10. The magnetism of magnet is due to **[JIPMER 1997]**

(a) The spin motion of electron
(b) Earth
(c) Pressure of big magnet inside the earth
(d) Cosmic rays

11. The pole strength of a bar magnet is 48 *ampere-metre* and the distance between its poles is 25 *cm*. The moment of the couple by which it can be placed at an angle of 30^o with the uniform magnetic intensity of flux density 0.15 *Newton* /*ampere-metre* will be

(a) 12 *Newton* × *metre* (b) 18 *Newton* × *metre*
(c) 0.9 *Newton* × *metre* (d) None of the above

12. The magnetic field at a point *x* on the axis of a small bar magnet is equal to the field at a point *y* on the equator of the same magnet. The ratio of the distances of *x* and *y* from the centre of the magnet is **[MP PMT 1990]**

(a) 2^{-3} (b) $2^{-1/3}$
(c) 2^3 (d) $2^{1/3}$

13. A magnet of magnetic moment 20 C.G.S. units is freely suspended in a uniform magnetic field of intensity 0.3 C.G.S. units. The amount of work done in deflecting it by an angle of 30^o in C.G.S. units is **[MP PET 1991]**

(a) 6 (b) $3\sqrt{3}$
(c) $3(2-\sqrt{3})$ (d) 3

14. A bar magnet having centre O has a length of 4 *cm*. Point P_1 is in the broad side-on and P_2 is in the end side-on position with $OP_1 = OP_2 = 10$ *metres*. The ratio of magnetic intensities *H* at P_1 and P_2 is **[MP PET 1990]**

(a) $H_1 : H_2 = 16 : 100$ (b) $H_1 : H_2 = 1 : 2$
(c) $H_1 : H_2 = 2 : 1$ (d) $H_1 : H_2 = 100 : 16$

15. The magnetic field due to a short magnet at a point on its axis at distance *X cm* from the middle point of the magnet is 200 *Gauss*. The magnetic field at a point on the neutral axis at a distance *X cm* from the middle of the magnet is

[CPMT 1971, 88; MP PET 1985]

(a) 100 *Gauss* (b) 400 *Gauss*
(c) 50 *Gauss* (d) 200 *Gauss*

16. Which of the following, the most suitable material for making permanent magnet is

(a) Steel (b) Soft iron
(c) Copper (d) Nickel

17. In the case of bar magnet, lines of magnetic induction

[CPMT 1975; CBSE PMT 1990]

(a) Start from the north pole and end at the south pole
(b) Run continuously through the bar and outside
(c) Emerge in circular paths from the middle of the bar
(d) Are produced only at the north pole like rays of light from a bulb

18. A sensitive magnetic instrument can be shielded very effectively from outside magnetic fields by placing it inside a box of

[CPMT 1974]

(a) Teak wood
(b) Plastic material
(c) Soft iron of high permeability
(d) A metal of high conductivity

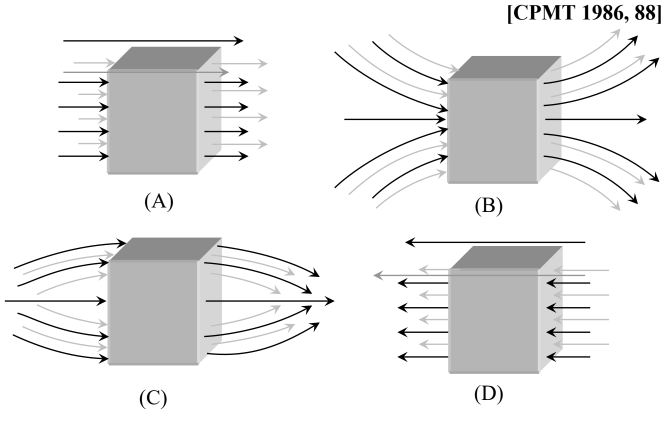
19. The field due to a magnet at a distance *R* from the centre of the magnet is proportional to

[MP PET 1996]

(a) R^2 (b) R^3
(c) $1/R^2$ (d) $1/R^3$

20. A uniform magnetic field, parallel to the plane of the paper existed in space 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

[CPMT 1986, 88]

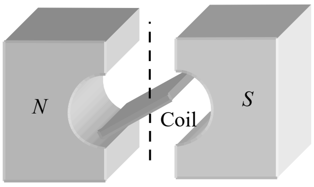


(a) Figure (A) (b) Figure (B)

(c) Figure (C) (d) Figure (D)

21. The figure below shows the north and south poles of a permanent magnet in which n turn coil of area of cross-section A is resting, such that for a current i passed through the coil, the plane of the coil makes an angle θ with respect to the direction of magnetic field B. If the plane of the magnetic field and the coil are horizontal and vertical respectively, the torque on the coil will be

[CPMT 1986, 88; DPMT 2002]



(a) $\tau = niAB\cos\theta$

(b) $\tau = niAB\sin\theta$

(c) $\tau = niAB$

(d) None of the above, since the magnetic field is radial

22. Points A and B are situated perpendicular to the axis of a 2cm 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 **[CPMT 1988]**

(a) 1 : 9 (b) 2 : 9

(c) 27 : 1 (d) 9 : 1

23. Two short magnets with their axes horizontal and perpendicular to the magnetic meridian are placed with their centres 40 cm east and 50 cm west of magnetic needle. If the needle remains undeflected, the ratio of their magnetic moments $M_1 : M_2$ is **[MP PET 1990]**

(a) 4 : 5 (b) 16 : 25

(c) 64 : 125 (d) $2 : \sqrt{5}$

24. If a bar magnet of magnetic moment M is freely suspended in a uniform magnetic field of strength B, the work done in rotating the magnet through an angle θ is

[AFMC 1997; MNR 1998; RPET 1999; MP PMT 1989, 96, 99; MP PET 1984, 89, 2000; UPSEAT 1999, 2000, 05]

(a) $MB(1-\sin\theta)$ (b) $MB\sin\theta$

(c) $MB\cos\theta$ (d) $MB(1-\cos\theta)$

25. Two small bar magnets are placed in a line with like poles facing each other at a certain distance d apart. If the length of each magnet is negligible as compared to d, the force between them will be inversely proportional to

[CPMT 1971; NCERT 1971; MP PMT 1992]

(a) d (b) d^2

(c) $\frac{1}{d^2}$ (d) d^4

26. A magnet of magnetic moment M is situated with its axis along the direction of a magnetic field of strength B. The work done in rotating it by an angle of 180° will be

[MP PMT 1985; MP PET 1997]

(a) $-MB$ (b) $+MB$

(c) 0 (d) $+2MB$

27. A long magnet is cut in two parts in such a way that the ratio of their lengths is 2 : 1. The ratio of pole strengths of both the section is

[CPMT 1986]

(a) Equal (b) In the ratio of 2 : 1

(c) In the ratio of 1 : 2 (d) In the ratio of 4 : 1

28. 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

[MP PMT 1993]

(a) $2\pi \times 10^{-7}\ N \times m$ (b) $2\pi \times 10^{-5}\ N \times m$

(c) $0.5\ N \times m$ (d) $0.5 \times 10^{2}\ N \times m$

($\mu_0 = 4\pi \times 10^{-7}$ *weber/ amp*$\times m$)

29. Magnetic field intensity is defined as **[MP PET 1993]**

(a) Magnetic moment per unit volume

(b) Magnetic induction force acting on a unit magnetic pole

(c) Number of lines of force crossing per unit area

(d) Number of lines of force crossing per unit volume

30. If the magnetic flux is expressed in *weber*, then magnetic induction can be expressed in

[CPMT 1974, 77, 83, 86, 87; MP PET 1989]

(a) *Weber/m*^{2} (b) *Weber/m*

(c) *Weber-m* (d) *Weber-m*^{2}

31. A magnetic needle is kept in a non-uniform magnetic field. It experiences **[MP PMT 1987; IIT 1982; Kerala PET 2002; AMU 1999; AIEEE 2005]**

(a) A force and a torque

(b) A force but not a torque

(c) A torque but not a force

(d) Neither a torque nor a force

32. The magnetic induction in air at a distance *d* from an isolated point pole of strength *m* unit will be **[MNR 1987; CPMT 1991; MP PET 1995; AMU 1999; J & K CET 2005]**

(a) $\frac{m}{d}$ (b) $\frac{m}{d^2}$

(c) md (d) md^2

33. A magnetic needle lying parallel to a magnetic field requires *W* units of work to turn it through 60°. The torque required to maintain the needle in this position will be **[KCET 1994; MNR 1991; MP PET 1996; [AIEEE 2003; UPSEAT 2000; BHU 2004; Pb PET 2004]**

(a) $\sqrt{3}\,W$ (b) *W*

(c) $\frac{\sqrt{3}}{2}W$ (d) 2*W*

34. A long magnetic needle of length 2*L*, magnetic moment *M* and pole strength *m* units is broken into two pieces at the middle. The magnetic moment and pole strength of each piece will be **[NCERT 1983; DPMT 1987]**

(a) $\frac{M}{2}, \frac{m}{2}$ (b) $M, \frac{m}{2}$

(c) $\frac{M}{2}, m$ (d) M, m

35. Two identical thin bar magnets each of length *l* and pole strength *m* are placed at right angle to each other with north pole of one touching south pole of the other. Magnetic moment of the system is **[MNR 1981; MP PET 2002]**

(a) *ml* (b) 2*ml*

(c) $\sqrt{2}ml$ (d) $\frac{1}{2}ml$

36. Magnetic induction is a **[AFMC 1986]**

(a) Scalar quantity (b) Vector quantity

(c) Both (a) and (b) (d) None of the above

37. What happens to the force between magnetic poles when their pole strength and the distance between them are both doubled **[CPMT 1978, 80, 84, 85; MP PET 2005]**

(a) Force increases to two times the previous value

(b) No change

(c) Force decreases to half the previous value

(d) Force increases to four times the previous value

38. Force between two unit pole strength placed at a distance of one metre is **[CPMT 1987]**

(a) 1 *N* (b) $\frac{10^{-7}}{4\pi}N$

(c) $10^{-7}\,N$ (d) $4\pi\times10^{-7}\,N$

39. A small bar magnet of moment *M* is placed in a uniform field *H*. If magnet makes an angle of 30° with field, the torque acting on the magnet is **[CPMT 1989]**

(a) *MH* (b) $\frac{MH}{2}$

(c) $\frac{MH}{3}$ (d) $\frac{MH}{4}$

40. If a hole is made at the centre of a bar magnet, then its magnetic moment will

(a) Increase (b) Decrease

(c) Not change (d) None of these

41. The small magnets each of magnetic moment 10 *A-m*^{2} are placed end-on position 0.1*m* apart from their centres. The force acting between them is **[MNR 1994]**

(a) $0.6\times10^{7}\,N$ (b) $0.06\times10^{7}\,N$

(c) $0.6\,N$ (d) $0.06\,N$

42. Magnetic lines of force **[MP PET 1994]**

(a) Always intersect

(b) Are always closed

(c) Tend to crowd far away from the poles of magnet

(d) Do not pass through vacuum

43. Rate of change of torque τ with deflection θ is maximum for a magnet suspended freely in a uniform magnetic field of induction B, when

[MP PET 1994]

(a) $\theta = 0°$ (b) $\theta = 45°$

(c) $\theta = 60°$ (d) $\theta = 90°$

44. A magnet of magnetic moment M is rotated through 360° in a magnetic field H, the work done will be

[KCET 1998; MP PMT 1994; Roorkee 2000]

(a) MH (b) $2MH$

(c) $2\pi MH$ (d) Zero

45. The direction of line of magnetic field of bar magnet is

[AFMC 1995]

(a) From south pole to north pole

(b) From north pole to south pole

(c) Across the bar magnet

(d) From south pole to north pole inside the magnet and from north pole to south pole outside the magnet

46. The work done in turning a magnet of magnetic moment 'M' by an angle of 90° from the meridian is 'n' times the corresponding work done to turn it through an angle of 60°, where 'n' is given by [CBSE PMT 1995; MP PET 2003]

(a) 1/2 (b) 2

(c) 1/4 (d) 1

47. Force between two identical bar magnets whose centres are r *metre* apart is 4.8 N, when their axes are in the same line. If separation is increased to $2r$, the force between them is reduced to [AIIMS 1995]

(a) 2.4N (b) 1.2N

(c) 0.6N (d) 0.3N

48. A bar magnet of magnetic moment $10^4 J/T$ is free to rotate in a horizontal plane. The work done in rotating the magnet slowly from a direction parallel to a horizontal magnetic field of 4×10^{-5} T to a direction 60° from the field will be

[MP PET 1995]

(a) 0.2 J (b) 2.0 J

(c) 4.18 J (d) 2×10^2 J

49. Magnetic lines of force due to a bar magnet do not intersect because [MP PMT 1995]

(a) A point always has a single net magnetic field

(b) The lines have similar charges and so repel each other

(c) The lines always diverge from a single point

(d) The lines need magnetic lenses to be made to intersect

50. The unit of magnetic moment is

[MP PET 1996; AMU 2000; MP PMT 1995, 2002]

(a) Wb/m (b) $Wb.m^2$

(c) $A.m$ (d) $A.m^2$

51. The dipole moment of a short bar magnet is 1.25 A-m^2. The magnetic field on its axis at a distance of 0.5*metre* from the centre of the magnet is

(a) 1.0×10^{-4} *Newton/ amp– meter*

(b) 4×10^{-2} *Newton/ amp– metre*

(c) 2×10^{-6} *Newton/ amp– metre*

(d) 6.64×10^{-8} *Newton/ amp– metre*

52. A permanent magnet [MP PET 1996]

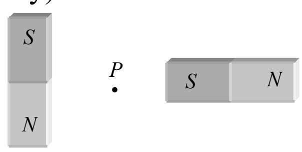
(a) Attracts all substances

(b) Attracts only magnetic substances

(c) Attracts magnetic substances and repels all non-magnetic substances

(d) Attracts non-magnetic substances and repels magnetic substances

53. Two equal bar magnets are kept as shown in the figure. The direction of resultant magnetic field, indicated by arrow head at the point P is (approximately)



(a) → (b) ↗

(c) ↘ (d) ↑

54. The S.I. unit of magnetic permeability is [MP PET 1997]

(a) Am^{-1}

(b) Am

(c) $Henry\, m^{-1}$

(d) No unit, it is a dimensionless number

55. A short bar magnet placed with its axis at 30° with a uniform external magnetic field of 0.16 *Tesla* experiences a torque of magnitude 0.032 *Joule*. The magnetic moment of the bar magnet will be **[MP PMT 1997; UPSEAT 2004]**

(a) 0.23 *Joule/Tesla* (b) 0.40 *Joule/Tesla*

(c) 0.80*Joule/Tesla* (d) Zero

56. The magnetic field to a small magnetic dipole of magnetic moment *M*, at distance *r* from the centre on the equatorial line is given by (in M.K.S. system) **[MP PMT/PET 1998]**

(a) $\frac{\mu_0}{4\pi} \times \frac{M}{r^2}$ (b) $\frac{\mu_0}{4\pi} \times \frac{M}{r^3}$

(c) $\frac{\mu_0}{4\pi} \times \frac{2M}{r^2}$ (d) $\frac{\mu_0}{4\pi} \times \frac{2M}{r^3}$

57. The incorrect statement regarding the lines of force of the magnetic field *B* is **[MP PET 1999]**

(a) Magnetic intensity is a measure of lines of force passing through unit area held normal to it

(b) Magnetic lines of force form a close curve

(c) Inside a magnet, its magnetic lines of force move from north pole of a magnet towards its south pole

(d) Due to a magnet magnetic lines of force never cut each other

58. A straight wire carrying current *i* is turned into a circular loop. If the magnitude of magnetic moment associated with it in M.K.S. unit is *M*, the length of wire will be **[MP PET 1999]**

(a) $4\pi iM$ (b) $\sqrt{\frac{4\pi M}{i}}$

(c) $\sqrt{\frac{4\pi i}{M}}$ (d) $\frac{M\pi}{4i}$

59. A bar magnet of magnetic moment $\vec{M}$ is placed in a magnetic field of induction $\vec{B}$. The torque exerted on it is **[EAMCET (Engg.) 1995; CBSE PMT 1999; BHU 2003; CPMT 2004; MP PMT 2001, 05]**

(a) $\vec{M}.\vec{B}$ (b) $-\vec{M}.\vec{B}$

(c) $\vec{M}\times\vec{B}$ (d) $\vec{B}\times\vec{M}$

60. For protecting a sensitive equipment from the external magnetic field, it should be **[KCET 1993; CBSE PMT 1998]**

(a) Placed inside an aluminium cane

(b) Placed inside an iron cane

(c) Wrapped with insulation around it when passing current through it

(d) Surrounded with fine copper sheet

61. If a piece of metal was thought to be magnet, which one of the following observations would offer conclusive evidence **[KCET 1994]**

(a) It attracts a known magnet

(b) It repels a known magnet

(c) Neither (a) nor (b)

(d) It attracts a steel screw driver

62. The magnet can be completely demagnetized by **[KCET 1994]**

(a) Breaking the magnet into small pieces

(b) Heating it slightly

(c) Droping it into ice cold water

(d) A reverse field of appropriate strength

63. A current loop placed in a magnetic field behaves like a **[AFMC 1994]**

(a) Magnetic dipole (b) Magnetic substance

(c) Magnetic pole (d) All are true

64. A magnet when placed perpendicular to a uniform field of strength $10^{-4}\, Wb/m^2$ experiences a maximum couple of moment $4\times10^{-5}\, N/m$. What is its magnetic moment **[Bihar MEE 1995]**

(a) $0.4\, A\times m^2$ (b) $0.2\, A\times m^2$

(c) $0.16\, A\times m^2$ (d) $0.04\, A\times m^2$

(e) $0.06\, A\times m^2$

65. *Weber/m*^{2} is equal to **[CPMT 1985; AFMC 1997]**

(a) *Volt* (b) *Henry*
(c) *Tesla* (d) All of these

66. Two magnets, each of magnetic moment '*M*' are placed so as to form a cross at right angles to each other. The magnetic moment of the system will be

[AFMC 1999; Pb PET 2001]

(a) 2 *M* (b) $\sqrt{2}\, M$
(c) 0.5 *M* (d) *M*

67. Two like magnetic poles of strength 10 and 40 SI units are separated by a distance 30 *cm*. The intensity of magnetic field is zero on the line joining them **[JIPMER 1999]**

(a) At a point 10 *cm* from the stronger pole
(b) At a point 20 *cm* from the stronger pole
(c) At the mid-point
(d) At infinity

68. If a magnet of length 10 *cm* and pole strength 40 *A-m* is placed at an angle of 45° in an uniform induction field of intensity 2×10^{-4} *T*, the couple acting on it is

[Pb. PMT 1999; MH CET (Med.) 1999]

(a) 0.5656×10^{-4} *N-m* (b) 0.5656×10^{-3} *N-m*
(c) 0.656×10^{-4} *N-m* (d) 0.656×10^{-5} *N-m*

69. The intensity of magnetic field is *H* and moment of magnet is *M*. The maximum potential energy is

[Pb. PMT 1999; MH CET (Med.) 1999]

(a) *MH* (b) 2 *MH*
(c) 3 *MH* (d) 4 *MH*

70. A bar magnet of magnetic moment 200 $A\text{-}m^2$ is suspended in a magnetic field of intensity 0.25 *N/A-m*. The couple required to deflect it through 30° is

[AFMC 1999; Pb. PET 2000]

(a) 50 *N-m* (b) 25 *N-m*
(c) 20 *N-m* (d) 15 *N-m*

71. Two similar bar magnets *P* and *Q*, each of magnetic moment *M*, are taken, If *P* is cut along its axial line and *Q* is cut along its equatorial line, all the four pieces obtained have **[EAMCET (Engg.) 2000]**

(a) Equal pole strength (b) Magnetic moment $\frac{M}{4}$
(c) Magnetic moment $\frac{M}{2}$ (d) Magnetic moment *M*

72. A magnet of magnetic moment $50\hat{i}\ A\text{-}m^2$ is placed along the *x*-axis in a magnetic field $\vec{B} = (0.5\hat{i} + 3.0\hat{j})\ T$. The torque acting on the magnet is

[MP PMT 2000]

(a) $175\ \hat{k}\ N\text{-}m$ (b) $150\ \hat{k}\ N\text{-}m$
(c) $75\ \hat{k}\ N\text{-}m$ (d) $25\sqrt{37}\ \hat{k}\ N\text{-}m$

73. 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

[CBSE PMT 2000]

(a) 30° (b) 45°
(c) 60° (d) 90°

74. There is no couple acting when two bar magnets are placed coaxially separated by a distance because

[EAMCET (Engg.) 2000]

(a) There are no forces on the poles
(b) The forces are parallel and their lines of action do not coincide
(c) The forces are perpendicular to each other
(d) The forces act along the same line

75. A bar magnet of magnetic moment 3.0 $A\text{-}m^2$ is placed in a uniform magnetic induction field of 2×10^{-5} *T*. If each pole of the magnet experiences a force of 6×10^{-4} *N*, the length of the magnet is **[EAMCET (Med.) 2000]**

(a) 0.5 *m* (b) 0.3 *m*
(c) 0.2 *m* (d) 0.1 *m*

76. A bar magnet when placed at an angle of 30° to the direction of magnetic field induction of 5×10^{-2} *T*, experiences a moment of couple 25×10^{-6} *N-m*. If the length of the magnet is 5 *cm* its pole strength is

[EAMCET (Med.) 2000]

(a) 2×10^{-2} *A-m* (b) 5×10^{-2} *A-m*
(c) 2 *A-m* (d) 5 *A-m*

77. Two lines of force due to a bar magnet **[MP PMT 2002]**

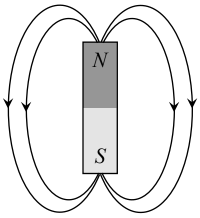
(a) Intersect at the neutral point
(b) Intersect near the poles of the magnet
(c) Intersect on the equatorial axis of the magnet
(d) Do not intersect at all

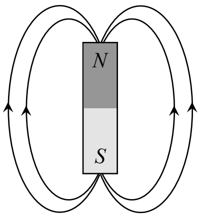
78. The ultimate individual unit of magnetism in any magnet is called **[MP PET 2002; J & K CET 2004]**

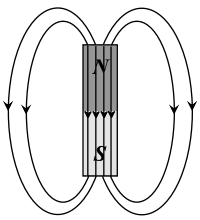
(a) North pole (b) South pole

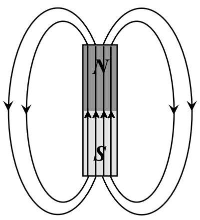
(c) Dipole (d) Quadrupole

79. The magnetic field lines due to a bar magnet are correctly shown in **[IIT-JEE (Screening) 2002]**

(a) 

(b) 

(c) 

(d) 

80. The magnetic lines of force inside a bar magnet **[AIEEE 2003]**

(a) Are from south-pole to north-pole of the magnet

(b) Are from north-pole to south-pole of the magnet

(c) Do not exist

(d) Depend upon the area of cross-section of the bar magnet

81. If a magnet is hanged with its magnetic axis then it stops in **[AFMC 2003]**

(a) Magnetic meridian (b) Geometric meridian

(c) Angle of dip (d) None of these

82. The work done in rotating a magnet of magnetic moment 2 $A\text{-}m^2$ in a magnetic field of 5×10^{-3} T from the direction along the magnetic field to opposite direction to the magnetic field, is **[MP PET 2003]**

(a) Zero (b) 2×10^{-2} J

(c) 10^{-2} J (d) 10 J

83. The torque on a bar magnet due to the earth's magnetic field is maximum when the axis of the magnet is **[MP PMT 2004]**

(a) Perpendicular to the field of the earth

(b) Parallel to the vertical component of the earth's field

(c) At an angle of 33° with respect to the N-S direction

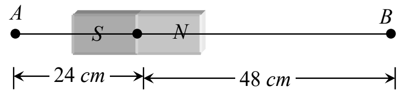
(d) Along the North-South (N-S) direction

84. Magnetic dipole moment is a **[AFMC 2004]**

(a) Scalar quantity (b) Vector quantity

(c) Constant quantity (d) None of these

85. 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 **[DPMT 2004]**



(a) 8 (b) $1/2\sqrt{2}$

(c) 3 (d) 4

86. A magnet of magnetic moment $2\,JT^{-1}$ is aligned in the direction of magnetic field of 0.1 T. What is the net work done to bring the magnet normal to the magnetic field **[DCE 2004]**

(a) 0.1 J (b) 0.2 J

(c) 1 J (d) 2 J

87. The magnetic moment of a magnet of length 10 *cm* and pole strength 4.0 *Am* will be **[DPMT 2003]**

(a) 0.4 Am^2 (b) 1.6 Am^2

(c) 20 Am^2 (d) 8.0 Am^2

88. The effective length of a magnet is 31.4 *cm* and its pole strength is 0.5 *Am*. The magnetic moment, if it is bent in the form of a semicircle will be **[DPMT 2003]**

(a) 0.1 Am^2 (b) 0.01 Am^2

(c) 0.2 Am^2 (d) 1.2 Am^2

89. The magnetic potential at a point on the axial line of a bar magnet of dipole moment M is V. What is the magnetic potential due to a bar magnet of dipole moment $\frac{M}{4}$ at the same point

[MH CET 2004]

(a) $4V$ (b) $2V$

(c) $\frac{V}{2}$ (d) $\frac{V}{4}$

90. A small bar magnet has a magnetic moment 1.2 $A\text{-}m^2$. The magnetic field at a distance 0.1 m on its axis will be : ($\mu_0 = 4\pi \times 10^{-7}$ $T\text{-}m/A$)

[BHU 2003]

(a) 1.2×10^{-4} T (b) 2.4×10^{-4} T

(c) 2.4×10^{4} T (d) 1.2×10^{4} T

91. Two identical short bar magnets, each having magnetic moment of 10 Am^2, are arranged such that their axial lines are perpendicular to each other and their centres be along the same straight line in a horizontal plane. If the distance between their centres is 0.2 m, the resultant magnetic induction at a point midway between them is

$(\mu_0 = 4\pi \times 10^{-7}\ Hm^{-1})$ **[EAMCET 2005]**

(a) $\sqrt{2} \times 10^{-7}$ *Tesla* (b) $\sqrt{5} \times 10^{-7}$ *Tesla*

(c) $\sqrt{2} \times 10^{-3}$ *Tesla* (d) $\sqrt{5} \times 10^{-3}$ *Tesla*

92. A magnet of length 0.1 m and pole strength 10^{-4} $A.m.$ is kept in a magnetic field of $30\ Wb/m^2$ at an angle 30°. The couple acting on it is ……… $\times 10^{-4}$ $Nm.$ **[MP PET 2005]**

(a) 7.5 (b) 3.0

(c) 1.5 (d) 6.0

Earth Magnetism

1. A very small magnet is placed in the magnetic meridian with its south pole pointing north. The null point is obtained 20 cm away from the centre of the magnet. If the earth's magnetic field (horizontal component) at this point be 0.3 *gauss*, the magnetic moment of the magnet is

[CPMT 1987; MNR 1978]

(a) 8.0×10^2 $e.m.u.$ (b) 1.2×10^3 $e.m.u.$

(c) 2.4×10^3 $e.m.u.$ (d) 3.6×10^3 $e.m.u.$

2. Intensity of magnetic field due to earth at a point inside a hollow steel box is

[MP PET 1995]

(a) Less than outside (b) More than outside

(c) Same (d) Zero

3. Earth's magnetic field always has a horizontal component except at or Horizontal component of earth's magnetic field remains zero at

[CPMT 1971, 81, 83]

(a) Equator (b) Magnetic poles

(c) A latitude of 60° (d) An altitude of 60°

4. A dip needle in a plane perpendicular to magnetic meridian will remain **[NCERT 1975; MP PMT 1984; MP PET 1995]**

(a) Vertical

(b) Horizontal

(c) In any direction

(d) At an angle of dip to the horizontal

5. At magnetic poles of earth, angle of dip is

[CPMT 1977, 91; NCERT 1981; MP PET 1997; Pb PET 2002]

(a) Zero (b) 45°

(c) 90° (d) 180°

6. The correct relation is

[CPMT 1986; MP PET 1981; AFMC 1996]

(a) $B = \frac{B_V}{B_H}$ (b) $B = B_V \times B_H$

(c) $|B| = \sqrt{B_H^2 + B_V^2}$ (d) $B = B_H + B_V$

(Where B_H = Horizontal component of earth's magnetic field; B_V = Vertical component of earth's magnetic field and B = Total intensity of earth's magnetic field)

7. At a certain place, the horizontal component of earth's magnetic field is $\sqrt{3}$ times the vertical component. The angle of dip at that place is **[MP PMT 1984, 85; AFMC 2000]**

(a) 60° (b) 45°

(c) 90° (d) 30°

8. The vertical component of earth's magnetic field is zero at or The earth's magnetic field always has a vertical component except at the [NCERT 1980, 88; CPMT 1983; MP PMT 1996]

(a) Magnetic poles (b) Geographical poles

(c) Every place (d) Magnetic equator

9. The angle between the magnetic meridian and geographical meridian is called

[MNR 1990; UPSEAT 1999, 2000; MP PMT 2000]

(a) Angle of dip (b) Angle of declination

(c) Magnetic moment (d) Power of magnetic field

10. The lines of forces due to earth's horizontal component of magnetic field are [CPMT 1985; MP PMT 1980; AIIMS 1998]

(a) Parallel straight lines (b)Concentric circles

(c) Elliptical (d) Parabolic

11. At a place, if the earth's horizontal and vertical components of magnetic fields are equal, then the angle of dip will be

[SCRA 1994; DCE 2001; MP PMT 2002]

(a) 30° (b) 90°

(c) 45° (d) 0°

12. If the angles of dip at two places are 30^o and 45^o respectively, then the ratio of horizontal components of earth's magnetic field at the two places will be [MP PET 1989]

(a) $\sqrt{3}:\sqrt{2}$ (b) $1:\sqrt{2}$

(c) $1:\sqrt{3}$ (d) $1:2$

13. At a place the earth's horizontal component of magnetic field is $0.36\times10^{-4}\ weber/m^2$. If the angle of dip at that place is 60^o, then the vertical component of earth's field at that place in $weber/m^2$ will be approximately [MP PMT 1985]

(a) 0.12×10^{-4} (b) 0.24×10^{-4}

(c) 0.40×10^{-4} (d) 0.62×10^{-4}

14. The angle of dip at a place is 40.6^o and the intensity of the vertical component of the earth's magnetic field $V=6\times10^{-5}\ Tesla$. The total intensity of the earth's magnetic field (I) at this place is [MP PMT 1993]

(a) 7×10^{-5} *tesla* (b) 6×10^{-5} *tesla*

(c) 5×10^{-5} *tesla* (d) 9.2×10^{-5} *tesla*

15. The angle of dip is the angle [CPMT 1978]

(a) Between the vertical component of earth's magnetic field and magnetic meridian

(b) Between the vertical component of earth's magnetic field and geographical meridian

(c) Between the earth's magnetic field direction and horizontal direction

(d) Between the magnetic meridian and the geographical meridian

16. At a certain place the angle of dip is 30° and the horizontal component of earth's magnetic field is 0.50 *Oersted*. The earth's total magnetic field is [CPMT 1990]

(a) $\sqrt{3}$ (b) 1

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

17. The angle of dip at the magnetic equator is [MP PET 1984; MP PMT 1987; CBSE PMT 1989, 90; MP Board 1980; CPMT 1977, 87, 90; Manipal MEE 1995]

(a) 0° (b) 45°

(c) 30° (d) 90°

18. The line on the earth's surface joining the points where the field is horizontal is [MNR 1985; UPSEAT 1999; Pb PET 2004]

(a) Magnetic meridian (b) Magnetic axis

(c) Magnetic line (d) Magnetic equator

(e) Isogonic line

19. The angle between the earth's magnetic and the earth's geographical axes is [MNR 1979]

(a) Zero (b) 17°

(c) 23° (d) None of these

20. The lines joining the places of the same horizontal intensity are known as [MNR 1984]

(a) Isogonic lines (b) Aclinic lines

(c) Isoclinic lines (d) Agonic lines

(e) Isodynamic lines

21. Ratio between total intensity of magnetic field at equator to poles is **[IIT 1970; CPMT 1981]**

(a) 1 : 1 (b) 1 : 2

(c) 2 : 1 (d) 1 : 4

22. A line passing through places having zero value of magnetic dip is called **[CPMT 1987]**

(a) Isoclinic line (b) Agonic line

(c) Isogonic line (d) Aclinic line

23. At a place, the horizontal and vertical intensities of earth's magnetic field is 0.30 *Gauss* and 0.173 *Gauss* respectively. The angle of dip at this place is **[MP PMT 1986]**

(a) 30° (b) 90°

(c) 60° (d) 45°

24. The angle of dip at a place is 60°. At this place the total intensity of earth's magnetic field is 0.64 units. The horizontal intensity of earth's magnetic field at this place is **[MP PET 1984]**

(a) 1.28 units (b) 0.64 units

(c) 0.16 units (d) 0.32 units

25. The magnetic compass is not useful for navigation near the magnetic poles because **[BIT Ranchi 1982]**

(a) The magnetic field near the poles is zero

(b) The magnetic field near the poles is almost vertical

(c) At low temperature, the compass needle looses its magnetic properties

(d) Neither of the above

26. The angle of dip at a place on the earth gives **[MP PET 1994]**

(a) The horizontal component of the earth's magnetic field

(b) The location of the geographic meridian

(c) The vertical component of the earth's field

(d) The direction of the earth's magnetic field

27. At the magnetic north pole of the earth, the value of horizontal component of earth's magnetic field and angle of dip are, respectively **[MP PMT 1994]**

(a) Zero, maximum (b) Maximum, minimum

(c) Maximum, maximum (d)Minimum, minimum

28. At a place, the magnitudes of the horizontal component and total intensity of the magnetic field of the earth are 0.3 and 0.6 *Oersted* respectively. The value of the angle of dip at this place will be **[MP PMT 1994]**

(a) 60° (b) 45°

(c) 30° (d) 0°

29. A dip circle is at right angle to the magnetic meridian. What will be the apparent dip **[AFMC 1995]**

(a) 0° (b) 30°

(c) 60º (d) 90°

30. A bar magnet is placed north-south with its north pole due north. The points of zero magnetic field will be in which direction from the centre of the magnet **[MNR 1995; MP PMT 1995; UPSEAT 2000]**

(a) North and south

(b) East and west

(c) North-east and south-west

(d) North-west and south-east

31. In two separate experiments the neutral points due to two small magnets are at a distance of r and $2r$ in broad side-on position. The ratio of their magnetic moments will be **[MP PMT 1985]**

(a) 4 : 1 (b) 1 : 2

(c) 2 : 1 (d) 1 : 8

32. The magnetic field due to the earth is closely equivalent to that due to **[BIT Ranchi 1982]**

(a) A large magnet of length equal to the diameter of the earth

(b) A magnetic dipole placed at the centre of the earth

(c) A large coil carrying current

(d) Neither of the above

33. The earth's magnetic field at a certain place has a horizontal component 0.3 *Gauss* and the total strength 0.5 *Gauss*. The angle of dip is **[MP PMT 1995]**

(a) $\tan^{-1}\frac{3}{4}$ (b) $\sin^{-1}\frac{3}{4}$

(c) $\tan^{-1}\frac{4}{3}$ (d) $\sin^{-1}\frac{3}{5}$

34. The value of the horizontal component of the earth's magnetic field and angle of dip are $1.8\times10^{-5}\ Weber/m^2$ and 30° respectively at some place. The total intensity of earth's magnetic field at that place will be **[MP PET 1996]**

(a) $2.08\times10^{-5}\ Weber/m^2$ (b) $3.67\times10^{-5}\ Weber/m^2$

(c) $3.18\times10^{-5}\ Weber/m^2$ (d) $5.0\times10^{-5}\ Weber/m^2$

35. When the *N*-pole of a bar magnet points towards the south and *S*-pole towards the north, the null points are at the **[MP PMT 1996]**

(a) Magnetic axis

(b) Magnetic centre

(c) Perpendicular divider of magnetic axis

(d) *N* and *S* poles

36. Lines which represent places of constant angle of dip are called

(a) Isobaric lines (b) Isogonic lines

(c) Isoclinic lines (d) Isodynamic lines

37. The vertical component of the earth's magnetic field is zero at a place where the angle of dip is **[MP PMT/PET 1998]**

(a) 0° (b) 45°

(c) 60° (d) 90°

38. At a certain place, the horizontal component B_0 and the vertical component V_0 of the earth's magnetic field are equal in magnitude. The total intensity at the place will be **[MP PMT 1999, 2003]**

(a) B_0 (b) B_0^2

(c) $2B_0$ (d) $\sqrt{2}B_0$

39. A compass needle will show which one of the following directions at the earth's magnetic pole **[KCET 1993, 94]**

(a) Vertical (b) No particular direction

(c) Bent at 45° to the vertical (d) Horizontal

40. The north pole of the earth's magnet is near the geographical **[KCET 1994]**

(a) South (b) East

(c) West (d) North

41. The magnetic field of earth is due to **[JIPMER 1997]**

(a) Motion and distribution of some material in and outside the earth

(b) Interaction of cosmic rays with the current of earth

(c) A magnetic dipole buried at the centre of the earth

(d) Induction effect of the sun

42. A short magnet of moment 6.75 Am^2 produces a neutral point on its axis. If horizontal component of earth's magnetic field is $5\times10^{-5}\ Wb/m^2$, then the distance of the neutral point should be **[SCRA 1994]**

(a) 10 *cm* (b) 20 *cm*

(c) 30 *cm* (d) 40 *cm*

43. Due to the earth's magnetic field, charged cosmic ray particles **[CBSE PMT 1997]**

(a) Require greater kinetic energy to reach the equator than the poles

(b) Require less kinetic energy to reach the equator than the poles

(c) Can never reach the equator

(d) Can never reach the poles

44. Two bar magnets with magnetic moments 2 *M* and *M* are fastened together at right angles to each other at their centres to form a crossed system, which can rotate freely about a vertical axis through the centre. The crossed system sets in earth's magnetic field with magnet having magnetic moment 2*M* making and angle θ with the magnetic meridian such that

(a) $\theta = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (b) $\theta = \tan^{-1}(\sqrt{3})$

(c) $\theta = \tan^{-1}\left(\frac{1}{2}\right)$ (d) $\theta = \tan^{-1}\left(\frac{3}{4}\right)$

45. Angle of dip is 90° at **[AIIMS 1999]**

(a) Poles (b) Equator

(c) Both (a) and (b) (d) None of these

46. At a certain place the horizontal component of the earth's magnetic field is B_0 and the angle of dip is 45°. The total intensity of the field at that place will be

[MP PET 2000; Pb PET 2003]

(a) B_0 (b) $\sqrt{2}\,B_0$

(c) 2 B_0 (d) B_0^2

47. The value of angle of dip is zero at the magnetic equator because on it

(a) V and H are equal

(b) The value of V and H is zero

(c) The value of V is zero

(d) The value of H is zero

48. Which of the following relation is correct in magnetism

[KCET (Engg./Med.) 2001]

(a) $I^2 = V^2 + H^2$ (b) $I = V + H$

(c) $V = I^2 + H^2$ (d) $V^2 = I + H$

49. The direction of the null points is on the equatorial line of a bar magnet, when the north pole of the magnet is pointing

[AFMC 1999; Pb. PMT 2000; CPMT 2001; MH CET 2003]

(a) North (b) South

(c) East (d) West

50. Magnetic meridian is a **[Orissa JEE 2002]**

(a) Point (b) Horizontal plane

(c) Vertical plane (d) Line along N-S

51. The angle of dip at a certain place is 30°. If the horizontal component of the earth's magnetic field is H, the intensity of the total magnetic field is

[UPSEAT 1993, 2000; MP PMT 2002]

(a) $\frac{H}{2}$ (b) $\frac{2H}{\sqrt{3}}$

(c) $H\sqrt{2}$ (d) $H\sqrt{3}$

52. The horizontal component of the earth's magnetic field is 0.22 *Gauss* and total magnetic field is 0.4 *Gauss*. The angle of dip. is

[MP PMT 2004]

(a) $\tan^{-1}(1)$ (b) $\tan^{-1}(\infty)$

(c) $\tan^{-1}(1.518)$ (d) $\tan^{-1}(\pi)$

53. A bar magnet is situated on a table along east-west direction in the magnetic field of earth. The number of neutral points, where the magnetic field is zero, are **[MP PMT 2004]**

(a) 2 (b) 0

(c) 1 (d) 4

54. At which place, earth's magnetism become horizontal

[AFMC 2004]

(a) Magnetic pole **[MP PET 2001]** (b) Geographical pole

(c) Magnetic meridian (d) Magnetic equator

55. Isogonic lines on magnetic map will have **[AFMC 2004]**

(a) Zero angle of dip

(b) Zero angle of declination

(c) Same angle of declination

(d) Same angle of dip

56. A current carrying coil is placed with its axis perpendicular to N-S direction. Let horizontal component of earth's magnetic field be H_o and magnetic field inside the loop is H. If a magnet is suspended inside the loop, it makes angle θ with H. Then $\theta =$ **[Orissa PMT 2004]**

(a) $\tan^{-1}\left(\frac{H_0}{H}\right)$ (b) $\tan^{-1}\left(\frac{H}{H_0}\right)$

(c) $\operatorname{cosec}^{-1}\left(\frac{H}{H_0}\right)$ (d) $\cot^{-1}\left(\frac{H_0}{H}\right)$

57. Let V and H be the vertical and horizontal components of earth's magnetic field at any point on earth. Near the north pole

[UPSEAT 2004]

(a) $V >> H$ (b) $V << H$

(c) $V = H$ (d) $V = H = 0$

58. At the magnetic poles of the earth, a compass needle will be

[DCE 2003]

(a) Vertical

(b) Bent slightly

(c) Horizontal

(d) Inclined at 45° to the horizontal

59. If magnetic lines of force are drawn by keeping magnet vertical, then number of neutral points will be

[MP PMT 1985; CPMT 1985]

(a) One (b) Two

(c) Four (d) Five

Magnetic Equipments

1. Time period of a freely suspended magnet does not depend upon **[NCERT 1980; CPMT 1980; MP PET 1997]**

(a) Length of the magnet

(b) Pole strength of the magnet

(c) Horizontal component of earth's magnetic field

(d) Length of the suspension thread

2. Magnetic moments of two bar magnets may be compared with the help of **[MP PET/PMT 1988]**

(a) Deflection magnetometer

(b) Vibration magnetometer

(c) Both of the above

(d) None of the above

3. The time period of oscillation of a freely suspended bar magnet with usual notations is given by

[CPMT 1973, 76, 87; MP PET 1994, 96]

(a) $T = 2\pi\sqrt{\frac{I}{MB_H}}$ (b) $T = 2\pi\sqrt{\frac{MB_H}{I}}$

(c) $T = \sqrt{\frac{I}{MB_H}}$ (d) $T = 2\pi\sqrt{\frac{B_H}{MI}}$

4. In sum and difference method in vibration magnetometer, the time period is more if

[MP PMT 1989; MP PET/PMT 1988]

(a) Similar poles of both magnets are on same sides

(b) Opposite poles of both magnets are on same sides

(c) Both magnets are perpendicular to each other

(d) Nothing can be said

5. At a certain place a magnet makes 30 oscillations per minute. At another place where the magnetic field is double, its time period will be

[MP PMT 1989; MP PET/PMT 1988]

(a) 4 *sec* (b) 2 *sec*

(c) $\frac{1}{2}$ sec (d) $\sqrt{2}$ sec

6. Vibration magnetometer is used for comparing

[MP PET/PMT 1988]

(a) Magnetic fields (b) Earth's field

(c) Magnetic moments (d) All of the above

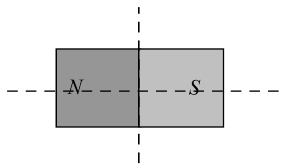
7. Two magnets of same size and mass make respectively 10 and 15 *oscillations per minute* at certain place. The ratio of their magnetic moments is

[Bihar PET 1984; MP PET/PMT 1988; MP PET 1992]

(a) 4 : 9 (b) 9 : 4

(c) 2 : 3 (d) 3 : 2

8. Time period for a magnet is *T*. If it is divided in four equal parts along its axis and perpendicular to its axis as shown then time period for each part will be



(a) $4T$ (b) $T/4$

(c) $T/2$ (d) T

9. Keeping dissimilar poles of two magnets of equal pole strength and length same side, their time period will be

[DPMT 2001]

(a) Zero (b) One second

(c) Infinity (d) Any value

10. Time period in vibration magnetometer will be infinity at

(a) Magnetic equator (b) Magnetic poles

(c) Equator (d) At all places

11. Twists of suspension fibre should be removed in vibration magnetometer so that

(a) Time period be less

(b) Time period be more

(c) Magnet may vibrate freely

(d) Cannot be said with certainty

12. The period of oscillation of a magnet in vibration magnetometer is 2 sec. The period of oscillation of a magnet whose magnetic moment is four times that of the first magnet is

[CPMT 1975, 77, 79, 89, 90; MP PMT 1986]

(a) 1 *sec* (b) 4 *sec*

(c) 8 *sec* (d) 0.5 *sec*

13. Moment of inertia of a magnetic needle is 40 *gm-cm*^{2} has time period 3 *seconds* in earth's horizontal field = 3.6×10^{-5} *weber/m*^{2}. Its magnetic moment will be

(a) $0.5\, A \times m^2$ (b) $5\, A \times m^2$

(c) $0.250\, A \times m^2$ (d) $5 \times 10^2\, A \times m^2$

14. Vibration magnetometer before use, should be set

(a) In magnetic meridian

(b) In geographical meridian

(c) Perpendicular to magnetic meridian

(d) In any position

15. If a brass bar is placed on a vibrating magnet, then its time period

(a) Decreases

(b) Increases

(c) Remains unchanged

(d) First increases then decreases

16. A magnetic needle is made to vibrate in uniform field H, then its time period is T. If it vibrates in the field of intensity $4H$, its time period will be

[MP Board 1988; MP PMT 1992; MH CET (Med.) 1999]

(a) $2T$ (b) $T/2$

(c) $2/T$ (d) T

17. Two bar magnets of the same mass, length and breadth but magnetic moments M and $2M$ respectively, when placed in same position, time period is 3 *sec*. What will be the time period when they are placed in different position

[NCERT 1977; DPMT 1999]

(a) $\sqrt{3}$ sec (b) $3\sqrt{3}$ sec

(c) 3 sec (d) 6 sec

18. To compare magnetic moments of two magnets by vibration magnetometer, 'sum and difference method' is better because

(a) Determination of moment of inertia is not needed which minimises the errors

(b) Less observations are required

(c) Comparatively less calculations

(d) All the above

19. A magnet is suspended in such a way that it oscillates in the horizontal plane. It makes 20 *oscillations per minute* at a place where dip angle is 30° and 15 *oscillations per minute* at a place where dip angle is 60°. The ratio of total earth's magnetic field at the two places is

[MP PMT 1991; BHU 1997]

(a) $3\sqrt{3} : 8$ (b) $16 : 9\sqrt{3}$

(c) $4 : 9$ (d) $2\sqrt{3} : 9$

20. The time period of oscillation of a magnet in a vibration magnetometer is 1.5 *seconds*. The time period of oscillation of another magnet similar in size, shape and mass but having one-fourth magnetic moment than that of first magnet, oscillating at same place will be

[MP PMT 1991; MP PMT 2002]

(a) 0.75 *sec* (b) 1.5 *sec*

(c) 3 *sec* (d) 6 *sec*

21. A bar magnet A of magnetic moment M_A is found to oscillate at a frequency twice that of magnet B of magnetic moment M_B when placed in a vibrating *magneto-meter*. We may say that

[MP PMT 1991]

(a) $M_A = 2M_B$ (b) $M_A = 8M_B$

(c) $M_A = 4M_B$ (d) $M_B = 8M_A$

22. Two magnets A and B are identical in mass, length and breadth but have different magnetic moments. In a vibration magnetometer, if the time period of B is twice the time period of A. The ratio of the magnetic moments M_A / M_B of the magnets will be **[MP PET 1990; MP PMT 1990]**

(a) $1/2$ (b) 2

(c) 4 (d) 1/4

23. A magnet of magnetic moment *M* oscillating freely in earth's horizontal magnetic field makes *n* oscillations per minute. If the magnetic moment is quadrupled and the earth's field is doubled, the number of oscillations made per minute would be

[MP PET 1991]

(a) $\frac{n}{2\sqrt{2}}$ (b) $\frac{n}{\sqrt{2}}$

(c) $2\sqrt{2}n$ (d) $\sqrt{2}n$

24. A magnetic needle suspended horizontally by an unspun silk fibre, oscillates in the horizontal plane because of the restoring force originating mainly from **[CPMT 1980, 89]**

(a) The torsion of the silk fibre

(b) The force of gravity

(c) The horizontal component of earth's magnetic field

(d) All the above factors

25. At two places *A* and *B* using vibration magnetometer, a magnet vibrates in a horizontal plane and its respective periodic time are 2 *sec* and 3 *sec* and at these places the earth's horizontal components are H_A and H_B respectively. Then the ratio between H_A and H_B will be

[MP PMT 1985, 89]

(a) 9 : 4 (b) 3 : 2

(c) 4 : 9 (d) 2 : 3

26. The time period of a bar magnet suspended horizontally in the earth's magnetic field and allowed to oscillate

[MP PET 1992]

(a) Is directly proportional to the square root of its mass

(b) Is directly proportional to its pole strength

(c) Is inversely proportional to its magnetic moment

(d) Decreases if the length increases but pole strength remains same

27. Magnets *A* and *B* are geometrically similar but the magnetic moment of *A* is twice that of *B*. If T_1 and T_2 be the time periods of the oscillation when their like poles and unlike poles are kept together respectively, then $\frac{T_1}{T_2}$ will be

[SCRA 1998]

(a) $\frac{1}{3}$ (b) $\frac{1}{2}$

(c) $\frac{1}{\sqrt{3}}$ (d) $\sqrt{3}$

28. A small bar magnet *A* oscillates in a horizontal plane with a period *T* at a place where the angle of dip is 60°. When the same needle is made to oscillate in a vertical plane coinciding with the magnetic meridian, its period will be

[MP PMT 1992]

(a) $\frac{T}{\sqrt{2}}$ (b) T

(c) $\sqrt{2}T$ (d) $2T$

29. Vibration magnetometer works on the principle of

[MP PET 1993]

(a) Torque acting on the bar magnet

(b) Force acting on the bar magnet

(c) Both the force and the torque acting on the bar magnet

(d) None of these

30. Tangent galvanometer is used to measure **[MP PET 1993]**

(a) Steady currents

(b) Current impulses

(c) Magnetic moments of bar magnets

(d) Earth's magnetic field

31. A tangent galvanometer has a coil with 50 turns and radius equal to 4 *cm*. A current of 0.1 *A* is passing through it. The plane of the coil is set parallel to the earth's magnetic meridian. If the value of the earth's horizontal component of the magnetic field is 7×10^{-5} *tesla* and $\mu_0 = 4\pi\times10^{-7}$ *weber/amp* × *m*, then the deflection in the galvanometer needle will be

[MP PMT 1993]

(a) 45° (b) 48.2°

(c) 50.7° (d) 52.7°

32. A bar magnet has a magnetic moment equal to 5×10^{-5} *weber* × *m*. It is suspended in a magnetic field which has a magnetic induction (*B*) equal to $8\pi\times10^{-4}$ *tesla* The magnet vibrates with a period of vibration equal to 15 *sec*. The moment of inertia of the magnet is

[MP PMT 1993; CBSE PMT 2001]

(a) $22.5\,kg\times m^2$ (b) $11.25\times kg\times m^2$

(c) $5.62\times kg\times m^2$ (d) $7.16\times10^{-7}\,kg-m^2$

33. The time period of a freely suspended magnet is 4 *seconds*. If it is broken in length into two equal parts and one part is suspended in the same way, then its time period will be **[NCERT 1984; CPMT 1991; MP PMT 1994; MH CET 2004]**

(a) 4 *sec* (b) 2 *sec*

(c) 0.5 *sec* (d) 0.25 *sec*

34. Which of the following statement is true about magnetic moments of atoms of different elements **[CPMT 1977]**

(a) All have a magnetic moment

(b) None has a magnetic moment

(c) All acquire a magnetic moment under external magnetic field and in same direction as the field

(d) None of the above statements are accurate

35. The number of turns and radius of cross-section of the coil of a tangent galvanometer are doubled. The reduction factor *K* will be **[NCERT 1983; MP PMT 2002]**

(a) *K* (b) 2*K*

(c) 4*K* (d) *K*/4

36. A magnetic needle suspended by a silk thread is vibrating in the earth's magnetic field. If the temperature of the needle is increased by 500°*C*, then **[MNR 1994]**

(a) The time period decreases

(b) The time period remains unchanged

(c) The time period increases

(d) The needle stops vibrating

37. The sensitivity of a tangent galvanometer is increased if **[AFMC 1995]**

(a) Number of turn decreases (b) Number of turn increases

(c) Field increases (d) None of the above

38. Two tangent galvanometers having coils of the same radius are connected in series. A current flowing in them produces deflections of 60° and 45° respectively. The ratio of the number of turns in the coils is **[MP PET 1995; MP PMT 1999]**

(a) 4/3 (b) $(\sqrt{3}+1)/1$

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

39. Using a bar magnet *P*, a vibration magnetometer has time period 2*seconds*. When a bar *Q* (identical to *P* in mass and size) is placed on top of *P*, the time period is unchanged. Which of the following statements is true **[MP PMT 1995]**

(a) *Q* is of non-magnetic material

(b) *Q* is a bar magnet identical to *P*, and its north pole placed on top of *P*'s north pole

(c) *Q* is of unmagnetized ferromagnetic material

(d) Nothing can be said about *Q*'s properties

40. The strength of the magnetic field in which the magnet of a vibration magnetometer is oscillating is increased 4 times its original value. The frequency of oscillation would then become **[Haryana CEE 1996]**

(a) Twice its original value

(b) Four times its original value

(c) Half its original value

(d) One-fourth its original value

41. A certain amount of current when flowing in a properly set tangent galvanometer, produces a deflection of 45°. If the current be reduced by a factor of $\sqrt{3}$, the deflection would **[MP PMT 1996; DPMT 2005]**

(a) Decrease by 30° (b) Decrease by 15°

(c) Increase by 15° (d) Increase by 30°

42. Two normal uniform magnetic field contain a magnetic needle making an angle 60° with *F*. Then the ratio of $\frac{F}{H}$ is **[CPMT 1987; DPMT 2001]**

(a) 1 : 2 (b) 2 : 1

(c) $\sqrt{3}:1$ (d) $1:\sqrt{3}$

43. A short magnetic needle is pivoted in a uniform magnetic field of strength 1 *T*. When another magnetic field of strength $\sqrt{3}\ T$ is applied to the needle in a perpendicular direction, the needle deflects through an angle θ, where θ is **[KCET 1999]**

(a) 30° (b) 45°
(c) 90° (d) 60°

44. Two magnets are held together in a vibration magnetometer and are allowed to oscillate in the earth's magnetic field with like poles together, 12 oscillations per minute are made but for unlike poles together only 4 oscillations per minute are executed. The ratio of their magnetic moments is **[MP PMT 1996; CPMT 2002]**

(a) 3 : 1 (b) 1 : 3
(c) 3 : 5 (d) 5 : 4

45. To measure which of the following, is a tangent galvanometer used **[MP PET 1997; CBSE PMT 2001]**

(a) Charge (b) Angle
(c) Current (d) Magnetic intensity

46. When $\sqrt{3}$ *ampere* current is passed in a tangent galvanometer, there is a deflection of 30° in it. The deflection obtained when 3 *amperes* current is passed, is **[MP PMT 1997]**

(a) 30° (b) 45°
(c) 60° (d) 75°

47. The period of oscillations of a magnetic needle in a magnetic field is 1.0 *sec*. If the length of the needle is halved by cutting it, the time period will be **[MP PMT/PET 1998]**

(a) 1.0 *sec* (b) 0.5 *sec*
(c) 0.25 *sec* (d) 2.0 *sec*

48. The time period of a freely suspended magnet is 2 *sec*. If it is broken in length into two equal parts and one part is suspended in the same way, then its time period will be **[MP PMT 1999]**

(a) 4 *sec* (b) 2 *sec*
(c) $\sqrt{2}$ sec (d) 1 *sec*

49. The bob of a simple pendulum is replaced by a magnet. The oscillations are set along the length of the magnet. A copper coil is added so that one pole of the magnet passes in and out of the coil. The coil is short-circuited. Then which one of the following happens **[KCET 1994]**

(a) Period decreases
(b) Period does not change
(c) Oscillations are damped
(d) Amplitude increases

50. The period of oscillation of a vibration magnetometer depends on which of the following factors **[KCET 1994]**

(a) *I* and *M* only (b) *M* and *H* only
(c) *I* and *H* only (d) *I*, M and *H* only

where *I* is the moment of inertia of the magnet about the axis of suspension, *M* is the magnetic moment of the magnet and *H* is the external magnetic field

51. The time period of oscillation of a bar magnet suspended horizontally along the magnetic meridian is T_0. If this magnet is replaced by another magnet of the same size and pole strength but with double the mass, the new time period will be **[SCRA 1994; JIPMER 2001, 02]**

(a) $\frac{T_0}{2}$ (b) $\frac{T_0}{\sqrt{2}}$
(c) $\sqrt{2}T_0$ (d) $2T_0$

52. Two short magnets having magnetic moments in the ratio 27 : 8, when placed on opposite sides of a deflection magnetometer, produce no deflection. If the distance of the weaker magnet is 0.12 *m* from the centre of deflection magnetometer, the distance of the stronger magnet from the centre is

(a) 0.06 *m* (b) 0.08 *m*
(c) 0.12 *m* (d) 0.18 *m*

53. The magnet of a vibration magnetometer is heated so as to reduce its magnetic moment by 19%. By doing this the periodic time of the magnetometer will **[MP PMT 2000, 01]**

(a) Increase by 19% (b) Decrease by 19%
(c) Increase by 11% (d) Decrease by 21%

54. A magnet makes 40 oscillations per minute at a place having magnetic field intensity of 0.1 × 10^{-5} *T*. At another place, it takes 2.5 *sec* to complete one vibration. The value of earth's horizontal field at that place is **[AIIMS 2000; CPMT 2000; Pb PET 2002]**

(a) 0.25 × 10^{-6} *T* (b) 0.36 × 10^{-6} *T*
(c) 0.66 × 10^{-8} *T* (d) 1.2 × 10^{-6} *T*

55. A tangent galvanometer has a coil of 25 turns and radius of 15 *cm*. The horizontal component of the earth's magnetic field is 3×10^{-5} *T*. The current required to produce a deflection of 45° in it, is **[MP PMT 2000]**

(a) 0.29 *A* (b) 1.2 *A*

(c) 3.6×10^{-5} *A* (d) 0.14 *A*

56. The time period of a vibration magnetometer is T_0. Its magnet is replaced by another magnet whose moment of inertia is 3 times and magnetic moment is 1/3 of the initial magnet. The time period now will be **[MP PMT 2000]**

(a) $3T_0$ (b) T_0

(c) $T_0/\sqrt{3}$ (d) $T_0/3$

57. The error in measuring the current with a tangent galvanometer is minimum when the deflection is about **[MP PET 2001]**

(a) 0° (b) 30°

(c) 45° (d) 60°

58. Before using the tangent galvanometer, its coil is set in **[MP PMT 2001; CPMT 2005]**

(a) Magnetic meridian (or vertically north south)

(b) Perpendicular to magnetic meridian

(c) At angle of 45° to magnetic meridian

(d) It does not require any setting

59. The time period of a thin bar magnet in earth's magnetic field is *T*. If the magnet is cut into two equal parts perpendicular to its length, the time period of each part in the same field will be **[MP PET 2001]**

(a) $\frac{T}{2}$ (b) *T*

(c) $\sqrt{2}\,T$ (d) $2T$

60. A magnet freely suspended in a vibration magnetometer makes 10 oscillations per minute at a place *A* and 20 oscillations per minute at a place *B*. If the horizontal component of earth's magnetic field at *A* is 36×10^{-6} *T*, then its value at *B* is **[EAMCET (Med.) 2001]**

(a) 36×10^{-6} *T* (b) 72×10^{-6} *T*

(c) 144×10^{-6} *T* (d) 288×10^{-6} *T*

61. When 2 *amperes* current is passed through a tangent galvanometer, it gives a deflection of 30°. For 60° deflection, the current must be

(a) 1 *amp* (b) $2\sqrt{3}$ *amp*

(c) 4 *amp* (d) 6 *amp*

62. Which of the following statement is not the true **[KCET (Engg./Med.) 2001]**

(a) While taking reading of tangent galvanometer, the plane of the coil must be set at right angles to the earth's magnetic meridian

(b) A short magnet is used in a tangent galvanometer since a long magnet would be heavy and may not easily move

(c) Measurements with the tangent galvanometer will be more accurate when the deflection is around 45°

(d) A tangent galvanometer can not be used in the polar region

63. The period of oscillations of a magnet is 2 *sec*. When it is remagnetised so that the pole strength is 4 times its period will be

(a) 4 *sec* (b) 2 *sec*

(c) 1 *sec* (d) 1/2 *sec*

64. When two magnetic moments are compared using equal distance method the deflections produced are 45° and 30°. If the length of magnets are in the ratio 1 : 2, the ratio of their pole strengths is **[JIPMER 2002]**

(a) 3 : 1 (b) 3 : 2

(c) $\sqrt{3} : 1$ (d) $2\sqrt{3} : 1$

65. The magnetic needle of a tangent galvanometer is deflected at an angle 30° due to a magnet. The horizontal component of earth's magnetic field 0.34×10^{-4} *T* is along the plane of the coil. The magnetic intensity is **[AIIMS 2000, 2002; BHU 2000; AFMC 2000; KCET (Engg./Med.) 1999]**

(a) 1.96×10^{-4} *T* (b) 1.96×10^{-5} *T*

(c) 1.96×10^{4} *T* (d) 1.96×10^{5} *T*

66. In a tangent galvanometer a current of 0.1 *A* produces a deflection of 30°. The current required to produce a deflection of 60° is

(a) 0.2 A (b) 0.3 A

(c) 0.4 A (c) 0.5 A

67. A bar magnet is oscillating in the Earth's magnetic field with a period *T*. What happens to its period and motion if its mass is quadrupled **[CBSE PMT 2003]**

(a) Motion remains S.H.M. with time period = 2*T*

(b) Motion remains S.H.M. with time period = 4*T*

(c) Motion remains S.H.M. and period remains nearly constant

(d) Motion remains S.H.M. with time period $= \frac{T}{2}$

68. A thin rectangular magnet suspended freely has a period of oscillation equal to *T*. Now it is broken into two equal halves (each having half of the original length) and one piece is made to oscillate freely in the same field. If its period of oscillation is *T* ′, then ratio $\frac{T'}{T}$ is

(a) $\frac{1}{4}$ (b) $\frac{1}{2\sqrt{2}}$

(c) $\frac{1}{2}$ (c) 2

69. A bar magnet is oscillating in the earth's magnetic field with time period *T*. If its mass is increased four times then its time period will be **[J & K CET 2004]**

(a) 4 *T* (b) 2 *T*

(c) *T* (d) *T*/2

70. The length of a magnet is large compared to its width and breadth. The time period of its oscillation in a vibration magnetometer is 2 *s*. The magnet is cut along its length into three equal parts and three parts are then placed on each other with their like poles together. The time period of this combination will be **[AIEEE 2004]**

(a) 2 *s* (b) 2/3 *s*

(c) $2\sqrt{3}\, s$ (d) $2/\sqrt{3}\, s$

71. A magnet oscillating in a horizontal plane has a time period of 2 *second* at a place where the angle of dip is 30° and 3 *seconds* at another place where the angle of dip is 60°. The ratio of resultant magnetic fields at the two places is **[Pb. PET 2001]**

(a) $\frac{4\sqrt{3}}{7}$ (b) $\frac{4}{9\sqrt{3}}$

(c) $\frac{9}{4\sqrt{3}}$ (d) $\frac{9}{\sqrt{3}}$

72. Two identical bar magnets are placed on above the other such that they are mutually perpendicular and bisect each other. The time period of this combination in a horizontal magnetic field is *T*. The time period of each magnet in the same field is **[CPMT 2005]**

(a) $\sqrt{2}\, T$ (b) $2^{\frac{1}{4}}\, T$

[AIEEE 2003]

(c) $2^{-\frac{1}{4}}\, T$ (d) $2^{-\frac{1}{2}}\, T$

73. 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° $(B_H = 4 \times 10^{-5}\, T)$ is **[MP PET 2005]**

(a) 3 *A* (b) 1.1 *A*

(c) 2.1 *A* (d) 1.5 *A*

Magnetic Materials

1. Magnets cannot be made from which of the following substances **[Bihar PET 1984]**

(a) Iron (b) Nickel

(c) Copper (d) All of the above

2. The magnetic moment of atomic neon is **[NCERT 1984]**

(a) Zero (b) $\mu B/2$

(c) μB (d) $3\mu B/2$

3. Which of the following is most suitable for the core of electromagnets **[AIIMS 1980; NCERT 1980; AFMC 1988; CBSE PMT 1990]**

(a) Soft iron (b) Steel

(c) Copper-nickel alloy (d) Air

4. Demagnetisation of magnets can be done by **[DPMT 1984; CBSE PMT 1988]**

(a) Rough handling

(b) Heating

(c) Magnetising in the opposite direction
(d) All the above

5. A ferromagnetic material is heated above its curie temperature. Which one is a correct statement

[MP PET 1995]

(a) Ferromagnetic domains are perfectly arranged
(b) Ferromagnetic domains becomes random
(c) Ferromagnetic domains are not influenced
(d) Ferromagnetic material changes itself into diamagnetic material

6. If a diamagnetic substance is brought near north or south pole of a bar magnet, it is

[EAMCET (Engg.) 1995; CBSE PMT 1999; AFMC 2003]

(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

7. The material of permanent magnet has

[KCET 1994, 2003; AFMC 2004]

(a) High retentivity, low coercivity
(b) Low retentivity, high coercivity
(c) Low retentivity, low coercivity
(d) High retentivity, high coercivity

8. The permanent magnet is made from which one of the following substances

[Bihar MEE 1995]

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

9. Temperature above which a ferromagnetic substance becomes paramagnetic is called

[SCRA 1994; J & K CET 2004]

(a) Critical temperature (b) Boyle's temperature
(c) Debye's temperature (d) Curie temperature

10. When a magnetic substance is heated, then it

[AIIMS 1999]

(a) Becomes a strong magnet
(b) Losses its magnetism
(c) Does not effect the magnetism
(d) Either (a) or (c)

11. The only property possessed by ferromagnetic substance is

[KCET 1999]

(a) Hysteresis
(b) Susceptibility
(c) Directional property
(d) Attracting magnetic substances

12. Substances in which the magnetic moment of a single atom is not zero, is known as

(a) Diamagnetism (b) Ferromagnetism
(c) Paramagnetism (d) Ferrimagnetism

13. Diamagnetic substances are

(a) Feebly attracted by magnets
(b) Strongly attracted by magnets
(c) Feebly repelled by magnets
(d) Strongly repelled by magnets

14. The magnetic susceptibility is

(a) $\chi = \frac{I}{H}$ (b) $\chi = \frac{B}{H}$
(c) $\chi = \frac{M}{V}$ (d) $\chi = \frac{M}{H}$

15. Which of the following statements are true about the magnetic susceptibility χ_m of paramagnetic substance

[Roorkee 1999]

(a) Value of χ_m is inversely proportional to the absolute temperature of the sample
(b) χ_m is positive at all temperature
(c) χ_m is negative at all temperature
(d) χ_m does not depend on the temperature of the sample

16. Relative permeability of iron is 5500, then its magnetic susceptibility will be **[KCET 2000; Kerala PMT 2004]**

(a) 5500×10^{7} (b) 5500×10^{-7}
(c) 5501 (d) 5499

17. An example of a diamagnetic substance is

[KCET 2000]

(a) Aluminium (b) Copper
(c) Iron (d) Nickel

18. The use of study of hysteresis curve for a given material is to estimate the

(a) Voltage loss (b) Hysteresis loss
(c) Current loss (d) All of these

19. Magnetic permeability is maximum for

[AIIMS 2000; MH CET 2003; DPMT 2003]

(a) Diamagnetic substance (b) Paramagnetic substance

(c) Ferromagnetic substance (d) All of these

20. If a diamagnetic solution is poured into a *U*-tube and one arm of this *U*-tube placed between the poles of a strong magnet with the meniscus in a line with the field, then the level of the solution will **[AMU 1999, 2000]**

(a) Rise (b) Fall

(c) Oscillate slowly (d) Remain as such

21. The relative permeability is represented by μ_r and the susceptibility is denoted by χ for a magnetic substance. Then for a paramagnetic substance

[KCET (Engg./Med.) 2001]

(a) $\mu_r < 1, \chi < 0$ (b) $\mu_r < 1, \chi > 0$

(c) $\mu_r > 1, \chi < 0$ (d) $\mu_r > 1, \chi > 0$

22. Which of the following is true

(a) Diamagnetism is temperature dependent

(b) Paramagnetism is temperature dependent

(c) Paramagnetism is temperature independent

(d) None of these

23. The magnetic susceptibility does not depend upon the temperature in

(a) Ferrite substances (b) Ferromagnetic substances

(c) Diamagnetic substances (d) Paramagnetic substances

24. Identify the paramagnetic substance **[KCET 2001]**

(a) Iron (b) Aluminium

(c) Nickel (d) Hydrogen

25. If a magnetic substance is kept in a magnetic field, then which of the following is thrown out

[DCE 1999, 2001]

(a) Paramagnetic (b) Ferromagnetic

(c) Diamagnetic (d) Antiferromagnetic

26. If the angular momentum of an electron is $\vec{J}$ then the magnitude of the magnetic moment will be **[MP PET 2002]**

(a) $\frac{eJ}{m}$ (b) $\frac{eJ}{2m}$

(c) $eJ\,2m$ (d) $\frac{2m}{eJ}$

27. The magnetic susceptibility is negative for **[AIEEE 2002]**

(a) Paramagnetic materials

(b) Diamagnetic materials

(c) Ferromagnetic materials

(d) Paramagnetic and ferromagnetic materials

28. The universal property of all substances is **[CPMT 2002]**

(a) Diamagnetism (b) Ferromagnetism

(c) Paramagnetism (d) All of these

29. Which of the following statements is incorrect about hysteresis **[UPSEAT 2002]**

(a) This effect is common to all ferromagnetic substances

(b) The hysteresis loop area is proportional to the thermal energy developed per unit volume of the material

(c) The hysteresis loop area is independent of the thermal energy developed per unit volume of the material

(d) The shape of the hysteresis loop is characteristic of the material

30. Curies law can be written as

[BHU 2001] **[MH CET 2002; CBSE PMT 2003]**

(a) $\chi \propto (T - T_c)$ (b) $\chi \propto \frac{1}{T - T_c}$

(c) $\chi \propto \frac{1}{T}$ (d) $\chi \propto T$

31. A superconductor exhibits perfect **[CBSE PMT 2001]**

(a) Ferrimagnetism (b) Ferromagnetism

(c) Paramagnetism (d) Diamagnetism

32. A small rod of bismuth is suspended freely between the poles of a strong electromagnet. It is found to arrange itself at right angles to the magnetic field. This observation establishes that bismuth is **[Kerala 2002]**

(a) Diamagnetic (b) Paramagnetic

(c) Ferri-magnetic (d) Antiferro-magnetic

33. A diamagnetic material in a magnetic field moves

[Pb. PMT 1999; AIIMS 2000; MH CET 2000; CBSE PMT 2003]

(a) From weaker to the stronger parts of the field

(b) Perpendicular to the field

(c) From stronger to the weaker parts of the field

(d) In none of the above directions

34. Curie temperature is the temperature above which

[DCE 2002; AIEEE 2003]

(a) A paramagnetic material becomes ferromagnetic

(b) A ferromagnetic material becomes paramagnetic

(c) A paramagnetic material becomes diamagnetic

(d) A ferromagnetic material becomes diamagnetic

35. A frog can be deviated 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 **[AIIMS 2003]**

(a) Paramagnetic (b) Diamagnetic

(c) Ferromagnetic (d) Antiferromagnetic

36. Which one of the following is a non-magnetic substance **[MP PET 2004]**

(a) Iron (b) Nickel

(c) Cobalt (d) Brass

37. Liquid oxygen remains suspended between two pole faces of a magnet because it is **[AIIMS 2004]**

(a) Diamagnetic (b) Paramagnetic

(c) Ferromagnetic (d) Antiferromagnetic

38. Curie-Weiss law is obeyed by iron at a temperature ...... **[KCET 2004]**

(a) Below Curie temperature (b) Above Curie temperature

(c) At Curie temperature only (d) At all temperatures

39. The materials suitable for making electromagnets should have **[AIEEE 2004]**

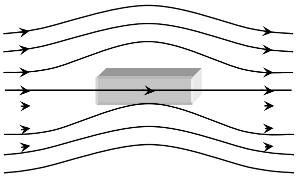
(a) High retentivity and high coercivity

(b) Low retentivity and low coercivity

(c) High retentivity and low coercivity

(d) Low retentivity and high coercivity

40. The given figure represents a material which is **[Orissa PMT 2004]**



(a) Paramagnetic (b) Diamagnetic

(c) Ferromagnetic (d) None of these

41. For an isotropic medium B, μ, H and M are related as (where B, μ_0, H and M have their usual meaning in the context of magnetic material **[Pb. PMT 2004]**

(a) $(B - M) = \mu_0 H$ (b) $M = \mu_0(H + M)$

(c) $H = \mu_0(H + M)$ (d) $B = \mu_0(H + M)$

42. The magnetic susceptibility of any paramagnetic material changes with absolute temperature T as **[UPSEAT 2004; DCE 2005]**

(a) Directly proportional to T

(b) Remains constant

(c) Inversely proportional to T

(d) Exponentially decaying with T

43. When a piece of a ferromagnetic substance is put in a uniform magnetic field, the flux density inside it is four times the flux density away from the piece. The magnetic permeability of the material is **[UPSEAT 2004]**

(a) 1 (b) 2

(c) 3 (d) 4

44. Which of the following is diamagnetism **[DCE 2002]**

(a) Aluminium (b) Quartz

(c) Nickel (d) Bismuth

45. If a ferromagnetic material is inserted in a current carrying solenoid, the magnetic field of solenoid **[DCE 2004]**

(a) Largely increases (b) Slightly increases

(c) Largely decreases (d) Slightly decreases

46. In the hysteresis cycle, the value of H needed to make the intensity of magnetisation zero is called **[DCE 2004]**

(a) Retentivity (b) Coercive force

(c) Lorentz force (d) None of the above

47. If the magnetic dipole moment of an atom of diamagnetic material, paramagnetic material

and ferromagnetic material denoted by μ_d, μ_p, μ_f respectively then **[CBSE PMT 2005]**

(a) $\mu_d \neq 0$ and $\mu_f \neq 0$ (b) $\mu_p = 0$ and $\mu_f \neq 0$

(c) $\mu_d = 0$ and $\mu_p \neq 0$ (d) $\mu_d \neq 0$ and $\mu_p = 0$

48. Among the following properties describing diamagnetism identify the property that is wrongly stated **[KCET 2005]**

(a) Diamagnetic material do not have permanent magnetic moment

(b) Diamagnetism is explained in terms of electromagnetic induction

(c) Diamagnetic materials have a small positive susceptibility

(d) The magnetic moment of individual electrons neutralize each other

49. Susceptibility of ferromagnetic substance is **[Orissa JEE 2005]**

(a) > 1 (b) < 1

(c) 0 (d) 1

50. When a ferromagnetic material is heated to temperature above its Curie temperature, the material **[UPSEAT 2005]**

(a) Is permanently magnetized

(b) Remains ferromagnetic

(c) Behaves like a diamagnetic material

(d) Behaves like a paramagnetic material

Critical Thinking

Objective Questions

1. Two identical magnetic dipoles of magnetic moments 1.0 A-m^2 each, placed at a separation of 2m with their axis perpendicular to each other. The resultant magnetic field at a point midway between the dipoles is **[Roorkee 1995]**

(a) $5 \times 10^{-7}\ T$ (b) $\sqrt{5} \times 10^{-7}\ T$

(c) $10^{-7}\ T$ (d) None of these

2. Two short magnets placed along the same axis with their like poles facing each other repel each other with a force which varies inversely as

(a) Square of the distance

(b) Cube of the distance

(c) Distance

(d) Fourth power of the distance

3. Two identical short bar magnets, each having magnetic moment M, are placed a distance of $2d$ apart with axes perpendicular to each other in a horizontal plane. The magnetic induction at a point midway between them is **[IIT-JEE (Screening) 2000]**

(a) $\frac{\mu_0}{4\pi}(\sqrt{2})\frac{M}{d^3}$ (b) $\frac{\mu_0}{4\pi}(\sqrt{3})\frac{M}{d^3}$

(c) $\left(\frac{2\mu_0}{\pi}\right)\frac{M}{d^3}$ (d) $\frac{\mu_0}{4\pi}(\sqrt{5})\frac{M}{d^3}$

4. If a magnet is suspended at an angle 30^o to the magnetic meridian, it makes an angle of 45^o with the horizontal. The real dip is

(a) $\tan^{-1}(\sqrt{3}/2)$ (b) $\tan^{-1}(\sqrt{3})$

(c) $\tan^{-1}(\sqrt{3/2})$ (d) $\tan^{-1}(2/\sqrt{3})$

5. A short bar magnet with its north pole facing north forms a neutral point at P in the horizontal plane. If the magnet is rotated by 90^o in the horizontal plane, the net magnetic induction at P is (Horizontal component of earth's magnetic field = B_H)

(a) 0 (b) 2 B_H

(c) $\frac{\sqrt{5}}{2}B_H$ (d) $\sqrt{5}\,B_H$

6. The true value of angle of dip at a place is 60^o, the apparent dip in a plane inclined at an angle of 30^o with magnetic meridian is

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

(c) $\tan^{-1}\left(\frac{2}{3}\right)$ (d) None of these

7. A vibration magnetometer consists of two identical bar magnets placed one over the other such that they are perpendicular and bisect each other. The time period of oscillation in a horizontal magnetic field is $2^{5/4}$ *seconds*. One of the magnets is removed and if the other magnet oscillates in the same field, then the time period in seconds is

[EAMCET (Med.) 2003]

(a) $2^{1/4}$ (b) $2^{1/2}$

(c) 2 (d) $2^{3/4}$

8. In a vibration magnetometer, the time period of a bar magnet oscillating in horizontal component of earth's magnetic field is 2 *sec*. When a magnet is brought near and parallel to it, the time period reduces to 1 *sec*. The ratio *H*/*F* of the horizontal component *H* and the field *F* due to magnet will be **[MP PMT 1990; Pb PET 2000]**

(a) 3 (b) $1/3$

(c) $\sqrt{3}$ (d) $1/\sqrt{3}$

9. A cylindrical rod magnet has a length of 5 cm and a diameter of 1 cm. It has a uniform magnetisation of 5.30 × $10^3 Amp/m^3$. What its magnetic dipole moment

(a) $1\times10^{-2}\ J/T$ (b) $2.08\times10^{-2}\ J/T$

(c) $3.08\times10^{-2}\ J/T$ (d) $1.52\times10^{-2}\ J/T$

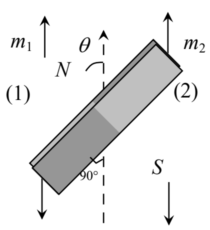
10. Two magnets of equal mass are joined at right angles to each other as shown the magnet 1 has a magnetic moment 3 times that of magnet 2. This arrangement is pivoted so that it is free to rotate in the horizontal plane. In equilibrium what angle will the magnet 1 subtend with the magnetic meridian

(a) $\tan^{-1}\left(\frac{1}{2}\right)$

(b) $\tan^{-1}\left(\frac{1}{3}\right)$

(c) $\tan^{-1}(1)$

(d) 0°



11. The dipole moment of each molecule of a paramagnetic gas is 1.5 × 10^{-23} *amp* × m^2. The temperature of gas is 27°*C* and the number of molecules per unit volume in it is 2 × 10^{26} m^{-3}. The maximum possible intensity of magnetisation in the gas will be

(a) 3 × 10^3 *amp*/*m* (b) 4 × 10^{-3} *amp*/*m*

(c) 5 × 10^5 *amp*/*m* (d) 6 × 10^{-4} *amp*/*m*

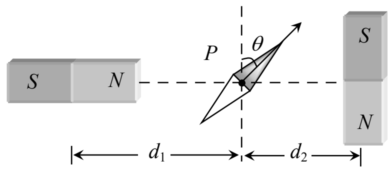
12. Two magnets *A* and *B* are identical and these are arranged as shown in the figure. Their length is negligible in comparison to the separation between them. A magnetic needle is placed between the magnets at point *P* which gets deflected through an angle θ under the influence of magnets. The ratio of distance d_1 and d_2 will be

(a) $(2\tan\theta)^{1/3}$

(b) $(2\tan\theta)^{-1/3}$

(c) $(2\cot\theta)^{1/3}$

(d) $(2\cot\theta)^{-1/3}$



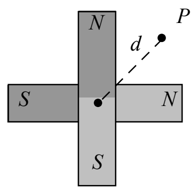
13. Two short magnets of equal dipole moments *M* are fastened perpendicularly at their centre (figure). The magnitude of the magnetic field at a distance *d* from the centre on the bisector of the right angle is

(a) $\frac{\mu_0}{4\pi}\frac{M}{d^3}$

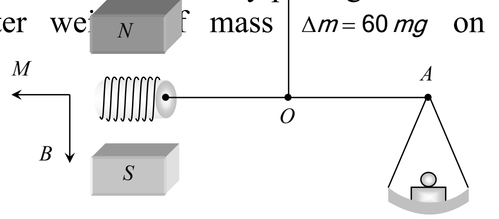
(b) $\frac{\mu_0}{4\pi}\frac{M\sqrt{2}}{d^3}$

(c) $\frac{\mu_0}{4\pi}\frac{2\sqrt{2}M}{d^3}$

(d) $\frac{\mu_0}{4\pi}\frac{2M}{d^3}$



14. A small coil C with *N* = 200 turns is mounted on one end of a balance beam and introduced between the poles of an electromagnet as shown in figure. The cross sectional area of coil is A= 1.0 cm^2, length of arm OA of the balance beam is $l = 30\,cm$ When there is no current in the coil the balance is in equilibrium. On passing a current *I* = 22 mA through the coil the equilibrium is restored by putting the additional counter wei f mass $\Delta m = 60\,mg$ on the

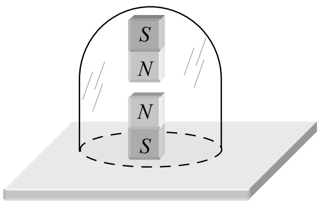


balance pan. Find the magnetic induction at the spot where coil is located.

(a) 0.4 *T* (b) 0.3 *T*

(c) 0.2 *T* (d) 0.1 *T*

15. Two identical bar magnets with a length 10 *cm* and weight 50 *gm-weight* are arranged freely with their like poles facing in a inverted vertical glass tube. The upper magnet hangs in the air above the lower one so that the distance between the nearest pole of the magnet is 3*mm*. Pole strength of the poles of each magnet will be



(a) 6.64 *amp* × *m*

(b) 2 *amp* × *m*

(c) 10.25 *amp* × *m*

(d) None of these

16. If ϕ_1 and ϕ_2 be the angles of dip observed in two vertical planes at right angles to each other and ϕ be the true angle of dip, then

(a) $\cos^2\phi = \cos^2\phi_1 + \cos^2\phi_2$

(b) $\sec^2\phi = \sec^2\phi_1 + \sec^2\phi_2$

(c) $\tan^2\phi = \tan^2\phi_1 + \tan^2\phi_2$

(d) $\cot^2\phi = \cot^2\phi_1 + \cot^2\phi_2$

17. Each atom of an iron bar $(5\,cm \times 1\,cm \times 1\,cm)$ has a magnetic moment $1.8 \times 10^{-23}\,Am^2$. Knowing that the density of iron is $7.78 \times 10^3\,kg^{-3}m$, atomic weight is 56 and Avogadro's number is 6.02×10^{23} the magnetic moment of bar in the state of magnetic saturation will be

(a) $4.75\,Am^2$ (b) $5.74\,Am^2$

(c) $7.54\,Am^2$ (d) $75.4\,Am^2$

18. An iron rod of volume $10^{-4}\,m^3$ and relative permeability 1000 is placed inside a long solenoid wound with 5 *turns/cm*. If a current of 0.5 *A* is passed through the solenoid, then the magnetic moment of the rod is

(a) $10\,Am^2$ (b) $15\,Am^2$

(c) $20\,Am^2$ (d) $25\,Am^2$

19. A bar magnet has coercivity $4 \times 10^3\,Am^{-1}$. It is desired to demagnetise it by inserting it inside a solenoid 12 *cm* long and having 60 turns. The current that should be sent through the solenoid is

(a) 2 *A* (b) 4 *A*

(c) 6 *A* (d) 8 *A*

20. A magnet is suspended in the magnetic meridian with an untwisted wire. The upper end of wire is rotated through 180° to deflect the magnet by 30° from magnetic meridian. When this magnet is replaced by another magnet, the upper end of wire is rotated through 270° to deflect the magnet 30° from magnetic meridian. The ratio of magnetic moments of magnets is

(a) 1 : 5 (b) 1 : 8

(c) 5 : 8 (d) 8 : 5

21. A dip needle vibrates in the vertical plane perpendicular to the magnetic meridian. The time period of vibration is found to be 2 *seconds*. The same needle is then allowed to vibrate in the horizontal plane and the time period is again found to be 2 *seconds*. Then the angle of dip is

(a) 0° (b) 30°

(c) 45° (d) 90°

22. The unit for molar susceptibility is

(a) m^3 (b) $kg\text{-}m^{-3}$

(c) $kg^{-1}\,m^3$ (d) No units

23. A short magnet oscillates with a time period 0.1 *s* at a place where horizontal magnetic field is $24\,\mu T$. A downward current of 18 *A* is established in a vertical wire 20 *cm* east of the magnet. The new time period of oscillator

(a) 0.1 *s* (b) 0.089 *s*

(c) 0.076 *s* (d) 0.057 *s*

24. A dip needle lies initially in the magnetic meridian when it shows an angle of dip θ at a place. The dip circle is rotated through an angle x in the horizontal plane and then it shows an angle of dip θ'. Then $\frac{\tan\theta'}{\tan\theta}$ is

(a) $\frac{1}{\cos x}$ (b) $\frac{1}{\sin x}$

(c) $\frac{1}{\tan x}$ (d) $\cos x$

25. A dip circle is adjusted so that its needle moves freely in the magnetic meridian. In this position, the angle of dip is 40°. Now the dip circle is rotated so that the plane in which the needle moves makes an angle of 30° with the magnetic meridian. In this position the needle will dip by an angle

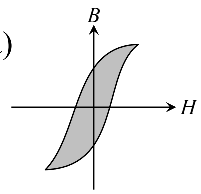
[DCE 2005]

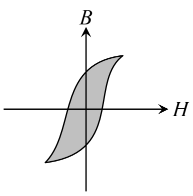
(a) 40° (b) 30°

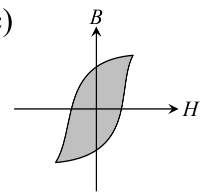
(c) More than 40° (d) Less than 40°

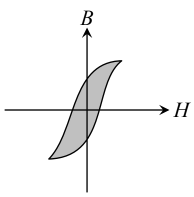
GQ Graphical Questions

1. For substances hysteresis *(B - H)* curves are given as shown in figure. For making temporary magnet which of the following is best.

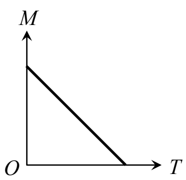
(a)


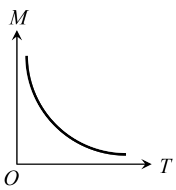
(b)


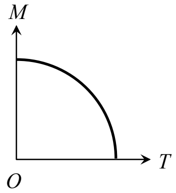
(c)


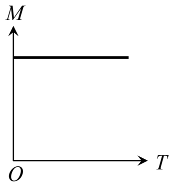
(d)


2. A curve between magnetic moment and temperature of magnet is

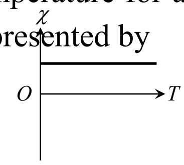
(a)


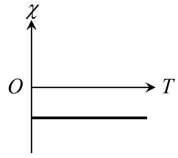
(b)


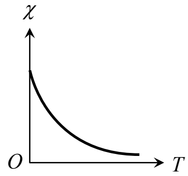
(c)


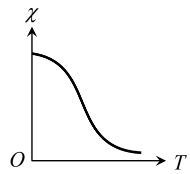
(d)


3. The variation of magnetic susceptibility (χ) with temperature for a diamagnetic substance is best represented by

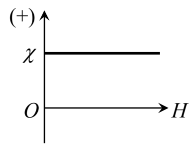
(a)


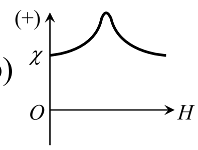
(b)


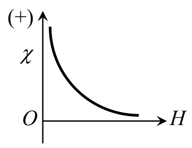
(c)


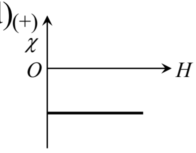
(d)


4. The variation of magnetic susceptibility (χ) with magnetising field for a paramagnetic substance is

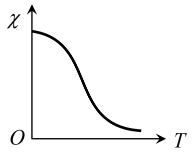
(a)


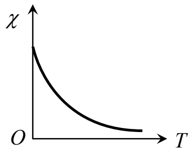
(b)


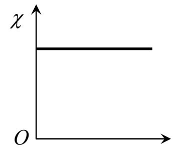
(c)


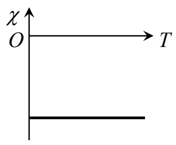
(d)


5. The variation of magnetic susceptibility (χ) with absolute temperature T for a ferromagnetic material is

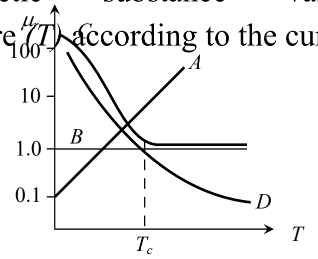
(a)


(b)


(c) 

(d) 

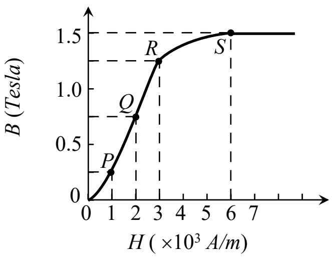
6. The relative permeability (μ_r) of a ferromagnetic substance varies with temperature (T) according to the curve



(a) A (b) B

(c) C (d) D

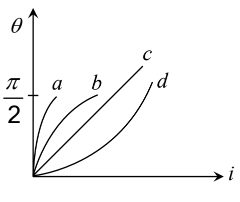
7. The basic magnetization curve for a ferromagnetic material is shown in figure. Then, the value of relative permeability is highest for the point



(a) P (b) Q

(c) R (d) S

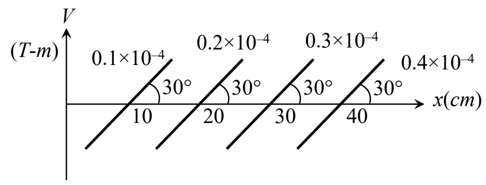
8. Which curve may best represent the current deflection in a tangent galvanometer



(a) A (b) B

(c) C (d) D

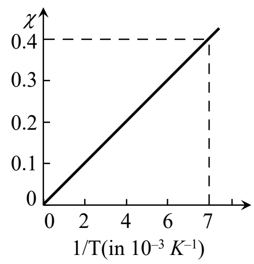
9. Some equipotential surfaces of the magnetic scalar potential are shown in the figure. Magnetic field at a point in the region is



(a) $10^{-4}\,T$ (b) $2\times10^{-4}\,T$

(c) $0.5\times10^{-4}\,T$ (d) None of these

10. The $\chi - 1/T$ graph for an alloy of paramagnetic nature is shown in Fig. The curie constant is, then

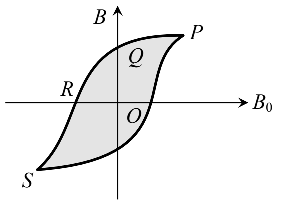


(a) 57 K (b) $2.8\times10^{-3}\,K$

(c) 570 K (d) $17.5\times10^{-3}\,K$

11. The figure illustrate how B, the flux density inside a sample of unmagnetised ferromagnetic material varies with B_0, the magnetic flux density in which the sample is kept. For the sample to be suitable for making a permanent magnet

[AMU 2001]



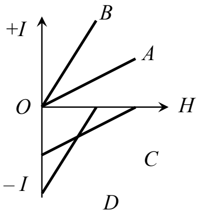
(a) OQ should be large, OR should be small

(b) OQ and OR should both be large

(c) OQ should be small and OR should be large

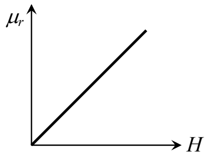
(d) OQ and OR should both be small

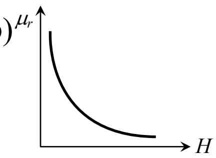
12. The variation of the intensity of magnetisation *(I)* with respect to the magnetising field *(H)* in a diamagnetic substance is described by the graph **[KCET 2002]**

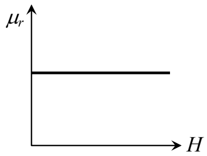


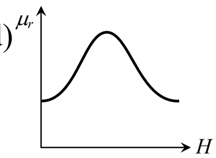
(a) OD (b) OC
(c) OB (d) OA

13. For ferromagnetic material, the relative permeability (μ_r), versus magnetic intensity *(H)* has the following shape

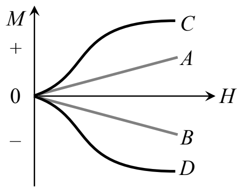
(a) 

(b) 

(c) 

(d) 

14. The most appropriate magnetization M versus magnetising field H curve for a paramagnetic substance is



(a) A (b) B
(c) C (d) D

AR Assertion & Reason

For AIIMS Aspirants

Read the assertion and reason carefully to mark the correct option out of the options given below:

(a) If both assertion and reason are true and the reason is the correct explanation of the assertion.
(b) If both assertion and reason are true but reason is not the correct explanation of the assertion.
(c) If assertion is true but reason is false.
(d) If the assertion and reason both are false.
(e) If assertion is false but reason is true.

1. Assertion : We cannot think of magnetic field configuration with three poles.
Reason : A bar magnet does exert a torque on itself due to its own field. **[AIIMS 2002]**

2. Assertion : The poles of magnet cannot be separated by breaking into two pieces.
Reason : The magnetic moment will be reduced to half when a magnet is broken into two equal pieces. **[SCRA 1994]**

3. Assertion : Basic difference between an electric line and magnetic line of force is that former is discontinuous and the latter is continuous or endless.
Reason : No electric lines of forces exist inside a charged body but magnetic lines do exist inside a magnet.

4. Assertion : Magnetic moment of an atom is due to both, the orbital motion and spin motion of every electron.
Reason : A charged particle produces a magnetic field.

5. Assertion : When radius of circular loop carrying current is doubled, its magnetic moment becomes four times.
Reason : Magnetic moment depends on area of the loop.

6. Assertion : The earth's magnetic field is due to iron present in its core.
Reason : At a high temperature magnet losses its magnetic property or magnetism.

7. Assertion : A compass needle when placed on the magnetic north pole of the earth rotates in vertical direction.
Reason : The earth has only horizontal component of its magnetic field at the north poles.

8. Assertion : The tangent galvanometer can be made more sensitive by increasing the number of turns of its coil.
Reason : Current through galvanometer is proportional to the number of turns of coil.

9. Assertion : The ferromagnetic substance do not obey Curie's law.
Reason : At Curie point a ferromagnetic substance start behaving as a paramagnetic substance.

10. Assertion : The properties of paramagnetic and ferromagnetic substance are not effected by heating.
Reason : As temperature rises, the alignment of molecular magnets gradually decreases.

11. Assertion : Soft iron is used as transformer core.
Reason : Soft iron has narrow hysteresis loop.

12. Assertion : Magnetism is relativistic.
Reason : When we move along with the charge so that there is no motion relative to us, we find no magnetic field associated with the charge.

13. Assertion : The earth's magnetic field does not affect the working of a moving coil galvanometer.
Reason : Earth's magnetic field is very weak.

14. Assertion : A paramagnetic sample display greater magnetisation (for the same magnetising field) when cooled.
Reason : The magnetisation does not depend on temperature.

15. Assertion : Electromagnets are made of soft iron.
Reason : Coercivity of soft iron is small.

16. Assertion : To protect any instrument from external magnetic field, it is put inside an iron body.
Reason : Iron is a magnetic substance.

17. Assertion : When a magnet is brought near iron nails, only translatory force act on it.
Reason : The field due to a magnet is generally uniform.

18. Assertion : When a magnetic dipole is placed in a non uniform magnetic field, only a torque acts on the dipole.
Reason : Force would also acts on dipole if magnetic field were uniform.

19. Assertion : Reduction factor (K) of a tangent galvanometer helps in reducing deflection to current.
Reason : Reduction factor increases with increase of current.

20. Assertion : The susceptibility of diamagnetic materials does not depend upon temperature.
Reason : Every atom of a diamagnetic material is not a complete magnet in itself.

21. Assertion : The permeability of a ferromagnetic material is independent of the magnetic field.
Reason : Permeability of a material is a constant quantity.

22. Assertion : For a perfectly diamagnetic substance permeability is always one.
Reason : The ability of a material of permit the passage of magnetic lines of force through it is called magnetic permeability.

23. Assertion : Gauss theorem is not applicable in magnetism.
Reason : Mono magnetic pole does not exist.

24. Assertion : Magnetic moment of helium atom is zero.

Reason : All the electron are paired in helium atom orbitals.

25. Assertion : For making permanent magnets, steel is preferred over soft iron.

Reason : As retentivity of steel is smaller.

Answers

Magnet and It's Properties

1	b	2	d	3	c	4	d	5	b
6	d	7	b	8	c	9	c	10	a
11	c	12	d	13	c	14	b	15	a
16	a	17	b	18	c	19	d	20	b
21	a	22	c	23	c	24	d	25	d
26	d	27	a	28	a	29	b	30	a
31	a	32	b	33	a	34	c	35	c
36	b	37	b	38	c	39	b	40	c
41	c	42	b	43	a	44	d	45	d
46	b	47	d	48	a	49	a	50	d
51	c	52	b	53	b	54	c	55	b
56	b	57	c	58	b	59	c	60	b
61	b	62	d	63	a	64	a	65	c
66	b	67	b	68	b	69	a	70	b
71	c	72	b	73	c	74	d	75	d
76	a	77	d	78	c	79	d	80	a
81	a	82	b	83	a	84	b	85	a
86	b	87	a	88	a	89	d	90	b
91	d	92	c						

Earth Magnetism

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

46	b	47	c	48	a	49	a	50	c
51	b	52	c	53	b	54	d	55	c
56	a	57	a	58	b	59	a		

Magnetic Equipments

1	d	2	c	3	a	4	b	5	d
6	d	7	a	8	c	9	c	10	b
11	c	12	a	13	a	14	a	15	b
16	b	17	b	18	d	19	b	20	c
21	c	22	c	23	c	24	c	25	a
26	a	27	c	28	a	29	a	30	a
31	b	32	d	33	b	34	d	35	a
36	c	37	b	38	d	39	b	40	a
41	b	42	d	43	d	44	d	45	c
46	b	47	b	48	d	49	c	50	d
51	c	52	d	53	c	54	b	55	a
56	a	57	c	58	a	59	a	60	c
61	d	62	a	63	c	64	d	65	b
66	b	67	a	68	c	69	b	70	b
71	c	72	c	73	b				

Magnetic Materials

1	c	2	a	3	a	4	d	5	b
6	b	7	d	8	c	9	d	10	b
11	a	12	c	13	c	14	a	15	ab
16	d	17	b	18	b	19	c	20	b
21	d	22	b	23	c	24	b	25	c
26	b	27	b	28	a	29	c	30	c
31	d	32	a	33	c	34	b	35	b
36	d	37	b	38	b	39	c	40	b
41	d	42	c	43	d	44	d	45	a
46	b	47	c	48	c	49	a	50	d

Critical Thinking Questions

1	b	2	d	3	d	4	a	5	d
6	b	7	c	8	b	9	b	10	b
11	a	12	c	13	c	14	a	15	a
16	d	17	c	18	d	19	d	20	c
21	c	22	a	23	c	24	a	25	c

Graphical Questions

1	d	2	c	3	b	4	a	5	a
6	c	7	b	8	b	9	b	10	a

11	b	12	b	13	d	14	a		

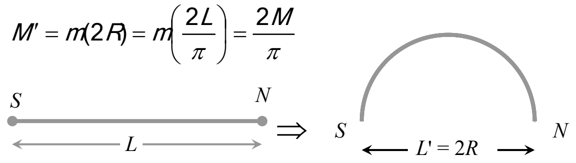
Assertion and Reason

1	d	2	b	3	a	4	c	5	b
6	e	7	d	8	b	9	b	10	e
11	a	12	a	13	a	14	c	15	a
16	a	17	d	18	d	19	c	20	c
21	d	22	e	23	a	24	a	25	b

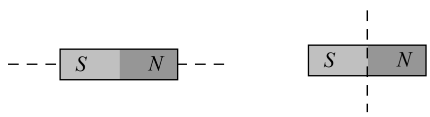
AS Answers and Solutions

Magnet and it's Properties

1. (b) On bending a rod it's pole strength remains unchanged where as its magnetic moment changes.
New magnetic moment $M' = m(2R) = m\left(\frac{2L}{\pi}\right) = \frac{2M}{\pi}$



2. (d)
3. (c) $B_a = \frac{\mu_0}{4\pi}\frac{2M}{d^3} = \frac{\mu_0}{2\pi}\frac{M}{d^3}$
4. (d)
5. (b) If cut along the axis of magnet of length l, then new pole strength $m' = \frac{m}{2}$ and new length $l' = l$
$\therefore$ New magnetic moment $M' = \frac{m}{2} \times l = \frac{ml}{2} = \frac{M}{2}$



If cut perpendicular to the axis of magnet, then new pole strength $m' = m$ and new length, $l' = l/2$
$\therefore$ New magnetic moment $M' = m \times \frac{l}{2} = \frac{ml}{2} = \frac{M}{2}$