PRACTICE EXERCISES

SINGLE CORRECT CHOICE TYPE QUESTIONS

This section contains Single Correct Choice Type Questions. Each question has four choices (A), (B), (C) and (D), out of which ONLY ONE is correct.

1. Relative permeability of iron is 5500, then its magnetic susceptibility will be

(A) 5500×10^{7} (B) 5500×10^{-7}

(C) 5501 (D) 5499

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

(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

3. A magnet of magnetic moment 20 C.G.S. units are 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° in C.G.S. units is

(A) 6 (B) $3\sqrt{3}$

(C) $3\left(2-\sqrt{3}\right)$ (D) 3

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

(A) North (B) South

(C) East (D) West

5. Which of the following statements is false

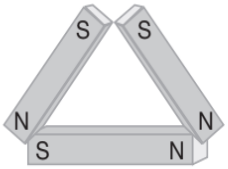
(A) magnetic intensity is a measure of magnetic lines of force passing through unit area held normal to it

(B) magnetic lines of force form a closed curve

(C) due to magnet magnetic lines of force never cut each other

(D) inside a magnet the magnetic lines of force run from north pole of a magnet towards south pole

6. Three identical bar magnets each of magnetic moment M are placed in the form of an equilateral triangle as shown.

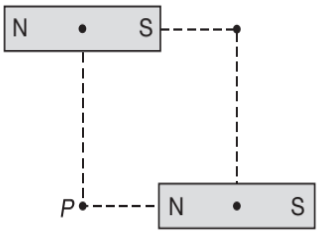


The net magnetic moment of the system is

(A) ZERO (B) $2M$

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

7. Two short magnets of magnetic moment 1000 Am^2 are placed as shown at the corners of a square of side 10 cm . The net magnetic induction at P is



(A) 0.1 T (B) 0.2 T

(C) 0.3 T (D) 0.4 T

8. 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) $\theta=0^\circ$ (B) $\theta=45^\circ$

(C) $\theta=60^\circ$ (D) $\theta=90^\circ$

9. The area of hysteresis loop of a material is equivalent to 250 J . When 10 kg material is magnetised by an alternating field of 50 Hz then energy lost in one hour will be if the density of material is 7.5 gcm^{-3}

(A) 6×10^{4} J (B) 6×10^{4} erg

(C) 3×10^{2} J (D) 3×10^{2} erg

10. 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

(A) 4 : 9 (B) 9 : 4

(C) 2 : 3 (D) 3 : 2

11. The sensitivity of a tangent galvanometer is increases if

(A) Number of turn decreases

(B) Number of turn increases

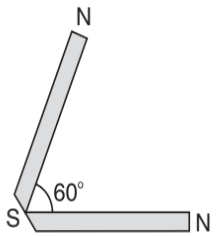
(C) Field increases

(D) None of the above

12. 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) 2.4 N (B) 1.2 N
(C) 0.6 N (D) 0.3 N

13. The net magnetic moment of two identical magnets each of magnetic moment M_0, inclined at $60°$ with each other is



(A) M_0 (B) $\sqrt{2}M_0$
(C) $\sqrt{3}M_0$ (D) $2M_0$

14. The magnetic needle of an oscillation magnetometer makes 10 oscillations per minute under the action of earth's magnetic field. When a bar magnet is placed at some distance along the axis of the needle it makes 14 oscillations per minute. If the bar magnet is turned so that its poles interchange their position, then the new frequency of oscillation of the needle is

(A) 10 vibrations per minute
(B) 14 vibrations per minute
(C) 4 vibrations per minute
(D) 2 vibrations per minute

15. 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

(A) $2^{\frac{1}{4}}$ (B) $2^{\frac{1}{2}}$
(C) 2 (D) $2^{\frac{3}{4}}$

16. 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

(A) $\frac{T}{\sqrt{2}}$ (B) T
(C) $\sqrt{2}T$ (D) $2T$

17. The distance between the poles of horse shoe magnet is 10 cm and its pole strength is 10^{-4} Am. The magnetic field induction at point P midway between the poles is

(A) ZERO (B) 2×10^{-9} T
(C) 4×10^{-9} T (D) 8×10^{-9} T

18. 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

(A) $4\pi iM$ (B) $\sqrt{\frac{4\pi M}{i}}$
(C) $\sqrt{\frac{4\pi i}{M}}$ (D) $\frac{M\pi}{4i}$

19. The distance of two points on the axis of a magnet from its centre is 10 cm and 20 cm respectively. The ratio of magnetic intensity at these points is 12.5 : 1. The length of the magnet will be

(A) 5 cm (B) 25 cm
(C) 10 cm (D) 20 cm

20. A magnet is parallel to a uniform magnetic field. If it is rotated by $60°$, the work done is 0.8 J. The work done in rotating it further by $30°$ is

(A) 0.8×10^7 erg (B) 0.4 J
(C) 8 J (D) 0.8 erg

21. At a certain place, the horizontal component B_0 and the vertical component 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) $\sqrt{2}B_0$

22. 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 $60°$ (if horizontal component of earth's field is 4×10^{-4} T) is

(A) 3 A (B) 1.1 A
(C) 2.1 A (D) 1.5 A

23. The moment of a magnet is 0.1 Am^2 and the force acting on each pole in a uniform magnetic field of strength 0.36 oersted is 1.224×10^{-4} N. The distance between the poles of the magnet is

(A) 1.56 cm (B) 0.78 cm
(C) 2.50 cm (D) 1.17 cm

24. If the earth's field induction at a place is 0.36 G and the angle of dip is $60°$. The horizontal and vertical components of the field are B_H and B_V respectively.

(A) $B_H = 0.18$ G, $B_V = \frac{0.18}{\sqrt{3}}$ G

(B) $B_H = 0.18\sqrt{3}$ G, $B_V = 0.18$ G

(C) $B_H = 0.18$ G, $B_V = 0.36$ G

(D) $B_H = 0.18$ G, $B_V = 0.18\sqrt{3}$ G

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 and angle of $30°$ with the magnetic meridian. In this position the needle will dip by an angle

(A) $40°$ (B) $30°$

(C) More than $40°$ (D) Less than $40°$

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

(A) 100 G (B) 400 G

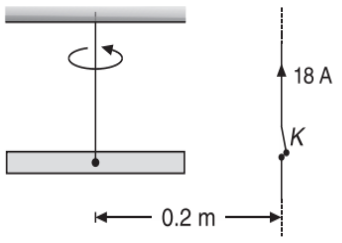
(C) 50 G (D) 200 G

27. 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 magnetometer. We may say that

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

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

28. Figure shows a short magnet executing small oscillations in a vibration magnetometer in earth's magnetic field having horizontal component 24 μT. The period of oscillation is 0.1 s. When the key K is closed, and upward current of 18 A is established as shown. The new time period is



(A) 0.1 s (B) 0.2 s

(C) 0.3 s (D) 0.4 s

29. The values of the apparent angles of dip in two planes at right angles to each other are $30°$ and $45°$. Then the true value of the angle of dip at the place is

(A) $\tan^{-1} 1$ (B) $\tan^{-1} 2$

(C) $\cot^{-1} 2$ (D) $\cot^{-1} 1$

30. The magnet of vibration magnetometer is heated so as to reduce its magnetic moment by 36%. By doing this the periodic time of the magnetometer will

(A) Increases by 36%

(B) Increases by 25%

(C) Decreases by 25%

(D) Decreases by 64%

31. 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 (in oersted) is

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

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

32. A bar magnet of length 10 cm and having the pole strength equal to 10^{-3} Wb is kept in a magnetic field having magnetic induction (B) equal to $4\pi \times 10^{-3}$ T. It makes an angle of $30°$ with the direction of magnetic induction. The value of the torque acting on the magnet is

(A) $2\pi \times 10^{-7}$ Nm (B) $2\pi \times 10^{-5}$ Nm

(C) 0.5 Nm (D) 0.5×10^{2} Nm

$\left(\mu_0 = 4\pi \times 10^{-7}\ \text{WbA}^{-1}\text{m}^{-1}\right)$

33. A dip circle lying initially in the magnetic meridian is rotated through angle θ in the horizontal plane. The tangent of angle of dip is increased in the ratio

(A) $\cos\theta : 1$ (B) $\sin\theta : 1$

(C) $1 : \cos\theta$ (D) $1 : \sin\theta$

34. Magnetic 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 period of the oscillation when their like poles and unlike poles are kept together respectively, then $\frac{T_1}{T_2}$ will be

(A) $\frac{1}{3}$ (B) $\frac{1}{2}$

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

35. The dip at a place is ϕ. For measuring it, the axis of the dip needle is perpendicular to the magnetic meridian. If the axis of the dip needle makes angle θ with the magnetic meridian, the apparent dip will be given $\tan\phi'$ which is equal to:

(A) $\tan\phi\cos\theta$ (B) $\tan\phi\sec\theta$

(C) $\tan\phi\sin\theta$ (D) $\tan\phi\operatorname{cosec}\theta$

36. A dip needle in a plane perpendicular to magnetic meridian will remain

(A) vertical
(B) horizontal
(C) in any direction
(D) inclined at $45°$ with horizontal

37. 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

38. A thin magnet of magnetic moment M is divided into two equal parts by cutting it along its length. The new magnetic moment of each part is M' . If the time period of each part is T' and the time period of original magnet is T for oscillations in the same magnetic field, then

(A) $M' = \frac{M}{2}, T' = \frac{T}{2}$ (B) $M' = \frac{M}{2}, T' = T$

(C) $M' = M, T' = T$ (D) $M' = M, T' = 2T$

39. A bar magnet is oscillating in earth's magnetic field with a period T . What happens to its period and motion if its mass is quadrupled?

(A) motion remains simple harmonic with a new period $4T$
(B) motion remains simple harmonic with a new period $\frac{T}{2}$
(C) motion does not remain simple harmonic and the period stays nearly constant
(D) motion remains simple harmonic with a new period $2T$

40. If the angular momentum of an electron is J, then the magnitude of the magnetic moment will be

(A) $\frac{eJ}{m}$ (B) $\frac{eJ}{2m}$

(C) $eJ2m$ (D) $\frac{2m}{eJ}$

41. In a vibration magnetometer, the time period of a bar magnet oscillating in a horizontal component of earth's magnetic field is 2 s. When the magnet is brought near and parallel to it, the time period reduces to 1 s . The ratio of the horizontal component of earth's magnetic field to the magnetic field due to magnet is

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

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

42. In a vibration magnetometer, the time period of a bar magnet oscillating in horizontal component of earth's magnetic field is 2 s . When a magnet is brought near and parallel to it, the time period reduces to 1 s . The ratio of the horizontal component of earth's field to the field due to magnet is

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

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

43. 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 distance of x and y from the centre of the magnet is

(A) 2^{-3} (B) $2^{-\frac{1}{3}}$

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

44. The real angle of dip, if magnet is suspended at an angle of $30°$ to the magnetic meridian and the dip needle makes an angle of $45°$ with horizontal is

(A) $\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$ (B) $\tan^{-1}\left(\sqrt{3}\right)$

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

45. Which of the following statement is incorrect about hysteresis?

(A) This effect is common to all ferromagnetic substance
(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 material
(D) The shape of the hysteresis loop is characteristic of the material

46. Two short magnets have equal to pole strengths but one is twice as long as the other. The shorter magnet is placed 20 cm in tan A position from the compass needle. The longer magnet must be placed on the other side of the magnetometer for no deflection at a distance that equals

(A) 20 cm (B) $20\times(2)^{\frac{1}{3}}$ cm

(C) $20\times(2)^{\frac{4}{3}}$ cm (D) $20\times(2)^{\frac{2}{3}}$ cm

47. A thin magnet of magnetic moment M is divided into two equal parts by cutting it perpendicular to its length. The new magnetic moment of each part is M'. If the time period of each part is T' and the time period of original magnet is T for oscillations in the same magnetic field, then

(A) $M'=\frac{M}{2}, T'=\frac{T}{2}$ (B) $M'=\frac{M}{2}, T'=T$

(C) $M'=M, T'=T$ (D) $M'=M, T'=2T$

48. A short magnet oscillates with a time period 0.1 s at a place where horizontal magnetic field is 24 μT. 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

49. Two small identical magnetic dipoles of magnetic moments 1.0 Am^2 each, placed at a separation of 2 m with their axis perpendicular to each other. The resultant magnetic field at a point midway between the dipoles is

(A) 5×10^{-7} T (B) $\sqrt{5}\times10^{-7}$ T

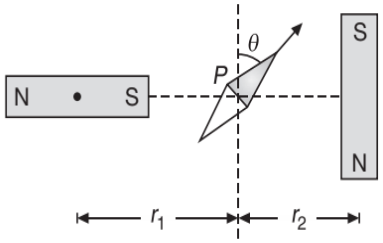
(C) 10^{-7} T (D) 2×10^{-7} T

50. 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°

51. Two magnets A and B are identical and these are arranged as shown in 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 r_1 and r_2 will be



(A) $(2\tan\theta)^{\frac{1}{3}}$ (B) $(2\tan\theta)^{-\frac{1}{3}}$

(C) $(2\cot\theta)^{\frac{1}{3}}$ (D) $(2\cot\theta)^{-\frac{1}{3}}$

52. 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 magnetometer. We may say that

(A) $M_A=2M_B$ (B) $M_B=4M_A$

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

53. A tangent galvanometer shown a deflection 45° when 10 mA current pass through it. If the horizontal component of the earth's field is 3.6×10^{-5} T and radius of the coil is 10 cm. The number of turns in the coil is

(A) 5700 turns (B) 57 turns

(C) 570 turns (D) 5.7 turns

54. In a deflection magnetometer experiment the deflections produced separately by two short bar magnets kept at the same distance are 45° and 30°. Then the ratio of the magnetic moments of the two magnets is

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

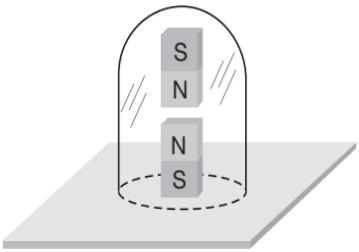
(C) $\sqrt{2}:1$ (D) $1:\sqrt{3}$

55. Two tangent galvanometer have radii 7.5 cm and 10 cm, number of turns are 15 and 10 and resistances are 8 Ω and 12 Ω. They are joined in parallel in circuit. If deflection in one is 60°, the deflection in second galvanometer is

(A) 45° (B) 30°

(C) 40° (D) 35°

56. Two identical bar magnets with a length 10 cm and weight 50 gwt are arranged freely with their like poles facing in an 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 Am (B) 2 Am
(C) 10.25 Am (D) None of these

57. 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) $\cot^2\phi = \cot^2\phi_1 + \cot^2\phi_2$

58. A thin rectangular magnet suspended freely has a period of oscillation of 4 s. If it is broken into two halves (each having half the original length) and one of the pieces is suspended similarly. The period of its oscillation will be

(A) 4 s (B) 2 s
(C) 0.5 s (D) 0.25 s

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

(A) 1:9 (B) 2:9
(C) 27:1 (D) 9:1

60. A magnetic needle vibrates in a vertical plane parallel to the magnetic meridian about a horizontal axis passing through its centre. Its frequency is n. If the plane of oscillation is turned about a vertical axis by 90°, the frequency of its oscillation in vertical plane will be

(A) n (B) ZERO
(C) less than n (D) more than n

61. The angle of dip at a place is 40.6° and the intensity of the vertical component of the earth's magnetic field $V = 6\times10^{-5}$ T. The total intensity of the earth's magnetic field (B) at this place is

(A) 7×10^{-5} T (B) 6×10^{-5} T
(C) 5×10^{-5} T (D) 9.2×10^{-5} T

62. A needle of a deflection magnetometer shows a deflection of 60° due to a short bar magnet at a distance in $\tan A$ position. The deflection under same conditions in $\tan B$ position will be (Given $\tan 74° = 3.464$ and $\tan 41° = 0.866$).

(A) 74° (B) 41°
(C) 47° (D) 33°

63. The earth's magnetic field at a certain place has a horizontal component 0.3 G and the total strength 0.5 G. The angle of dip is

(A) $\tan^{-1}\left(\frac{3}{4}\right)$ (B) $\sin^{-1}\left(\frac{3}{4}\right)$

(C) $\tan^{-1}\left(\frac{4}{3}\right)$ (D) $\sin^{-1}\left(\frac{3}{5}\right)$

64. A copper bar on suspension in a magnetic field orients itself across the field lines. This shows that copper is a

(A) non-magnetic substance
(B) paramagnetic substance
(C) ferromagnetic substance
(D) diamagnetic substance

65. Susceptibility of Mg at 300 K is 1.2×10^{-5}. The temperature at which susceptibility will be 1.8×10^{-5} is

(A) 450 K (B) 200 K
(C) 375 K (D) None of these

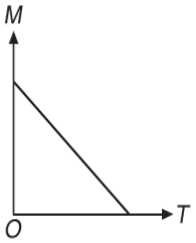
66. Which of the following is most suitable for the core of the electromagnets?

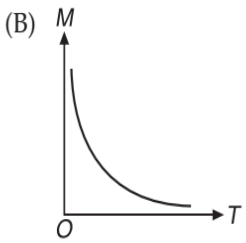
(A) Air (B) Steel
(C) Soft iron (D) *Cu-Ni* alloy

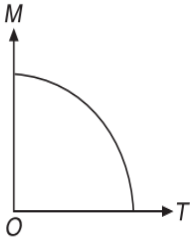
67. Two short magnets with their axes horizontal and perpendicular to the magnetic meridian are placed with their centres 40 cm east and 50 cm west of magnetic needle. If the needle remains undeflected, the ratio of their magnetic moments $M_1 : M_2$ is

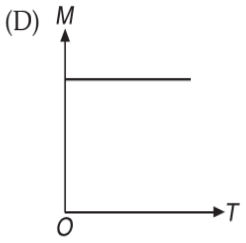
(A) 4:5 (B) 16:25
(C) 64:125 (D) $2:\sqrt{5}$

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

(A) 

(B) 

(C) 

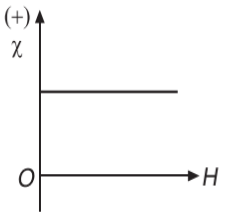
(D) 

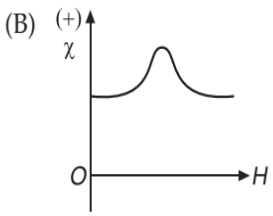
69. A compass needle whose magnetic moment is $60\ \text{Am}^2$ pointing geographical north at a certain place, where the horizontal component of earth's field is $40\mu\ \text{Wbm}^{-2}$, experience a torque $1.2\times10^{-3}\ \text{Nm}$. The declination at this place is

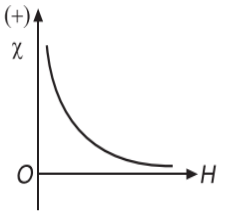
(A) 30° (B) 45°

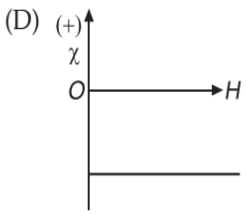
(C) 60° (D) 25°

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

(A) 

(B) 

(C) 

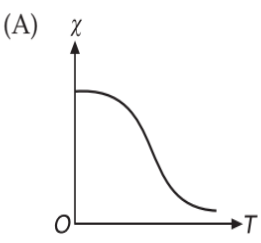
(D) 

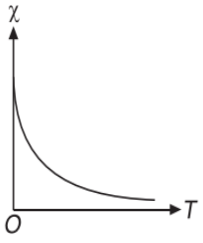
71. A tangent galvanometer has a coil of 25 turns and radius of 15 cm. The horizontal component of the earth's magnetic field is 3×10^{-5} T. The current required to produce a deflection of 45° in it, is

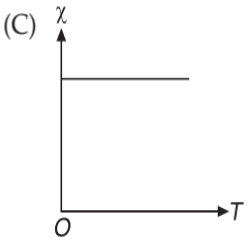
(A) 0.29 A (B) 1.2 A

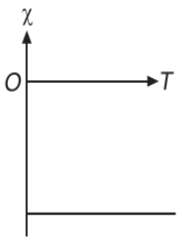
(C) 3.6×10^{-5} A (D) 0.14 A

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

(A) 

(B) 

(C) 

(D) 

73. Iron is ferromagnetic

(A) at all temperatures (B) at NTP only

(C) above 770 °C (D) below 770 °C

74. The most suitable metal for making permanent magnets is

(A) iron (B) copper

(C) steel (D) aluminium

75. 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 (D) 0.5 A

76. All the magnetic materials lose their magnetic properties when

(A) dipped in water

(B) dipped in oil

(C) heated

(D) brought near a piece of iron

77. When all the molecules in a magnet arrange themselves in the direction of the magnetic field lines, the condition is called

(A) saturation (B) reluctance

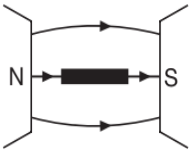
(C) retentivity (D) permeability

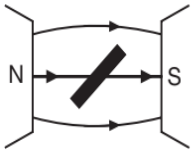
78. A magnetic needle lying parallel to a magnetic field requires W units of work to turn it through 60°. The torque required to maintain the needle in this position will be

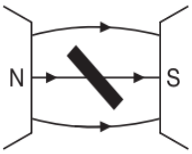
(A) $\sqrt{3}W$ (B) W

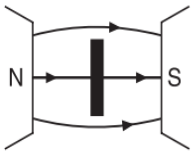
(C) $\frac{\sqrt{3}}{2}W$ (D) $2W$

79. A rod of a diamagnetic material is placed in a non-uniform strong magnetic field. Which of the figure below shows the alignment of the rod in the field?

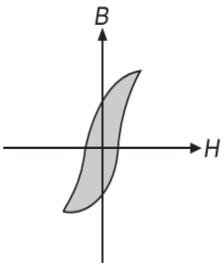
(A) 

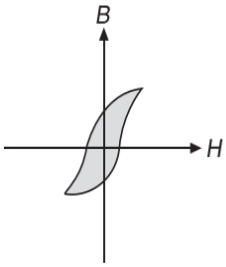
(B) 

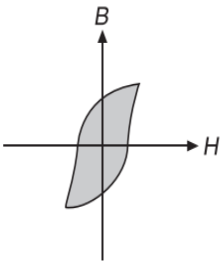
(C) 

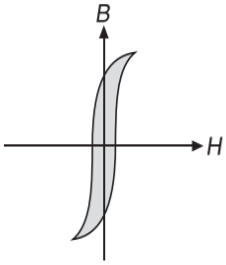
(D) 

80. For substance hysteresis $(B-H)$ curves are given as shown in Figure. For making temporary magnet which of the following is the best?

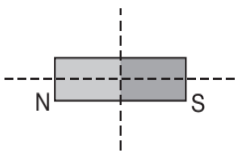
(A) 

(B) 

(C) 

(D) 

81. Time period for 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) $\frac{T}{4}$

(C) $\frac{T}{2}$ (D) T

82. A bar magnet has coercivity 4×10^3 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

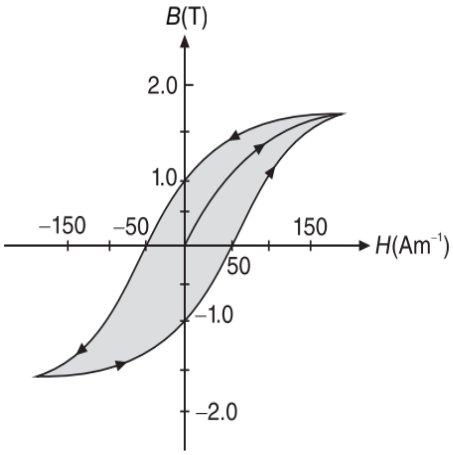
(C) 6 A (D) 8 A

83. 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

84. The figure gives experimentally measured B vs. H variation in a ferromagnetic material. The retentivity, co-ercivity and saturation, respectively, of the material are



(A) 150 Am^{-1}, 1.0 T and 1.5 T

(B) 1.0 T, 50 Am^{-1} and 1.5 T

(C) 1.5 T, 50 Am^{-1} and 1.0 T

(D) 1.5 T, 50 Am^{-1} and 1.0 T

85. At a place the earth's horizontal component of magnetic field is 0.36×10^{-4} Wbm^{-2}. If the angle of dip at that place is $60°$, then the vertical component of earth's field at that place in Wbm^{-2} will be approximately

(A) 0.12×10^{-4} (B) 0.24×10^{-4}

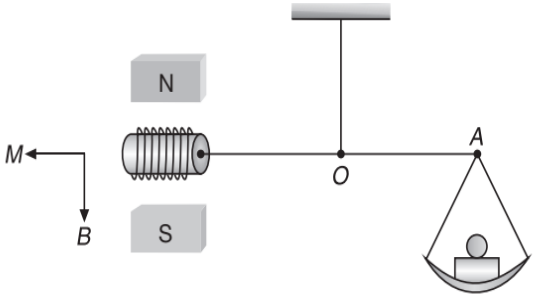
(C) 0.40×10^{-4} (D) 0.62×10^{-4}

86. A watch glass containing some powdered substance is placed between the pole pieces of a magnet. Deep concavity is observed at the centre. The substance in the watch glass is

(A) iron (B) chromium

(C) carbon (D) wood

87. 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 weight of mass $\Delta m = 60\ mg$ on the balance pan. Fine 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

88. A current carrying coil is placed with its axis perpendicular to NS direction. Let horizontal component of earth's magnetic field be H_0 and magnetic field inside the loop be H. If a magnet is suspended inside the loop, it makes angle θ with H. Then $\theta =$

(A) $\tan^{-1}\left(\frac{H_0}{H}\right)$ (B) $\tan^{-1}\left(\frac{H}{H_0}\right)$

(C) $\text{cosec}^{-1}\left(\frac{H}{H_0}\right)$ (D) $\cot^{-1}\left(\frac{H_0}{H}\right)$

89. A bar magnet has coercivity $4\times10^3\ Am^{-1}$. 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

90. The magnetic moment produced in a substance of mass 1 g is $6\times10^{-7}\ Am^2$. If its density is $5\ gcm^{-3}$, then the intensity of magnetisation in Am^{-1} will be

(A) 8.3×10^6 (B) 3.0

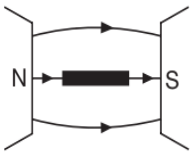
(C) 1.2×10^{-7} (D) 3×10^{-6}

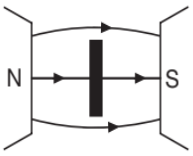
91. A magnet freely suspended in a vibration magnetometer makes 10 oscillations per minute at a place A and 20 oscillation per minute at a place B. If the horizontal component of earth's magnetic field at A is 36×10^{-6} T, then its value at B is

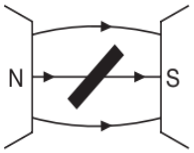
(A) 36×10^{-6} T (B) 72×10^{-6} T

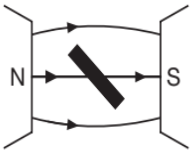
(C) 144×10^{-6} T (D) 288×10^{-6} T

92. A rod of a paramagnetic substance is placed in a non-uniform magnetic field. Which of the following figure shows its alignment in the field?

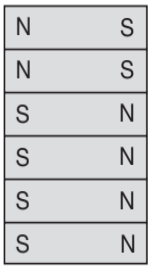
(A) 

(B) 

(C) 

(D) 

93. The length of a magnet is large compared to its width and breadth. The time period of its oscillation in a vibration magnetometer is T. The magnet is cut along its length into six parts and these parts are then placed together as shown in Figure. The time period of this combination will be



(A) T (B) $\frac{T}{\sqrt{3}}$

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

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1. [Online January 2019]

A paramagnetic material has 10^{28} atoms m^{-3}. Its magnetic susceptibility at temperature 350 K is 2.8×10^{-4}. Its susceptibility at 300 K is

(A) 3.726×10^{-4} (B) 3.672×10^{-4}

(C) 2.672×10^{-4} (D) 3.267×10^{-4}

2. [Online January 2019]

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

(A) 3.3×10^{-2} (B) 2.3×10^{-2}

(C) 3.3×10^{-4} (D) 4.3×10^{-2}

3. [Online January 2019]

A hoop and a solid cylinder of same mass and radius are made of a permanent magnetic material with their magnetic moment parallel to their respective axes. But the magnetic moment of hoop is twice of solid cylinder. They are placed in a uniform magnetic field in such a manner that their magnetic moments make a small angle with the field. If the oscillation periods of hoop and cylinder are T_h and T_c respectively, then

(A) $T_h = 0.5T_c$ (B) $T_h = T_c$

(C) $T_h = 2T_c$ (D) $T_h = 1.5T_c$

4. [Online January 2019]

At some location on earth the horizontal component of earth's magnetic field is 18×10^{-6} T. At this location, magnetic needle of length 0.12 m and pole strength 1.8 Am is suspended from its mid-point using a thread, it makes 45° angle with horizontal in equilibrium. To keep this needle horizontal, the vertical force that should be applied at one of its ends is

(A) 1.3×10^{-5} N (B) 1.8×10^{-5} N

(C) 6.5×10^{-5} N (D) 3.6×10^{-5} N

5. [Online January 2019]

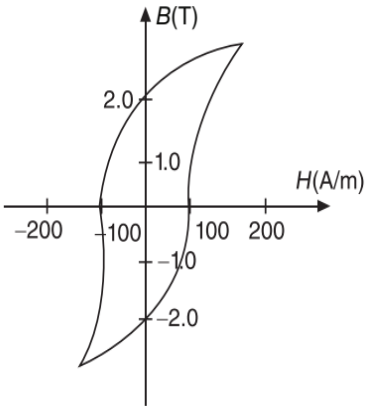
A magnet of total magnetic moment $10^{-2}\hat{i}$ Am^2 is placed in a time varying magnetic field, $B\hat{i}(\cos\omega t)$ where $B = 1$ Tesla and $\omega = 0.125$ $rads^{-1}$. The work done for reversing the direction of the magnetic moment at $t = 1$ second, is

(A) 0.028 J (B) 0.007 J

(C) 0.014 J (D) 0.01 J

6. [Online 2018]

The B-H curve for a ferromagnet is shown in Figure.



The ferromagnet is placed inside a long solenoid with 1000 turns/cm. The current that should be passed in the solenoid to demagnetise the ferromagnet completely is

(A) 1 mA (B) 20 μA

(C) 2 mA (D) 40 μA

7. [2017]

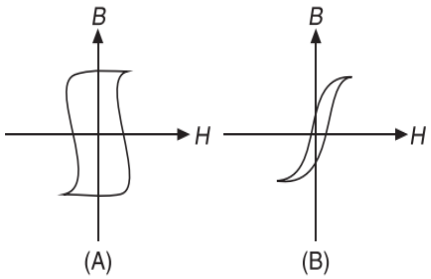
A magnetic needle of magnetic moment 6.7×10^{-2} Am^2 and moment of inertia 7.5×10^{-6} kgm^2 is performing simple harmonic oscillations in a magnetic field of 0.01 T. Time taken for 10 complete oscillations is

(A) 6.65 s (B) 8.89 s

(C) 6.98 s (D) 8.76 s

8. [2016]

Hysteresis loops for two magnetic materials A and B are given below



These materials are used to make magnets for electric generators, transformer core and electromagnet core. Then it is proper to use

(A) A for electric generators and transformers.

(B) A for electromagnets and B for electric generators.

(C) A for transformers and B for electric generators.

(D) B for electromagnets and transformers.

9. [Online 2016]

A magnetic dipole is acted upon by two magnetic fields which are inclined to each other at an angle of $75°$. One of the fields has a magnitude of 15 mT. The dipole attains stable equilibrium at an angle of $30°$ with this field. The magnitude of the other field (in mT) is close to

(A) 1 (B) 11

(C) 36 (D) 1060

10. [Online 2015]

A 25 cm long solenoid has radius 2 cm and 500 total number of turns. It carries a current of 15 A. If it is equivalent to a magnet of the same size and magnetisation $\vec{M}$ (magnetic moment/volume), then $|\vec{M}|$ is

(A) 3π Am^{-1} (B) 30000 Am^{-1}

(C) 300 Am^{-1} (D) 30000π Am^{-1}

11. [Online 2015]

A short bar magnet is placed in the magnetic meridian of the earth with north pole pointing north. Neutral points are found at a distance of 30 cm from the magnet on the East – West line, drawn through the middle point of the magnet. The magnetic moment of the magnet in Am^2 is close to

(Given that $\frac{\mu_0}{4\pi} = 10^{-7}$ in SI units and B_H is the horizontal component of earth's magnetic field equal to 3.6×10^{-5} tesla)

(A) 9.7 (B) 4.9

(C) 19.4 (D) 14.6

12. [2014]

The coercivity of a small magnet where the ferromagnet gets demagnetized is 3×10^3 Am^{-1}. The current required to be passed in a solenoid of length 10 cm and number of turns 100, so that the magnet gets demagnetized when inside the solenoid, is

(A) 6 A (B) 30 mA

(C) 60 mA (D) 3 A

13. [2013]

Two short bar magnets of length 1 cm each have magnetic moments 1.20 Am^2 and 1.00 Am^2 respectively. They are placed on a horizontal table parallel to each other with their N poles pointing towards the South. They have a common magnetic equator and are separated by a distance of 20.0 cm. The value of the resultant horizontal magnetic induction at the mid-point O of the line joining their centres is close to
(Horizontal component of earth's magnetic induction is 3.6×10^{-5} Wbm^{-2})

(A) 5.80×10^{-4} Wbm^{-2}

(B) 3.6×10^{-5} Wbm^{-2}

(C) 2.56×10^{-4} Wbm^{-2}

(D) 3.50×10^{-4} Wbm^{-2}

ANSWER KEYS–TEST YOUR CONCEPTS AND PRACTICE EXERCISES

Test Your Concepts-I (Based on Bar Magnet and Properties)

1. $60°$
2. 12 cm
3. 8×10^{-7} T
4. $\frac{IL^2}{4\pi}$
5. $\frac{M}{\sqrt{2}}$
6. $\frac{3M}{\pi}$
7. For stable equilibrium
   $\theta = 0°$ and $U_{min} = -0.048$ J
   For unstable equilibrium
   $\theta = 180°$ and $U_{max} = +0.048$ J
8. L
9. $\frac{iBl^2}{4\pi}$
10. 100 μJ

Test Your Concepts-II (Based on Earth's Magnetism)

1. $41°$
2. 30 cm
3. $35.2°$
4. $30°$
5. 32 μT , in a vertical plane $12°$ west of geographic meridian at an angle of $60°$ above the horizontal line.
6. 1.2×10^{3} e.m.u.
7. $82°$ west of magnetic north
8. $59°\ 56'$, 0.427 G
9. $\tan^{-1}(2)$
10. 0.45 G , 0.52 G

Test Your Concepts-III (Based on Tangent Law, Tangent Galvanometer and Vibration Magnetometer)

1. $42.2°$
2. $45°$
3. (a) 5.58 Am^2 , (b) 4.30 s
4. $\frac{16}{9\sqrt{3}}$
5. $\sqrt{3}:1$
6. 50%
7. $30°$
8. 17 : 8
9. 10 oscillations/min

Test Your Concepts-IV (Based on Magnetic Properties of Materials)

1. 8.0 A
2. 4×10^{4} Am^{-1}
3. 3×10^{3} Am^{-1}
4. 11.5 A
5. 1.81×10^{-5} Wb
6. 0.015
7. 54000 J
8. 2.08×10^{-2} JT^{-1}
9. 5499

Single Correct Choice Type Questions

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

41. B	42. B	43. D	44. A	45. C	46. B	47. A	48. C	49. B	50. B
51. C	52. C	53. C	54. B	55. B	56. A	57. D	58. B	59. C	60. C
61. D	62. B	63. C	64. D	65. B	66. C	67. C	68. C	69. A	70. A
71. A	72. A	73. D	74. C	75. B	76. C	77. A	78. A	79. D	80. D
81. C	82. D	83. D	84. B	85. D	86. A	87. A	88. A	89. D	90. B
91. C	92. A	93. C							

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1. D	2. C	3. B	4. C	5. *	6. A	7. A	8. D	9. B	10. B
11. A	12. D	13. C							

* No given option is correct