MAGNETIC EFFECT OF CURRENT AND MAGNETISM

1. A point charge moving with constant velocity:-

(1) May produce radial magnetic field

(2) Always produces radial magnetic field

(3) Can not produce electric field

(4) Produces both electric and magnetic field

2. A circular coil of wire consisting of 100 turns, each of radius 8.0 cm carries a current of 0.40 A. What is the magnitude of the magnetic field B at the centre of the coil ?

(1) $2\pi \times 10^{-4}$ T (2) $\pi \times 10^{-4}$ T

(3) $4\pi \times 10^{-4}$ T (4) 10^{-7} T

3. A long straight wire carries a current of 35 A. What is the magnitude of the field B at a point 20 cm from the wire ?

(1) 3.5×10^{-5} T

(2) 7×10^{-5} T

(3) 10^{-5} T

(4) 2×10^{-5} T

4. A long straight wire in the horizontal plane carries a current of 50 A in north to south direction. Give the magnitude and direction of B at a point 2.5m east of the wire :-

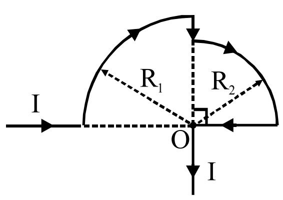
(1) 4×10^{-6} T upwards

(2) 6×10^{-6} T down

(3) 4×10^{-6} T east

(4) Both (1) and (3)

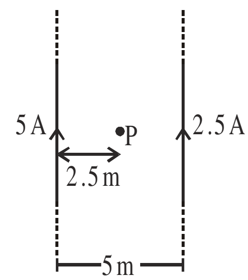
5. In the loop shown, the magnetic induction at the point 'O' is



(1) $\frac{\mu_0 I}{8}\left(\frac{R_1 - R_2}{R_1 R_2}\right)$ (2) $\frac{\mu_0 I}{8}\left(\frac{R_1 + R_2}{R_1 R_2}\right)$

(3) $\frac{\mu_0 I}{8}\left(\frac{R_1 R_2}{R_1 + R_2}\right)$ (4) Zero

6. For adjoining figure, The magnetic field at point 'P' will be:-



(1) $\frac{\mu_0}{4\pi}\odot$

(2) $\frac{\mu_0}{\pi}\otimes$

(3) $\frac{\mu_0}{2\pi}\otimes$

(4) $\frac{\mu_0}{2\pi}\odot$

7. A current i is flowing in a straight conductor of length L. The magnetic induction at a point on its axis at a distance $\frac{L}{4}$ from its centre will be :

(1) 0 (2) $\frac{\mu_0 i}{2\pi L}$

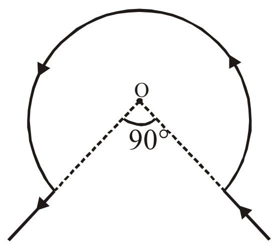
(3) $\frac{\mu_0 i}{\sqrt{2}L}$ (4) $\frac{4\mu_0 i}{\sqrt{5}\pi L}$

8. The magnetic field B_0 due to current carrying circular loop of radius 12 cm at its centre is 0.50×10^{-4} T. The magnetic field due to this loop at a point on the axis at a distance of 5 cm from the centre is -

(1) 3.5×10^{-9} T (2) 5.3×10^{-9} T

(3) 1.3×10^{-5} T (4) 3.9×10^{-5} T

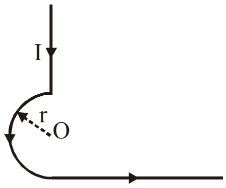
9. The wire shown in the figure carries a current of 40A. The magnetic field at O is 0.94 mT. What is the radius (in cm) of arc ?



(1) 1 cm (2) 2 cm

(3) 3 cm (4) 4 cm

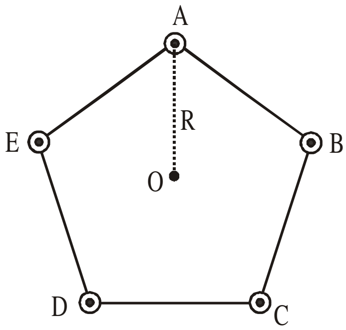
10. In the figure, the magnetic induction at point O is:-



(1) $\frac{\mu_0 I}{4\pi r}$ (2) $\frac{\mu_0 I}{4r} + \frac{\mu_0 I}{2\pi r}$

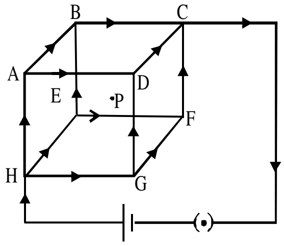
(3) $\frac{\mu_0 I}{4r} + \frac{\mu_0 I}{4\pi r}$ (4) $\frac{\mu_0 I}{4r} - \frac{\mu_0 I}{4\pi r}$

11. Five long wire A,B,C,D and E each carrying current I are arranged to form edges of a pentagonal prism as shown in figure. Each wire carries current out of the plane of paper. The magnetic induction at a point on the axis O is (axis O is at a distance R from each wire) is :-



(1) equal to zero (2) less than zero
(3) more than zero (4) infinite

12. A steady current is set up in a cubic network composed of wires of equal resistance and length d as shown in figure. What is the magnetic field at the centre P due to the cubic network ?



(1) $\frac{\mu_0}{4\pi}.\frac{2I}{d}$ (2) $\frac{\mu_0}{4\pi}.\frac{3I}{\sqrt{2}d}$

(3) Zero (4) $\frac{\mu_0}{4\pi}.\frac{8\pi I}{d}$

13. Biot savart law indicates that the moving electron (velocity v) produces a magnetic field B such that:-

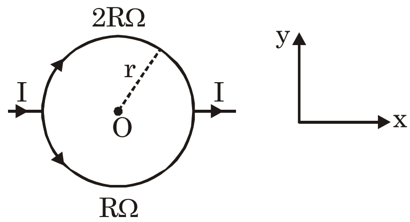
(1) B is perpendicular to v

(2) B is parallel to v

(3) it obeys inverse cube law

(4) it is along the line joining the electron and point of observation.

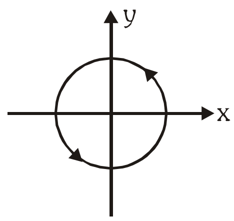
14. Two wires are bent (shown as joint-circle) with radius r (in xy plane). The upper half has resistance of 2R Ω and the lower half of R Ω. A current I is passed into circle as shown. The magnetic field at centre is :



(1) $\frac{\mu_0 I}{r}(\hat{k})$ (2) $\frac{\mu_0 I}{2r}(\hat{k})$

(3) zero (4) $\frac{\mu_0 I}{12r}(\hat{k})$

15. Current i = 2.5 A flows along the circle $x^2 + y^2 = 9\ cm^2$ (here x & y in cm) as shown



Magnetic field at point (0, 0, 4 cm) is

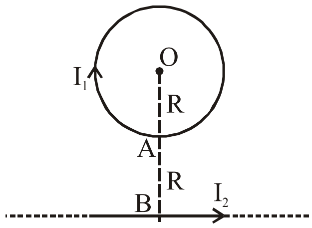
(1) $(36\pi \times 10^{-7}T)\hat{k}$

(2) $(36\pi \times 10^{-7}T)(-\hat{k})$

(3) $\left(\frac{9\pi}{5} \times 10^{-7}T\right)\hat{k}$

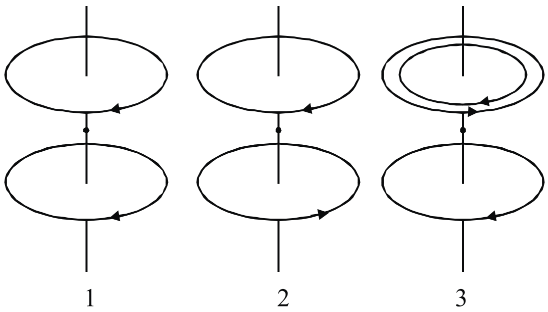
(4) $\left(\frac{9\pi}{5} \times 10^{-7}T\right)(-\hat{k})$

16. In the diagram, I_1, I_2 are the strengths of the currents in the loop and infinite long straight conductor respectively. OA = AB = R. The net magnetic field at the centre O is zero. The ratio of the currents in the loop and the straight conductor is :



(1) π (2) 2π (3) $\frac{1}{\pi}$ (4) $\frac{1}{2\pi}$

17. The diagram shows three arrangements of circular loops, centered on vertical axes and carrying identical currents in the directions indicated. Rank the arrangements according to the magnitude of the magnetic field at the midpoints between the loops on the central axes. (from minimum to maximum)



(1) 1, 2, 3 (2) 2, 3, 1 (3) 2, 1, 3 (4) 3, 2, 1

18. A current I flows along the length of an infinitely long, straight, solid pipe. The current is uniformly distributed on the cross section. Then incorrect statement –

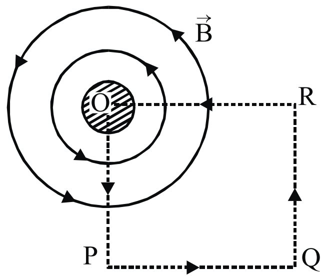
(1) The magnetic field is zero only on the axis of the pipe

(2) The magnetic field is different at different points on the same cross section inside the pipe

(3) The magnetic field is maximum on surface

(4) The magnetic field at all points inside the pipe is the same, but not zero

19. A current carrying thick wire (current = i) perpendicular to the plane of the paper produces a magnetic field, as shown in the figure. A square of side a is drawn with one of its vertices on the centre of the wire. The integral $\int \vec{B}.d\vec{r}$ along $OPQRO$ has the value



(1) $+\mu_0 i$ (2) $\frac{\mu_0 i}{8}$

(3) $\frac{\mu_0 i}{4}$ (4) $\frac{\mu_0 i}{2}$

20. Two identical current carrying co-axial loops, carry Current I in an opposite sense. A simple amperian loop C passes through both of them once. Then which is correct :-

(1) $\oint \vec{B}.\vec{dl} = +\mu_0 I$

(2) $\oint \vec{B}.\vec{dl} = 0$, independent of sense of C

(3) B vanishes every where on C

(4) None of these

21. A toroid of n turns, mean radius R and cross sectional radius 'a' carries current I. It is placed on a horizontal table taken as XY - Plane. Its magnetic moment M :-

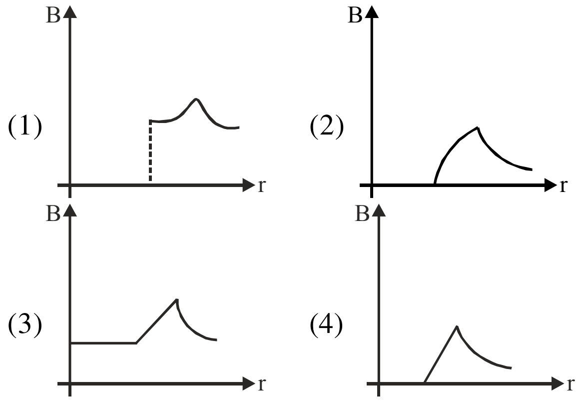
(1) is non-zero and points in the Z-direction by symmetry

(2) Points along the axis of the toroid

(3) is zero otherwise there would a field falling as $\frac{1}{r^3}$ at large distances out side the toroid

(4) is pointing radially outwards

22. A current i is uniformly distributed over the cross section of a long hollow cylindrical wire of inner radius R_1 and outer radius R_2. Magnetic field B varies with distance r from the axis of the cylinder as :-



23. If magnetic field in space is $1T\,\hat{i}$, electric field is $10\ N/C\,\hat{i}$, no gravitational field is present and a charged particle is released from rest from origin, it will

(1) not move at all

(2) move in circular path

(3) move in a helical path

(4) move on a straight line

24. An electron is projected with uniform velocity along the axis of a current carrying long solenoid. Which of the following is true?

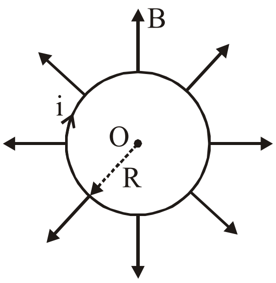
(1) The electron will be accelerated along the axis.

(2) The electron path will be circular about the axis.

(3) The electron will experience a force at 45° to the axis and hence executed a helical path.

(4) The electron will continue to move with uniform velocity along the axis of the solenoid.

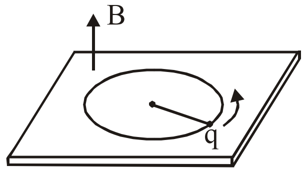
25. A current carrying circular loop of radius R placed in radial magnetic field B according to figure, magnetic force on loop is :-



(1) Bi(2πR) (2) Bi(πR)

(3) Bi(4πR) (4) zero

26. A charge particle is whirled in a horizontal circle on a frictionless table by attaching it to a string fixed at one point. If a magnetic field is switched on in vertical direction, the tension in string :-



(1) will increase

(2) will decrease

(3) will remaining same

(4) may increase or decrease.

27. A particle of charge +q and mass m at t = 0, enters in a uniform magnetic field $\vec{B} = B_0\hat{k}$, while moving with velocity $\vec{v} = v_0(\hat{i} + \hat{k})$ then:-

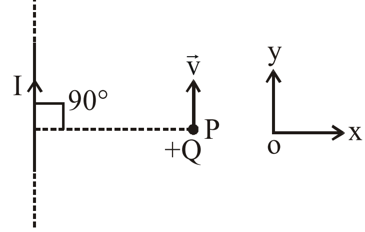
(1) it moves along a circular path of radius $\frac{mv_0}{qB_0}$

(2) it moves along a helical path of pitch $\frac{2\pi m}{qB_0}v_0$

(3) it moves along a helical path of pitch $\frac{2\sqrt{2}\pi m}{qB_0}v_0$

(4) it moves along straight line path along z axis.

28. A long straight wire carries a current I. At the instant, when a charge +Q at point P has velocity v as shown in figure. The direction of magnetic force on charge is :-



(1) along ox (2) along oy

(3) opposite to ox (4) opposite to oy

29. A magnetic field :-

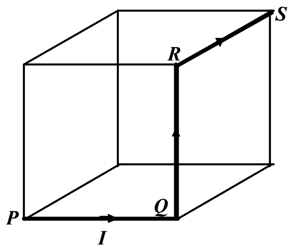
(1) Always exerts a force on a charged particle

(2) Never exerts a force on a charged particle

(3) Exerts a force, if the charged particle is moving across the magnetic field lines

(4) Exerts a force, if the charged particle is moving along the magnetic field lines

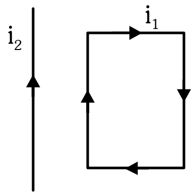
30. A wire *PQRS* carrying a current *I* runs along three edges of a cube of side *l* as shown. There exists a uniform magnetic field of magnitude *B* along one of the sides of the cube. The magnitude of the force acting on the wire is



(1) 0 (2) IlB

(3) $\sqrt{2}\, I\, lB$ (4) $2\, I\, lB$

31. A rectangular loop carrying a current i_1, is situated near a long straight wire carrying a steady current i_2. The wire is parallel to one of the sides of the loop and is in the plane of the loop as shown in the figure. Then the current loop will:–



(1) move away from the wire.

(2) move towards the wire.

(3) remain stationary.

(4) rotate about an axis parallel to the wire.

32. A charged particle moves through a uniform magnetic field in a direction perpendicular to it. Then the

(1) speed of the particle remains unchanged

(2) direction of the particle remains unchanged

(3) acceleration remains unchanged

(4) velocity remains unchanged

33. A charged particle can continue to move with a constant velocity in a region wherein,

(A) $E = 0, B \neq 0$ (B) $E \neq 0, B \neq 0$

(C) $E \neq 0, B = 0$ (D) $E = 0, B = 0$

Select correct alternative :-

(1) Only A, B, D (2) Only A, D

(3) Only A, C, D (4) Only B, D

34. Two long and parallel straight wires A and B carrying currents of 8.0 A and 5.0 A in the same direction are separated by a distance of 4.0 cm. Estimate the force on a 10 cm section of wire A:-

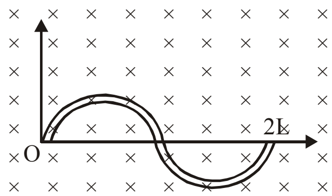
(1) 2×10^{-5} Attractive

(2) 4×10^{-5} Attractive

(3) 2×10^{-5} Repulsive

(4) 4×10^{-5} Repulsive

35. A wire carrying a current i is placed in a magnetic field in the form of the curve $y = a \sin\left(\frac{\pi x}{L}\right)$ $0 \leq x \leq 2L$. Force acting on the wire is :-



(1) $\frac{iBL}{\pi}$ (2) $iBL\pi$

(3) 2iBL (4) Zero

36. A charge having q/m equal to 10^8 C/kg and moving with velocity 3×10^5 m/s enters into a uniform magnetic field B = 0.3 tesla at an angle 30^0 with direction of field. Then radius of curvature will be:-

(1) 0.01 cm (2) 0.5 cm

(3) 1 cm (4) 2 cm

37. Two particles x and y having equal charges after being accelerated through the same PD enter a region of uniform magnetic field and describe circular paths of radii R_1 and R_2 respectively. The ratio of the mass of x and y is :-

(1) $(R_1/R_2)^{1/2}$ (2) (R_2/R_1)

(3) $(R_1/R_2)^2$ (4) (R_1/R_2)

38. A wire of mass 100 g, length 1m and current 5A is balanced in mid air by a uniform transverse magnetic field B, then find the value of 'B' :-

(1) 0.2T (2) 0.1 T

(3) 0.5 T (4) 0.6 T

39. A particle of mass m and charge q moving with velocity v enters a region of uniform magnetic field B. Then :-

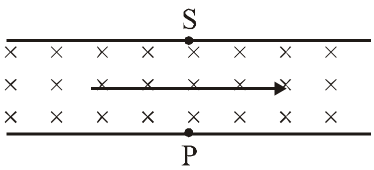
(1) Its path in the region of field is always circular.

(2) Its path in the region of field is circular if $\vec{v} \times \vec{B} = \vec{0}$

(3) Its path in the region is helical if $\vec{v} \times \vec{B} = \vec{0}$

(4) Time period T does not depend on the angle between $\vec{v}$ and $\vec{B}$. (Provided $\theta \neq 0$ & 180^o)

40. The charge carriers are moving from left to right in the magnetic field which is into the page and point S is at higher potential then the charge carrier are:-



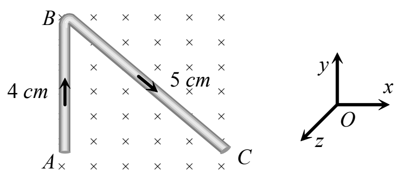
(1) negative

(2) positive

(3) neutral

(4) All of the above

41. A uniform conducting wire ABC has a mass of 10g. A current of 2A flows through it. The wire is kept in a uniform magnetic field B=2T. The acceleration of the wire will be:-



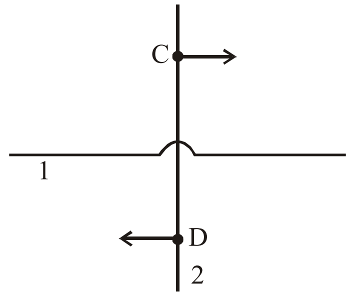
(1) Zero

(2) 12 ms^{-2} along y-axis

(3) $1.2 \times 10^{-3} ms^{-2}$ along y-axis

(4) $0.6 \times 10^{-3} ms^{-2}$ along y-axis

42. Two crossed wires each carrying current I are shown in the figure. The direction of the force exerted on wire 2 by wire 1 at the point C & D are shown by arrow :-



(1) Current in wire 1 flows from left to right and current in wire 2 flows from bottom to top.

(2) Current in wire 1 flows from left to right and current in wire 2 flows from top to bottom

(3) Current in wire 1 flows from right to left & current in wire 2 flows from bottom to top.

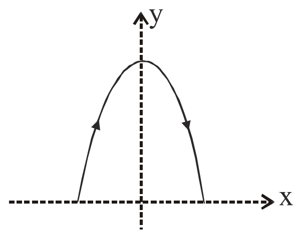
(4) It is impossible to have given force directions at point C & D

43. A 1.5 m diameter cyclotron is used to accelerate protons to an energy of 8 MeV. The required magnetic field strength for this cyclotron is (Given mass of proton = 1.6×10^{-27} kg)

(1) $\frac{2}{15}$T　　(2) $\frac{4}{15}$T

(3) $\frac{8}{15}$T　　(4) $\frac{14}{15}$T

44. A wire carrying a current of 4A is bent in the form of a parabola $x^2 + y = 16$ as shown in figure, where x and y are in meter. The wire is placed in a uniform magnetic field $\vec{B} = 5\hat{k}$ tesla. The force acting on the wire is



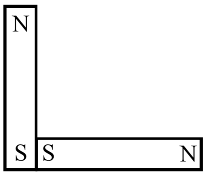
(1) $80\,\hat{j}$ N

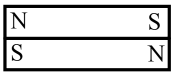
(2) $-80\,\hat{j}$ N

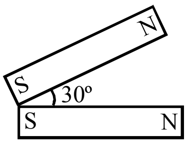
(3) $-160\,\hat{j}$ N

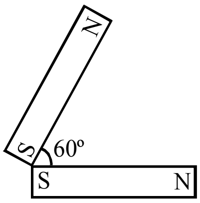
(4) $160\,\hat{j}$ N

45. Following figures show the arrangement of bar magnets in different configurations. Each magnet has magnetic dipole $\vec{M}$. Which configuration has highest net magnetic dipole moment :-

(1) 

(2) 

(3) 

(4) 

46. A solid conducting sphere of radius R is rotating with constant angular velocity ω about its diameter. If charge Q is uniformly distributed on its surface then its magnetic dipole moment is

(1) $\frac{1}{3}QR^2\omega$ (2) $\frac{2}{3}QR^2\omega$

(3) $\frac{1}{5}QR^2\omega$ (4) $\frac{2}{5}QR^2\omega$

47. The length of magnet is 31.4 cm and its pole strength is 0.8 A-m. The magnetic moment, if it is bent in the form of a semicircle is :-

(1) 1.2 (2) 1.6 (3) 0.16 (4) 0.12

48. A circular current loop of magnetic moment M is in an arbitrary orientation in an external magnetic field B. The work done to rotate the loop by 30° about an axis perpendicular to its plane is :-

(1) MB (2) $\sqrt{3}\frac{MB}{2}$

(3) $\frac{MB}{2}$ (4) Zero

49. If a magnet is held vertically on a horizontal paper, the numbers of neutral points which can be obtained on the paper is :-

(1) 1 (2) 2

(3) Zero (4) Infinite

50. The gyro–magnetic ratio of an electron in an H–atom, according to Bohr model is :-

(1) independent of orbit of electron

(2) increases with quantum number n

(3) decreases with quantum number n

(4) None of these

51. To increase the current sensitivity of a moving coil galvanometer, we should :–

(1) decrease number of turns in coil

(2) decrease area of cross section of the coil

(3) increase torsional constant of spiral springs

(4) None of the above

52. The magnetic needle of an oscillation magnetometer, executes 45 oscillations per minute at a place where the dip is 37°. The oscillation frequency at a place where the dip is 60° will be.: (the ratio of the magnetic fields at the two places is 405 : 512).

(1) 35 per minute

(2) 40 per minute

(3) 50 per minute

(4) 55 per minute

53. Force experienced by a particle having charge q and velocity $\vec{v}$ in a magnetic field B is given by $\vec{F} = q(\vec{v} \times \vec{B})$. What is the direction of force acting on electrons (negatively charged particles) falling vertically, at a place where the Earth's magnetic field is horizontal pointing towards North?

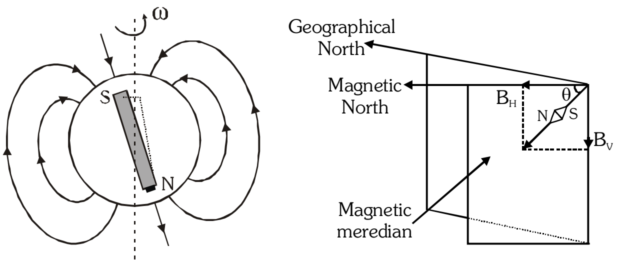
(1) East

(2) West

(3) Vertically up

(4) Vertically down

54. Our earth behaves as it has a powerful magnet within it. The value of magnetic field on the surface of earth is a few tenth of gauss ($1G = 10^{-4}$ T) There are three elements of Earth's magnetism



(i) Angle of declination

(ii) Angle of dip

(iii) Horizontal component of Earth's magnetic field.

In the magnetic meridian of a certain place, the horizontal component of Earth's magnetic field is 0.6 G and the dip angle is 53°. The value of net magnetic field at this place is

(1) 0.8 G (2) 0.6 G (3) 1.0 G (4) 2.0 G

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

(1) 6.98 s (2) 8.76 s

(3) 6.65 s (4) 8.89 s

56. A short bar magnet is placed with its north pole pointing north. The neutral point is 10 cm away from the centre of magnet. If B_H = 0.4 G, calcualte the magnetic moment of the magnet

(1) 0.6 A-m^2 (2) 0.4 Am^2

(3) 0.8 A-m^2 (4) None of these

57. A Ship is to reach a place 10° south of west. In which direction should it be steered if the declination at the place is 18° west of north :-

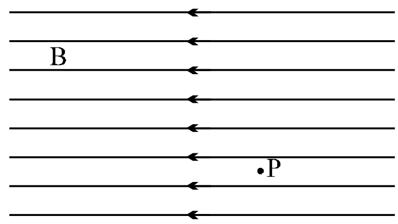
(1) W of magnetic north at 82°

(2) E of magnetic north at 82°

(3) W of magnetic north at 18°

(4) E of magnetic north at 10°

58. Consider the uniform magnetic field shown :



Starting from point P and without leaving the region of magnetic field, is it possible to choose a closed path (that is, a path that returns to P) for which the line integral of the magnetic field is nonzero ?

(1) Yes, but only positive

(2) Yes, but only negative

(3) Yes, both positive and negative

(4) No.

59. Which of the following is universal magnetic property?

(1) Ferromagnetism (2) Diamagnetism

(3) Paramagnetism

(4) Anti-ferromagnetism

60. A ferromagnetic material is placed in an external magnetic field. The magnetic domains

(1) may increase in size

(2) decrease in size

(3) aligns antiparallel to external magnetic field

(4) aligns perpendicular to external magnetic field

61. Susceptibility of a material is 100 then material will be :-

(1) Ferromagnetic (2) Paramagnetic

(3) Diamagnetic (4) All of the above

62. The magnetic materials having negative magnetic susceptibility are :-

(1) Non magnetic (2) Para magnetic

(3) Diamagnetic (4) Ferromagnetic

63. In a permanent magnet at room temperature

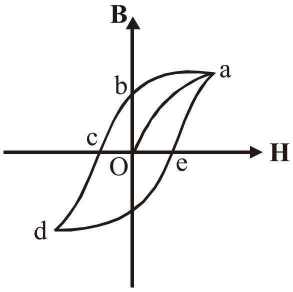
(1) magnetic moment of each molecule is zero.

(2) the individual molecules have non-zero magnetic moment which are all perfectly aligned.

(3) domains are partially aligned.

(4) domains are all perfectly aligned.

64. Figure shows the magnetic hysteresis loop that is the B-H curve for ferromagnetic materials. Mark the **INCORRECT** statement :-



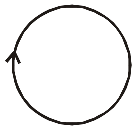
(1) The value of B at H = 0 is called remanence

(2) The value of H at c is called coercivity

(3) A permanent magnet has low remanence and low coercivity

(4) An electromagnet has low remanence and low coercivity

65. A field line is shown in figure. This field can not represent



(a) Magnetostatic field

(b) Electrostatic field

(c) Induced electric field

(d) Gravitational field

(1) (a), (b) (2) (b), (c)

(3) (b), (d) (4) (c), (d)

ANSWER KEY

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