current?
a) $I = \frac{2\pi r}{v}$ b) $I = \frac{ev}{2\pi r}$
c) $I = \frac{\pi r v}{2e}$ d) $I = \frac{\pi r e v}{2}$

155. Paramagnetic liquid is field in a glass U tube of which one limb is placed between the pole pieces of an electromagnet when the field is switch on the liquid in limb which is in the field will
a) Rise
b) Fall
c) Remains stationary
d) Initially rise and the fall

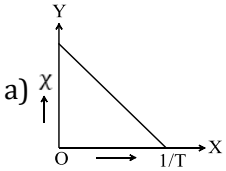
156. Susceptibility of ferromagnetic substance is
a) > 1 b) < 1 c) 0 d) 1

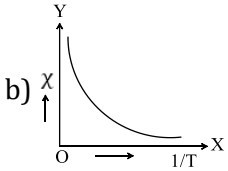
157. Of the following, paramagnetic substance is
a) Iron b) Aluminium
c) Nickel d) Copper

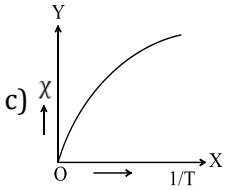
158. The electron in the hydrogen atom revolves around the nucleus in an orbit of radius 0.5 Å. What is the equivalent magnetic moment, if the frequency of revolution of the electron is 10^{10} MHz?
a) $0.8 \times 10^{-23} Am^2$ b) $1.1 \times 10^{-22}\ Am^2$
c) $1.256 \times 10^{-23}\ Am^2$ d) $1.256 \times 10^{-28}\ Am^2$

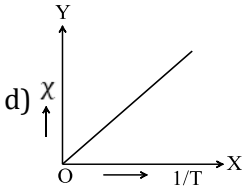
159. The cause of paramagnetism is
a) Unpaired electrons
b) Electron excess and spin motion of electrons
c) Paired electrons
d) Orbital motion of electrons

160. The graph between χ and $1/T$ for paramagnetic material will be represented by

a) 

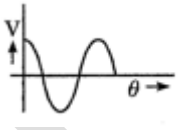
b) 

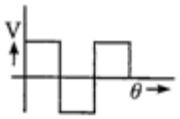
c) 

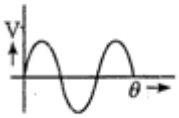
d) 

161. Keeping r constant a graph is plotted by varying both θ and a potential V due to magnetic dipole. Which is the correct graph in the figure given below?

a) 

b) 

c) 

d) 

162. The ends of the magnet at which magnetic properties of magnetic are concentrated are
a) Poles b) Pole strength
c) Axis d) Equator

163. Magnetic field intensity due to a dipole varies as x^n, where n is
a) 2 b) -2 c) 3 d) -3

164. Indicate the group containing only diamagnetic substances
a) Ar, Al, Ag, Ni, Co, Na, Cu
b) Fe, Co, Ni, Gd, Fe_3O_4
c) Al, Mn, Pt, Na, O_2, $CuCl_2$, Crown glass
d) Air, Mercury, Antimony, NaCl, Au

165. Domain formation is a necessary feature of
a) Non magnetics b) Paramagnetics
c) Diamagnetics d) Ferromagnetics

166. Magnetic induction at a point an end on position at a distance r from the centre of short magnetic dipole of moment M is
a) $\frac{\mu_0}{4\pi}\frac{2M}{r^3}$ directed along the axis away from N-pole
b) $\frac{\mu_0}{4\pi}\frac{2M}{r^2}$ directed along the axis away from N-pole
c) $\frac{\mu_0}{4\pi}\frac{2M}{r^3}$ directed along axis towards N-pole
d) $\frac{\mu_0}{4\pi}\frac{2M}{r^2}$ directed along axis towards N-pole

167. If a paramagnetic substance is placed in a non uniform magnetic field then it will move from
a) Weak field to strong b) Strong field to weak
c) Remains stable d) None of these

168. The numeric value of Bohr magneton is
a) $9.27 \times 10^{-27} Am^2$ b) $9.27 \times 10^{-24} Am^2$
c) $2.97 \times 10^{-24} Am^2$ d) $2.92 \times 10^{-27} Am^2$

169. If a substance move from the stronger to the wicker part of a non uniform magnetic field then it is known as
a) Paramagnetic b) Diamagnetic
c) Ferromagnetic d) Anti paramagnetic

170. Iron is ferromagnetic _____
a) Above 770°C b) Below 770°C
c) At all temperature d) Above 1100°C

171. Ferromagnetic substance have
a) Very high permeability and very high susceptibility
b) Very high permeability and very low susceptibility
c) Very low permeability and very low susceptibility
d) Very low permeability and very high susceptibility

172. A circular coil of radius 10 cm and 100 turns carries a current 1 A. What is the magnetic moment of the coil?
a) 3.142×10^4 A m^2 b) 10^4 A m^2
c) 3.142 A m^2 d) 3 A m^2

173. Which of the following phenomenon depends on temperature?
a) Diamagnetism b) Paramagnetism
c) Ferromagnetism d) Both 'b' and 'c'

174. The magnetic lines of force
a) Do not intersect
b) Intersects at infinity
c) Intersects within the magnet
d) Intersects at neutral point

175. Property of a bulk material called intensity of magnetisation is
a) magnetic moment per unit area b) magnetic moment per unit volume
c) a vector quantity and having unit of A m^{-1} d) Both (b) and (c)

176. The permeability of a material is the ratio of:
a) Magnetic induction and intensity of magnetisation
b) Intensity of magnetisation and magnetic induction
c) Magnetic induction and magnetic intensity
d) Magnetic intensity and magnetic induction

177. When a material is used in a magnetic field B, a magnetic movement proportional to B but opposite in direction is induced. The metal is
a) Diamagnetic b) Paramagnetic
c) Ferromagnetic d) Antimagnetic

178. If a paramagnetic liquid is placed in a watch glass, resting on a pole pieces, the liquid accumulates where the field is
a) Zero b) Weak
c) Strong d) None of these

179. Temperature above which a ferromagnetic substance becomes paramagnetic is called
a) Critical temperature b) Boyle's temperature
c) Debye's temperature d) Curie temperature

180. Energy possessed by a magnetic dipole placed in a magnetic fields is minimum when
a) Placed (parallel) along the direction of field
b) Placed perpendicular to the direction field
c) Placed antiparallel to the direction of field
d) Placed at 180° with the direction of field

181. The magnetic susceptibility of a paramagnetic material at -73 °C is 0.0075 and its value at -173 °C will be
a) 0.015 b) 0.0045 c) 0.0075 d) 0.0030

182. A bar magnet is held perpendicular to a uniform magnetic field. If the couple acting on the magnet is to be halved by rotating it, then the angle by which it is to be rotated is
a) 30° b) 45° c) 60° d) 90°

183. The basic difference between electric lines of force and magnetic lines of force
a) Electric lines of force are perpendicular to the surface and magnetic lines of force originate from pole
b) Electric lines of force do not intersect whereas magnetic lines of force intersect
c) Electric lines of force intersect but magnetic lines of force do not intersect
d) Magnetic lines of force are always in the form of closed loop whereas electric lines of force are always perpendicular to the surface

184. The ferromagnetic is not observed in
a) Solids b) Liquids
c) Cobalt's d) Powdered nickel

185. At curie temperature, the ferromagnetic material
a) Loses its ferromagnetism, Paramagnetism
b) Develops reverse polarity
c) Has maximum susceptibility
d) Has susceptibility equal to zero

186. Susceptibility of a paramagnetic substance
a) Increases with increase in temperature
b) Decreases with increase in temperature
c) Remain same at any temperature
d) First increases then decreases with increase in temperature

187. The ratio of magnetic dipole moment of an electron of charge 'e' and mass 'm' in Bohr's orbit in hydrogen atom to its angular momentum is

a) $\frac{e}{m}$ b) $\frac{m}{e}$ c) $\frac{2m}{e}$ d) $\frac{e}{2m}$

188. If a paramagnetic substance is placed in a magnetic field then the magnetic lines of force will

a) Pass through it
b) Move away from it
c) Will accumulate through it
d) None of these

189. A rod of ferromagnetic material has dimension 10 cm × 0.5 cm × 0.2 cm. It is placed in a magnetic field of strength $0.5 \times 10^4 Am^{-1}$. The magnetic moment produced in the rod is $5Am^2$. The value of magnetic induction will be

a) 0.54 T b) 6.28 T
c) 0.358 T d) 2.591 T

190. Obtain the earth's magnetisation assuming that the earth's field can be approximated by a giant bar magnet of magnetic moment $8.0 \times 10^{22}\ A - m^2$. The earth's radius is 6400 km.

a) $7.9 \times 10^5 Am^{-1}$ b) $73\ Am^{-1}$
c) $1.8 \times 10^{-5} Am^{-1}$ d) $1.0\ Am^{-1}$

191. Two equidistant points A and B are on the lines inclined at the angle θ_1 and θ_2 with the axis of magnetic dipole respectively, then the ratio of magnetic potentials at A and B is :

a) $\frac{\sin\theta_1}{\sin\theta_2}$ b) $\frac{\sin^2\theta_1}{\sin^2\theta_2}$ c) $\frac{\cos\theta_1}{\cos\theta_2}$ d) $\frac{\cos^2\theta_1}{\cos^2\theta_2}$

192. The magnetisation of bar magnet of length 5 cm, cross-sectional area 2 cm^2 and net magnetic

a) 3×10^5 A/m b) 4×10^5 A/m
c) 2×10^5 A/m d) 1×10^5 A/m

193. The ration of magnitude of magnetic induction (B) at a point due to a short magnetic dipole and the magnetic potential (V)at that point is given by

a) $\frac{B}{V} = \frac{\sqrt{3\cos^2\theta + 1}}{r\cos\theta}$ b) $\frac{B}{V} = \frac{r\cos\theta}{\sqrt{3\cos^2\theta + 1}}$
c) $\frac{B}{V} = \frac{\sqrt{2\cos^2\theta + 1}}{r\cos\theta}$ d) $\frac{B}{V} = \frac{\sqrt{\cos^2\theta + 1}}{r\cos\theta}$

194. Magnetic induction at a point due to a short magnetic dipole is B_1. the dipole is then cut into two equal parts. Magnetic induction at same point due to either part is

a) $\frac{B_1}{4}$ b) $\frac{B_1}{2}$ c) B_1 d) $2B_1$

195. The substances which are strongly attracted by the magnet are _____

a) Diamagnetic b) Paramagnetic
c) Ferromagnetic d) Electromagnetic

196. When a magnet is cut into two pieces along its length, then each [piece of magnet will have

a) Same pole strength
b) Reduced pole strength
c) Increased pole strength
d) Cannot be predicted

197. The vertical plane which passes through the axis of freely suspended magnet is

a) Magnetic length
b) Magnetic meridian
c) Geographical meridian
d) Magnetic moment

198. The magnetic moment of current / carrying circular coil of radius r and number of turns n varies as

a) $1/r^2$ b) $1/r$
c) r d) r^2

199. Dimensions of magnetization are

a) $[M^0L^{-1}T^0I^1]$ b) $[M^1L^1T^0I^{-1}]$
c) $[M^1L^{-1}T^{-1}I^{-1}]$ d) $[M^{-1}L^1T^0I^{-1}]$

200. A solenoid has a core of a material having relative permeability 350. The windings of the solenoid are insulated from the core and carry a current of 1 A. If the number of turns is 500 per metre, the magnetisation is

a) $1.8 \times 10^5 Am^{-1}$ b) $3.6 \times 10^5 Am^{-1}$
c) $5.4 \times 10^5 Am^{-1}$ d) $7.2 \times 10^5 Am^{-1}$

N.B.Navale

Date : 28.03.2025
Time : 03:00:00
Marks : 200

TEST ID: 57
PHYSICS

11.MAGNETISM MATTERIALS,6.MAGNETISM

: ANSWER KEY :

1)	c	2)	c	3)	a	4)	b	105)	a	106)	b	107)	d	108)	d
5)	a	6)	b	7)	b	8)	b	109)	c	110)	d	111)	a	112)	d
9)	b	10)	c	11)	a	12)	c	113)	a	114)	b	115)	c	116)	b
13)	b	14)	d	15)	a	16)	d	117)	c	118)	d	119)	d	120)	b
17)	d	18)	b	19)	c	20)	a	121)	a	122)	a	123)	d	124)	b
21)	d	22)	b	23)	d	24)	a	125)	a	126)	a	127)	b	128)	b
25)	a	26)	c	27)	c	28)	b	129)	a	130)	c	131)	b	132)	a
29)	a	30)	b	31)	a	32)	b	133)	a	134)	d	135)	c	136)	c
33)	b	34)	b	35)	b	36)	c	137)	b	138)	a	139)	c	140)	a
37)	a	38)	b	39)	c	40)	a	141)	b	142)	c	143)	c	144)	b
41)	b	42)	b	43)	b	44)	b	145)	c	146)	d	147)	a	148)	c
45)	a	46)	b	47)	b	48)	c	149)	c	150)	b	151)	b	152)	a
49)	a	50)	a	51)	a	52)	a	153)	c	154)	b	155)	a	156)	a
53)	d	54)	d	55)	a	56)	c	157)	b	158)	c	159)	b	160)	d
57)	c	58)	b	59)	a	60)	b	161)	b	162)	a	163)	d	164)	d
61)	c	62)	c	63)	a	64)	d	165)	d	166)	a	167)	a	168)	b
65)	a	66)	a	67)	b	68)	b	169)	b	170)	b	171)	a	172)	c
69)	a	70)	c	71)	a	72)	a	173)	d	174)	a	175)	d	176)	c
73)	b	74)	c	75)	b	76)	b	177)	a	178)	c	179)	d	180)	a
77)	a	78)	c	79)	c	80)	a	181)	a	182)	c	183)	d	184)	b
81)	a	82)	b	83)	c	84)	c	185)	a	186)	b	187)	d	188)	c
85)	b	86)	c	87)	a	88)	d	189)	b	190)	b	191)	b	192)	d
89)	d	90)	b	91)	a	92)	d	193)	a	194)	b	195)	c	196)	b
93)	d	94)	c	95)	a	96)	a	197)	b	198)	d	199)	a	200)	a
97)	c	98)	c	99)	d	100)	a								
101)	c	102)	a	103)	d	104)	c								

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PHYSICS

11.MAGNETISM MATTERIALS,6.MAGNETISM

: HINTS AND SOLUTIONS :

Single Correct Answer Type

4 **(b)**

Repelled due to induction of similar poles

8 **(b)**

As we know for circulating electron magnetic moment

$M = \frac{1}{2}evr$ ...(i)

and angular momentum $J = mvr$ ...(ii)

From equation (i) and (ii) $M = \frac{eJ}{2m}$

9 **(b)**

Magnetic intensity,

$H = nI = 500 \times 1 = 500\ Am^{-1}$

$\mu_r = 1 + \chi \Rightarrow \chi = (\mu_r - 1)$

$\therefore M = \chi H = (\mu_r - 1)H$

$= (500 - 1) \times 500 = 2.495 \times 10^5 Am^{-1}$

$\approx 2.5 \times 10^5\ Am^{-1}$

14 **(d)**

Both magnets exerts equal and opposite forces/torques on each other, so net force/torque on cork is zero.

23 **(d)**

Given, number of turns, $n = 800$

Area of cross-section of solenoid,

$A = 2.5 \times 10^{-4}\ m^2$

Current through solenoid, $i = 3$ A

Using the formula of magnetic moment,

$M = niA = 800 \times 3 \times 2.5 \times 10^{-4}$

$M = 0.6 JT^{-1}$ along the axis of the solenoid

26 **(c)**

Magnetic permeability, $\mu = \frac{B}{H}$

Its SI unit is $\frac{W\ b/m^2}{A/m} = \frac{V \times s}{A \times m} = \frac{\Omega \times s}{m} = \frac{H}{m}$ or henry m^{-1}

33 **(b)**

Diamagnetic will be feebly repelled

Paramagnetic will be feebly attracted

Ferromagnetic will be strongly attracted

41 **(b)**

$M_z = \frac{M_{net}}{V} = \frac{M}{Al} = \frac{1}{5 \times 10^{-4} \times 6 \times 10^{-2}}$

$= 3.3 \times 10^4\ A/m$

42 **(b)**

On heating, different domains have net magnetization in them which are randomly distributed. Thus the net magnetisation of the substance due to various domains decreases to minimum

44 **(b)**

Volume of the magnet,

$V = \frac{mass}{density} = \frac{75 \times 10^{-3}}{75 \times 10^2} = 10^{-5}\ m^3$

$\therefore$ Magnetization, $M_z = \frac{M_{net}}{V} = \frac{3}{10^{-5}}$

$\therefore M_z = 3 \times 10^4\ A/m$

48 **(c)**

Given, $L = 60$ cm, $\phi = 157 \times 10^{-6}$ Wb Magnetic induction inside the solenoid is

$B = \frac{\mu_0 Ni}{L}$ ...(i)

Magnetic flux, $\phi = BA = \frac{\mu_0 Ni \cdot A}{L}$ [from Eq. (i)]

Magnetic moment, $M = NiA = \frac{\phi L}{\mu_0}$

Substituting the given values, we get

$M = \frac{157 \times 10^{-6} \times 0.6}{4\pi \times 10^{-7}}$

$\Rightarrow M = \frac{157 \times 10^{-6} \times 0.6}{4 \times 3.14 \times 10^{-7}} = 0.75 Am^2$

49 **(a)**

The relation between magnetic moment (μ_f) and angular momentum (L) is $\mu_1 = -\frac{q}{2m}L \Rightarrow \frac{\mu_f}{L} = -\frac{q}{2m}$

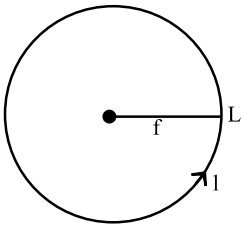
The negative sign indicates that the angular momentum of the electron is opposite in direction to the magnetic moment.

50 **(a)**

Given, magnetic susceptibility, $\chi_m = 299$
Permeability, $\mu_0 = 4\pi \times 10^{-7}\text{Hm}^{-1}, \mu = ?$
We know that, $\mu = \mu_0(1 + \chi_m)$
Absolute permeability of the material,

$$\begin{aligned}\mu &= 4\pi \times 10^{-7}(1 + 299) = 4 \times \frac{22}{7} \times 10^{-7} \times 30 \\ &= \frac{26400}{7} \times 10^{-7} = 3771.4 \times 10^{-7}\text{Hm}^{-1} \\ &= 3771 \times 10^{-7}\text{Hm}^{-1}\end{aligned}$$

52 **(a)**
Let a wire of length L is bent in a circular form of radius r.
Then, $2\pi r = L \Rightarrow r = \frac{L}{2\pi}$
... (i)



The magnetic dipole mome
The magnetic dipole moment of a circular ring.
or $M = iA$ (where, A is area of the ring)
On putting the value of r from Eq. (i) in Eq. (ii), we get

$$M = i\pi\left(\frac{L}{2\pi}\right)^2$$

$$\Rightarrow\ M = i\pi \times \frac{L^2}{4\pi^2}$$

$$\Rightarrow\ M = \frac{iL^2}{4\pi}Am^2$$

53 **(d)**
Magnetic moment is given as magnetic moment $(M_0) = \frac{e}{2m_e} \times L$ ... (i)

where, θ = electronic charge,
m_e = mass of electron
and L = orbital angular momentum.
As we know, $L = \frac{nh}{2\pi}$
where, n = principal quantum number
and h = Planck's constant.
$\Rightarrow\ L \propto n$ ...
(ii)
Therefore, from Eqs. (i) and (ii), we get
$M_0 \propto n$

61 **(c)**
$M = nIA$
For a coil, $A = \pi r^2$
$\therefore M \propto r^2 n$
But as radius becomes $\left(\frac{1}{4}\right)^{\text{th}}$, n becomes 4 times

$$\therefore \frac{M_1}{M_2} = \frac{n_1 r_1^2}{n_2 r_2^2} = \frac{n_1}{n_2} \times \left(\frac{r_1}{r_2}\right)^2 = \frac{1}{4} \times 4^2 = 4$$

$$\therefore M_2 = \frac{M_1}{4}$$

65 **(a)**
Given, number of atoms, $N = 8 \times 10^{10}$ atoms and dipole moment, $M = 9 \times 10^{-24}\text{Am}^2$
The maximum dipole moment is given by

$$\begin{aligned}M_{\max} &= NM = 8 \times 10^{10} \times 9 \times 10^{-24} \\ &= 7.2 \times 10^{-13}\text{Am}^2\end{aligned}$$

The volume of cubic domain,

$$\begin{aligned}V &= p^3 = (10^{-6})^3\ (\because l = 1\mu m = 10^{-6}\text{ m}) \\ &= 10^{-18}\text{ m}^3\end{aligned}$$

The magnetisation of domain

$$= \frac{M_{\max}}{V} = \frac{7.2 \times 10^{-13}}{10^{-18}} = 7.2 \times 10^5\text{Am}^{-1}$$

68 **(b)**
$B = \mu_0\mu_r H \Rightarrow \mu_r \propto \frac{B}{H}$ = slope of B-H curve
According to the given graph, slope of the graph is highest at point Q

73 **(b)**
Intensity of magnetisation, $I = \frac{M}{V} = \frac{M}{\text{mass / density}}$
Given, mass = 1 g = 10^{-3} kg
and density = 5 g/cm^3 = $\frac{5 \times 10^{-3}\text{ kg}}{(10^{-2})^3} = 5 \times 10^3\text{kgm}^{-3}$
Hence,

$$I = \frac{6 \times 10^{-7} \times 5 \times 10^3}{10^{-3}} = 3\text{Am}^{-1}$$

77 **(a)**
We know that, intensity of magnetisation, $I = \frac{M}{V}$
(where, M = magnetic moment, V = volume)
So, $M = IV = 5.0 \times 10^4 \times \frac{12}{100} \times \frac{1}{(100)^2} = 60 \times 10^4 \times 10^{-6} = 0.6\text{Am}^2$

82 **(b)**

$$l_{\text{eff}} = \left[\left(\frac{l}{2}\right)^2 + \left(\frac{l}{2}\right)^2\right]^{\frac{1}{2}} = \left[\frac{l^2}{4} + \frac{l^2}{4}\right]^{\frac{1}{2}}$$

$= \left[\frac{l^2}{2}\right]^{\frac{1}{2}} = \frac{l}{\sqrt{2}}$

$\therefore M' = ml_{eff} = \frac{ml}{\sqrt{2}} = \frac{M}{\sqrt{2}}$

83 **(c)**

$\chi \propto \frac{1}{T} \Rightarrow \frac{\chi_1}{\chi_2} = \frac{T_2}{T_1}$

$\Rightarrow T_2 = \frac{1.0 \times 10^{-5}}{1.5 \times 10^{-5}} \times (273 + 27)$

$= 200\ K = -73\ ^\circ C$

89 **(d)**

As magnetic moment, $m = q_m \times 2/$

$\Rightarrow\ q_m = \frac{m}{2l}$

Further, as length of semi-circular magnet, $\pi r = 21$ or $r = 21/\pi$

Distance between the two poles, $2l^r = 2r = \frac{4l}{\pi}$

Magnetic moment,

$m' = q_m \times 2l' = \left(\frac{m}{21}\right)\left(\frac{4l}{\pi}\right) = 2m/\pi$

92 **(d)**

$\chi_m = (\mu_r - 1) \Rightarrow \chi_m = (5500 - 1) = 5400$

93 **(d)**

Given, $L = 3\ cm = 3 \times 10^{-2}$ m,

$A = 2\ cm^2 = 2 \times 10^{-4}\ m^2$,

$M = 3 Am^2$

Intensity of magnetisation,

$= \frac{M}{L \times A} = \frac{3}{3 \times 2 \times 10^{-6}}$

$= \frac{1}{2} \times 10^6\ A/m$

$= 5 \times 10^5\ A/m$

94 **(c)**

The magnetic dipole moment is the product of either of pole strength and the magnetic length of dipole. Thus, it is independent of the distance of point at which it is measured. So, it remains unchanged, if the distance between point and the magnet is halved.

99 **(d)**

Gyromagnetic ratio,

$\frac{M}{L} = \frac{e}{2m}$

$\therefore m = \frac{e}{2(M/L)} = \frac{1.6 \times 10^{-19}}{2 \times 8.8 \times 10^{10}}$

$= \frac{1}{11} \times 10^{-29} kg$

102 **(a)**

$\mu_r < 1$ and $\varepsilon_r > 1$

104 **(c)**

From Curie's law, $\chi \propto \frac{1}{T}$

$\therefore \frac{\chi_2}{\chi_1} = \frac{T_1}{T_2}$ but it is given that $\frac{\chi_2}{\chi_1} = \frac{1}{2}$

and $T_1 = 273 + 127 = 400\ K$

$\therefore \frac{1}{2} = \frac{400}{T_2}$

$\therefore T_2 = 800\ K = (800 - 273) = 527^\circ C$

105 **(a)**

The magnetic dipole moment of the earth

$M = IA - 1\ \pi R^2$

$\therefore I = \frac{M}{\pi R^2} = \frac{6.4 \times 10^{21}}{3.14 \times 6.4 \times 6.4 \times 10^{12}} = \frac{10^9}{6.4 \times 3.14}$

$\therefore I \approx 5 \times 10^7\ A$

107 **(d)**

Net magnetic induction $B = B_0 + B_m$

$= \mu_0 H + \mu_0 M_z$

112 **(d)**

A natural bar magnet always stays in North-South direction. It has two poles and made of iron and its alloys.

114 **(b)**

Gyromagnetic ratio $= \frac{M_0}{L_0}$

116 **(b)**

$\text{time(t)} = \frac{\text{Distance travelled}}{\text{Velocity}}$

$\therefore t = \frac{2R + \pi R}{v} = \frac{R(\pi + 2)}{v}$

$\therefore I = \frac{q}{t} = \frac{qv}{R(\pi + 2)}$

$\therefore M = I \times A = \frac{qv}{R(\pi + 2)} \times \frac{\pi R^2}{2} = \frac{\pi R q v}{2(\pi + 2)}$

118 **(d)**

Given, magnetic field intensity, $H = 2000 Am^{-1}$

Magnetic flux, $\phi = 6 \times 10^{-4}$ Wb

Cross-sectional area, $A = 3\ cm^2 = 3 \times 10^{-4}\ m^2$

As we know, $\phi = BA$ and $B = \mu H$

$\Rightarrow\ \mu = \frac{B}{H} = \frac{\phi}{AH} = \frac{6 \times 10^{-4}}{3 \times 10^{-4} \times 2000}$

$= 10^{-3}$ Wb/Am

$\Rightarrow\ \mu = \frac{B}{H} = \frac{\phi}{AH} = \frac{6 \times 10^{-4}}{3 \times 10^{-4} \times 2000}$

$= 10^{-3}$ Wb/Am

119 **(d)**

If q_m is strength of each pole and / is the length of steel wire, then $m = q_m \times I$.
When the wire is bent into L-shape, effective distance between the poles $= \sqrt{(1/2)^2 + (I/2)^2} = I/\sqrt{2}$
$\therefore m' = q_m \times \frac{1}{\sqrt{2}} = \frac{m}{\sqrt{2}}$ (m will remain unchanged)

123 **(d)**
According to question, change in magnetic field due to insertion of iron core is given by

$$B' = \mu ni$$
$$= \mu_0(1+\chi)ni$$

$[\because \mu = \mu_0(1+x)]$

where, B = magnetic field in air,
μ_0 = permeability of vacuum
and χ = magnetic susceptibility.

125 **(a)**
As temperature of a ferromagnetic material is raised, its susceptibility χ remains constant first and then decreases

129 **(a)**
Torque,
$\tau = MB_H \sin\theta$
$= 0.1 \times 10^{-3} \times 4\pi \times 10^{-3} \times \sin 30°$
$= 10^{-7} \times 4\pi \times \frac{1}{2}$
$= 2\pi \times 10^{-7} N \times m$

130 **(c)**
Magnetic induction is defined as the force exerted on a fictitious dipole of unit pole strength
$\therefore B = \frac{F}{m} \Rightarrow F = Mb$

132 **(a)**
% increase in magnetic field
$= \frac{B - B_0}{B_0} \times 100$
$= \frac{\mu_0 \chi H \times 100}{\mu_0 H}$
$= \chi \times 100$
$= 6.8 \times 10^{-5} \times 100 = 6.8 \times 10^{-3}$

133 **(a)**
Neon atom is diamagnetic. Hence its net magnetic moment is zero

134 **(d)**
Initial magnetic moment $= M_1$
When bar magnet is cut in two parts, magnetic moment of each part

$$M' = \frac{M_1}{2}$$

When two pieces are placed perpendicular, effective magnetic moment,

$$M_2 = \sqrt{2}M' = \sqrt{2} \times \frac{M_1}{2}$$
$$\frac{M_1}{M_2} = \frac{2}{\sqrt{2}} = \sqrt{2}$$

138 **(a)**
Given, side of cube $= 1$ cm $= 10^{-2}$ m
$\therefore$ Volume, $V = 10^{-5}$ m^3
Dipole moment, $M = 20 \times 10^{-6}$ J/T
Applied magnetic intensity, $H = 60 \times 10^3$ A/m
$\therefore$ Intensity of magnetisation.

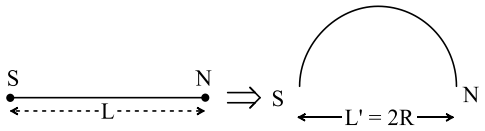
$$I = \frac{M}{V} = \frac{20 \times 10^{-6}}{10^{-6}} = 20 \text{ A/m}$$

Now, magnetic susceptibility χ.

$$\chi = \frac{\text{intensity of magnetisation}}{\text{applied magnetic intensity}} = \frac{1}{H} = \frac{20}{60 \times 1}$$
$$\Rightarrow \chi = \frac{1}{3} \times 10^{-3} = 3.33 \times 10^{-4}$$

140 **(a)**
Soft iron is highly ferromagnetic

144 **(b)**
On bending a rod, its pole strength remains unchanged whereas its magnetic moment changes



New magnetic moment
$M'' = m(2R) = m\left(\frac{2L}{\pi}\right) = \frac{2M}{\pi}$

147 **(a)**
Given, $\mu_r = 400$, $i = 2$ A and $n = 1000$
(i) The field H depends on the material of core and it is

$$H = ni = 1000 \times 2 = 2 \times 10^3 Am^{-1}$$

(ii) Magnetisation, $M = (B - \mu_0 H)/\mu_0$

$$\Rightarrow M = (\mu_r \mu_0 H - \mu_0 H)/\mu_0 \ (\because B = \mu_r \mu_0 H)$$
$$= (\mu_r - 1)H = (400 - 1)H = 399 \times H$$
$$= 399 \times 2 \times 10^3 = 8 \times 10^5 Am^{-1}$$

Hence, the value of H and M are $2 \times 10^3 Am^{-1}$ and $8 \times 10^5 Am^{-1}$, respectively.

148 **(c)**

The magnetic flux density (B) inside a magnetised substance is given by the sum of magnetic field (B_0) and magnetic field $\mu_0 I$ produced due to magnetisation.

i.e.

$$\begin{aligned} B &= B_0 + \mu_0 I \\ &= \mu_0 H + \mu_0 I \\ B &= \mu_0 (H + I) \end{aligned}$$

$(\because B_0 = \mu_0 H)$

153 **(c)**

The relation between electron's angular momentum L and magnetic moment μ is given as $\mu = -\frac{e}{2m_e} L$ where e and m_0 are the charges and mass of the electron.

Here, negative sign shows that the angular momentum and magentic moment are in opposite direction to each other, . θ. if L in $+z$-direction, then μ in - z-direction.

So, the angle between L and μ is 180°.

158 **(c)**

$r = 0.5\ \text{Å} = 0.5 \times 10^{-10}\text{m}$,

$f = 10^{10}\ \text{MHz} = 10^{16}\ \text{Hz}$

The revolving electron is equivalent to a current

$M = IA = (ef)\pi r^2$

$\therefore M = 1.6 \times 10^{-19} \times 10^{16} \times 3.14 \times (0.5 \times 10^{-10})^2$

$= 1.256 \times 10^{-23}\ \text{Am}^2$

163 **(d)**

Magnetic field intensity $= \frac{\mu_0}{4\pi}\frac{M}{x^2} \propto Mx^{-3}$

$\therefore n = -3$

168 **(b)**

1 Bohr magneton, $n = 9.27 \times 10^{-24}\text{Am}^2$

172 **(c)**

$M = nIA = nI\pi r^2$

$= 10^2 \times 1 \times 3.142 \times 10^{-2}$

$= 3.142\ \text{Am}^2$

175 **(d)**

Intensity of magnetisation of a bulk material is given by magnetic dipole moment developed per unit volume when it is placed in magnetic field,

$i, e, l = \frac{m_{\text{net}}}{V}$

where, m_{net} = magnetic moment and V = volume.

Unit of $I = \text{Am}^{-1}$ and it is a vector quantity.

181 **(a)**

$\chi \propto \frac{1}{T}$

$\frac{\chi_2}{\chi_1} = \frac{T_1}{T_2}$

$\frac{\chi_2}{0.0075} = \frac{273 - 73}{273 - 173}$

$\frac{\chi_2}{0.0075} = \frac{200}{100}$

$\chi_2 = 0.0150$

182 **(c)**

$\tau = MB\sin\theta \Rightarrow \tau \propto \sin\theta$

$\Rightarrow \frac{\tau_1}{\tau_2} = \frac{\sin\theta_1}{\sin\theta_2} \Rightarrow \frac{\tau}{\tau/2} = \frac{\sin 90}{\sin\theta_2}$

$\Rightarrow \sin\theta_2 = \frac{1}{2} \Rightarrow \theta_2 = 30°$

$\Rightarrow$ angle of rotation $= 90° - 30° = 60°$

186 **(b)**

With rise in temperature, their magnetic susceptibility decreases i.e.

$\chi_m \propto \frac{1}{T}$

187 **(d)**

$L = \frac{nh}{2\pi}$

$I = \frac{q}{T} = \frac{e\omega}{2\pi}$

Now, $M = IA$

$\therefore M = \frac{e\omega}{2\pi}\pi R^2 = \frac{e\omega R^2}{2}$

$\therefore M = \frac{e}{2}R^2 \times \frac{nh}{2\pi mR^2} = \frac{enh}{4\pi m}$

$\therefore \frac{M}{L} = \frac{enh}{4\pi m} \times \frac{2\pi}{nh} = \frac{2}{2m}$

189 **(b)**

Here, $V = (10 \times 0.5 \times 0.2)\text{cm}^3$

$= 1\ \text{cm}^3 = 10^{-6}\ \text{m}^3$,

$H = 0.5 \times 10^4\text{Am}^{-1}$ and $m = 5\text{Am}^2$

Intensity of magnetisation, $M = \frac{m}{V} = \frac{5}{10^{-6}}$

$= 5 \times 10^6\text{Am}^{-1}$

Magnetic induction, $B = \mu_0(M + H)$

$B = 4\pi \times 10^{-7}(5 \times 10^6 + 0.5 \times 10^4) = 6.28\ \text{T}$

Hence, the magnetic induction will be 6.28 T.

190 **(b)**

Given, $m = 8.0 \times 10^{22}\text{Am}^2$ and $R = 6400\ \text{km}$

Magnetisation, $M = \frac{m_{\text{ret}}}{V} = \frac{8.0 \times 10^{22}}{(4/3)\pi R^3}$ $\left(\because V = \frac{4}{3}\pi R^3\right)$

$= \frac{8.0 \times 10^{22}}{(4/3)(3.14)(6.4 \times 10^5)^3} = 73\text{Am}^{-1}$

Hence, the earth's magnetisation is 73Am^{-1}.

192 **(d)**

Given, $I = 5\text{ cm} = 5 \times 10^{-2}\text{ m}$,
$A = 2\text{ cm}^2 = 2 \times 10^{-4}\text{ m}^2$ and $M = 1\text{Am}^2$
The magnetisation of the bar magnet is given by

$$i = \frac{M}{V}$$

where, V = volume of bar magnet $= A \times i \Rightarrow i = \frac{M}{A \times I}$

Substituting given values, we get

$$i = \frac{1}{2 \times 10^{-4} \times 5 \times 10^{-2}}$$
$$= \frac{1}{10^{-5}} = 1 \times 10^5\text{ A/m}$$

194 **(b)**

If the bar magnet is cut into two equal parts then each part has a magnetic moment equal to M/2.

Therefore, magnetic induction at a point is also $\frac{B_1}{2}$

198 **(d)**

From the formula, the magnetic moment of a current carrying circular coil is given by

$$M = niA = ni\pi r^2$$

where, r is the radius of circular coil.
Therefore, magnetic moment is proportional to r^2.