



## PHYSICS

### BOOKS - NCERT FINGERTIPS PHYSICS (HINGLISH)

#### MAGNETISM AND MATTER

##### The Bar Magnet

1. The primary origin(s) of magnetism lies in
  - A. atomic currents and intrinsic spin of electrons
  - B. pauli exclusion principle.
  - C. polar nature of molecules
  - D. electronegative nature of materials

**Answer: A**



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2. Magnetic moment for a solenoid and corresponding bar magnet is

- A. equal for both
- B. more for solenoid
- C. more for bar magnet
- D. none of these

**Answer: A**



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3. Which of the following is not correct about the magnetic field lines?

- A. The magnetic field lines of a magnet form continuous closed loops
- B. The tangent to the field line at a given point represents the direction of the net magnetic field  $B$  at that point.
- C. The larger the number of field lines crossing per unit area, the stronger is the magnitude of the magnetic field  $B$ .
- D. The magnetic field lines may intersect to each other in certain conditions.

**Answer: D**



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4. Which of the following is correct about magnetic monopole?

A. Magnetic monopole exist.

B. Magnetic monopole does not exist.

C. Magnetic monopole have constant value of monopole momentum.

D. The monopole momentum increase due to increase at its distance from the field.

**Answer: B**



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5. If  $B_E$  represents equatorial magnetic field and  $B_A$  represents axial magnetic field due to a bar magnet. Which of the following

relationships between  $B_E$  and  $B_A$  is correct ?

A.  $B_E = 2B_A$

B.  $B_A = 2B_E$

C.  $B_E = 4B_A$

D.  $B_A = 4B_E$

**Answer: B**



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**6.** A short bar magnet has a magnetic moment of  $0.48 \text{ JT}^{-1}$ . Give the direction and magnitude of the magnetic field produced by the magnet at a distance of  $10 \text{ cm}$  from the centre of the magnet on (i) the axis (ii) the equatorial line (normal bisector) of the magnet.

A.  $0.48 \times 10^{-4}$  T along N-S direction

B.  $0.28 \times 10^{-4}$  T along S-N direction

C.  $0.28 \times 10^{-4}$  T along N-S direction

D.  $0.96 \times 10^{-4}$  T along S-N direction

**Answer: D**



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7. A short bar magnet has a magnetic moment of  $0.39 \text{ JT}^{-1}$ .

The magnitude and direction of the magnetic field produced by the magnet at a distance of  $20 \text{ cm}$  from the centre of the magnet on the equatorial line of the magnet is

A.  $0.049 \text{ G}$ , N-S direction

B.  $4.95 \text{ G}$ , S-N direction

C. 0.0195 G, S-N direction

D. 19.5 G, N-S direction

**Answer: A**



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8. The magnet induction at a point  $1 \text{ \AA}$  away from a proton measured along its axis of spin is (magnetic moment of the proton is  $1.4 \times 10^{-26} \text{ A m}^2$ )

A. 0.28 mT

B. 28 mT

C. 0.028 mT

D. 2.8 mT

**Answer: D**



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9. The pole strength of  $12\text{cm}$  long bar magnet is  $20\text{Am}$ . The magnetic induction at a point  $10\text{ cm}$  away from the centre of the magnet on its axial line is  $\left[ \frac{\mu_0}{4\pi} = 10^{-7}\text{H m}^{-1} \right]$

A.  $1.17 \times 10^{-3}\text{ T}$

B.  $2.20 \times 10^{-3}\text{ T}$

C.  $1.17 \times 10^{-2}\text{ T}$

D.  $2.20 \times 10^{-2}\text{ T}$

**Answer: A**



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10. Two short bar magnets of magnetic moments  $m$  each are arranged at the opposite corners of a square of side  $d$  such that their centres coincide with the corners and their axes are parallel. If the like poles are in the same direction, the magnetic induction at any of the other corners of the square is

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

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

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

D.  $\frac{\mu_0}{4\pi} \frac{m^3}{2d^3}$

**Answer: A**



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11. Two identical magnetic dipoles of magnetic moments  $2Am^2$  are placed at a separation of  $2m$  with their axes perpendicular to each other in air. The resultant magnetic field at a mid point between the dipole is

A.  $4\sqrt{5} \times 10^{-5} \text{ T}$

B.  $2\sqrt{5} \times 10^{-5} \text{ T}$

C.  $4\sqrt{5} \times 10^{-7} \text{ T}$

D.  $2\sqrt{5} \times 10^{-7} \text{ T}$

**Answer: D**



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12. The magnitude of the equatorial magnetic field due to a bar magnet of length 2 cm at a distance of 1m from its mid-point is

(magnetic moment of the bar magnet is 0.60 A m)

A.  $5.0 \times 10^{-5} \text{ T}$

B.  $6.0 \times 10^{-8} \text{ T}$

C.  $7.0 \times 10^{-7} \text{ T}$

D.  $8.0 \times 10^{-8} \text{ T}$

**Answer: B**



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**13.** What is the magnitude of axial field due to a bar magnet of length 3 cm at a distance of 75 cm from its mid-point if its magnetic moment is 0.6 Am?

A.  $0.013 \mu \text{ T}$

B.  $0.113 \mu \text{ T}$

C.  $0.213 \mu\text{T}$

D.  $0.313 \mu\text{T}$

**Answer: C**



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**14.** A magnetic needle has magnetic moment  $5.8 \times 10^{-2} \text{ A m}$  and moment of inertia of  $7.8 \times 10^{-5} \text{ kg m}^2$ , it performs 12 complete oscillations in 6.0 s. What is the magnitude of magnetic field?

A. 0.011 T

B. 0.021 T

C. 0.031 T

D. 0.041 T

**Answer: B**



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**15.** A magnetic needle has a magnetic moment  $5.0 \times 10^{-2} \text{Am}^2$  and moment of inertia of  $7.8 \times 10^{-6} \text{kg m}^2$ , it performs 12 complete oscillations in 6.0 s. What is the magnitude of magnetic field ?

A. 0.0016 T

B. 0.16 T

C. 1.6 T

D. 16 T

**Answer: A**



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16. A bar magnet of magnetic moment  $M$  and moment of inertia  $I$  (about centre, perpendicular to length) is cut into two equal pieces, perpendicular to length. Let  $T$  be the period of oscillation of the original magnet about an axis through the mid point, perpendicular to length, in a magnetic field  $\vec{B}$ . What would be the similar period  $T'$  for each piece?

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

B.  $\frac{3T}{4}$

C.  $\frac{5T}{2}$

D.  $T$

**Answer: A**



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17. A bar magnet has a magnetic moment of  $200Am$ . The magnet is suspended in a magnetic field of  $0.30NA^{-1}m^{-1}$ . The torque required to rotate the magnet from its equilibrium position through an angle of  $30^\circ$ , will be

A.  $30Nm$

B.  $30\sqrt{30}Nm$

C.  $60Nm$

D.  $60\sqrt{3}Nm$

**Answer: A**



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18. A circular coil of 16 turns and radius 10cm carrying a current of 0.75A rests with its plane normal to an external field of

magnitude  $5.0 \times 10^{-2} T$ . The coil is free to turn about an axis in its plane perpendicular to the field direction. When the coil is turned slightly and released, it oscillates about its stable equilibrium with a frequency of  $2.0 s^{-1}$ . What is the moment of inertia of the coil about its axis of rotation?

- A.  $1.13 \times 10^{-1} \text{kg m}^2$
- B.  $1.13 \times 10^{-2} \text{kg m}^2$
- C.  $1.113 \times 10^{-3} \text{kg m}^2$
- D.  $1.13 \times 10^{-4} \text{kg m}^2$

**Answer: D**

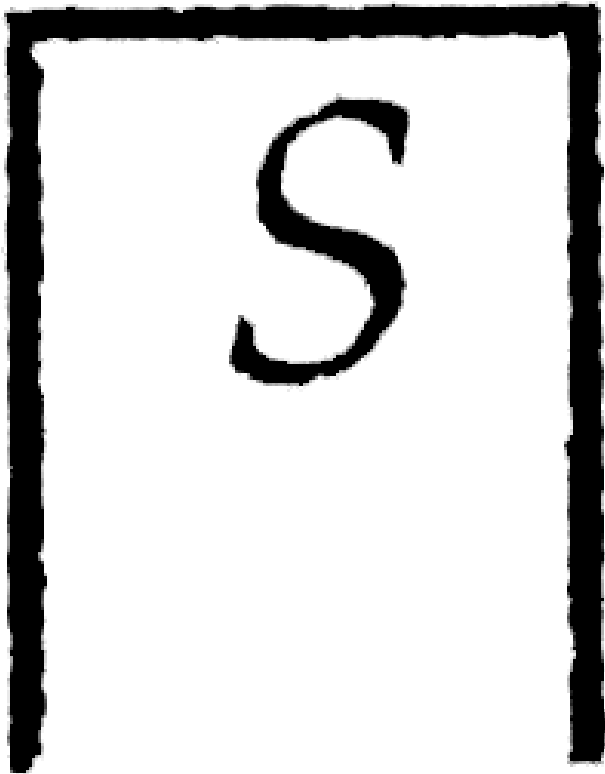


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19. A wire is placed between the poles of two fixed bar magnets as shown in the figure. A small current in the wire is into the plane of the paper. The direction of the magnetic force on the wire is





A. ↑

B. ↓

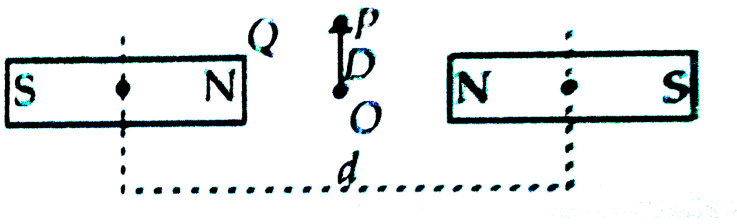
C. →

D. ←

Answer: D

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20. 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: A**

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21. A solenoid of cross-sectional area  $2 \times 10^{-4} m^2$  and 900 turns has  $0.6 Am^2$  magnetic moment. Then the current flowing through it is

A. 2.4A

B. 2.34mA

C. 3.33A

D. 3.33mA

**Answer: C**

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22. A closely wound solenoid of 750 turns and area of cross section of  $5 \times 10^{-4} \text{ m}^2$  carries a current of 3.0 A. Its associated magnetic moment is

A.  $4.12 \text{ JT}^{-1}$

B.  $3.12 \text{ JT}^{-1}$

C.  $2.12 \text{ JT}^{-1}$

D.  $1.13 \text{ JT}^{-1}$

**Answer: D**

23. A closely wound solenoid of 1000 turns and area of cross section  $1.4 \times 10^{-4} m^2$  carrying a current of 3 A is suspended through its centre allowing it to turn in a horizontal plane. The magnetic moment associated with this solenoid is

A.  $0.22 JT^{-1}$

B.  $0.32 JT^{-1}$

C.  $0.42 JT^{-1}$

D.  $0.52 JT^{-1}$

**Answer: C**



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24. A circular coil of 300 turns and diameter  $14cm$  carries a current of  $15A$ . What is the magnitude of magnetic moment

linked with the loop?

A.  $51.7JT^{-1}$

B.  $69.2JT^{-1}$

C.  $38.6JT^{-1}$

D.  $19.5JT^{-1}$

**Answer: B**



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**25.** A closely wound solenoid of 3000 turns and area of cross section  $2 \times 10^{-4}m^2$ , carrying a current of 6 A is suspended through its centre allowing it to turn in a horizontal plane. The magnetic moment associated with this solenoid is

A.  $1.2JT^{-1}$

B.  $2.4JT^{-1}$

C.  $3.0JT^{-1}$

D.  $3.6JT^{-1}$

**Answer: D**



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26. The torque and magnetic potential energy of a magnetic dipole in most stable position in a uniform magnetic field  $\vec{B}$  having magnetic moment  $\vec{m}$  will be

A.  $-mB$ , zero

B.  $mB$ , zero

C. zero,  $mB$

D. zero,  $-mB$



**Answer: D**



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27. The work done in moving a dipole from its most stable to most unstable position in a  $0.09T$  uniform magnetic field is (dipole moment of this dipole =  $0.5Am^2$ )

A.  $0.07J$

B.  $0.08J$

C.  $0.09J$

D.  $0.1J$

**Answer: C**



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28. A circular coil of 25 turns and radius of 12 cm is placed in a uniform magnetic field of 0.5 T normal to the plane of coil. If the current in the coil is 5 A, then total torque experienced by the coil is

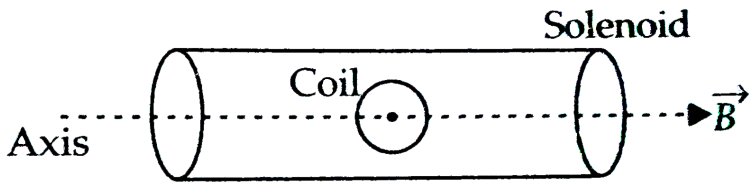
- A. 1.5Nm
- B. 2.5Nm
- C. 3.5Nm
- D. zero

**Answer: D**

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29. The torque required to hold a small circular coil of 10 turns, area  $1\text{mm}^2$  and carrying a current of  $\left(\frac{21}{44}\right)\text{A}$  in the middle of a

long solenoid of  $10^3$  turns / m carrying a current of 2.5A, with its axis perpendicular to the axis of the solenoid is



- A.  $1.5 \times 10^{-6} Nm$
- B.  $1.5 \times 10^{-8} Nm$
- C.  $1.5 \times 10^6 Nm$
- D.  $1.5 \times 10^8 Nm$

**Answer: B**



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**30.** A short bar magnet placed with its axis at  $30^\circ$  with a uniform external magnetic field of 0.35 T experiences a torque of

magnitude equal to  $4.5 \times 10^{-2} Nm$ . The magnitude of magnetic moment of the given magnet is

A.  $0.26 JT^{-1}$

B.  $2.6 JT^{-1}$

C.  $0.26 JT^{-1}$

D.  $0.026 JT^{-1}$

**Answer: C**



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**31.** If the solenoid in the above question is free to turn about the vertical direction, and a uniform horizontal magnetic field of  $0.25T$  is applied, what is the magnitude of the torque on the

solenoid when its axis makes an angle of  $30^\circ$  with the direction of the applied field?

A. 0.075Nm

B. 0.080Nm

C. 0.081Nm

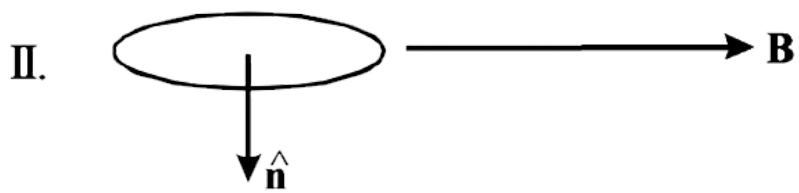
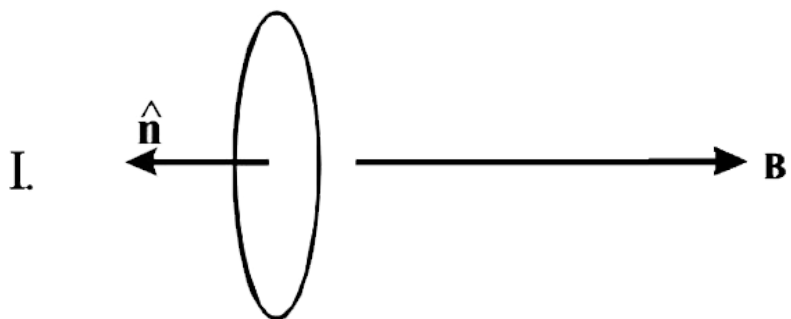
D. 0.091Nm

**Answer: C**

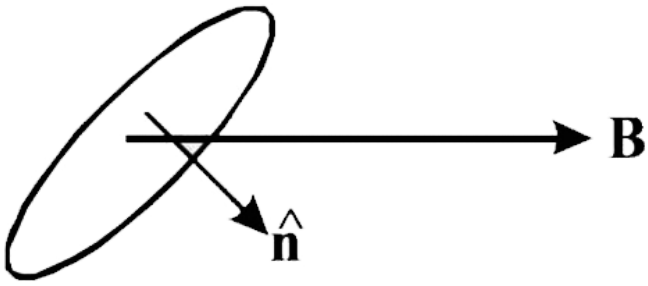


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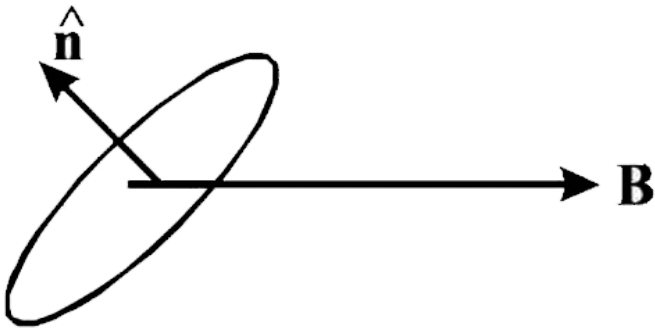
**32.** A current carrying loop is placed in a uniform magnetic field in four different orientations , i,ii,iii & iv arrange them in the decreasing order of potential Energy`



III



IV



A. 4,2,3,1

B. 1,4,2,3

C. 4,3,2,1

D. 1,2,3,4

**Answer: B**



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**33.** A circular coil of 100 turns radius 10cm, carries a current of 5A. It is suspended vertically in a uniform horizontal magnetic field of 0.5T and the field lines make an angle of  $60^\circ$  with the plane of the coil. The magnitude of the torque that must be applied on it to prevent it from turning is

A. 2.93Nm

B. 3.41Nm

C. 3.93Nm

D. 4.93Nm

**Answer: C**



34. A dipole of magnetic moment  $\vec{m} = 30\hat{j}Am^2$  is placed along the y-axis in a uniform magnetic field  $\vec{B} = (2\hat{i} + 5\hat{j})T$ . The torque acting on it is

- A.  $-40\hat{k}Nm$
- B.  $-50\hat{k}Nm$
- C.  $-60\hat{k}Nm$
- D.  $-70\hat{k}Nm$

**Answer: C**

35. A uniform horizontal magnetic field of  $7.5 \times 10^{-2} T$  is set up at an angle of  $30^\circ$  with the axis of an solenoid and the magnetic moment associated with it is  $1.28 JT^{-1}$ . Then the torque on it is

A.  $4.8 \times 10^{-2} Nm$

B.  $1.6 \times 10^{-2} Nm$

C.  $1.2 \times 10^{-2} Nm$

D.  $4.8 \times 10^{-4} Nm$

**Answer: A**



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36. A magnetic dipole is under the influence of two magnetic fields. The angle between the field direction is  $60^\circ$  and one of

the fields has magnitude of  $1.2 \times 10^{-2}T$ . If the dipole comes to stable equilibrium at an angle of  $30^\circ$  with this field, then the magnitude of the field is

A.  $1.2 \times 10^{-4}T$

B.  $2.4 \times 10^{-4}T$

C.  $1.2 \times 10^{-2}T$

D.  $2.4 \times 10^{-2}T$

**Answer: C**



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**37.** The magnetic moment of a short bar magnet placed with its magnetic axis at  $30^\circ$  to an external field of 900 G and experiences a torque of 0.02 N m is

A.  $0.35Am^2$

B.  $0.44Am^2$

C.  $2.45Am^2$

D.  $1.5Am^2$

**Answer: B**



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**38.** Which of the following is not showing the essential difference between electrostatic shielding by a conducting shell and magnetostatic shielding?

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

B. Magnetic field lines can end but conductors cannot end them.

C. Lines of magnetic field cannot end on any material and perfect shielding is not possible.

D. Shells of high permeability materials can be used to divert lines of magnetic field from the interior region.

**Answer: B**



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## Magnetisation And Magnetic Intensity

1. A magnetising field of  $1500 \text{ A/m}$  produces a flux of  $2 \cdot 4 \times 10^{-5}$  weber in a bar of iron of cross-sectional area

$0.5 \text{ cm}^2$ . Calculate the permeability and susceptibility of the iron bar used.

A. 245

B. 250

C. 252

D. 255

**Answer: D**



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2. A solenoid has a core of a substance with relative permeability 600. What is the magnetic permeability of the given substance?

A.  $20\pi \times 10^{-5} \text{ NA}^{-2}$

B.  $21\pi \times 10^{-5} \text{ NA}^{-2}$

C.  $22\pi \times 10^{-5} NA^{-2}$

D.  $24\pi \times 10^{-5} NA^{-2}$

**Answer: D**



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3. A permanent magnet in the shape of a thin cylinder of length 50 cm has intensity of magnetization  $10^6 Am^{-1}$ . The magnetization current is

A.  $5 \times 10^5 A$

B.  $6 \times 10^5 A$

C.  $5 \times 10^4 A$

D.  $6 \times 10^5 A$

**Answer: A**



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4. A domain in ferromagnetic iron in the form of cube shaving  $5 \times 10^{10}$  atoms. If the side length of this domain is  $1.5\mu$  and each atom has a dipole moment of  $8 \times 10^{-24} Am^2$ , then magnetisation of domain is

A.  $11.8 \times 10^5 Am^{-1}$

B.  $1.18 \times 10^5 Am^{-1}$

C.  $11.8 \times 10^4 Am^{-1}$

D.  $1.18 \times 10^5 Am^{-1}$

**Answer: D**



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5. A magnetizing field of  $2 \times 10^3 \text{ Am}^{-1}$  produces a magnetic flux density of  $8\pi T$  in an iron rod. The relative permeability of the rod will be

A.  $10^2$

B. 1

C.  $10^4$

D.  $10^3$

**Answer: C**



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6. A permanent magnet in the shape of a thin cylinder of length 10 cm has magnetization ( $M$ ) =  $10^6 \text{ Am}^{-1}$ . Its magnetization

current  $I_m$  is

A.  $10^5 A$

B.  $10^6 A$

C.  $10^7 A$

D.  $10^8 A$

**Answer: A**



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7. A ring of mean radius 15 cm has 3500 turns of wire wound on a ferromagnetic core of relative permeability 800. The magnetic field in the core for a magnetising current of 1.2 A is

A. 2.48T

B. 3.48T

C. 4.48T

D. 5.48T

**Answer: C**



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8. A solenoid has a core of a material with relative permeability of 500. The windings of the solenoid are insulated from the core and carry a current of 2 A. If the number of turns is 1000 per meter, then magnetization is

A.  $7.78 \times 10^5 \text{ Am}^{-1}$

B.  $8.88 \times 10^5 \text{ Am}^{-1}$

C.  $9.98 \times 10^5 \text{ Am}^{-1}$

D.  $10.2 \times 10^5 \text{ Am}^{-1}$

**Answer: C**



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9. A solenoid has core of a material with relative permeability 500 and its windings carry a current of 1 A. The number of turns of the solenoid is 500per meter. The magnetization of the material is nearly

A.  $2.25 \times 10^3 Am^{-1}$

B.  $2.25 \times 10^5 Am^{-1}$

C.  $2.0 \times 10^3 Am^{-1}$

D.  $2.0 \times 10^5 Am^{-1}$

**Answer: B**



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10. The relation connecting magnetic susceptibility  $\chi_m$  and relative permeability  $\mu_r$ , is

A.  $\chi_m = \mu_r + 1$

B.  $\chi_m = \mu_r - 1$

C.  $\chi_m = \frac{1}{\mu_r}$

D.  $\chi_m = 3(1 + \mu_r)$

**Answer: B**



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11. The relative permeability of iron is 6000. Its magnetic susceptibility is

A. 5999

B. 6001

C.  $6000 \times 10^{-7}$

D.  $6000 \times 10^7$

**Answer: A**



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## Magnetic Properties Of Materials

1. Which of the following is not correct about relative magnetic permeability ( $\mu_r$ )?

A. It is a dimensionless pure ratio.

B. For vacuum medium its value is one.

C. For ferromagnetic materials of  $\mu > > 1$

D. For paramagnetic materials  $\mu_r > 1$

**Answer: D**

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2. Point out the correct set of diamagnetic substances

A. aluminum, sodium calcium and oxygen

B. bismuth, copper, lead and silicon

C. cobalt, nickel, gadolinium and aluminum

D. silver, niobium, magnesium and calcium

**Answer: B**

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3. Which of the following is universal magnetic property

- A. Ferromagnetis
- B. Diamagnetism
- C. Pararnagnetis
- D. Anti-ferromagnetism

**Answer: B**



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4. Superconductors are:

- A. most exotic diamagnetic materials
- B. ferromagnetic material with low resistivity



C. Paramagnetic materials at high temperature

D. none of these

**Answer: A**



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5. Magnetic susceptibility of a diamagnetic substances

A. increases with increase in temperature

B. increases with decrease in temperature

C. remains constant with change in temperature

D. none of these

**Answer: C**



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6. If a magnetic material is having magnetic susceptibility  $(\chi) = -1$  then the relative magnetic permeability  $(\mu_r)$  and type of magnetic material is

- A. 0, diamagnetic
- B. 2, ferromagnetic
- C. 1, paramagnetic
- D.  $-1$ , diamagnetic

**Answer: A**



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7. A ball of superconducting material is dipped in liquid nitrogen and placed near a bar magnet. In which direction will it move?

- A. Away from bar magnet
- B. Towards the bar magnet
- C. Around the bar magnet
- D. Remain constant

**Answer: A**



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**8.** The range of magnetic susceptibility and relative magnetic permeability for diamagnetic substance are

- A.  $-1 \geq \chi > 0, 0 \leq \mu_r < 1$
- B.  $-1 \leq \chi > 0, 0 \geq \mu_r < 1$
- C.  $-1 \geq \chi > 1, 0 \leq \mu_r < 1$

$$D. -1 \geq \chi < 0, 0 \leq \mu_r < 1$$

**Answer: D**



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9. Out of given paramagnetic substance (Calcium, Chromium, Oxygen and Tungsten) which substance has maximum susceptibility

A. Calcium

B. Chromium

C. Oxygen

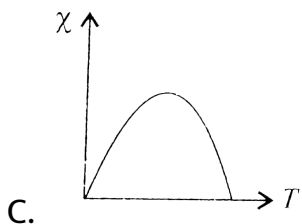
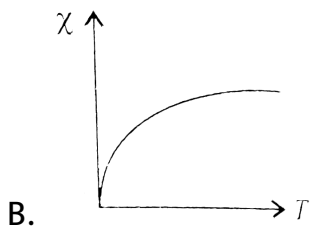
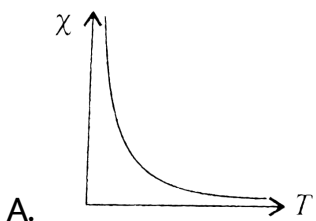
D. Tungsten

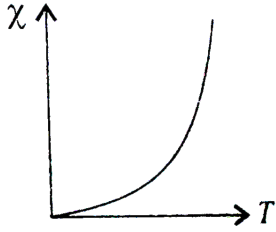
**Answer: B**



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10. Point out the best representation of relation between magnetic susceptibility ( $\chi$ ) and temperature (T) for a paramagnetic material



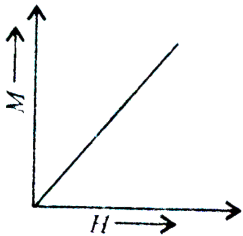


D.

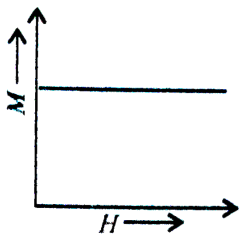
**Answer: A**

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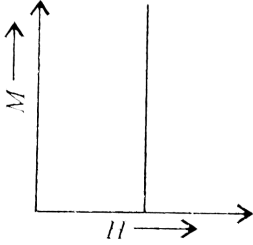
11. The correct M-H curve for a paramagnetic material at a constant temperature ( $T$ ) is represented by



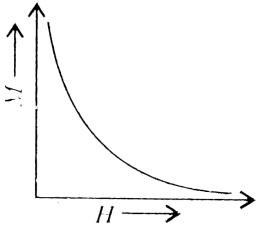
A.



B.



C.



D.

**Answer: A**



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**12.** The magnetic susceptibility of a paramagnetic material at  $-73^{\circ}C$  is  $0.0075$ , its value at  $-173^{\circ}C$  will be

A. 0.045

B. 0.03

C. 0.015

D. 0.0075

**Answer: C**



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**13.** The magnetic susceptibility of a paramagnetic substance at  $-173.^\circ C$  is  $1.5 \times 10^{-2}$  then its value at

A.  $7.5 \times 10^{-1}$

B.  $7.5 \times 10^{-2}$

C.  $7.5 \times 10^{-3}$



D.  $7.5 \times 10^{-4}$

**Answer: C**



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14. A paramagnetic liquid is taken in a U-tube and arranged so that one of its limbs is kept between pole pieces of the magnet.

The liquid level in the limb

- A. goes down
- B. rise up
- C. remains same
- D. first goes down and then rise

**Answer: B**



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15. Mark the correct set of ferromagnetic substances

- A. iron, cobalt and nickel
- B. iron, copper and lead
- C. silicon, bismuth and nickel
- D. aluminum, sodium and copper.

**Answer: A**

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16. In an experiment it is found that the magnetic susceptibility of given substance is much more greater than one. The possible substance is

- A. diamagnetic
- B. paramagnetic
- C. ferromagnetic
- D. nonmagnetic

**Answer: C**



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**17. Magnetic permeability is maximum for**

- A. ferromagnetic substances
- B. diamagnetic substances
- C. paramagnetic substances
- D. all of these

**Answer: A**



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**18.** Which of following property shows the property of ferromagnetic substances?

- A. The ferromagnetic property depends, on temperature.
- B. The ferromagnetic property does not depend on temperature.
- C. At high enough temperature ferromagnet becomes a diamagnet.
- D. At low temperature ferromagnet becomes a paramagnet.

**Answer: A**



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

- A. anti ferromagnetism
- B. no magnetic property
- C. diamagnetism
- D. paramagnetism

**Answer: D**



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20. The temperature of transition from ferromagnet property to paramagnetic property is called

- A. Transition temperature
- B. Critical temperature
- C. Curie temperature
- D. Triplet temperature.

**Answer: C**



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21. A domain in ferromagnetic iron is in the form of a cube of side length  $2\mu\text{m}$  then the number of iron atoms in the domain are

(Molecular mass of iron =  $55\text{g mol}^{-1}$  and density =  $7.92\text{g cm}^{-3}$ )

A.  $6.92 \times 10^{12}$  atoms

B.  $6.92 \times 10^{11}$  atoms

C.  $6.92 \times 10^{10}$  atoms

D.  $6.92 \times 10^{13}$  atoms

**Answer: B**



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**22.** In question number 91, maximum value of magnetisation of the given domain is (Dipole moment of an iron atom  $9.27 \times 10^{-24} \text{ Am}^2$ )

A.  $8.0 \times 10^5 \text{ Am}^{-1}$

B.  $6.0 \times 10^4 \text{ Am}^{-1}$

C.  $8.0 \times 10^3 \text{ Am}^{-1}$

$$D. 6.0 \times 10^3 \text{ Am}^{-1}$$

**Answer: A**



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**23.** Point out the wrong statement about the magnetic properties of soft iron and steel.

- A. Retentivity of soft iron is more than retentivity of steel.
- B. Coercivity of soft iron is less than coercivity of steel.
- C. Area of B-H loop in soft iron is smaller than the area of B-H loop for steel.
- D. Area of B-H in soft iron is greater than the area of B-H loop for steel.



**Answer: D**



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**24.** The hysteresis cycle for the material of a transformer core is

A. short and wide

B. tall and narrow

C. tall and wide

D. short and narrow

**Answer: B**



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25. The magnetising field required to be applied in opposite direction to reduce residual magnetism to zero is called

- A. retentivity
- B. coercivity
- C. hysteresis
- D. flux

**Answer: B**



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26. Which of the following material is used in making the core of a moving coil galvanometer?

- A. Copper

B. Nickel

C. Iron

D. Both (a) and (b)

**Answer: C**



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## Permanent Magnets And Electromagnets

1. Materials suitable for permanent magnet, must have which of the following properties?

A. High retativity low coercivity and high permeability

B. Low retativity low coercivity and low permeability

C. Low retativity high coercivity and low permeability

D. High retativity high coercivity and high permeability

**Answer: D**



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2. Permanent magnets are the substances having the property of

A. ferromagnetism at room temperature for long period of time.

B. paramagnetism at room temperature for a long period of time.

C. anti ferromagnetism at room temperature for a long period of time.

D. diamagnetism at room temperature for a long period of time.

**Answer: A**



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3. Core of electromagnets are made of ferromagnetic materials which have

- A. low permeability and low retentivity
- B. high permeability and high retentivity
- C. high permeability and low retentivity
- D. low permeability and high retentivity.

**Answer: D**

4. Identify the mismatched pair.

Hard magnet      Alnico

Soft magnet      Soft iron

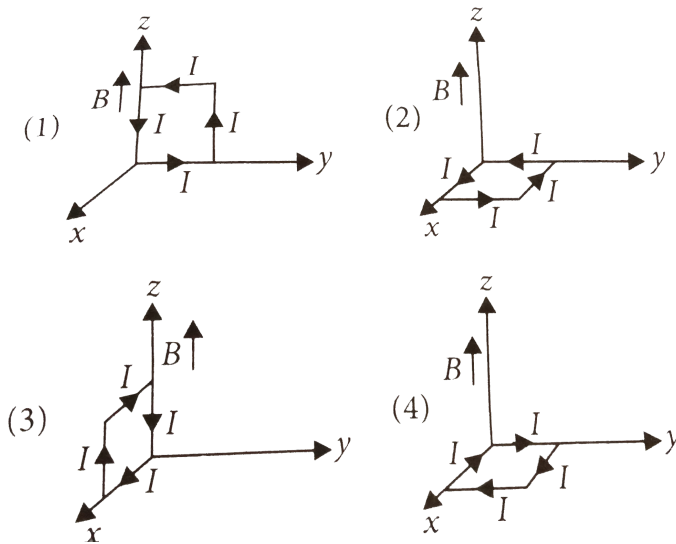
Bar magnet      Equivalent solenoid

Electromagnet      Loud speaker

- A. Hard magnet      Alnico
- B. Soft magnet      Soft iron
- C. Bar magnet      Equivalent solenoid
- D. Electromagnet      Loud speaker

**Answer: A**

1. A rectangular loop of sides 10cm and 5cm carrying a current  $I$  of 12A is placed in different orientations as shown in the figure



If there is a uniform magnetic field of 0.3 T in the positive  $z$ -direction, in which orientations the loop would be in (i) stable equilibrium and (ii) unstable equilibrium .

- A. (2)and(4), respectively
- B. (2)and(3), respectively
- C. (1)and(2), respectively

D. (1)and(3), respectively

**Answer: A**



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2. A compass needle free to turn in a horizontal plane is placed at the centre of a circular coil of 30 turns and radius 12 cm. The coil is in a vertical plane making an angle of  $45^\circ$  with the magnetic meridian when the current in the coil is  $0.35\text{amp.}$  , the needle points west to east.

(a) Determine the horizontal component of earth's magnetic field at the location.

(b) The current in the coil is reversed and the coil is rotated about its vertical axis by an angle of  $90^\circ$  in the anticlockwise sense looking from above. Predict the direction of the needle.

Take the magnetic declination at the places to be zero.



A.  $3.9 \times 10^{-7}$  tesla

B.  $3.9 \times 10^{-5}$  tesla

C.  $8.0 \times 10^{-5}$  tesla

D.  $7.0 \times 10^{-7}$  tesla

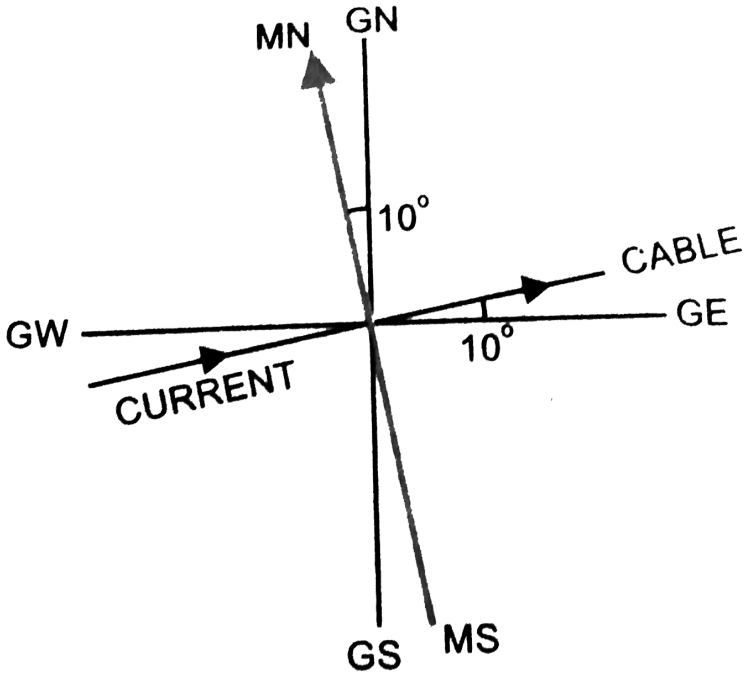
**Answer: B**



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**3.** A long straight horizontal cable carries a current of  $2.5 \text{ amp}$ . In the direction  $10^\circ$  south of west to  $10^\circ$  north of east, figure. The magnetic meridian of the place happens to be  $10^\circ$  west of the geographic meridian. The earth's magnetic field at the location is  $0.33G$  and the angle of dip is zero. Locate the line of neutral points (Ignore the thickness of the cable). [At neutral points, magnetic field due to a current cable is equal and

opposite to the horizontal component of earth's magnetic field.]



- A. 15.15mm
- B. 30.15mm
- C. 35.15mm
- D. 40.15mm

**Answer: A**

4. A telephonic cable at a place has four long straight horizontal wires carrying a current of  $1.0\text{amp}$ . in the same direction east to west. The earth's magnetic field at the place is  $0.39G$  and the angle of dip is  $35^\circ$ . The magnetic declination is almost zero. What are the resultant magnetic fields at points  $4.0\text{cm}$  below and above the cable?

A.  $0.25G, 0.55G$

B.  $0.50G, 0.75G$

C.  $1.25G, 0.95G$

D.  $2.50G, 0.45G$

**Answer: A**

5. There are two current carrying planar coils made each from identical wires of length  $L$ .  $C_1$  is the circular (radius  $R$ ) and  $C_2$  is square (side  $a$ ). They are so constructed that they have same frequency of oscillation when they are placed in the same uniform  $\vec{B}$  and carry the same current  $i$ . Find  $a$  in terms of  $R$ .

A.  $a=R$

B.  $a=2R$

C.  $a=3R$

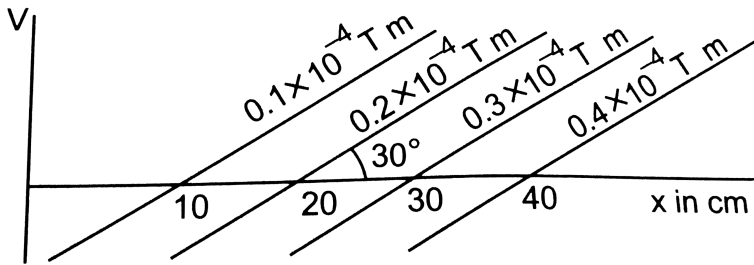
D.  $2a=5R$

**Answer: C**



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



- A.  $10^{-4}T$
- B.  $0.5 \times 10^{-4}T$
- C.  $2 \times 10^{-4}T$
- D. none of these

**Answer: C**



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7. A rod of ferromagnetic material with dimensions  $10\text{cm} \times 0.5\text{cm} \times 2\text{cm}$  is placed in a magnetising field of intensity  $2 \times 10^5 \text{ A/m}$ . The magnetic moment produced due to it is  $6 \text{ amp} - \text{m}^2$ . The value of magnetic induction will be-----  $10^{-2} \text{ T}$ .

A. 0.358T

B. 0.54T

C. 6.28T

D. 2.519T

**Answer: B**



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8. The percentage increase in magnetic field B when the space within a current carrying toroid is filled with aluminum ( $\chi = 2.1 \times 10^{-5}$ ) is

A. 0.002

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

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

D.  $2 \times 10^{-4} \%$

**Answer: B**



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1. A toroid of  $n$  turns, mean radius  $R$  and cross-sectional radius  $a$  carries current  $I$ . It is placed on a horizontal table taken as  $x$ - $y$  plane. Its magnetic moment  $\vec{M}$

A. is non-zero and points in the  $z$ -direction by symmetry

B. points along the axis of the toroid  $\left(\vec{M} = m\hat{\phi}\right)$

C. is zero, otherwise there would be a field falling as  $\frac{1}{r^3}$  at

large distances outside the toroid

D. is pointing radially outwards.

**Answer: A**



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2. The magnetic field of Earth can be modelled by that of a point dipole placed at the centre of the Earth. The dipole axis makes an angle of  $11.3^\circ$  with the axis of Earth. At Mumbai, declination is nearly zero. Then,

A. the declination varies between  $11.3^\circ W$  to  $11.3^\circ W$

B. the least declination is  $0^\circ$

C. the plane defined by dipole axis and the earth axis passes through Greenwich.

D. declination averaged over the earth must be always negative.

**Answer: C**



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3. In a permanent magnet at room temperature.

A. magnetic moment of each molecule is zero.

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

C. domains are partially aligned.

D. domains are all perfectly aligned.

**Answer: B**



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4. Consider the two idealized systems: (i) a parallel plate capacitor with large plates and small separation and (ii) a long solenoid of length  $L \gg R$ , radius of cross-section. In (i)  $\vec{E}$  is ideally treated as a constant between plates and zero outside. In

(ii) magnetic field is constant inside the solenoid and zero outside. These idealised assumptions, however, contradict fundamental law as below:

A. case(i) contradicts Gauss's law for electrostatic fields.

B. case(ii) contradicts Gauss's law for electrostatic fields.

C. case (i) agrees with  $\oint \vec{E} \cdot d\vec{l} = 0$

D. case (i) agrees with  $\oint \vec{H} \cdot d\vec{l} = I_{en}$

**Answer: B**



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5. A paramagnetic sample shows a net magnetisation of  $8Am^{-1}$  when placed in an external magnetic field of  $0.6T$  at a temperature of  $4K$ . When the same sample is placed in an

external magnetic field of  $0.2T$  at a temperature of  $16K$ , the magnetisation will be

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

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

C.  $6 Am^{-1}$

D.  $2.4 Am^{-1}$

**Answer: A**



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### Assertion And Reason

1. Assertion : When a bar magnet is freely suspended, it points in the north-south direction.

Reason : The earth behaves as a magnet with the magnetic field pointing approximately from the geographic south to north.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

**Answer: D**



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2. Assertion: Magnetic force between two short magnets, when they are co-axial follows inverse square law of distance.

Reason: The magnetic forces between two poles do not follow inverse square law of distance.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

**Answer: C**



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**3. Statement-1:** Magnetic field strength at a point on axial line of a bar magnet is along South to North pole of magnet.

Statement-2: The magnetic field strength can never be along North to South pole of magnet.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

**Answer: A**



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4. Assertion : Gauss's law of magnetism is different from that for electrostatics.

Reason Isolated magnetic poles are not known to exist.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

**Answer: A**



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5. Assertion : Earth's magnetic field does not affect the working of a moving coil galvanometer.



Reason: The earth's magnetic field is quite weak as compared to magnetic field produced in the moving coil galvanometer.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

**Answer: C**



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**6. Assertion :** The magnetic field lines of the earth resemble that of a magnetic dipole located at the centre of the earth.

Reason : The axis of the dipole coincide with the axis of rotation of the earth.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

**Answer: C**



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7. Assertion In water, value of magnetic field decreases.

Reason: Water is a diamagnetic substance. When diamagnetic

material is placed in

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

**Answer: A**



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8. Assertion" When diamagnetic material is placed in a non-uniform magnetic field, it tends to move from stronger to the

weaker part of the magnetic field.

Reason: Diamagnetic materials possess strong magnetism.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

**Answer: C**



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**9. Assertion:** Diamagnetism is universal, it is present in all materials

Reason: Field due to induced magnetic moment is opposite to the magnetising field.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

**Answer: A**



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**10. Assertion :** The ability of a material to permit the passage of magnetic lines of force through it is called magnetic

permeability.

Reason: For a perfect diamagnetic substance, permeability is always one.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

**Answer: C**



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**11. Assertion:** Paramagnetic substances get weakly attracted to a magnet.

**Reason:** They have tendency to from a region of strong magnetic field to weak magnetic Held.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason is not the correct explanation of assertion.
- C. If assertion is ture but reason is false.
- D. If both assertion and reason are false.

**Answer: C**



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12. Assertion : The product of magnetic susceptibility and absolute temperature for a paramagnetic substance is constant.

Reason: Susceptibility is positive but very small for paramagnetic substance.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true and reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

**Answer: B**



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**13. Assertion** At high temperature, a ferromagnet becomes, a paramagnet.

**Reason:** The ferromagnetic property depends on temperature.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

**Answer: A**



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**14.** Assertion: Substances which at room temperature retain their ferromagnetic property for a long period of time are called permanent magnets.

Reason: permanent magnet can be made by placing a ferromagnetic rod in a solenoid and passing current through it.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

**Answer: B**



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**15.** Assertion: Soft iron is used as transformer core.

Reason: Soft iron has narrow hysteresis loop.

- A. If both assertion and reason are true and reason is the correct explanation of assertion.
- B. If both assertion and reason are true and reason is not the correct explanation of assertion.
- C. If assertion is true but reason is false.
- D. If both assertion and reason are false.

**Answer: A**



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