EXERCISE-I

Magnet and It's Properties

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

(A) Steel (B) Soft iron

(C) Copper (D) Nickel

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

(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

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

(A) Teak wood

(B) Plastic material

(C) Soft iron of high permeability

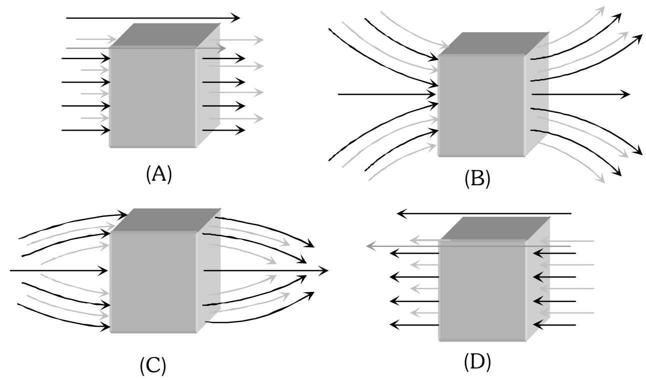
(D) A metal of high conductivity

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

(A) R^2 (B) R^3

(C) $1/R^2$ (D) $1/R^3$

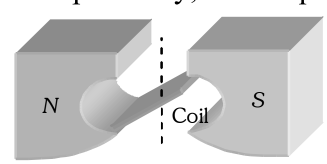
5. A uniform magnetic field, parallel to the plane of the paper existed in space initially directed from left to right. When a bar of soft iron is placed in the field parallel to it, the lines of force passing through it will be represented by



(A) Figure (A) (B) Figure (B)

(C) Figure (C) (D) Figure (D)

6. 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



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

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

(C) $\tau = niAB$

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

7. 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

(A) 1 : 9 (B) 2 : 9

(C) 27 : 1 (D) 9 : 1

8. 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

(A) 4 : 5 (B) 16 : 25

(C) 64 : 125 (D) $2:\sqrt{5}$

9. 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

(A) $MB(1-\sin\theta)$ (B) $MB\sin\theta$
(C) $MB\cos\theta$ (D) $MB(1-\cos\theta)$

10. 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

(A) d (B) d^2
(C) $\frac{1}{d^2}$ (D) d^4

11. The small magnets each of magnetic moment 10 $A\text{-}m^2$ are placed end-on position 0.1m apart from their centres. The force acting between them is

(A) $0.6\times10^7\,N$ (B) $0.06\times10^7\,N$
(C) $0.6N$ (D) $0.06N$

12. Magnetic lines of force

(A) Always intersect
(B) Are always closed
(C) Tend to crowd far away from the poles of magnet
(D) Do not pass through vacuum

13. 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

(A) $\theta = 0°$ (B) $\theta = 45°$
(C) $\theta = 60°$ (D) $\theta = 90°$

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

(A) MH (B) $2MH$
(C) $2\pi MH$ (D) Zero

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

(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

16. 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

(A) 1/2 (B) 2
(C) 1/4 (D) 1

17. 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

(A) 2.4N (B) 1.2N
(C) 0.6N (D) 0.3N

18. 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

(A) 0.2 J (B) 2.0 J
(C) 4.18 J (D) $2\times10^2\,J$

19. Magnetic lines of force due to a bar magnet do not intersect because

(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

20. The unit of magnetic moment is

(A) Wb/m (B) $Wb.m^2$
(C) $A.m$ (D) $A.m^2$

21. 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

(A) 2 M (B) $\sqrt{2}\,M$
(C) 0.5 M (D) M

22. 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

(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

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

(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*

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

(A) *MH* (B) 2 *MH*
(C) 3 *MH* (D) 4 *MH*

25. 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^o is

(A) 50 *N-m* (B) 25 *N-m*
(C) 20 *N-m* (D) 15 *N-m*

26. 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

(A) Equal pole strength
(B) Magnetic moment $\frac{M}{4}$
(C) Magnetic moment $\frac{M}{2}$
(D) Magnetic moment *M*

27. 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

(A) 175 $\hat{k}$ *N-m* (B) 150 $\hat{k}$ *N-m*
(C) 75 $\hat{k}$ *N-m* (D) $25\sqrt{37}\,\hat{k}$ *N-m*

28. A bar magnet is held perpendicular to a uniform magnetic field. If the couple acting on the magnet is to be halved by rotating it, then the angle by which it is to be rotated is

(A) 30^o (B) 45^o
(C) 60^o (D) 90^o

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

(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

30. 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

(A) 0.5 *m* (B) 0.3 *m*
(C) 0.2 *m* (D) 0.1 *m*

Earth Magnetism

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

(A) 30° (B) 90°
(C) 45° (D) 0°

32. 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

(A) $\sqrt{3} : \sqrt{2}$ (B) $1 : \sqrt{2}$
(C) $1 : \sqrt{3}$ (D) $1 : 2$

33. At a place the earth's horizontal component of magnetic field is $0.36 \times 10^{-4}\, weber / m^2$. 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

(A) 0.12×10^{-4} (B) 0.24×10^{-4}
(C) 0.40×10^{-4} (D) 0.62×10^{-4}

34. The angle of dip at a place is 40.6° 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

(A) $7\times10^{-5}\,tesla$ (B) $6\times10^{-5}\,tesla$

(C) $5\times10^{-5}\,tesla$ (D) $9.2\times10^{-5}\,tesla$

35. The angle of dip is the angle

(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

36. 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

(A) $\sqrt{3}$ (B) 1

(C) $\frac{1}{\sqrt{3}}$ (D) $\frac{1}{2}$

37. The angle of dip at the magnetic equator is

(A) 0° (B) 45°

(C) 30° (D) 90°

38. The line on the earth's surface joining the points where the field is horizontal is

(A) Magnetic meridian (B) Magnetic axis

(C) Magnetic line (D) Magnetic equator

39. The angle between the earth's magnetic and the earth's geographical axes is

(A) Zero (B) 17°

(C) 23° (D) None of these

40. The lines joining the places of the same horizontal intensity are known as

(A) Isogonic lines (B) Aclinic lines

(C) Isoclinic lines (D) Agonic lines

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

(A) Isobaric lines (B) Isogonic lines

(C) Isoclinic lines (D) Isodynamic lines

42. The vertical component of the earth's magnetic field is zero at a place where the angle of dip is

(A) 0° (B) 45°

(C) 60° (D) 90°

43. 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

(A) B_0 (B) B_0^2

(C) $2B_0$ (D) $\sqrt{2}B_0$

44. A compass needle will show which one of the following directions at the earth's magnetic pole

(A) Vertical

(B) No particular direction

(C) Bent at 45° to the vertical

(D) Horizontal

45. The north pole of the earth's magnet is near the geographical

(A) South (B) East

(C) West (D) North

46. The magnetic field of earth is due to

(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

47. 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

(A) 10 *cm* (B) 20 *cm*

(C) 30 *cm* (D) 40 *cm*

48. Due to the earth's magnetic field, charged cosmic ray particles

(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

49. 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 2M making and angle θ with the magnetic meridian such that

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

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

Magnetic Equipments

50. 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

(A) $2T$ (B) $T/2$

(C) $2/T$ (D) T

51. 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

(A) $\sqrt{3}$ sec (B) $3\sqrt{3}$ sec

(C) 3 sec (D) 6 sec

52. 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

53. 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

(A) $3\sqrt{3}:8$ (B) $16:9\sqrt{3}$

(C) $4:9$ (D) $2\sqrt{3}:9$

54. 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

(A) 0.75 *sec* (B) 1.5 *sec*

(C) 3 *sec* (D) 6 *sec*

55. 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

(A) $M_A = 2M_B$ (B) $M_A = 8M_B$

(C) $M_A = 4M_B$ (D) $M_B = 8M_A$

56. 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

(A) $1/2$ (B) 2

(C) 4 (D) $1/4$

57. 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

(A) $\frac{n}{2\sqrt{2}}$ (B) $\frac{n}{\sqrt{2}}$

(C) $2\sqrt{2}n$ (D) $\sqrt{2}n$

58. A magnetic needle suspended horizontally by an unspun silk fibre, oscillates in the horizontal plane because of the restoring force originating mainly from

(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

59. 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

(A) 9 : 4 (B) 3 : 2

(C) 4 : 9 (D) 2 : 3

60. 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

(A) Decrease by 30° (B) Decrease by 15°

(C) Increase by 15° (D) Increase by 30°

61. Two normal uniform magnetic field contain a magnetic needle making an angle 60° with F. Then the ratio of $\frac{F}{H}$ is

(A) 1 : 2 (B) 2 : 1

(C) $\sqrt{3}:1$ (D) $1:\sqrt{3}$

62. 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

(A) 30° (B) 45°

(C) 90° (D) 60°

63. 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

(A) 3 : 1 (B) 1 : 3

(C) 3 : 5 (D) 5 : 4

64. To measure which of the following, is a tangent galvanometer used

(A) Charge

(B) Angle

(C) Current

(D) Magnetic intensity

65. 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

(A) 30° (B) 45°

(C) 60° (D) 75°

66. 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

(A) 1.0 *sec* (B) 0.5 *sec*

(C) 0.25 *sec* (D) 2.0 *sec*

67. 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

(A) 4 *sec* (B) 2 *sec*

(C) $\sqrt{2}$ sec (D) 1 *sec*

68. 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

(A) Period decreases

(B) Period does not change

(C) Oscillations are damped

(D) Amplitude increases

69. The period of oscillation of a vibration magnetometer depends on which of the following factors

(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

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

(A) 1 *amp* (B) $2\sqrt{3}$ *amp*

(C) 4 *amp* (D) 6 *amp*

71. Which of the following statement is not the true

(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^o

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

72. 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*

73. When two magnetic moments are compared using equal distance method the deflections produced are 45^o and 30^o. If the length of magnets are in the ratio 1 : 2, the ratio of their pole strengths is

(A) 3 : 1 (B) 3 : 2

(C) $\sqrt{3}:1$ (D) $2\sqrt{3}:1$

74. The magnetic needle of a tangent galvanometer is deflected at an angle 30^o 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

(A) 1.96×10^{-4} T

(B) 1.96×10^{-5} T

(C) 1.96×10^{4} T

(D) 1.96×10^{5} T

Magnetic Materials

75. The only property possessed by ferromagnetic substance is
(A) Hysteresis
(B) Susceptibility
(C) Directional property
(D) Attracting magnetic substances

76. Substances in which the magnetic moment of a single atom is not zero, is known as
(A) Diamagnetism (B) Ferromagnetism
(C) Paramagnetism (D) Ferrimagnetism

77. Diamagnetic substances are
(A) Feebly attracted by magnets
(B) Strongly attracted by magnets
(C) Feebly repelled by magnets
(D) Strongly repelled by magnets

78. The magnetic susceptibility is
(A) $\chi = \frac{I}{H}$ (B) $\chi = \frac{B}{H}$
(C) $\chi = \frac{M}{V}$ (D) $\chi = \frac{M}{H}$

79. Relative permeability of iron is 5500, then its magnetic susceptibility will be
(A) 5500×10^{7} (B) 5500×10^{-7}
(C) 5501 (D) 5499

80. An example of a diamagnetic substance is
(A) Aluminium (B) Copper
(C) Iron (D) Nickel

81. 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

82. Magnetic permeability is maximum for
(A) Diamagnetic substance
(B) Paramagnetic substance
(C) Ferromagnetic substance
(D) All of these

83. 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
(A) Rise (B) Fall
(C) Oscillate slowly (D) Remain as such

84. A superconductor exhibits perfect
(A) Ferrimagnetism (B) Ferromagnetism
(C) Paramagnetism (D) Diamagnetism

85. 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
(A) Diamagnetic
(B) Paramagnetic
(C) Ferri-magnetic
(D) Antiferro-magnetic

86. A diamagnetic material in a magnetic field moves
(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

87. Curie temperature is the temperature above which
(A) A paramagnetic material becomes ferromagnetic
(B) A ferromagnetic material becomes paramagnetic
(C) A paramagnetic material becomes diamagnetic
(D) A ferromagnetic material becomes diamagnetic

88. 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

(A) Paramagnetic (B) Diamagnetic
(C) Ferromagnetic (D) Antiferromagnetic

89. Which one of the following is a non-magnetic substance

(A) Iron (B) Nickel
(C) Cobalt (D) Brass

90. Liquid oxygen remains suspended between two pole faces of a magnet because it is

(A) Diamagnetic (B) Paramagnetic
(C) Ferromagnetic (D) Antiferromagnetic

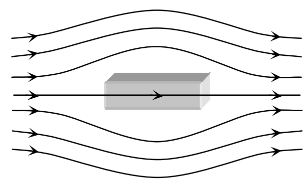
91. Curie-Weiss law is obeyed by iron at a temperature ......

(A) Below Curie temperature
(B) Above Curie temperature
(C) At Curie temperature only
(D) At all temperatures

92. The materials suitable for making electromagnets should have

(A) High retentivity and high coercivity
(B) Low retentivity and low coercivity
(C) High retentivity and low coercivity
(D) Low retentivity and high coercivity

93. The given figure represents a material which is



(A) Paramagnetic (B) Diamagnetic
(C) Ferromagnetic (D) None of these