PHYSICS

FOR IIT JEE ASPIRANTS OF CLASS 12 FOR PHYSICS

MAGNETISM AND MATTER

Illustration

1. When a bar magnet is placed at 90° to a uniform magnetic field, it is acted upon by a couple which is maximum. For the couple to be half of the maximum value, at what angle should the magnet be inclined to the magnetic field (B)?

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2. A bar magnet of magnetic moment M_1 is suspended by a wire in a magnetic field. The upper end of the wire is rotated through 180°, then the magnet is rotated through 45°. Under similar conditions another magnet of magnetic moment M_2 is rotated through 30^0. Then find the ratio of $M_1 \& M_2$.

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3. A magnetic dipole is under the influence of two magnetic fields. The angle between the two field directions is 60° and one of the fields has a magnitude of $1.2 \times 10^{-2} T$. If the dipole comes to stable equilibrium at an angle of 15° with this field, what is the magnitude of the other field?

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4. A compass needle whose magnetic moment is $60 Am^2$ pointing geographic north at a certain place where horizontal component of earth's magnetic field is $40 \mu Wb / m^2$ experiences a torque of

$1 \cdot 2 \times 10^{-3} Nm$. What is the declination of the place?

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5. A magnet is suspended at an angle 60^0 in an external magnetic field of $5 \times 10^{-4} T$. What is the work done by the magnetic field in bringing it in its direction? $\left[\text{The magnetic moment } = 20A - m^2\right]$

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

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7. A bar magnet has a magnetic moment $2.5 JT^{-1}$ and is placed in a magnetic field of $0.2T$. Calculate the work done in turning the magnet from parallel to antiparallel position relative to field direction.

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8. A bar magnetic with poles $25cm$ apart and pole strength $14 \cdot 4A.m$ rests with its centre on a frictionless pivot. It is held in equilibrium at 60° to a uniform magnetic field of induction $0 \cdot 25T$ by applying a force F at right angles to its axis, $10cm$ from the pivot. Calculate the value of F. What will happen if the force is removed?

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9. Two bar magnets placed together in a vibration magnetometer take 3 seconds for 1 vibration. If one magnet is reversed, the combination takes 4 seconds for 1 vibration. Find the ratio of their magnetic moments.

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10. A bar magnet makes 40 oscillations per minute in an oscillation magnetometer. An identical magnet is demagnetized completely and is placed over the magnet in the magnetometer. Find the time taken for 40 oscillations by this combination. Neglect any induced magnetism.

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11. A short magnet oscillates in a vibration magnetometer with a time period of 0.10 s where the horizontal component of earth's magnetic field is $24\mu T$. An upward current of 18 A is established in the vertical wire placed 20 cm east of the magnet . Find the new time period.

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12. A magnet is suspended so as to swing horizontally makes 50 vibrations//min at a place where dip is 30^0, and 40 vibration//min where dip is 45^0. Compare the earth's total fields at the two places.

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13. When a short bar magnet is kept in tan A position on a deflection magnetometer, the magnetic needle oscillates with a frequency $'f'$ and the deflection produced is 45^0. If the bar magnet is removed find the frequency of oscillation of that needle ?

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14. Two bar magnets of the same length and breadth but having magnetic moments M and $2M$ are joined with like poles together and suspended by a string.

The time of oscillation of this assembly in a magnetic field of strength B is 3 sec. What will be the period of oscillation, if the polarity of one of the magnets is changed and the combination is again made to oscillate in the same field ?

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15. A magnetic field of $1600Am^{-1}$ produces a magnetic flux of $2 \cdot 4 \times 10^{-5}$ weber in a bar of iron of cross section $0 \cdot 2cm^2$. Calculate permeability and susceptibility of the bar.

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16. The permeability of substance is $6.28 \times 10^{-4} Wb / A - m$. Find its relative permeability and susceptibility ?

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17. The magnetic moment of a magnet of mass $75 gm$ is $9 \times 10^{-7} A - m^2$. If the density of the material of magnet is $7.5 \times 10^3 kgm^{-3}$, then find intensity of magnetisation is

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18. A magnetic field strength $(H) 3 \times 10^3 Am^{-1}$ produces a magnetic field of induction (B) of $12\pi T$ in an iron rod. Find the relative permeability of iron ?

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19. An iron bar of length $10cm$ and diameter $2cm$ is placed in a magnetic field of intensity $1000Am^{-1}$ with its length parallel to the direction of the field. Determine the magnetic moment produced in the bar if permeability of its material is $6.3 \times 10^{-4} TmA(-1)$.

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20. Considering the earth as a short magnet with its centre coinciding with the centre of earth, show that the angle of dip ϕ is related to magnetic latitude λ through the relation $\tan\phi = 2\tan\lambda$

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CUQ

1. If two bar magnets of different magnetic lengths have equal moments, then the pole strength is

A. equal for both the magnets

B. less for shorter magnet

C. more for longer magnet

D. more for shorter magnet

Answer: D

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2. A bar magnet of moment M is bent into arc, its moment

A. decreases

B. increases

C. does not change

D. may change

Answer: A

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3. A bar magnet is cut into two equal halves by a plane parallel to the magnetic axis of the following physical quantities the one which remains unchanged is

A. pole strength

B. magnetic moment

C. intensity of magnetisation

D. moment of inertia

Answer: C

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4. A small hole is made at the centre of the magnet then its magnetic moment

A. decreases

B. increases

C. remains same

D. depends on the nature of the magnetic material

Answer: A

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5. The source of magnetic field is

A. iso lated Magnetic pole

B. static electric charge

C. current loop

D. moving light source

Answer: C

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6. The earth's magnetic field

A. varies in direction but not in magnitude

B. varies in magnitude but not in direction

C. varies in both magnitude and in direction

D. is centred exactly about the centre of the earth

Answer: C

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7. The electric and magnetic field lines differ in that

A. electric lines of force are closed curves while magnetic field lines are not

B. magnetic field lines are closed while electric lines are not

C. electric lines of force can give direction of the electric field while magnetic lines can not

D. magnetic lines can give direction of magnetic field while electric lines can not.

Answer: B

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8. The incorrect statement regarding the lines of force of the magnetic field B is

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 closed curve

C. Inside a magnet, its magnetic lines of force move from north pole of a magnet towards its south pole

D. Magnetic lines of force never cut each other

Answer: C

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9. Two bar magnets are placed on a piece of cork which floats on water. The magnets are so placed that their axis are mutually perpendicular. Then the cork

A. rotates

B. moves a side

C. oscillates

D. neither rotates nor oscillates

Answer: D

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10. When a bar magnet of magnetic moment $\overline{M}$ is placed in a magnetic field of induction field strength $\overline{B}$, each pole experiences a force of $\overline{F}$ then the distance between the south and north pole of the magnet measured inside it is

A. MBF

B. $\frac{MB}{F}$

C. $\frac{F}{MB}$

D. $\frac{FB}{M}$

Answer: B

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11. Lines of force due to earth's horizontal magnetic field are

A. parallel and straight

B. elliptical

C. concentric circles

D. curved lines

Answer: D

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12. In case of a bar magnet, lines of magnetic induction

A. start from the north pole and end at the south pole.

B. run continuously through the bar magnet 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

Answer: B

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13. The total number of magnetic lines of force originating or terminating on a pole of strength

$'m'$ is

A. $\frac{\mu_0 m}{4\pi}$

B. $\frac{m}{\mu_0}$

C. m^2

D. $\mu_0 m$

Answer: D

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14. A magnetic needle is kept in a non uniform magnetic field . It experiences

A. a force and a torque

B. a force but not a torque

C. torque but not a force

D. neither a torque nor a force

Answer: A

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15. A bar magnet of moment $\overline{M}$ is in a magnetic field of induction $\overline{B}$. Then the couple is

A. $\overline{M} \times \overline{B}$

B. $\overline{B} \times \overline{M}$

C. $\overline{M} \cdot \overline{B}$

D. $\overline{B} \cdot \overline{M}$

Answer: A

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16. The effect due to uniform magnetic field on a freely suspended magnetic needle is as follows

A. both torque and net force are present

B. torque is present but no net force

C. both torque and net force are absent

D. net force is present but no torque

Answer: B

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17. A magnet is kept fixed with its length parallel to the magnetic meridian. An identical magnet is parallel to this such that its center lies on perpendicular bisector of both. If the second magnet is free to move, it will have

A. translatory motion only

B. rotational motion only

C. both translatory rotational motion

D. vibrational motion only

Answer: C

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18. There is no. couple acting when two bar magnets are placed co-axially 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

Answer: D

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19. Find the wrong statement among the following. Two unlike isolated magnetic poles are at some distance apart in air.

A. the resultant induction at a point between the poles is $B_1 + B_2$ on the line joining them

B. The resultant induction is B_1~B_2 at any point out side the poles on the line joining them

C. No neutral point is formed on the line joining them if the pole strengths are equal.

D. A neutral point is formed in between the poles and nearer to weak pole on the line joining them.

Answer: D

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20. A magnetic field is produce and directed along $y-$ axis. A magnet is placed along $x-$ axis. The direction of torque on the magnet is

A. in the x-y plane

B. along y-axis

C. along z-axis

D. Torque will be zero

Answer: D

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21. When $N-$ pole of the given bar magnet is placed on a table pointing geographic north,the null points are formed due to the superposition of the magnetic field of the "bar" magnet and the earth's magnetic field. The two null points are located

A. on the axial line at equidistant on either sides

B. on the equitorial line at equidistant on either sides

C. on the axial line only on one side of the magnet

D. on the equitorial line only on one side of the magnet

Answer: B

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22. When $S-$ pole of the given "bar" magnet is placed on a table pointing geographical $N-$ pole

A. two null points are located on the axial line at equidistant on either sides

B. two null points are located on the equitorial line at equidistant on either sides

C. two null points are located on the axial line only on one side of the magnet

D. two null points are located on the equitorial line only on one side of the magnet

Answer: A

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23. A very long magnet is held vertically with its south pole on a table. A single neutral point is located on the table to the

A. East of the magnet

B. North of the magnet

C. West of the magent

D. South of the magent

Answer: B

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24. The null points are on the axial line of a "bar" Magnet when it is placed such that its south pole points geographically

A. South

B. East

C. North

D. West

Answer: C

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25. When the N-pole of a bar magnet points towards the south and S-pole towards the north, the null points are at the

A. magnetic axis

B. magnetic centre

C. perpendicular division of magnetic axis

D. N and S pole

Answer: A

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26. The restoring couple for a magnet oscillating in the uniform magnetic field is provided by

A. horizontal component of earth's magnetic field

B. gravity

C. torsion in the suspended thread

D. magnetic field of magnet

Answer: A

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27. Vibration of suspended magnet works on the principle of

A. torque acting on the bar magnet and rotational inertia

B. force acting on the bar magnet and rotational inertia

C. both the force and torque acting on the bar magnet

D. neither force nor torque

Answer: A

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28. The factors on which the period of oscillation of a "bar" magnet in uniform magnetic field depend

A. nature of suspension fibre

B. length of the suspension fibre

C. vertical component of earth's magnetic induction

D. moment of inertia of the magnet

Answer: D

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29. The time period of a freely suspended magnetic needle does not depend upon

A. length of the magnet

B. pole strength

C. horizontal component of earth's magnetic field

D. length of the suspension fibre

Answer: D

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30. 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 $500^{\circ} C$, then

A. the time period decreases

B. the time period increases

C. the time period remain unchanged

D. the needle stops vibrating

Answer: B

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31. The following instrument i.e. used to measure magnetic field

A. Thermometer

B. Pyrometer

C. Hygrometer

D. Fluxmeter

Answer: D

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32. 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

Answer: A

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33. Out of dia, para and ferromagnetism, the universal property of all substances is

A. diamagnetism

B. paramagnetism

C. ferromagnetism

D. antiferromagnetism

Answer: A

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34. Ferromagnetic ore properties are due to

A. filled inner sub-shells

B. vacant inner sub-shells

C. partially filled inner sub-shells

D. all the sub-shells equally filled

Answer: C

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35. The major contribution of magnetism in substance is due to

A. orbital motion of electrons

B. spin motion of electrons

C. equally due to orbital and spin motions of electrons

D. hidden magnets

Answer: B

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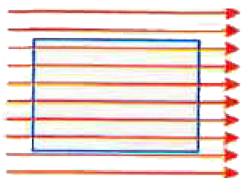
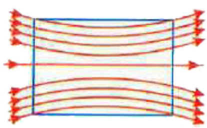
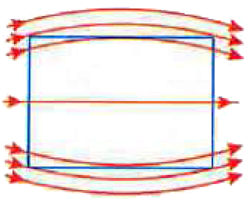
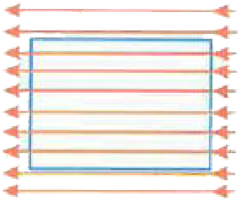
36. A uniform magnetic field exists in certain space in the plane of the paper and initially it is directed from left to right. When a rood of soft iron is placed parallel to the field-direction, the magnetic lines of force passing within the rod will be represented by figure

A. 

B. 

C. 

D. 

Answer: B

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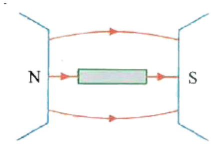
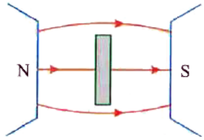
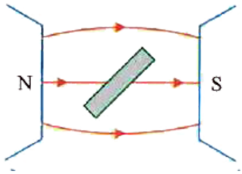
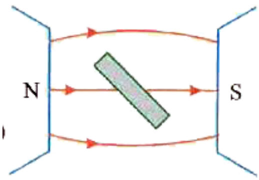
37. A rod of a paramagnetic substance is placed in a non-uniform magnetic field. Which of the following figure shows its alignment in the field?

A. 

B. 

C. 

D. 

Answer: A

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38. The relative permeability of silicon is 0.99837 and that of palladium is 1.00692, choose the correct options of the following

A. silicon is paramagnetic and palladium is ferromagnetic

B. silicon is ferromagnetic and palladium is paramagnetic

C. silicon is diamagnetic and palladium is paramagnetic

D. Both are paramagnetic

Answer: C

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39. The relative permeability is represented by μ_r and susceptibility is denoted by χ for a magnetic substance then for a paramagnetic substance.

A. $\mu_r < 1, \chi < 0$

B. $\mu_r < 1, \chi > 0$

C. $\mu_r > 1, \chi < 0$

D. $\mu_r > 1, \chi > 0$

Answer: D

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40. Two like poles of strengths m_1 and m_2 are at far distance apart. The energy repuired to bring them r_0 distance apart is

A. $\frac{\mu_0}{4\pi}\frac{m_1 m_2}{r_0}$

B. $\frac{\mu_0}{8\pi}\frac{m_1 m_2}{r_0}$

C. $\frac{\mu_0}{16\pi}\frac{m_1 m_2}{r_0}$

D. $\frac{\mu_0}{2\pi}\frac{m_1 m_2}{r_0}$

Answer: A

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41. For a paramagnetic materical, the dependence of the magnetic susceptibility χ on the absolute tempreture T is given by

A. $\chi \alpha T$

B. $\chi \alpha \text{constant} \times T$

C. $\chi \alpha \frac{1}{T}$

D. χ = constant

Answer: C

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42. The area enclosed by a hysteresis loop is a measure of

A. retentivity

B. susceptibility

C. permeability

D. energy loss per cycle

Answer: D

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43. A material produces a magnetic field which oppose the applied magnetic field, then it is

A. diamagnetic

B. para magnetic

C. electro magnetic

D. ferro magnetic

Answer: A

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44. The susceptibility of a diamagnetic substance is

A. ∞

B. zero

C. small but negative

D. small but positive

Answer: C

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45. Liquids and gases never exhibit

A. diamagnetic properties

B. para magnetic properties

C. ferro magnetic properties

D. electro magnetic properties

Answer: C

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46. Alnico is used for making permanent magnets because it has

A. High coercivity and high retentivity

B. high coercivity and low retentivity

C. low coercivity and low retentivity

D. low coercivity and high retentivity

Answer: A

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47. A marners compass is used

A. to compare magnetic moments

B. for determination of H

C. for determination of direction

D. for determination of dip at a place

Answer: C

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48. The hysteresis cylcle for the material of a permanent magnet is

A. Short and wide

B. tall and narrow

C. tall and wide

D. short and narrow

Answer: C

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

A. at all temperatures

B. above the curie temperature

C. below the curie temperature

D. at the curie temperature

Answer: B

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50. Which of the following quantities: (I) magnetic declination (II) dip is used to determine the strength of earths magnetic field at a point on the earths surface

A. Both I & II

B. Neither I nor II

C. I Only

D. II Only

Answer: A

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51. Domain formation is the necessary feature of

A. ferro magnetism

B. paramagnetism

C. diamagnetism

D. electro magnetism

Answer: A

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52. The magnetic force required to demagnetise the material is

A. retentivity

B. coercivity

C. energy loss

D. hysterisis

Answer: B

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53. The only property possessed by ferromagnetic substance is

A. attracting magnetic substance

B. hysterisis

C. directional property

D. susceptibility independent of temperature

Answer: B

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54. Needles $N_1, N_2,$ and N_3 are made of a ferromagnetic, a paramagnetic and a diamagnetic substance respectively . A magnet when brought close to them will

A. attract all three of them

B. attract N_1 and N_2 strongly but repel N_3 weakly

C. attract N_1 strongly, N_2 weakly and repel N_3 weakly

D. attract N_1 strongly, but repel N_2, N_3 weakly

Answer: C

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55. Relative permittivity and permeability of a material are ε_r and μ_r respectively which of the following values of these quantities are allowed for a diamagnetic material ?

A. $\varepsilon_r = 1.5, \mu_r = 0.5$

B. $\varepsilon_r = 0.5, \mu_r = 0.5$

C. $\varepsilon_r = 1.5, \mu_r = 1.5$

D. $\varepsilon_r = 0.5, \mu_r = 1.5$

Answer: A

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56. For soft iron, in comparison with steel

A. hysteresis loss is more

B. hysteresis loss is same

C. hysteresis loss is less

D. hysteresis loss is negligible

Answer: C

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57. χ_1 and χ_2 are susceptibilities of diamagnetic substance at temperatures T_1K and T_2K respectively. Then

A. $\chi_1 T_1 = \chi_2 T_2$

B. $\chi_1 = \chi_2$

C. $\chi_1 \sqrt{T_1} = \chi_2 \sqrt{T_2}$

D. $\chi_1 T_2 = \chi_2 T_1$

Answer: B

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58. Ferromagnetic msterials owe their properties to

A. vacant inner subshells

B. partially filled inner subshells

C. filled inner subshells

D. completely filled outer shells

Answer: B

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59. If a diamagnetic solution is poured into a U-tube and one aem 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. fall

B. rise

C. oscillate

D. remain unchanged

Answer: A

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60. At curie temperature, in ferromagnetic materials

A. the atomic dipoles get aligned

B. the atomic dipoles lose alignment

C. the atomic dipoles lose alignment

D. magnetism is zero

Answer: C

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

A. wood

B. plastic

C. metal of high conductivity

D. soft iron of high permeability

Answer: D

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62. In a permanent magnet at room temperature.

A. magnetic moment of each molecules is zero

B. the individual molecules have non-zero magnetic moments which are all perfectly aligned

C. domains are partially aligned

D. domains are all perfectly aligned

Answer: C

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63. The angle of dip at a place on the earth gives

A. direction of earth's magnetic field

B. horizontal component of earth's magnetic field

C. vertical component of earth's magnetic field

D. location of geographic poles

Answer: A

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64. A point near the equator has

A. $B_V > \; > B_H$

B. $B_H > \; > B_V$

C. $B_V = B_H$

D. $B_V = B_H = 0$

Answer: B

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65. If I is the intensity of earth's magnetic field, H its horizontal component and V the vertical component, then these are related as

A. I = V + H

B. $I = \sqrt{H^2 + V^2}$

C. $I = \sqrt{H^2 - V^2}$

D. $I^2 = V^2 - H^2$

Answer: B

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66. A line joining places of zero declination is called

A. agonic

B. isoclinic

C. isodynamic

D. isogonal

Answer: A

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67. A line joining places of equal declinaiton is called

A. aclinic

B. isoclinic

C. isodynamic

D. isogonal

Answer: D

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68. The needle of a dip circle when place at a geomagnetic pole stays along

A. south north direction only

B. east west direction only

C. vertical direction

D. horizontal direction

Answer: C

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69. 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 are zero

C. the value of V is zero

D. the value of H is zero

Answer: C

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

A. equator

B. magnetic pole

C. a latitude of 60°

D. an inclination of 60°

Answer: B

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71. The core of electromagnet is made of soft iron because

a) the susceptibility of soft iron is very high

b) coercivity of soft iron is very low

A. only a is correct

B. only b is correct

C. both a and b are correct

D. both a and b are wrong

Answer: C

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72. The angle of dip at the poles and the equator respectively are

A. $30^\circ, 60^\circ$

B. $90^\circ, 0^\circ$

C. $30^\circ, 90^\circ$

D. $0^\circ, 0^\circ$

Answer: B

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73. Select the correct answer.

a) When $'n'$ identical magnets are arranged in the form of closed polygon with unlike poles nearer, the resultant magnetic moment is zero.

b) If one magnet is removed from the polygon, the resultant magnetic moment becomes $'M'$.

c) If one magnet is reversed in the polygon, the resultant magnetic moment of combination becomes $2M$

A. a, b and c are correct

B. a and b are correct but c is wrong

C. only a is correct

D. a, b and c are worng

Answer: A

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74. Match the following:

Physical quantity	Unit
a) Magnetic moment	e) Amp-m
b) Magnetic flux density	f) Amp/m
c) Intensity of magnetic field	g) $N - m^3 / wb$
d) Pole strength	h) Gauss

A. a-e, b-f, c-g, d-h

B. a-g, b-h, c-f, d-e

C. a-g, b-f, c-h, d-e

D. a-e, b-f, c-h, d-g

Answer: B

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75. Assertion (A): The net magnetic flux coming out of a closed surface is always zero.

Reason (R): Unlike poles of equal strength exist together

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not correct explanation of A.

C. A is true, But R is false

D. A is false, But R is true

Answer: A

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76. Assertion (A): $\chi - T$ graph for a diamagnetic material is a straight line parallel to $T-$ axis

Reason (R): This is because susceptibility of a diamagnetic material is not affected by temperature

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not correct explanation of A.

C. A is true, But R is false

D. A is false, But R is true

Answer: A

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77. Assertion (A): If one arm of a $U-$tube containing a diamagnetic solution is placed in between the poles of a strong magnet with the level in line with the field, the level of the solution falls,

Reason (R): Diamagnetic substances do not aligned with the field

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not correct explanation of A.

C. A is true, But R is false

D. A is false, But R is true

Answer: A

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78. Assertion (A): Earth's magnetic field inside a closed iron box is less as compared to the outside

Reason (R): The magnetic permeability of iron is low

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not correct explanation of A.

C. A is true, But R is false

D. A is false, But R is true

Answer: C

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79. Assertion (A): Magnetic moment of an atom is due to both, the orbitla motion and spin motion of every electron.

Reason (R): A charged particle at rest produces magnetic field

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not correct explanation of A.

C. A is true, But R is false

D. A is false, But R is true

Answer: C

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80. Assertion: Electromagnets are made of soft iron.

Reason: Coercivity of soft iron is small.

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not correct explanation of A.

C. A is true, But R is false

D. A is false, But R is true

Answer: A

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81. 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.

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not correct explanation of A.

C. A is true, But R is false

D. A is false, But R is true

Answer: A

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82. Assertion (A): Steel is attracted by a magnet

Reason (R): Steel is a magnetic substance

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not correct explanation of A.

C. A is true, But R is false

D. A is false, But R is true

Answer: C

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83. Assertion (A): It is not necessary that every magnet has one north pole and one south pole.

Reason (R): It is a basic fact that magnetic poles occur in pairs

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not correct explanation of A.

C. A is true, But R is false

D. A is false, But R is true

Answer: D

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84. Assertion (A): Relative magnetic permeability has no units and no dimmensions

Reason (R): $\mu_r = \mu / \mu_0$, where the symbols have their standard meaning.

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not correct explanation of A.

C. A is true, But R is false

D. A is false, But R is true

Answer: A

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85. Assertion (A): A magnetic suspended freely in an uniform magnetic field experiences no net force, but a torque that tends to align the magnet along the field when it is deflected form equilibrium position

Reason (R): Net force $mB - mB = 0$, but the forces on north and south poles being equal, unlike and parallel make up a couple that tends to align the magnet, along the field.

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not correct explanation of A.

C. A is true, But R is false

D. A is false, But R is true

Answer: A

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86. 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 force exist inside a charged body but magnetic lines do exist inside a magnet.

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not correct explanation of A.

C. A is true, But R is false

D. A is false, But R is true

Answer: A

Watch Video Solution

87. Assertion (A): The earth's magnetic field is due to iron present in its core.

Reason (R): At a high tempeature magnet losses its magnetic property or magnetism.

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not correct explanation of A.

C. A is true, But R is false

D. A is false, But R is true

Answer: D

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Exercise 1 C W

1. The geometric length of a bar magnet is $24cm$. The length of the magnet is

A. 24 cm

B. 28.8 cm

C. 20 cm

D. 30 cm

Answer: C

Watch Video Solution

2. The magnetic moment of a magnet is $3.6 \times 10^{-3} A. m^2$. Its pole strength is 120mili amp.M`. Its magnetic length is

A. 3 cm

B. 0.3 cm

C. 33.33 cm

D. 3×10^{-2} cm

Answer: A

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3. Two magnets have their lengths in the ratio $2:3$ and their pole strength in the ratio $3:4$. The ratio of their magnetic moment is

A. $2:1$

B. $4:1$

C. $1:2$

D. $1:4$

Answer: C

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4. The length of a magnet is $16cm$. Its pole strength is $250milli. amp. m$. When it is cut into four equal pieces parallel to its axis, The magnetic length, pole strength and moments of each piece are: (respectively)

A. 4 cm, 62.5 milli Am, 250 milli amp. cm^2

B. 8 cm, 500 milli Am, 400 milli amp. cm^2

C. 16 cm, 250 milli Am, 4000 milli amp. cm^2

D. 16 cm, 62.5 milli Am, 0.01 $A.\ m^2$

Answer: D

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5. A bar magnet of magnetic moment M_1 is axially cut into two equal parts. If these two pieces are arranged perpendiucular to each other, the resultant magnetic moment is M_2.

Then the vale of $\frac{M_1}{M_2}$ is

A. $\frac{1}{2\sqrt{2}}$

B. 1

C. $\frac{1}{\sqrt{2}}$

D. $\sqrt{2}$

Answer: D

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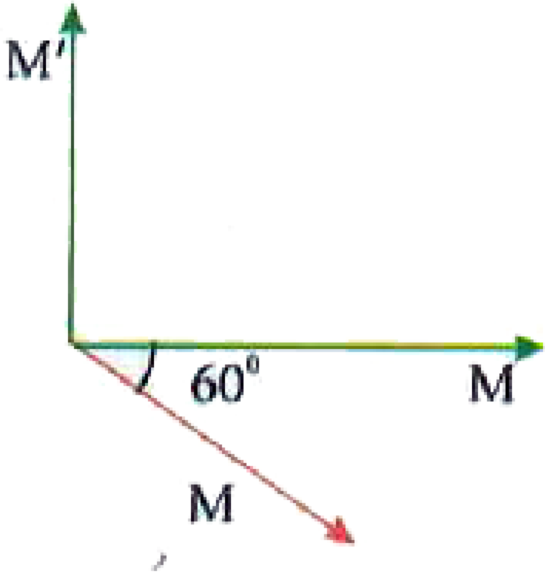
6. The resultant magnetic moment for the following arrangement (non coplanar vectors)



A. 1 M

B. 2 M

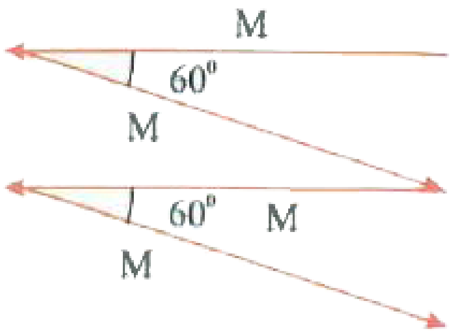
C. 3 M

D. 4 M

Answer: B

View Text Solution

7. The resultant magnetic moment for the following arrangement is



A. M

B. 2M

C. 3M

D. 4M

Answer: B

View Text Solution

8. A magnet of magnetic moment M and length $2l$ is bent at its mid-point such that the angle of bending is 60^0. The new magnetic moment is.

A. M

B. $\frac{M}{2}$

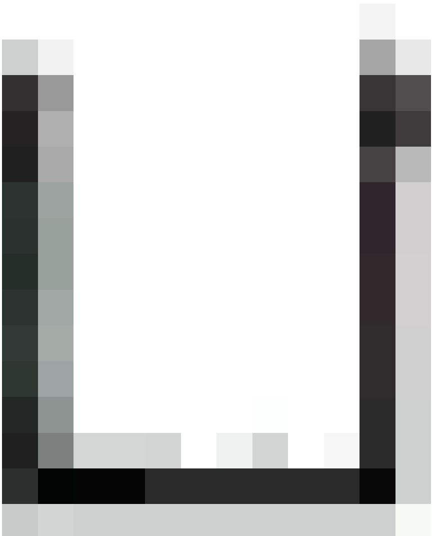
C. 2M

D. $\frac{M}{\sqrt{2}}$

Answer: B

Watch Video Solution

9. A bar magnet of magnetic moment M is bent in



shape

such that all the parts are of equal lengths. Then new magnetic moment is

A. M/3

B. 2M

C. $\sqrt{3}M$

D. $3\sqrt{3}M$

Answer: A

View Text Solution

10. A thin "bar" magnet of length $'l'$ and magnetic moment $'M'$ is bent at the mid point so that the two parts are at right angles. The new magnetic length and magnetic moment are respectively

A. $\sqrt{2}l, \sqrt{2}M$

B. $\frac{l}{\sqrt{2}}, \frac{M}{\sqrt{2}}$

C. $\sqrt{2}l, \frac{M}{\sqrt{2}}$

D. $\frac{l}{\sqrt{2}}, \sqrt{2}M$

Answer: B

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11. Three magnets of same length but moments $M, 2M$ and $3M$ are arranged in the form of an equilateral triangle with oppositive poles nearer, the resultnat magnetic moment of the arrangement is

A. 6 M

B. zero

C. $\sqrt{3}M$

D. $\frac{\sqrt{3}}{2}M$

Answer: C

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12. A "bar" magnet of moment M is cut into two identical pieces along the length. One piece is bent in the form of a semi circle. If two pieces are perpendicular to each other, then resultant magnetic moment is

A. $\left(\frac{M}{\pi}\right)^2 + \left(\frac{M}{2}\right)^2$

B. $\sqrt{\left(\frac{M}{\pi}\right)^2 + \left(\frac{M}{2}\right)^2}$

C. $\sqrt{\left(\frac{M}{\pi}\right)^2 - \left(\frac{M}{2}\right)^2}$

D. $\frac{M}{\pi} + \frac{M}{2}$

Answer: B

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13. A magnetic pole of pole strength $9.2Am$. Is placed in a field induction 50×10^{-6} tesla. The force expericenced by the pole is

A. 46 N

B. $46 \times 10^{-4} N$

C. $4.6 \times 10^{-4} N$

D. 460N

Answer: C

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14. The magnetic induction at distance of $0.1m$ from a strong magnetic pole of strength $1200Am$ is

A. $12 \times 10^{-3} T$

B. $12 \times 10^{-4} T$

C. $1.2 \times 10^{-3} T$

D. $24 \times 10^{-3} T$

Answer: A

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15. If area vector $\overline{A} = 3\overline{i} + 2\overline{j} + 5\overline{k} m^2$ flux density vector $\overline{B} = 5\overline{i} + 10\overline{j} + 6\overline{k} \left(web / m^2\right)$. The magnetic flux linked with the coil is

A. 31 Wb

B. 9000 Wb

C. 65 Wb

D. 100 Wb

Answer: C

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16. P and Q are two unlike magnetic poles. Induction due to $'P'$ at the location of $'Q'$ is B, and induction due to $'Q'$ at the location of P is $B/2$. The ratio of strength of P and Q is

A. $1:1$

B. $1:2$

C. $2:1$

D. $1:\sqrt{2}$

Answer: C

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17. Two north poles each of pole strength m and a south pole of pole strength m are placed at the three corners of an equilateral triangle of side a. The intensity of magnetic induction field strength at the centre of the triangle is

A. $\frac{\mu_0}{4\pi}\frac{m}{a^2}$

B. $\frac{\mu_0}{4\pi}\frac{6m}{a^2}$

C. $\frac{\mu_0}{4\pi}\frac{9m}{a^2}$

D. $\frac{\mu_0}{4\pi}\frac{m}{2a^2}$

Answer: B

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18. The pole strength of a horse shoe magnet is $90Am$ and distance between the poles is $6cm$. The magnetic induction at mid point of the line joining the poles is,

A. $10^{-2}T$

B. Zero

C. $2 \times 10^{-2}T$

D. $10^{-4}T$

Answer: C

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19. The force acting on each pole of a magnet when placed in a uniform magnetic field of $7A/m$ is $4.2 \times 10^{-4}N$. If the distance between the poles is $10cm$, the moment of the magnet is

A. $\frac{15}{\pi}$

B. $\frac{\pi}{15} Am^2$

C. $7.5 \times 10^{-12} Am^2$

D. $6 \times 10^{-6} Am^2$

Answer: A

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20. An iron specimen has relative permeability of 600 when placed in uniform magnetic field of intensity $110 amp/m$. Then the magnetic flux density inside is......tesls.

A. 18.29×10^{-3}

B. 8.29×10^{-2}

C. 66×10^{3}

D. 7.536×10^{-4}

Answer: B

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21. A magnetic needle of pole strength $'m'$ is privoted at its centre. Its $N-$pole is pulled eastward by a string. Then the horizontal force required to produce a deflection of θ from magnetic meridian

$(B_H \text{horizontal componet of earths magnetic field})$

A. $mB\cos\theta$

B. $mB\sin\theta$

C. $mB\tan\theta$

D. $mB\cot\theta$

Answer: C

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22. Two identical "bar" magnets are jouned to form a cross. If this conbination is suspended freely in a uniform field the angles made by the magnets with field direction are respectively

A. $60^{\circ}, 30^{\circ}$

B. $37^{\circ}, 53^{\circ}$

C. $45^{\circ}, 45^{\circ}$

D. $20^{\circ}, 70^{\circ}$

Answer: C

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23. A "bar" magnet of length $16cm$ has a pole strength of 500 milli amp.m. The angle at which it should be placed to the direction of external magnetic field of induction 2.5 gauses so that it may experience a torque of $\sqrt{3} \times 10^{-5} Nm$ is

A. π

B. $\pi / 2$

C. $\pi / 3$

D. $\pi / 6$

Answer: C

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24. A "bar" magnet is at right angles to a uniform magnetic field. The couple acting on the magnet is to be one fourth by rotating it from the position. The angle of rotation is

A. $\sin^{-1}(0.25)$

B. $90^{\circ} - \sin^{-1}(0.25)$

C. $\cos^{-1}(0.25)$

D. $90^{\circ} - \cos^{-1}(0.25)$

Answer: B

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25. A "bar" magnet of moment $\overline{M} = \hat{i} + \hat{j}$ is placed in a magnetic field induction $\overrightarrow{B} = 3\hat{i} + 4\hat{j} + 4\hat{k}$.

The torque acting on the magnet is

A. $4\hat{i} - 4\hat{j} + \hat{k}$

B. $\hat{i} + \hat{k}$

C. $\hat{i} - \hat{j}$

D. $\hat{i} + \hat{j} + \hat{k}$

Answer: A

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26. A "bar" magnet of magnetic moment $1.5J/T$ is aligned with the direction of a uniform magnetic field of $0.22T$. The work done in turning the magnet so as to align its magnetic moment opposite to the field and the torque acting on it in this position are respectively.

A. 0.33 J, 0.33N-m

B. 0.66J, 06.66N-m

C. 0.33J, 0

D. 0.66J, 0

Answer: D

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27. 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. $\frac{1}{2}$

B. 2

C. $\frac{1}{4}$

D. 1

Answer: B

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28. A "bar" magnet of moment $4Am^2$ is placed in a nonuniform magnetic field. If the field strength at poles are $0.2T$ and $0.22T$ then the maximum couple acting on it is

A. 0.04Nm

B. 0.84Nm

C. 0.4Nm

D. 0.44Nm

Answer: B

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29. A magnet of length $10cm$ and pole strength $4 \times 10^{-4} Am$ is placed in a manetic field of induction $2 \times 10^{-5} weberm^{-2}$, such that the axis of the magnet makes an angel 30^0 with the lines of induction. The moment of the couple acting on the magnet is

A. 4×10^{-10} Nm

B. 8×10^{-10} Nm

C. 4×10^{-6} Nm

D. $\sqrt{3} \times 10^{-11} Nm$

Answer: A

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30. A bar magnet of magnetic moment $2Am^2$ is free to rotate about a vertical axis passing through its centre. The magnet is released from rest from east-west position. Then the KE of the magnet as it takes N-S position is

$(B_H = 25\mu T)$

A. $25\mu J$

B. $50\mu J$

C. $100\mu J$

D. $12.5\mu J$

Answer: B

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31. A bar magnet of length $10cm$ and pole strength $2Am$ makes an angle 60^0 with a uniform magnetic field of induction $50T$. The couple acting on it is

A. $5\sqrt{3}Nm$

B. $\sqrt{3}Nm$

C. $10\sqrt{3}Nm$

D. $20\sqrt{3}Nm$

Answer: A

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32. The magnetic induction field strength at a distance $0.3m$ on the axial line of a short bar magnet of moment $3.6Am^2$ is

A. $4.5 \times 10^{-4}T$

B. $9 \times 10^{-4}T$

C. $9 \times 10^{-5} T$

D. $2.6 \times 10^{-5} T$

Answer: D

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33. A magnet of length $10cm$ and magnetic moment $1Am^2$ is placed along the side of an equilateral triangle of the side AB of length $10cm$. The magnetic induction at third vertex C is

A. $10^{-9} T$

B. $10^{-7} T$

C. $10^{-5}T$

D. $10^{-4}T$

Answer: D

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34. The length of a magnet of moment $5Am^2$ is $14cm$. The magnetic induction at a point, equidistant form both the poles is $3.2 \times 10^{-5}Wb/m^3$. The distance of the point form either pole is

A. 25 cm

B. 10 cm

C. 15 cm

D. 5 cm

Answer: A

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35. A pole of pole strength $80Am$ is placed at a point at a distance $20cm$ on the equatorial line from the centre of a short magnet of magnetic moment $20Am^2$. The force experienced by it is

A. 8×10^{-2}N

B. 2×10^{-2}N

C. $16 \times 10^{-2} N$

D. $64 \times 10^{-2} N$

Answer: B

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36. A short bar magnet produces manetic fields of equal induction at two points one on the axial line and the other on the equatorial line. The ratio of their distance is

A. $2 : 1$

B. $2^{1/2} : 1$

C. $2^{1/3} : 1$

D. $2^{1/4} : 1$

Answer: C

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37. Two short bar magnets with magnetic moments $8Am^2$ and $27Am^2$ are placed $35cm$ apart along their common axial line with their like poles facing each other. The neutral point is

A. midway between them

B. 21 cm from weaker magnet

C. 14 cm from weaker magnet

D. 27 cm from weaker magnet

Answer: C

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38. A short magnetic needle is pivoted in a uniform magnetic field of induction $1T$. Now, simultaneously another magnetic field of induction $\sqrt{3}T$ is applied at right angles to the first field, the needle deflects through an angle θ where its value is

A. 30°

B. 45°

C. 90°

D. 60°

Answer: D

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39. Two magnetic poles of pole strength $324 milliamp. m.$ and $400 milliampm$ are kept at a distance of $10 cm$ in air. The null point will be at a distance of ......cm, on the line joining the two poles, from the weak pole if they are like poles.

A. 4.73

B. 5

C. 6.2

D. 5.27

Answer: A

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40. With a standard rectangular bar magnet, the time period in the uniform magnetic field is $4 \sec$. The bar magnet is cut parallel to its length into 4 equal pieces. The time period in the uniform magnetic field when the piece is used (in sec) (bar magnet breadth is small)

A. 16

B. 8

C. 4

D. 2

Answer: C

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41. A bar magnet of moment of inertia $1 \times 10^{-2} kgm^2$ vibrates in a magnetic field of induction 0.36×10^{-4} tesla. The time period of vibration is $10s$. Then the magnetic moment of the bar magnet is (Am^2)

A. 120

B. 111

C. 140

D. 160

Answer: B

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42. Two bar magnets placed together in a vibration magnetometer take 3 seconds for 1 vibration. If one magnet is reversed, the combination takes 4 seconds for 1 vibration. Find the ratio of their magnetic moments.

A. $3 : 1$

B. $5 : 18$

C. $18 : 5$

D. $25 : 7$

Answer: D

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43. A bar magnet of length $'I'$ breadth $'b'$ mass $'m'$ suspended horizontally in the earths magnetic field, oscillates with period T. If $'I'm, b$ are doubled with pole strength remaining the same, the now will be

A. 8T

B. 4T

C. T/2

D. 2T

Answer: D

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Watch Video Solution

44. 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

A. $3T_0$

B. T_0

C. $\frac{T_0}{\sqrt{3}}$

D. $\frac{T_0}{3}$

Answer: A

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45. A magnetic needle is kept in a uniform magnetic field of induction 0.5×10^{-4} tesla. It makes 30 oscillaitons per minute. If it is kept in a field of induction 2×10^{-4} tesla. Then its frequency is

A. 1 oscillation/s

B. 60 oscillations/s

C. 15 oscillations/min

D. 15 oscillations/s

Answer: A

46. A magnet is suspended horizontally in the earth's field. The period of oscillation in the place is T. If a piece of wood of the same moment of inertia as the magnet is attached to it, new period of oscillation would be

A. $\frac{T}{\sqrt{2}}$

B. T/2

C. T/3

D. $\sqrt{2}T$

Answer: D

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47. A magnet freely suspended makes 20 vibrations per minute at first place and 30 vibrations per minute at another place. If the value of B_H at first place is 0.27 tesla. The value of B_H at other place is

A. 0.12 T

B. 2.1 T

C. 5.4 T

D. 0.61 T

Answer: A

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48. A magnet has a dimensions of $25cmX10cmX5cm$ and pole strength of 200 milli ampm The intensity of magnetisation due to it is

A. 6.25A/m

B. 62.5A/m

C. 40A/m

D. 4A/m

Answer: C

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49. The mass of iron rod is $110g$, its magnetic moment is $20Am^2$. The density of iron is $8g/cm^3$. The intensity of magntization is nearby

A. $2 \times 10^5 Am^{-1}$

B. $2.26 \times 10^6 Am^{-1}$

C. $1.6 \times 10^6 Am^{-1}$

D. $1.4 \times 10^6 Am^{-1}$

Answer: B

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

A. 5500×10^{7}

B. 5500×10^{-7}

C. 5501

D. 5499

Answer: D

Watch Video Solution

51. A specimen of iron is uniformly magnetised by a magnetising field of $500 Am^{-1}$. If the magnetic induction in the specimen is $0.2 Wbm^{-2}$. The susceptibility nearly is

A. 317.5

B. 418.5

C. 217.5

D. 175

Answer: A

Watch Video Solution

52. The magnetic susceptibility of a rod is 499. The absolute permeability of vacuum is $4\pi \times 10^{-7} H/m$. The absolute permeability of the material of the rod is

A. $\pi \times 10^{-4} H/m$

B. $2\pi \times 10^{-4} H/m$

C. $3\pi \times 10^{-4} H/m$

D. $4\pi \times 10^{-4} H/m$

Answer: B

Watch Video Solution

Exercise 1 H W

1. If a bar magnet of pole strength $'m'$ and magnetic moment $'M'$ is cut equally 5 times parallel to its axis and 4 times perpendicular to its axis then the pole strength and magnetic moment of each piece are respectively

A. $\frac{m}{20}, \frac{M}{20}$

B. $\frac{m}{4}, \frac{M}{20}$

C. $\frac{m}{5}, \frac{M}{20}$

D. $\frac{m}{5}, \frac{M}{4}$

Answer: C

Watch Video Solution

2. If two identical bar mangets, each of length $'I'$, pole strength $'m'$ and magnetic moment $'M'$ are placed perpendicular to each other with their unlike poles in contact, the magnetic moment of the combination is

A. $\dfrac{M}{\sqrt{2}}$

B. $lm\left(\sqrt{2}\right)$

C. $2lm\left(\sqrt{2}\right)$

D. 2M

Answer: B

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3. A magnetised wire of magnetic moment $'M'$ and length $'l'$ is bent in the form of a semicircle of radius $'r'$. The new magnetic moment is

A. $\frac{M}{\pi}$

B. $\frac{2Mr}{l}$

C. $\frac{M}{2\pi}$

D. $\frac{M}{4\pi}$

Answer: B

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4. A long thin magnet of moment M is bent into a semi circle. The decrease in the magnetic moment is

A. $2M/\pi$

B. $\pi M/2$

C. $M(\pi - 2)/\pi$

D. $M(2 - \pi)/2$

Answer: C

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5. A magnet of magnetic $'M'$ is in the form of a quadrant of a circle. If it is straightened, its new magnetic moment will be

A. $\frac{M\pi}{\sqrt{2}}$

B. $\frac{M}{\sqrt{2}}$

C. $\frac{\sqrt{2}M}{\pi}$

D. $\frac{M\pi}{2\sqrt{2}}$

Answer: D

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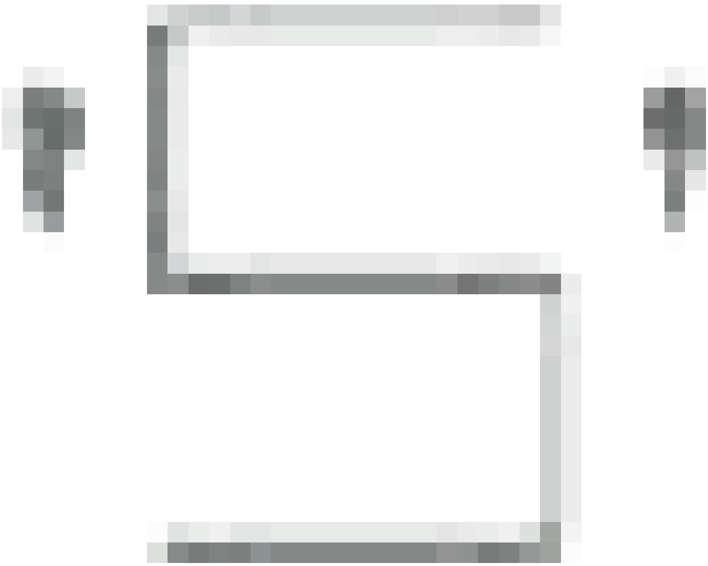
6. A bar magnet of moment 'M' is bent into a shape



. If the length of the each part is same, its new magnetic moment will be

A. $\frac{M}{\sqrt{3}}$

B. $\frac{M}{\sqrt{5}}$

C. $\frac{M}{\sqrt{2}}$

D. $\frac{2}{3}M$

Answer: B

View Text Solution

7. Four magnets of magnetic moments $M, 2M, 3M$ and $4M$ are arranged in the form of a square such that unlike poles are in contact. Then the resultant magnetic moment will be

A. $2\sqrt{2}M$

B. $\sqrt{2}M$

C. 10 M

D. 2M

Answer: A

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8. Three identical bar magnets each of magnetic moment M are arranged in the form of an equilateral triangle such that at two vertices like poles are in contact. The resultant magnetic moment will be

A. Zero

B. 2M

C. $\sqrt{2}M$

D. $M\sqrt{3}$

Answer: B

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9. A torque of $2X10^{-4}Nm$ is required to hold a magnet at right angle to the magnetic meridian. The torque required to hold it at 30° to the magnetic meridian in $N-m$ is

A. 0.5×10^{-4}

B. 1×10^{-4}

C. 4×10^{-4}

D. 8×10^{-4}

Answer: B

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10. A bar magnet of $5cm$ long having a pole strenght of $20A.m.$ Is deflected through 30° from the magnetic meridian. If $H = \frac{320}{4\pi}A/m$, the deflecting couple is

A. 1.6×10^{-4}Nm

B. $3.2 \times 10^{-5} Nm$

C. 1.6×10^{-5}Nm

D. 1.6×10^{-2}Nm

Answer: C

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11. A short bar magnet placed with its axis at 30° with a uniform external magnetic field of $0.16T$ experience a torque of magnitude $0.032Nm$. If the bar magnet is free to rotate, its potential energies when it is in stable and unstable equilibrium are respectively

A. $-0.064J, \ +0.0641J$

B. $-0.032J, \ +0.032J$

C. $+0.064J, \ -0.128J$

D. $0.032J, \ -0.032J$

Answer: A

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12. When a bar magnet is placed at 90° to a uniform magnetic field, it is acted upon by a couple which is maximum. For the couple to be half of the maximum value, at what angle should the magnet be inclined to the magnetic field (B)?

A. 30°

B. 45°

C. 60°

D. 90°

Answer: A

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13. A magnet of moment $4Am^2$ is kept suspended in a magnetic field of induction $5 \times 10^{-5}T$. The workdone in rotating it through 180° is

A. $4 \times 10^{-4}J$

B. $5 \times 10^{-4}J$

C. $2 \times 10^{-4}J$

D. $10^{-4}J$

Answer: A

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14. The work done in rotating the magnet form the direction of uniform field to the opposite direction to the field is$W$. The work done in rotating the magnet form the field direction to half the maximum couple position is

A. 2 W

B. $\frac{\sqrt{3}W}{2}$

C. $\frac{W}{4}(2-\sqrt{3})$

D. $\frac{W}{2}(1-\sqrt{3})$

Answer: C

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15. The work done in rotating a magnet of pole strength $1A - m$ and length $1cm$ through an angle of 60° from the magnetic meridian is $(H = 30A/m)$

A. $9.42 \times 10^{-8} J$

B. $3.14 \times 10^{-8} J$

C. $18.84 \times 10^{-8} J$

D. $10 \times 10^{-8} J$

Answer: C

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16. The work done in turning a magnet normal to field direction from the direction of the field is $40 \times 10^{-6} J$. The kinetic energy attained by it when it reaches the field direction when released is

A. Zero

B. $30 \times 10^{-6} J$

C. $10 \times 10^{-6} J$

D. $40 \times 10^{-6} J$

Answer: D

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17. A magnet is parallel to a uniform magnetic field. The work done in rotating the magnetic through $60^\circ is 8 \times 10^{-5} J$. The work done in rotating through another 30° is

A. $4 \times 10^{-5} J$

B. $6 \times 10^{-5} J$

C. $8 \times 10^{-5} J$

D. $2 \times 10^{-5} J$

Answer: C

Watch Video Solution

18. The magnetic induction field strength at a distance $0.2m$ on the axial line of a short bar magnet of mement $3.6Am^2$ is

A. $4.5 \times 10^{-4}T$

B. $9 \times 10^{-4}T$

C. $9 \times 10^{-5}T$

D. $4.5 \times 10^{-5}T$

Answer: C

Watch Video Solution

19. A short bar magnet of magnetic moment $1.2 Am^2$ is placed in the magnetic meridian with its south pole pointing the north. If a neutral point is found at a distance of $20 cm$ from the centre of the magnet, the value of the horizontal component of the earth's magnetic field is

A. $3 \times 10^{-5} T$

B. $3 \times 10^{-4} T$

C. $3 \times 10^{3} T$

D. $3 \times 10^{-2} T$

Answer: A

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20. A very long magnet of pole strength $4Am$ is placed vertically with its one pole on the table. The distance form the pole, the neutral point will be formed is $\left(B_H = 4 \times 10^{-5}T\right)$

A. 0.5m

B. 0.1m

C. 0.15m

D. 6.66m

Answer: B

21. A bar magnet of magnetic moment M and moment of inertial I is in the direction of magnetic meridian. If the magnet is displaced by a very small angle (θ), the angular acceleration is (Magnetic induction of earth's horizontal field $= B_H$)

A. $\dfrac{MB_H\theta}{I}$

B. $\dfrac{IB_H\theta}{M}$

C. $\dfrac{M\theta}{IB_H}$

D. $\dfrac{I\theta}{MB_H}$

Answer: A

Watch Video Solution

22. If the moments of inertia of two bar magnets are same, and if their magnetic moments are in the ratio 14:9` and if their frequencies of oscillations are same, the ratio of the induction field strength in which they are vibrating is

A. $2:3$

B. $3:2$

C. $4:9$

D. $9:4$

Answer: D

Watch Video Solution

23. If the strength of the magnetic field is increased by 21% the frequency of a magnetic needle oscillating in the field.

A. Increased by 10%

B. Decreases by 10%

C. Increases by 11%

D. Decreased by 21%

Answer: A

Watch Video Solution

24. A bar magnet has a magnetic moment equal to 65×10^{-5} wever x metre. It is suspended in a magnetic field which has a magnetic induction (B) equal to $8\pi \times 10^{-4}$ tesla. The magnet vibrates with a period of vibration equal to 15seconds. The moment of inertia of the magnet is:

A. $9 \times 10^{-13} kgm^2$

B. $11.25 \times 10^{-13} kgm^2$

C. $5.62 \times 10^{-13} kgm^2$

D. $0.57 \times 10^{-13} kgm^2$

Answer: A

Watch Video Solution

25. Two bar magnets are placed in vibration magnetometer and allowed to vibrate. They make 20 oscillations per minute when their similar pole are on the same side, while they make 15 osicillations per minute when their opposite poles lie on the same side. The ratio of their magnetic moments is

A. $9:5$

B. $25:7$

C. $16:9$

D. $5:4$

Answer: B

Watch Video Solution

26. The magnetic induction and the intensity of magnetic field inside an iron core of an electromagnet are $1 Wb m^{-2}$ and $150 A m^{-1}$

respectively. The relative permeability of iron is :

$(\mu_0 = 4\pi \times 10^{-7} \text{henry} / m)$

A. $\frac{10^6}{4\pi}$

B. $\frac{10^6}{6\pi}$

C. $\frac{10^5}{4\pi}$

D. $\frac{10^5}{6\pi}$

Answer: D

Watch Video Solution

27. The mass of an iron rod is $80gm$ and its magnetic moment is $10Am^2$. If the density of iron is $8gm / c.\ c.$

Then the value of intensity of magnetisation will be

A. $10^6 A/m$

B. $10^4 A/m$

C. $10^2 A/m$

D. 10 A/m

Answer: A

Watch Video Solution

28. A rod of cross sectional area $10cm^2$ is placed with its length parallel to a magnetic field of intensity

1000 A/M the flux through the rod is 10^4 webers. Then the permeability of material of rod is

A. $10^4 wb / Am$

B. $10^3 wb / Am$

C. $10^2 wb / Am$

D. 10 wb/Am

Answer: A

Watch Video Solution

29. A bar magnet of magnetic moment $10Am^2$ has a cross sectional area of $2.5 \times 10^{-4}m^2$. If the intensity of magnetisation of the magnet is $10^6 A/m$, then the length of magnet is

A. 0.4 m

B. 0.04 cm

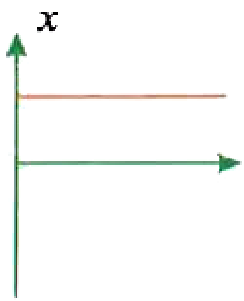
C. 0.04m

D. 40cm

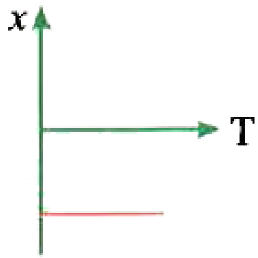
Answer: C

Watch Video Solution

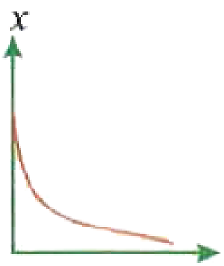
30. The variation of magnetic susceptibility (χ) with temperature for a diamagnetic substance is best represented by



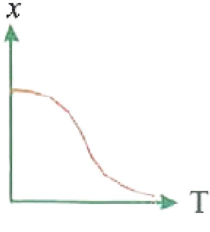
A.



B.



C.



D.

Answer: B

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Exercise 2 C W

1. A magnetised wire is bent into an arc of a circle subtending an angle 60° at its centre. Then its magnetic moment is X. If the same wire is bent into an are of a circle subtending an angle 90° at its centre then its magnetic moment will be

A. $\frac{x\sqrt{2}}{3}$

B. $\frac{x}{3}$

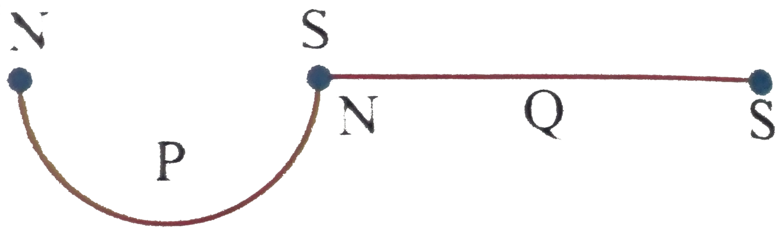
C. $\frac{\left(2\sqrt{2}\right)x}{3}$

D. $\frac{3x}{2\sqrt{2}}$

Answer: C

View Text Solution

2. A magnet of length $2L$ abd moment $'M'$ is axially cut into equal halves $'P'$ and $'Q'$. The piece $'P'$ is bent in the form of semi circle and $'Q'$ is attached to it as shown. Its moment is



A. $\frac{M}{\pi}$

B. $\frac{M}{2\pi}$

C. $\frac{M(2+\pi)}{2\pi}$

D. $\frac{M\pi}{(2+\pi)}$

Answer: C

Watch Video Solution

3. A bar magnet of magnetic moment $'M'$ is bent in the form of an arc which makes angle 60^0. The percentage change in the magnetic moment is

A. 9% Increase

B. 9% Decrease

C. 4.5% Decrease

D. 4.5% Increase

Answer: C

Watch Video Solution

4. At two corners A and B of an equilateral triangle ABC, a south and north pole each of strength $30Am$ are placed. If the side of the triangle is $1m$. The magnetic induction at C is

A. $3 \times 10^{-6} T$

B. $4 \times 10^{-6} T$

C. $8 \times 10^{-6} T$

D. $2 \times 10^{-6} T$

Answer: A

Watch Video Solution

5. A bar magnet of magnetic moment $3.0A - m^2$ is placed in a uniform magnetic induction field of $2 \times 10^{-5} T$. If each pole of the magnet experiences a force of $6 \times 10^{-4} N$, the length of the magnet is

A. 0.5m

B. 0.3m

C. 0.2m

D. 0.1m

Answer: D

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6. The magnetic induction at a distance $'d'$ form the magnetic pole of unkown strength $'m'$ is B. If an identical pole is now placed at a distance of $2d$ from the first pole, the force between the two poles is

A. mB

B. $\frac{mB}{2}$

C. $\frac{mB}{4}$

D. 2mB

Answer: C

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7. Two identical north poles each of strength m are kept at vertices A and B of an equilateral triangle AbC of side a. The mutual force of repulsion between them has a magnitude of F. The magnitude of magnetude at C is

A. F/m

B. $F / \sqrt{3}m$

C. F/3m

D. $\sqrt{3}F / m$

Answer: D

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8. Two magnets of magnetic moments M and $\sqrt{3}M$ are joined to form a cross $+$. The comnination is suspended freely in a uniform magnetic field. In the equilibrium position, the angle between the magnetic moment $\sqrt{3}M$ and the field is

A. 30°

B. 45°

C. 60°

D. 90°

Answer: A

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9. The rate of change of torque $'\tau'$ with deflection θ is maximum for a magnet suspended freely in a uniform magnetic field of induction B when θ is equal to

A. 0°

B. 45°

C. 60°

D. 90°

Answer: A

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10. The couple acting on a bar magnet of pole strength $2Am$ when kept in a magnetic field of intensity $10A/m$, such that axis of the magnet makes an angle 30^0 with the direction of the field is $80 \times 10^{-7} Nm$. The distance between the poles of the magnet is

A. $\frac{2}{\pi} m$

B. $\frac{\pi}{2} m$

C. 63.36m

D. $\frac{1}{2\pi} m$

Answer: A

Watch Video Solution

11. A bar magnet with poles $25cm$ apart and pole strength $14.4Am$ rests with its center on a frictionless pivot. If it is held in equilibrium at 60^0 to a uniform magnetic field on induction $0.25T$ by applying a force F at right angles to its axis $10cm$ from the pivolt, the value of F in newton is (nearly)

A. 3.9N

B. 7.8N

C. 15.6N

D. 31.2N

Answer: B

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12. Two magnets of moments M_1 and M_2 are rigidly fixed togetherat their centres so that their axes are inclined to each other. This system is suspended ibn a magnitude field of induction $'B'$ so that M_1 makes an angles θ_1 and M_2 makes an angles θ_2 with the field direction and unlike poles on either side of the field direction. The resultant torque on the rigid system is

A. $B(M_1 \sin\theta_1 + M_2 \sin\theta_2)$

B. $B(M_1\cos\theta_1 + M_2\cos\theta_2)$

C. $B(M_1\sin\theta_2 + M_2\sin\theta_1)$

D. $B(M_1\cos\theta_2 + M_2\cos\theta_1)$

Answer: A

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13. A short magnet placed with its axis making an angle with a uniform external magnetic field of induction B experiences a torque (τ). If the magnet is free to rotate, which orientation would correspong to its stable and unstable equilibrium.

A. $\theta = 0^\circ, \theta = 90^\circ$

B. $\theta = 0^\circ, \theta = 180^\circ$

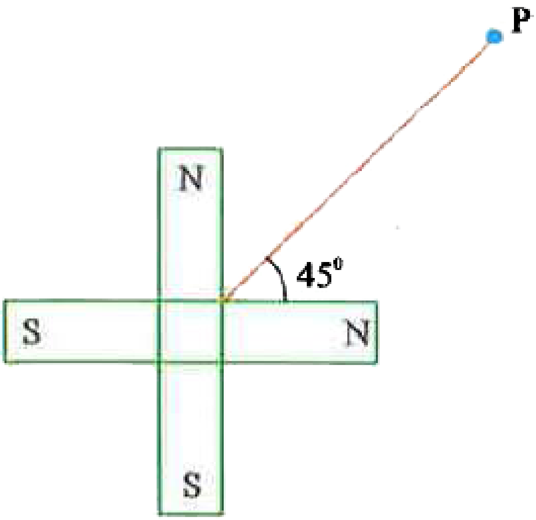
C. $\theta = 45^\circ, \theta = 135^\circ$

D. $\theta = 0^\circ, \theta = 270^\circ$

Answer: B

Watch Video Solution

14. Two short bar magnets of equal dipole moments 'M' each are fastened perpendicular at their centers as shown in figure. The magnitude of the magnetic field at 'P' at a distance d from their common centre as shown in figure is



A. $\frac{\mu_0}{4\pi}\frac{M}{d^3}$

B. $\frac{\mu_0}{4\pi}\frac{2\sqrt{2}M}{d^3}$

C. $\frac{\mu_0}{4\pi}\frac{2M}{d^3}$

D. $\frac{\mu_0}{2\pi}\frac{M}{d^3}$

Answer: B

View Text Solution

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

A. 0.4N

B. 0.5N

C. 0.6N

D. 0.8N

Answer: C

Watch Video Solution

16. The ratio of magnetic fields on the axial line of a long magnet at distance of $10cm$ and $20cm$ is $12:5.1$. The length of the magnet is

A. 5cm

B. 10cm

C. 10m

D. 15m

Answer: B

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17. Two short magnets AB and CD in the $X-Y$ plane and are parallel to $X-$ axis and the co-ordinates of their centres respectively are $(0, 2)$ and $(2, 0)$. Line joining the North-South poles of CD is opposite to that of AB and lies along the postive $X-$ axis. The resultant field induction due to AB and CD at a point $P(2, 2)$ is $100 \times 10^{-7} T$. When the poles of the magnet CD are reversed, the resultant field induction is $50 \times 10^{-7} T$. If the dipole comes to stable equilibrium at an angle of 30^0 with this field, then ,magnitude of the other field is

A. 300 : 200

B. 400 : 600

C. 200 : 100

D. 300 : 100

Answer: A

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18. 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

A. $\frac{\mu_0}{4\pi} \cdot \left(\sqrt{2}\right) \frac{M}{d^3}$

B. $\frac{\mu_0}{4\pi} \cdot (\sqrt{3}) \frac{M}{d^3}$

C. $\frac{\mu_0}{4\pi} \cdot \frac{M}{d^3}$

D. $\frac{\mu_0}{4\pi} \cdot (\sqrt{5}) \frac{M}{d^3}$

Answer: D

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19. Magnetic inducton at a point on the axial line of a short bar magnet is B towards east. If the magnet is turned through 90^0 in clock wise direction, then magnetic induction at the same point is (Neglect earth's magnetic field)

A. B/4 towards east

B. B/2 towards west

C. B/2 towards north

D. B/2 towards south

Answer: C

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20. A magnetic dipole is under the inflluence of two magnetic fields having an angle of 120^0 between them. One of the fields has a magnitude $1.2 \times 10^{-2} T$. If the dipole comes to stable equilibrium at an angle of 30^0 with this field, then magnitude of the other field is

A. $8.484 \times 10^{-2} T$

B. $0.6 \times 10^{-2} T$

C. $4.242 \times 10^{-3} T$

D. $4.242 \times 10^{-5} T$

Answer: B

Watch Video Solution

21. A short bar magnet is placed with its south pole facing geographic south and the distance between the null point is found to be $16cm$. When the magnet is turned pole to pole at the same place then the distance between the null points will be

A. will be same, along the axial line

B. will be same, along the equatorial line

C. will be $16 \times 2^{1/3}$, on the axial line

D. will be $16 \times 2^{1/3}$, on the equatorial line

Answer: C

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22. A bar magnet is placed with its North pole pointing North. Neutral point is at a distance $'d'$ from the center of magnet. The net magnetic induction at the same distance on the axial line of the magnet is

A. $2B_H$

B. $3B_H$

C. B_H

D. $7B_H$

Answer: B

Watch Video Solution

23. A bar magnet is placed with its North pole pointing North. Neutral point is at $12 cm$. Another magnet is now placed on the first magnet, then the neutral point is found to be at $8 cm$. The ratio of their magnetic moments is

A. $3:2$

B. $27:19$

C. $9:4$

D. $9:5$

Answer: B

Watch Video Solution

24. The period of a thin magnet in a magnetic field is $2s$. It is cut into four equal parts by cutting it along length and breadth. The period of each of them in the same field is

A. 1 s

B. 2 s

C. 3 s

D. 4 s

Answer: A

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25. A bar magnet suspended in magnetic meridian executes oscillations with a time period of 2 sec in the earth's horizontal magnetic field of 24 microtesla. When a horizontal field of 18 microtesla is produced opposite to the earth's field by placing a current carrying wire, the new time period of magnet will be:

A. 1s

B. 2s

C. 3s

D. 4s

Answer: D

Watch Video Solution

26. Two bar magnets are bound together side by side and suspended. They swing in $12s$ when their like poles are together and in $16s$ when their unlike poles are together, the magnetic moments of these magnets are in the ratio

A. $27:5$

B. $25:7$

C. $7:25$

D. $24:7$

Answer: B

Watch Video Solution

27. A short bar magnet is oscillating in a magnetic field and its time period is 2 seconds. If another piece of brass of double meoment of inertia be placed over that magnet the time period of that combination in that field is

A. $2\sqrt{3}$ s

B. $2\sqrt{2}$ s

C. 2 S

D. $1/\sqrt{2}$ S

Answer: A

Watch Video Solution

28. When two identical bar magnets placed one above the other, such that they are mutually perpendicular and bisect each other. The time period oscillation in a horizontal magnetic field is 4 seconds. If one of the magnets is removed the time period of the other in the same field $\left(2^{1/4} = 1.189\right)$

A. 1.34sec

B. 2.34sec

C. 3.36sec

D. 4.34sec

Answer: C

Watch Video Solution

29. A bar magnet suspended freely in uniform magnetic field is vibrating with a time period of 3 seconds. If the initial field strength is $2T$. Then the final field strength, for which time period becomes 4 seconds is

A. 1.125 Tesla

B. 0.625 Tesla

C. 3.55 Tesla

D. 0.75 Tesla

Answer: A

Watch Video Solution

30. A short bar magnet of magnetic moment $2Am^2$ and moment of inertia $6 \times 10^2 kgm^2$ is freely suspended such that the magetic axial line is in the direction of magnetic meridian. If the magnet is displaced by a very small angle (3^0),the angular acceleration is $-x10^{-6} rad / \sec^2$ (Magnetic induction of earth's horizontal field $= 4 \times 10^{-4} T$).

A. $\pi / 20$

B. $\pi / 45$

C. $\pi / 60$

D. $\pi / 75$

Answer: B

Watch Video Solution

31. The period of oscillation of a magnet at a place is 4seconds. When it is remagnetised, so that the pole strength becomes $1/9th$ of initial value, the period of oscillation in seconds is

A. 3

B. 12

C. 5

D. 4

Answer: B

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32. The magnetic needle of a vibration magnetometer makes 12 oscillations per minute in the horizontal component of earth's magnetic field. When an external short bar magnet is placed at some distance along the axis of the needle in the same line it makes 15 oscillations per minute. If the poles of the bar magnet are inter changed, the number of oscillations it takes per minute is

A. $\sqrt{61}$

B. $\sqrt{63}$

C. $\sqrt{65}$

D. $\sqrt{67}$

Answer: B

Watch Video Solution

33. The magnetic needle of a $V.M.M$ completes 10 oscillations in 92seconds. When a small magnet is placed in the magnetic meridian $10cm$ due north of needle with north pole towards south completes 15 oscillations in 69seconds. The magnetic moment of magnet

A. $4.5Am^2$

B. $0.45Am^2$

C. $0.75Am^2$

D. $0.225Am^2$

Answer: C

Watch Video Solution

34. A magnetic needle has a frequency of 20 oscillations per minute in the earth's horizontal field. When the field of a magnet supports the earths horizontal field, the frequency increases to 30 oscillations per minute. The ratio of the field of the magnet to that of the earth is

A. $4:7$

B. $7:4$

C. $5:4$

D. $4:5$

Answer: C

Watch Video Solution

35. A thin iron rod is cut into 10 equal parts parallel to its length. The intensity of magnetisation of each piece will be.....

A. $\frac{1}{10}$ th of initial value

B. 10 times initial value

C. does not change

D. become half

Answer: C

Watch Video Solution

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

A. 3×10^3

B. 4×10^{-3}

C. 5×10^5

D. 6×10^{-4}

Answer: A

Watch Video Solution

37. A paramagnetic sample shows a net magnetisation of $8Am^{-1}$ when placed in an external magnetic field of $0 \cdot 6T$ at a temperature of $4K$. When the same sample is placed in an external magnetic field of $0 \cdot 2T$ at a temperature of $16K$, the magnetisation will be

A. $\frac{32}{3} A / m$

B. $\frac{2}{3} A / m$

C. 6 A/m

D. 2.4 A/m

Answer: B

Watch Video Solution

38. The angle of dip at a place is 40.6° and the intensity of the vertical component of the earth's magnetic field $V = 6 \times 10^{-5}$ Tesla. The total intensity of the earth's magnetic field (I) at this place is

A. $7 \times 10^{-5} T$

B. $6 \times 10^{-5} T$

C. $5 \times 10^{-5} T$

D. $9.2 \times 10^{-5} T$

Answer: D

Watch Video Solution

39. The correct value of dip angle at a place is 45°. If the dip circle is rotated by 45° out of the meridian, then the tangent of the angle of apparent dip at the place is

A. 1

B. $1/2$

C. $1/\sqrt{2}$

D. $\sqrt{2}$

Answer: D

Watch Video Solution

40. A compass needle oscillates 20 times per minute at a place where the dip is 45° and 30 times per minute where the dip is 30°. Compare the total magnetic field due to the earth at the two places.

A. 1.51

B. 1.83

C. 1.63

D. 1.23

Answer: B

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41. The real angle of dip, if a 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. $\tan^{-1}(\sqrt{3})$

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

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

Answer: D

Watch Video Solution

42. At a place the value of B_H and B_V are $0.4 \times 10^{-4} T$ and $0.3 \times 10^{-4} T$ respectively. The resultant earth's magnetic field is

A. $0.5 \times 10^{-4} T$

B. $10^{-4} T$

C. $2 \times 10^{-4} T$

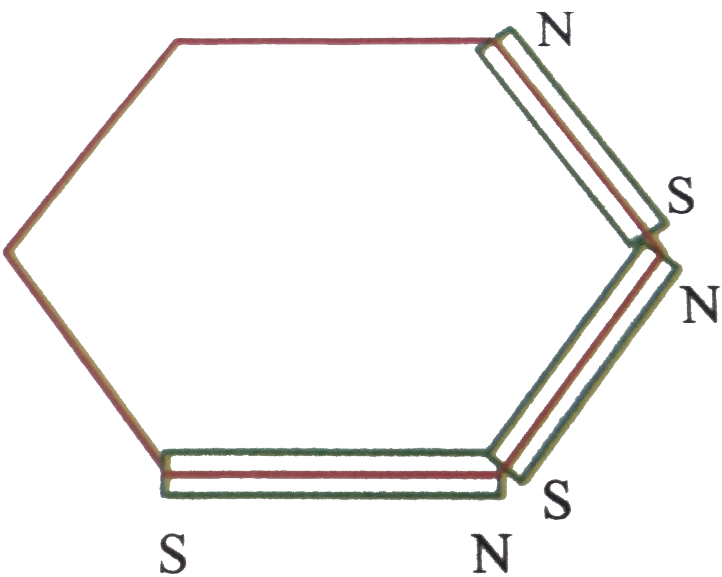
D. $5 \times 10^{-4} T$

Answer: A

Watch Video Solution

Exercise 2 H W

1. Three identical thin bar magnets each of moment M are placed along three adjacent sides of a regular hexagon as shown in figure. The resultant magnetic moment of the system is



A. M

B. $M\sqrt{3}$

C. $M\sqrt{2}$

D. 2M

Answer: D

Watch Video Solution

2. The magnetic moment of a bar magnet is $0.256 amp. m^2$. Its pole strength is 400 milli amp. m. It is cut into two equal pieces and these two pieces are arranged at right angles to each other with their unlike poles in contact (or like poles in contact). The resultant magnetic moment of the system is

A. $\sqrt{2} \times 256 \times 10^{-3} Am^2$

B. $250 \times 10^{-3} Am^2$

C. $\frac{256}{\sqrt{2}} \times 10^{-3} Am^2$

D. $\frac{128}{\sqrt{2}} \times 10^{-3} Am^2$

Answer: C

Watch Video Solution

3. A bar magnet is suspended in a uniform magnetic field in a position such that it experiences maximum torque. The angle through which it must be rotated from this position such that it experiences half of the maximum torque.

A. 60°

B. 30°

C. 45°

D. 37°

Answer: A

Watch Video Solution

4. If the maximum couple acting on a magnet in a field of induction 0.2 tesla is $10Nm$, what is its magnetic moment?

A. $50Am^2$

B. $2Am^2$

C. $5Am^2$

D. $20Am^2$

Answer: A

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5. A bar magnet of length $10cm$ experiences a torque of $0.141N-m$ in a uniform magnetic field of induction $0.4wb/m^2$, when it is suspended making an angle 45° with the field, the pole strength of the magnet is

A. 5 A-m

B. 2.5 A-m

C. 10 A-m

D. 15 A-m

Answer: A

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6. A bar magnet of pole strnegth $2A - m$ is kept in a magnetic field of induction $4 \times 10^{-5} wbm^{-2}$ such that the axis of the magnet makes an angle 30° with the directon of the field. The couple acting on the magnet is found $80 \times 10^{-7} N - m$. Then the distance between the poles of the magnet is

A. 20 m

B. 2 m

C. 3 cm

D. 20 cm

Answer: D

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7. A magnet of magnetic moment $20(\hat{k})Am^2$ is placed along the $z-$axis in a magnetic field $\overrightarrow{B} = (0.4\hat{j} + 0.5\hat{k})T$. The torque acting on the magnet is

A. $8\hat{i}N-m$

B. $6\hat{j}N-m$

C. $-8\hat{i}N-m$

D. $-6\hat{j}N-m$

Answer: C

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8. The torque required to keep a magnet of length $10cm$ at 45° to a uniform magnetic field is $\sqrt{2} \times 10^{-5} Nm$. The magnetic force on each pole is

A. 0.2mN

B. $20 \mu N$

C. 0.02N

D. 2N

Answer: A

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9. A bar magnet of moment $40A - m^2$ is free to rotate about a vetical axis passing through its centre. The magnet is released from rest from east west direction. The kinetic energy of the magnet as it takes north-south direction is $(B_H = 30\mu T)$

A. 0.6mJ

B. 1.2mJ

C. 2.4mJ

D. 0.3mJ

Answer: B

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10. A bar magnet of magnetic moment M is divided into $'n'$ equal parts cutting parallel to length. Then one part is suspended in a uniform magnetic field of strength $2T$ and held making an angle 60° with the direction of the field. When the magnet is released the $K.E$ of the magnet in the equilibrium position is

A. $\frac{M}{n}J$

B. Mn J

C. $\frac{M}{n^2}J$

D. Mn^2J

Answer: A

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11. A short bar magnet of magnetic moment $12.8 \times 10^{-3} Am^2$ is arranged in the magnetic meridian with its south pole pointing geographic north. If $B_H = 0.4$ gauss, the distance between the null points is

A. 4cm

B. 8cm

C. 12cm

D. 16cm

Answer: B

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12. The magnetic field strength at a point a distance $'d'$ form the centre on the axial line of a very short bar magnet of magnetic moment $'M'$ is $'B'$. Then magnetic induction at a diatance $2d$ from the centre on the equatorial line of a magnetic moment $8M$ will be

A. 4B

B. B/2

C. B/4

D. 2B

Answer: B

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13. Two north poles each of pole strength $8Am$ are placed at corners A and C of a square $ABCD$. The pole that should be placed at B to make D as null point is

A. North pole of pole strength $8\sqrt{2}Am$

B. North pole of pole strength $16\sqrt{2}Am$

C. North pole of pole strength $8\sqrt{2}Am$

D. North pole of pole strength $16\sqrt{2}Am$

Answer: D

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14. Two short bar magnets of magnetic moments $0.1245 Am^2$ and $0.512 Am^2$ are placed with their like poles facing each other. If the distance between the centres of the magnet is $0.26 m$. The distance of neutral point from the weaker magnet is

A. 0.13 m

B. 0.2 m

C. 0.26 m

D. 0.1 m

Answer: D

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15. A bar magnet of moment of inertia I is vibrated in a magnetic field of inducton is $0.4 \times 10^{-4} T$. The time period period of vibration is 12 sec. The magnetic moment of the magnet is $120 Am^2$. The moment of inertia of the magnet is ("in"kgm^(2))` approximately

A. 1728×10^{-2}

B. 172.8×10^{-4}

C. $2.1\pi^2$

D. 1.5×10^{-2}

Answer: B

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16. A bar magnet has moment of inertia $49x10^2 kgm^2$ vibrates in a magnetic field of induction $0.5x10^{-4}$ tesla. The time period of vibration is $8.8\,\text{sec}$. The magnetic moment of the bar magnet is

A. $350Am^2$

B. $490Am^2$

C. $490Am^2$

D. $500Am^2$

Answer: D

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17. A thin rod $30cm$ long is uniformly magnetised and its period of oscillation is $4s$. It is broken into three equal parts normal to its length. The period of oscillation of each part is

A. 12 s

B. 6 s

C. 1.33 s

D. 2.66 s

Answer: C

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18. 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 $36 \times 10^{-6} T$, then its value at B is

A. $36 \times 10^{-6} T$

B. $9 \times 10^{-6} T$

C. $144 \times 10^{-6} T$

D. $288 \times 10^{-6} T$

Answer: B

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19. A magnetic needle pivoted through its centre of mass and is free to rotate in a plane containing uniform magnetic field $200 \times 10^{-4} T$. When it is displaced slightly from the equilibrium it makes 2 oscillations per second. If the moment of inertia of the needle about the axis of oscillation is $0.75 \times 10^{-5} kgm^2$, the magnetic moment of the needle is

A. 0.06J/T

B. 0.03J/T

C. 0.12J/T

D. 0.6J/T

Answer: A

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20. The magnetic susceptibility of a medium is 0.825. Its relative permeability is

A. 1.825

B. 825

C. 285

D. 1825

Answer: A

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21. A magnetic field strength $(H) 3 \times 10^3 Am^{-1}$ produces a magnetic field of induction (B) of $12\pi T$ in an iron rod. Find the relative permeability of iron ?

A. 10^5

B. 10^4

C. 10^3

D. 10^2

Answer: B

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22. The magnetic moment of a magnet of mass $75gm$ is $9 \times 10^{-7} A - m^2$. If the density of the material of magnet is $7.5 \times 10^3 kgm^{-3}$, then find intensity of magnetisation is

A. 0.9 A/m

B. 0.09 A/m

C. 9 A/m

D. 90 A/m

Answer: B

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23. A magnetising field of 5000 A/m produces a magnetic flux of 5×10^{-5} weber in an iron rod. If the area of cross section of the rod is $0.5cm^2$, then the permeability of the rod will be

A. 1×10^{-3}

B. 2×10^{-4}

C. 3×10^{-5}

D. 4×10^{-6}

Answer: B

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24. A short bar magnet of magnetic moment $20Am^2$ has a cross sectional area of $1.5 \times 10^{-4}m^2$. If the intensity of magnetisation of the magnet is $10^5 A/m$. The length of magnet is

A. 0.33m

B. 0.13cm

C. 1.33m

D. 1.33cm

Answer: C

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Exercise 3

1. Correct relation between magnetic field B, Magnetic intensity H and intensity of Magnetisation I is

A. $B = \mu_0(H + I)$

B. $I = \mu_0(B + H)$

C. $H = \mu_0(B + I)$

D. $B = 2H(1 + I)$

Answer: A

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2. Which of the following material has zero magnetic moment of single atom?

A. Paramagnetic

B. Ferromagnetic

C. Diamagnetic

D. All

Answer: C

View Text Solution

3. Relation between μ_r and χ will be

A. $\mu_r = 1 + \chi$

B. $\chi = \mu_r + 1$

C. $\frac{\mu_0}{\mu}$

D. $\mu_0 \chi$

Answer: A

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

A. $\mu_d \neq 0 \text{ and } \mu_f \neq 0$

B. $\mu_p = 0 \text{ and } \mu_f \neq 0$

C. $\mu_d = 0 \text{ and } \mu_p \neq 0$

D. $\mu_d \neq 0 \text{ and } \mu_p \neq 0$

Answer: C

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5. Above Curie temperature

A. A ferromagnetic substance becomes paramagnetic

B. A paramagnetic substance becomes diamagnetic

C. A diamagnetic substance becomes paramagnetic

D. A paramagnetic substance becomes ferromagnetic

Answer: A

View Text Solution

6. Nickel shows ferromagnetic property at room temperature. If the temperature is increased beyond curie temperature, then it will show

A. Diamagnetism

B. Paramagnetism

C. Anti ferromagnetism

D. No magnetic property

Answer: B

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7. Curie temperature is the temperature above which

A. Ferromagnetic material becomes diamagnetic material

B. Ferromagnetic material become paramagnetic material

C. Paramagnetic material becomes diamagnetic material

D. Paramagnetic material becomes ferromagnetic material

Answer: B

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8. A bar magnet having a magnetic moment of $2 \times 10^4 JT^{-1}$ is free to rotate in a horizontal plane. A horizontal magnetic field $B = 6 \times 10^{-4} T$ exists in the space. The work done in taking the magnet slowly from a direction parallel to the field to a direction 60° from the field is

A. 12 J

B. 6 J

C. 2 J

D. 0.6 J

Answer: B

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

A. repelled by both the poles

B. repelled by the north pole and attracted by the south pole

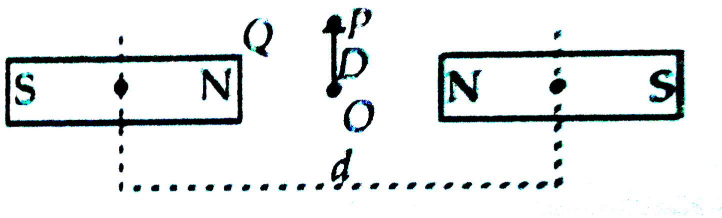
C. attracted by the north pole and repelled by the south pole

D. attracted by both the poles

Answer: A

Watch Video Solution

10. Two identical bar magnets are fixed with their centres at a distance d apart. A stationary charge Q is placed at P in between the gap of the two magnets at distance D from the centre O as shown in the figure. The force on the charge Q is



A. Zero

B. Directed along OP

C. Directed along PO

D. Directed perpendicular to the plane of paper

Answer: D

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11. The magnetic moment of a diamagnetic atom is

A. Much greater than one

B. 1

C. Between zero and one

D. Equal to zero

Answer: A

View Text Solution

12. A vibration magnetometer placed in magnetic meridian has a small bar magnet. The magnet executes oscillations with a time period of 2 sec in earth's horizontal magnetic field of 24 microtesla. When a horizontal field of 18 microtesla is produced opposite to the earth's field by placing a current carrying wire, the new time period of magnet will be

A. 4 s

B. 1 s

C. 2 s

D. 3 s

Answer: A

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13. Electromagnets are made of soft iron because soft iron has

A. High retentivity and low coercive force

B. Low retentivity and high coercive force

C. High retentivity and high coercive force

D. Low retentivity and low coercive force

Answer: A

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14. A short bar magnet of magnetic moment $0 \cdot 4JT^{-1}$ is placed in a uniform magnetic field of $0 \cdot 16T$. The magnet is in stable equilibrium when the potencial energy is

A. $-0.082J$

B. 0.064J

C. $-0.064J$

D. Zero

Answer: C

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15. There are four light-weight-rod sample A, B, C, D separately suspended by threads. A bar magnet is slowly brought near each sample and the following observations are noted

(i) A is feebly repelled

(ii) B is feebly attracted

(iii) C is strongly attracted

(iv) D remains unaffected

Which one of the following is true?

A. A is of a non-magnetic material

B. B is of a paramagnetic material

C. C is of a diamagnetic material

D. D is of a ferromagnetic material

Answer: B

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16. A magnetic needle suspended parallel to a magnetic field requires $\sqrt{3}J$ of work to turn it through 60°. The torque needed to maintain the needle in this postion will be:

A. $2\sqrt{3}N-m$

B. 3 N-m

C. $\sqrt{3}N-m$

D. $\frac{3}{2}N - m$

Answer: B

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17. A compose needle which is allowed to move in a horizontal plane is taken to a geomagnetic pole. It

A. Will stay in north-south direction only

B. Will stay in east-west direction only

C. Will becomes rigid showing no movement

D. Will stay in any position

Answer: D

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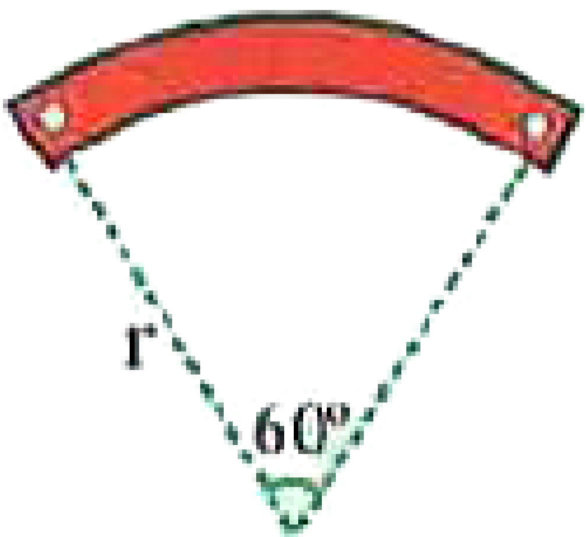
18. A bar magnet of length l and magnet dipole moment M is bent in the form of an arc. The new magnetic dipole moment is



A. $\frac{3}{\pi}M$

B. $\frac{2}{\pi}M$

C. $\frac{M}{2}$

D. M

Answer: A

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19. Following figures show the arrangement of bar magnets in different configurations. Each magnet has magnetic dipole moment (m). Which configuration has highest value of magnetic dipole moment?

A. 1

B. 2

C. 3

D. 4

Answer: C

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20. The magnetic susceptibility is negative for

A. diamagnetic material only

B. paramagnetic material only

C. ferromagnetic material only

D. paramagnetic and ferromagnetic materials.

Answer: A

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Exercise 4 Single Answer Type Question

1. A paramagnetic sample shows a net magnetisation of $8Am^{-1}$ when placed in an external magnetic field of $0 \cdot 6T$ at a temperature of $4K$. When the same sample is placed in an external magnetic field of $0 \cdot 2T$ at a temperature of $16K$, the magnetisation will be

A. $\frac{32}{3}Am^{-1}$

B. $\frac{2}{3}Am^{-1}$

C. $6Am^{-1}$

D. $2.4Am^{-1}$

Answer: B

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2. A permanent magnet in the shape of a thin cylinder of length 10 cm has $M = 10^6 A/m$. Calculate the magnetisation current I_M.

A. $10^5 A$

B. $10^3 A$

C. 1A

D. 2A

Answer: A

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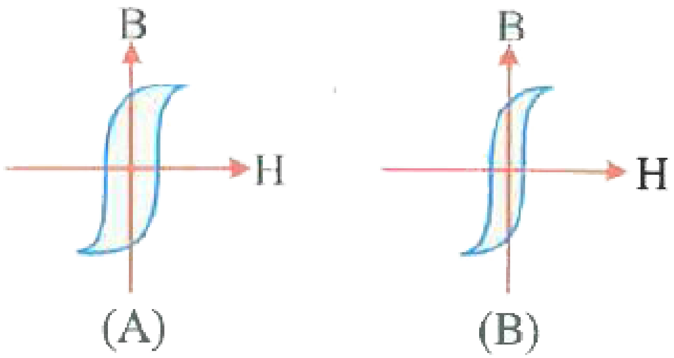
3. Hysteresis loops for two magnetic materials A and B are as given below:



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

Answer: D

View Text Solution

4. A bar magnet of length $8cm$ and having a pole strengh of $1.0Am$ is placed vertically on a horizontal table with its south pole on the table. A neutral point is found on the table at a distance of 6.0 cm north of the magnet. Calculate the earth's horizontal magnetic field.

A. $22 \times 10^{-6} T$

B. $44 \times 10^{-6} T$

C. $66 \times 10^{-6} T$

D. $88 \times 10^{-6} T$

Answer: A

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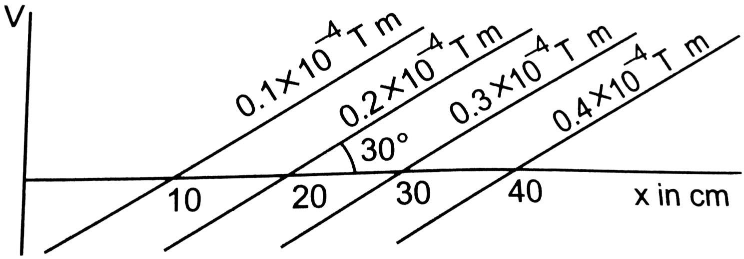
5. Figure shows some of the equipotential surfaces of the magnetic scalar potential. Find the magnetic field B at a point in the region.



A. $2 \times 10^{-4} T$

B. $4 \times 10^{-4} T$

C. $8 \times 10^{-4} T$

D. $12 \times 10^{-4} T$

Answer: A

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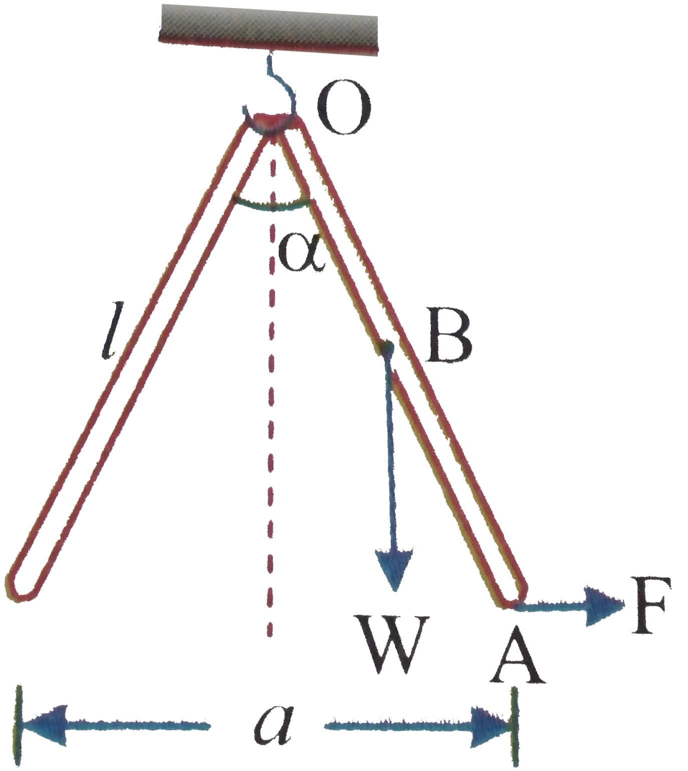
6. Two long equally magnetized needles are freely suspended by their like poles form a hooks shown in figure. The length of each needle is lcm and the weight is $W.$ in equillibrium the needles make an angle α with each other. The magnetic pole strength is concentrated at the ends of needles. The magnetic pole strength of the needles is



A. $l\sin\frac{\alpha}{2}\sqrt{2W\tan\frac{\alpha}{2}}$

B. $2l\sin\frac{\alpha}{2}\sqrt{2W\tan\frac{\alpha}{2}}$

C. $3l\sin\frac{\alpha}{2}\sqrt{2W\tan\frac{\alpha}{2}}$

D. $4l\sin\frac{\alpha}{2}\sqrt{2W\tan\frac{\alpha}{2}}$

Answer: A

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7. At a place on earth, horizontal component of earth's magnetic field is B_1 and vertical component of earth's magnetic field is B_2. If a magnetic needle is kept vertical, in a plane making angle α with the horizontal component of magnetic field, then square of time period of oscillation of needle when slightly distributed is proportional to

A. $\dfrac{1}{\sqrt{B_1 \cos \alpha}}$

B. $\dfrac{1}{\sqrt{B_2}}$

C. $\dfrac{1}{\sqrt{(B_1 \cos \alpha)^2 + B_2^2}}$

D. infinite

Answer: C

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8. The coercivity of a small magnet where the ferromagnet gets demagnetised is $3 \times 10^3 A.m^{-1}$ The current required to be passed in a solenoid of length 10cm and number of turns 100 so that the magnet gets demagnetised when inside the solenoid is

A. 30mA

B. 60mA

C. 3A

D. 6A

Answer: C

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9. Statement A : A proton has spin and magnetic moment just like an electron. But its effect is neglected in magnetism of material.

Statement B : The order of magnitude of difference between the diamagnetic suceptibility of $N_2(\text{~}5 \times 10^{-9})$(STP) and $Cu(\text{~}10^{-5})$ is 1.6×10^{-4}

Statement C : Suppose we went to verify the analogy between electrostatic and magnetostatic by an explicit experiment. Consider the motion of (i) electric dipole P in an electrostatic field E and (ii) magnetic dipole M in a magnetic field B. Set of conditions on E,B,p,M so that the two motions are verified to be identical. (Assume identical initial contiditions are (i) $P = \frac{M}{C}$

(ii) PE = MB

A. A correct B correct C correct

B. A correct B correct C wrong

C. A worng B correct C correct

D. A correct B worng C correct

Answer: A

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10. The figure shows two diamagnetic spheres located near the south pole of a bar magnet. Then,

A. the force on sphere 1 is directed towards the magnet

B. the force on sphere 2 is directed away from the magnet

C. the magnetic dipole moment of sphere is directed towards the magnet

D. the magnetic dipole moment of sphere 2 is directed away from the magnet.

Answer: B::D

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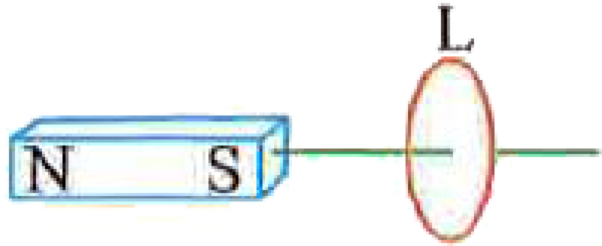
11. Figure shows a loop model (loop L) for a diamagnetic material.



A. the net dipole moment of the loop directed towards the magnet

B. The net dipole moment of the loop directed away from the loop

C. The loop gets attracted towards the magnet

D. The loop gets repelled by the magnet

Answer: B::D

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12. S is the surface of a lump of magnetic material .

A. Lines of $\vec{B}$ are necessarily continuous across S.

B. Some lines of $\vec{B}$ must be discontinuous across S.

C. Lines of $\vec{H}$ are necessarily continuous across S.

D. Lines of $\vec{H}$ cannot all be continuous across S.

Answer: A::D

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13. The primary origin(s) of magnetism lies in

A. atomic currents

B. Paili exclusion principle

C. polar nature of molecules

D. intrinsic spin of electron

Answer: A::D

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14. In a permanent magnet at room temperature.

A. magnetic moment of each molecules is zero

B. the individual molecules have non-zero magnetic moments which are all perfectly aligned

C. domains are partially aligned

D. domains are all perfectly aligned

Answer: C

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15. A long solenoid has 1000 turns per metre and carries a current of $1A$. It has a soft iron core of $\mu_r = 1000$. The core is heated beyond the Curie temperature, T_c.

A. The $\vec{H}$ field in the solenoid is (nearly) unchanged but the $\vec{B}$ field decreases drastically.

B. The $\vec{H}$ and $\vec{B}$ fields in the solenoid are nearly unchanged.

C. The magnetisation in the core reverses direction.

D. The magnetisation in the core diminishes by a factor of about 10^8.

Answer: A::D

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16. Essential difference between electrostatic shielding by a conducting shell and magnetostatic shielding is due to

A. electrostatic field lines can end on charges and conductors have free charges

B. lines of $\overrightarrow{B}$ can also end but conductors cannot end them

C. lines of $\overrightarrow{B}$ cannot end on any material and perfect shielding is not possible

D. shells of high permeability materials can be used to divert lines of $\overrightarrow{B}$ from the interior region

Answer: A::C::D

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17. Let the magnetic field on earth be modelled by that of a point magnetic dipole at the centre of earth. The angle of dip at a point on the geographical equator

A. is always zero

B. can be zero at specific points

C. can be positive or negative

D. is bounded

Answer: B::C::D

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