PHYSICS

BOOKS - MODERN PUBLISHERS PHYSICS (HINGLISH)

MAGNETISM AND MATTER

Solved Example

1. A magnetic pole of strength q_m is placed at a distance of 20 cm from another magnetic pole of triple its strength. If the two poles exert a force of 2.5 g f on each other, find the strength of each pole.

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2. Two magnets of length 10 cm each and pole strength 100 Am each are placed together such that separation between their south poles is 15 cm and that between their north poles is 35 cm. Calculate the force acting between the two magnets.

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3. A wire of length l has a magnetic moment M. Another wire of same length and magnetic moment is taken and is bent into a semicircular arc. Find the ratio of magnetic moment of wire to that of the semicircular arc.

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4. A bar magnet 20 cm in length has a magnetic moment of $1Am^2$. Calculate the magnetic field at a distance:

(i) 0.5 m from its centre at a point on its axial line

(ii) 0.6 m from its centre at a point on its equatorial line

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5. The arrangement given below shows two small bar magnets separated by a distance of 50 cm. If the ratio of magnetic moments of the magnets is 1:8, calculate the distance of point

O from the magnet, which is placed to its west and a compass needle placed at O shows no deflection

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6. A short bar magnet X of magnetic moment M is placed horizontally with its magnetic moment directed from west to east. Another short magnet Y of magnetic moment $\frac{2}{\sqrt{3}}M$ is placed with its magnetic axis perpendicular to

X and magnetic moment directed from north to south. Calculate the inclination of resultant magnetic field with the axis of X at a distance r from its prolonged axis.

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7. Two identical bar magnets of magnetic pole strength 10 Am and length 10 cm are placed 2 m apart such that their axes are perpendicular to each other. Calculate the resultant magnetic field at a point midway between the magnets.

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8. A short bar magnet experiences a torque of 0.012 Nm, with its axis placed at 60° with a uniform magnetic field of 0.4 T. What orientation of the magnet corresponds to its stable equilibrium in the magnetic field? Calculate the Potential energy in this position.

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9. A planar loop of irregular shape encloses an area of $8.5 \times 10^{-4} m^2$ and carries a current of 10 A. The sense of flow of current appears to be clockwise to an observer. What is the magnitude and direction of the magnetic moment vector associated with the current loop?

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10. A particle of charge q and mass m moves in a circular orbit or radius r with angular speed ω. The ratio of the magnitude of its magnetic moment to that of its angular momentum depends on

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11. A circular coil of radius 5 cm having 20 turns is lying in the Y-Z plane. If a current of 2 A is flowing through the coil, what will be the magnitude and direction of magnetic dipole moment associated with the coil? Also state in which direction the coil will be oriented to be in stable equilibrium, when placed in a uniform magnetic field along Y-axis.

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12. Two magnects of magnetic moments M and $M\sqrt{3}$ are joined to form a cross (+). The combination is suspended freely in a uniform magnetic field. In equilibrium position, the magnet of magnetic moment M makes an angle θ with the field. Determine θ.

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13. A short bar magnet with its axis at 30° with a uniform magnetic field of 160 gauss experiences a torque of 0.032 Nm.

(a) Estimate the magnetic moment of the magnet.

(b) If we rotate the magnet from its most stable to its most unstable position, what will be the work done by an external agent on the magnet?

(c) With reference to part (b), calculate the work done by the force due to the magnetic field in the process.

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14. A bar magnet of magnetic moment $5.4 Am^2$ is free to oscillate in a uniform magnetic field . If the moment of inertia of the bar magnet is $8 \times 10^{-6} kgm^2$ and it performs

12 oscillations in 7.2 s, then calculate the magnitude of magnetic field.

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15. If the declination at a place is 10° west of north, in which direction should a boat be steered so that it reaches a place (i) due east (ii) due west?

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16. The declination at a place is 15° west of north and a ship has to reach a place 18° south of east. In which direction should it be steered?

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17. In the magnetic meridian of a certain place, the horizontal component of the earth's magnetic field is 0.26 G and the dip angle is 60°. What is the magnetic field of the earth at this location ?

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18. Calculate the angle of dip at a place where the horizontal and vertical components of Earth's magnetic field are 0.24 gauss and 0.36 gauss respectively. Also, calculate the resultant intensity of Earth's field.

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19. A compass needle of magnetic moment $50Am^2$ experiences a torque of 1.3×10^{-3} Nm when pointing towards geographical north at a certain place where horizontal component of Earth's magnetic field is $30\mu Wb/m^2$. What is the declination of the place?

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20. The true dip at a place is 30° but a dip circle at that place shows an apparent dip of 45°. If the dip circle is now rotated through 90°, what will be the new apparent dip?

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21. A dip circle lies initially in the magnetic meridian. If it is now rotated through angle θ in the horizontal plane, then tangent of the angle of dip is changed in the ratio:

22. A magnet of length 10 cm and dipole moment $1.44 Am^2$ is placed on a horizontal surface in such a manner that its north pole is pointing towards the geographical north. Where will be the null point located from the centre of wire? Assume the horizontal component of Earth's magnetic field as $18 \mu T$.

23. A short bar magnet is placed in the magnetic meridian with its north pole pointing towards geographical south. A neutral point is found at a distance of 30 cm from the centre of the magnet. If the horizontal component of earth's field is 0.4G , calculate the magnetic moment of the magnet .

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24. A short bar magnet is placed in the magnetic meridian with its north pole pointing towards north of the Earth and a neutral point at a distance of 0.2 m is obtained from either pole. The magnet is now broken into two equal parts and one such part is placed in the similar position. Calculate the neutral point obtained in this case.

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25. The magnetic moment of the assumed dipole at the earth's centre is $8.0 \times 10^{22} Am^2$. Calculate the magnetic field B at the geomagnetic poles of the earth. Radius of the earth is $6400 km$.

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26. The magnetic field at a point on equator is 0.3 G. Find the magnetic moment of the assumed dipole at the Earth's centre. Take, radius of Earth = 6,400 km.

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27. An electron moves around the nucleus in a hydrogen of radius $0 \cdot 51 \text{Å}$ with a velocity of $2 \times 10^6 m/s$. Calculate (i) the equivalent current due to orbital motion, (ii) magnetic field produced at the centre of nucleus. (iii) magnetic moment associated with electron.

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28. A magnet weighing 70 g has a magnetic moment of $2.4Am^2$. If the density of the material is $6, 800kg/m^3$, find the intensity of magnetization.

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29. If a giant bar magnet of magnetic moment $8 \times 10^{22} Am^2$ is placed inside Earth such that Earth's field can be approximated by this magnet, estimate the intensity of magnetization of Earth. Take, radius of Earth = 6,400 km.

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30. In an iron bar magnet of cross-section $2cm^2$, α magnetic intensity of 1,200 A/m produces a magnetic flux of 3.2×10^{-5} weber. Calculate the permeability and susceptibility of the iron bar.

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31. There is one current carrying solenoid with 750 turns per metre. A current of 2 A is flowing through the solenoid. A rod of certain material is inserted as core inside this solenoid and the intensity of magnetization is found to be 0.12 A/m. What is magnetic susceptibility of the material used? What kind of material is this?

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32. For a specimen of iron weighing 15 kg the hysteresis loss is equivalent to $400 Jm^{-3}$

/cycle. Calculate the loss of energy per hour at 60 cycle/ s. Take density of iron = $7, 500kg/m^3$

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33. The coercive force for a certain material is 10^4 A/m. A magnet made out of this material is placed inside a solenoid having 1000 turns/metre. What amount of electric current is required to demagnetise the material completely?

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Practice Problem

1. Two identical thin bar magnets, each of length L and pole strength m are placed at right angles to each other, with the N pole of one touching the S-pole of the other. Find the magnetic moment of the system.

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2. A short bar magnet is placed along positive X-axis with its centre at origin. Calculate the magnitude of magnetic field strength at point (0,5 cm), if the magnetic moment of the bar magnet is $0.5Am^2$

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3. A short bar magnet has a magnetic moment of 10 Am^2.If its length is 10 cm,then the pole strength of the dipole is

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4. What is the magnitude of the equatorial and axial fields due to a bar manget of length $5 \cdot 0 cm$ at a distance of $50 cm$ from its mid-point? The magnetic moment of the bar magnet is $0 \cdot 40 Am^2$.

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5. A short bar magnet placed with its axis at 30° with an external field of 800 G experiences a torque of 0.016 Nm.

The bar magnet is replaced by a solenoid of cross-sectional area $2 \times 10^{-4} m^2$ and 1000 turns, but of the same magnetic moment. Determine the current flowing through the solenoid.

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6. Two bar magnets each of magnetic moments M are placed at an angle 60° with each other. Calculate the resultant dipole moment, if (a) like poles are placed at the same location (b) unlike poles are placed at the same location

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7. A bar magnet placed in a uniform magnetic field of strength $0 \cdot 3T$ with its axis at 30° to the field experiences a torque of $0 \cdot 06N - m$. What is the magnetic moment of the bar magnet?

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8. A short bar magnet is placed in an external uniform magnetic field of 0.6 G such that its north pole is pointing towards geographical north. Calculate the magnetic moment of the magnet, if its neutral point is 6 cm away from the centre.

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9. A bar magnet of length $10cm$ is placed in the magnetic meridian with its north pole pointing towards the geographical north. A neutral point is obtained at a distance of $12cm$ from the centre of the magnet. Find the magnetic moment of the magnet, when $H = 0 \cdot 34 gauss$.

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10. A short bar magnet of magnetic moment $0 \cdot 9 JT^{-1}$ is placed with its axis at 30° to a uniform magnetic field. It experiences a torque of $0 \cdot 063 J$. Calculate the magnitude of magnetic field. In which orientation will the bar magnet be in stable equilibrium in the magnetic field?

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11. A short bar magnet placed with its axis at 30° with an external field of 800 G experiences a torque of 0.016 Nm.

What is the magnetic moment of the magnet ?

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12. A magnetic needle has magnetic moment of $6 \cdot 7 \times 10^{-2} Am^2$ and moment of inertial of $7 \cdot 5 \times 10^{-6} kgm^2$. It perform 10 complete oscillations in $6 \cdot 70s$. What is the magnitude of the magnetic field?

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13. 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

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14. The earth's magnetic field at the equator is approximately $0 \cdot 4G$, Estimate the earth's dipole moment.

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15. A bar magnet is suspended in a region of earth's magnetic field such that its axis makes an angle of 60° with the field. Calculate the torque experienced by the magnet if its magnetic moment is $0.5Am^2$. Assume field to be 0.4 G.

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16. Two bar magnets of magnetic moment M and $\frac{3M}{5}$ are kept in a region of magnetic field

B such that both the magnets make an angle of 45° with each other. Calculate the angle between the magnet of magnetic moment $\frac{3M}{5}$ and the magnetic meridian.

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17. For a place, the true value of angle of dip is 30°. Find the apparent dip angle when the plane of dip circle is rotated through 45° from the magnetic meridian.

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18. A freely suspended bar magnet makes an angle of 60° with the horizontal component and 45° with the magnetic meridian of a place. Calculate the angle of dip for that place.

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19. In the magnetic meridian of a certain place, the horizontal component of the earth's magnetic field is $0 \cdot 26G$ and dip angle is 60°.

What is the magnetic field of earth at this location?

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20. For a place, horizontal component of the earth's magnetic magnetic field is $3 \times 10^{-5}T$. Calculate the magnetic field of the earth at this place when angle of dip is 45° N.

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21. A compass needle whose magnetic moment is $60Am^2$ points geographic north at a certain place where $H = 40\mu T$. The compass needle experience a torque of $1 \cdot 2 \times 10^{-3} N - m$. What is the declination at the place?

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22. A short bar magnet is placed with its north pole pointing north. The neutral point is $10cm$ away from the centre of the magnet. If

$H = 0.4G$, calculate the magnetic moment of the magnet.

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23. A 10 cm long bar magnet of magnetic moment 1.34 Am2 is placed in the magnetic meridian with its south pole pointing geographical south. The neutral point is obtained at a distance of 15 cm from the centre of the magnet. Calculate the horizontal component of earth's magnetic field.

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

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25. The magnetic moment of an electron of charge e moving in a circular orbit of radius r with speed v is given by

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

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27. Find the amount of current required to demagnetise a permanent magnet of coercivity $3 \times 10^4 Am^{-1}$ kept inside a 0.2 m long solenoid of 500 turns.

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28. A domain in ferromagnetic iron is in the form of a cube of side length $10^{-4}m$. Estimate the number of iron atoms in the domain and the maximum possible dipole moment and magnetisation of the domain. The molecular mass of iron is $55g/\text{mole}$, and its density is $7 \cdot 9g/cm^3$. Assume that each iron atom has a dipole moment of $9 \cdot 27 \times 10^{-24} Am^2$.

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Conceptual Questions

1. जब एक अचुम्बकीय पदार्थ को एक शक्तिशाली चुम्बक के पास लाया जाता है वह प्रतिकर्षित हो जाता है , पदार्थ है -

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2. (a) Name a material of which permanent magnets are made?

(b) Which of the two is stronger: and electromagnet or a permanent magnet?

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3. If you are given a hysteresis graph of two materials drawn in the same scale, then how will you decide that which one is going to produce more heat, when subjected to a variable magnetic field?

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4. What are ferromagnetic materials ? Give examples. What happens to a ferromagnetic material at curie temperature ?

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5. GEOMETRICAL LENGTH AND MAGNETIC LENGTH

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6. How do we know that the direction of magnetic field of the earth changes with time?

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

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8. A dip circle is at right angles to the magnetic meridian. What will be the apparent dip ?

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9. If we make small holes in a magnet, then what will be the effect on its magnetic moment?

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10. Two bar magnets of magnetic moments M_1 and M_2 are placed at an angle with each other. What will be the resultant dipole moment, if

(1) like poles are placed at the same location?

(2) unlike poles are placed at the same location?

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11. Which is more suitable for making the core of a transformer steel or soft iron?

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12. Under what situation a magnet suspended in a uniform magnetic field will be (a) in stable equilibrium and (b) in unstable equilibrium?

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13. How can we shield some instrument from magnetic field? Can we do it by keeping them inside a wooden box or iron box?

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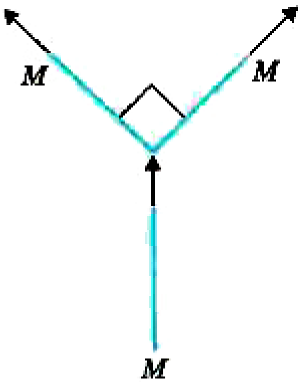
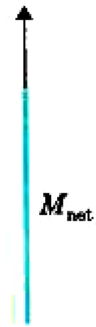
14. Three equal magnetic moments are arranged as shown in the figure. What will be the resultant magnetic moment of this combination?





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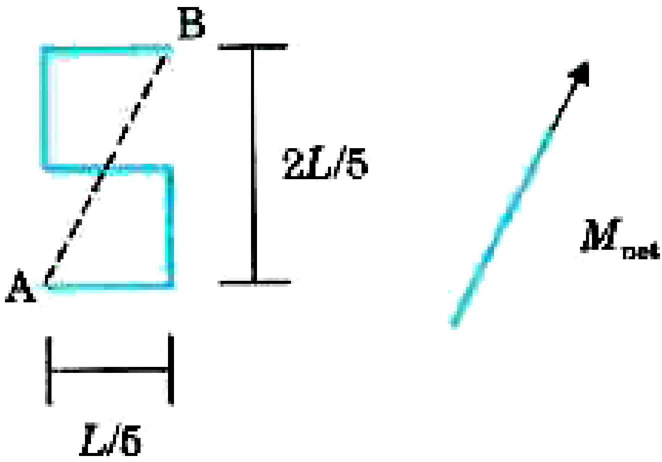
15. We have a straight magnetised wire with magnetic moment M. If we bend the wire to give it a shape as shown in the figure, with all parts equal in length, then what will be the new magnetic moment of the wire?



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16. 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

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17. If the magnetic susceptibility of a paramagnetic material at 300 K is 1.2×10^{-4}, then at what temperature it will be 2.4×10^{-5} ?

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18. The magnitude of the magnetic field inside a long solenoid is increased by

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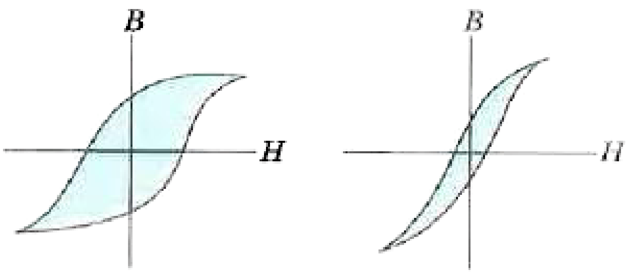
19. Which material would make a better permanent magnet, one whose hysteresis loop looks like figure (a) or one whose loop looks like figure (b)?



(a) (b)

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20. A current-carrying straight conductor is placed in the east-west direction. What will be the direction of the force experienced by this conductor due to the Earth's magnetic field? How will this force get affected on:

(a) reversing the direction of flow of current,

(b) doubling the magnitude of current?

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21. A sample of magnetised iron is heated to about$900^\circ C$ and then cooled down in a region free of magnetic field. Will it retain its magnetism?

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22. How does the intensity of magnetisation of a paramagnetic material vary with increasing applied magnetic field?

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23. 'Susceptibility of iron is more than that of aluminium ' . State the significance of the statement.

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24. A magnetic material X has a relative permeability slightly greater than unity. Another material Y has a relative permeability less than unity. Depict the nature of materials

X and Y. Also state whether their susceptibilities will be positive or negative.

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25. Comment on the state of magnetisation of a substance whose atoms contain odd number of electrons.

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26. प्रतिकर्षण चुंबकत्व का निश्चित परीक्षण क्यों है?

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27. How does declination at a place helps in navigation?

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28. Cosmic rays are charged particles that strike out atmosphere from some external source. We find that more low-energy cosmic rays reach the earth at the north and south magnetic poles than at the (magnetic) equator. Why it is so?

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29. A particle falls freely near the surface of the earth. Consider a fixed point O (not vertically below the particle) on the ground.

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30. The core of a transformer is made of magnetic material of high permeanbility. Why ?

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Tough And Tricky Problem

1. True dip at a place is 45° but dip circle shows an apparent dip of 60° . Dip circle is rotated through an angle 90° from initial orientation then what apparent dip will be shown by it?

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2. A bar magnet is put on the hanger of oscillation magnetometer and is made to oscillate in earth's magnetic field. Frequency of oscillation of bar magnet is found to be 3 Hz at a place where horizontal component of earth's magnetic field is 25 μT . Now a short magnet is placed to the north of magnetometer in such a manner that its North Pole points towards north. Distance of short magnet from the bar magnet hanging inside the magnetometer is 1 m. Frequency of oscillation now becomes 6 Hz. What is magnetic moment of short magnet?

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3. Mean radius of a toroid carrying current of 2A is $30/\pi$ cm. Total number of turns in toroid is 600. A paramagnetic substance is used to prepare a ring to make the core of toroid and its temperature is kept at 300 K. If intensity of magnetization in the core is 6.0×10^{-2} A/m. Find the magnetic susceptibility of the material at 300 K. How the intensity of magnetization will change when temperature of core is changed to 450 K?

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4. A long cylinder of iron having cross sectional area $6cm^2$. It is kept inside a long solenoid having 4000 turns per metre. Current flowing in the solenoid is 1.5 A. Magnetic field developed inside the core is 3.14 T. Calculate pole strength developed in the core.

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5. Bar magnet produces a magnetic field of $1.5 \times 10^{-4} T$ at a point on its axis, which is at a distance 15 cm away from the centre of magnet. If length and area of cross section of magnet are 1 cm and $1 cm^2$ respectively then find intensity of magnetization of bar magnet.

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Ncert File Ncert Textbook Exercise

1. A vector needs three quantities for its specification. Name the three independent quantities conventionally used to specify the earth's magnetic field.

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2. The angle of dip at a location in southern India is about 18°. Would you expect a greater or lesser dip angle in Britain?

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3. If you made a map of magnetic field lines at Melbourne in Australia, would the lines seem to go into the ground or come out of the ground ?

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4. Assertion: If a compass needle be kept at magnetic north pole of the earth, the compass needle may stay in way direction.

Reason: Dip needle will stay vertical at the north pole of earth.

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5. The earth's field, it is claimed, roughly approximates the field due to a dipole of magnetic moment $8 \times 10^{22} JT^{-1}$ located at its centre. Check the order of magnitude of this number in some way.

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6. Answer the following questions regarding earth's magnetism.

(a) A vector needs three quantities for its specification. name the three independent quantities conventionally used to specify the earth's magnetic field.

(b) The angle of dip at a location in southern india is about 18°. Would you expect a greater or lesser dip angle in Britain?

(c) If you made a map of magnetic field lines at Melbourne in Australia, would the lines seem to go into the ground or come out of the ground?

(d) Which direction would a compass needle point to, if located right on the geomagnetic north or south pole?

(e) The earth's field, it is claimed, roughly approximates the field due to a dipole of magnetic moment $8 \times 10^{22} JT^{-1}$ located at its centre. Check the order of magnetude of this number in some way.

(f) Geologists claim that besides the main magnetic n-s poles, there are several local poles on the earth's surface oriented in different directions. How is such a thing possible at all?

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7. Answer the following questions: (a) The earth's magnetic field varies from point to point in space.

Does is also change with time? If so, on what time scale does it change appreciably?

(b) The earth's corei s known to contain iron. Yet geologists do not regard this as a source of earth's magnetism, why?

(c) The charged currents in the outer conducting regions of earth's core are thought to be possible for earth's magnetism. What might be the battery to sustain these currents?

(d) The earth may have even reversed the direction of its field several times during its history of 4 to 5 billion years. How can geologits know about the earth's field in such distant past?

(e) The earth's field departs from its dipole shape substantially at large distances (greater than about 30000km). What agencies may be responsible for this distortion?

(f) Interstellar space has an extremely weak magnetic field of the order of $10^{-12} T$. Can such a weak field be of any significant consequence? Explain.

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8. The earth's core is known to contain iron. Yet geologists do not regard this as a source of the earth's magnetism. Why ?

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9. The charged currents in the outer conducting regions of the earth's core are thought to be responsible for earth's magnetism. What might be the 'battery' (i.e., the source of energy) to sustain these currents ?

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10. The earth may have been reversed the direction of its field several times during its history of 4 to 5 billion years. How can geologists know about the earth's field in such distant past ?

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11. The earth's field departs from its dipole shpae substantially at large distance (greater than about 3000 km). The responsible factor for this distortion is

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12. Answer the following questions: (a) The earth's magnetic field varies from point to point in space.

Does is also change with time? If so, on what time scale does it change appreciably?

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(f) Interstellar space has an extremely weak magnetic field of the order of $10^{-12}T$. Can such a weak field be of any significant consequence? Explain.

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13. A short bar magnet placed with its axis at 30° with a uniform external magnetic field of $0 \cdot 25T$ experiences a torque of magnitude equal to $4 \cdot 5 \times 10^{-2} J$. What is the magnitude of magnetic moment of the magnet?

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14. A short bar magnet of moment $0 \cdot 32 JT^{-1}$ is placed in a uniform external magnetic field of $0 \cdot 15T$, if the bar is free to rotate in the plane of the field, which orientations would correspond to its, (i) stable and (ii) unstable equilibrium? What is the potential energy of the magnet in each case?

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15. A closely wound solenoid of 800 turns and area of cross section $2 \cdot 5 \times 10^{-4} m^2$ carries a current of $3 \cdot 0A$. Explain the sense in which the solenoid acts like a bar magnet. What is its associated magnetic moment?

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16. If the solenoid in the above question is free to turn about the vertical direction, and a uniform horizontal magnetic field of $0 \cdot 25T$ is applied, what is the magnitude of the torque on the solenoid when its axis makes an angle of 30° with the direction of the applied field?

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17. A bar magnet of magnetic moment $1.5JT^{-1}$ lies aligned with the direction of a uniform magnetic field of $0.22T$.

(a) What is the amount of work done to turn the magnet so as to align its mangetic moment

(i) normal to the field direction, (ii) opposite to the field direction?

(b) What is the torque on the magnet in cases (i) and (ii)?

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18. A closely wound solenoid of 2000 turns and area of cross section $1.6 \times 10^{-4} m^2$, carrying a current of $4 amp.$ is suspended through its centre allowing it to turn in a horizontal plane:

(a) What is the magnetic moment associated with the solenoid?

(b) What are the force and torque on the solenoid if a uniform horizontal magnetic field of $7 \cdot 5 \times 10^{-2} T$ is set up at an angle of 30° with the axis of the solenoid?

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19. 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 $5 \cdot 0 \times 10^{-2} T$. 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 $2 \cdot 0 s^{-1}$. What is the moment of inertia of the coil about its axis of rotation?

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20. A magnetic needle free to rotate in a vertical plane parallel to the magnetic meridian has its north tip pointing down at 22° with the horizontal. The horizontal component of the earth's magnetic field at the place is known to be 0.35 G. Determine the magnitude of the earth's magnetic field at the place.

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21. At a certain location in Africa, a compass points 12° west of the geographic north. The north tip of the magnetic needle of a dip circle placed in the plane of magnetic meridian points 60° above the horizontal. The horizontal component of the earth's field is measured to be 0.16 G. Specify the direction and magnitude of the earth's field at the location.

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22. A short bar magnet has a magnetic moment of $0 \cdot 48JT^{-1}$. Give the direction and magnitude of the magnetic field produced by the magnet at a distance of $10cm$ from the centre of the magnet on (i) the axis (ii) the equatorial line (normal bisector) of the magnet.

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23. A short bar magnet placed in a horizontal plane has its axis aligned along the magnetic north south direction. Null points are found on the axis of the magnet at $14cm$ from the centre of the magnet. The earth's magnetic field at the plane is $0 \cdot 36G$ and the angle of dip is zero. What is the total magnetic field on the normal bisector of the magnet at the same distance as the null points (i.e. 14 cm) from the centre of the magnet? (At null points, field due to a magnet is equal and apposite to the horizontal component of earth's magnetic field).

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24. If the bar magnet in the above problem is turned around by 180°, where will the new null points be located?

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25. A short bar magnet of mangetic moment $5 \cdot 25 \times 10^{-2} JT^{-1}$ is placed with its axis perpendicular to earth's field direction. At what distance from the centre of the magnet, is the resultant field inclined at 45° with earth's field on (i) its normal bisector, (ii) its aixs? Magnitude of earth's field at the place $0 \cdot 42G$. Ignore the length of the magnet in comparison to the distances involved.

Watch Video Solution

26. Why does a paramagnetic sample display greater magnetisation (for the same magnetising field) when cooled?

Watch Video Solution

Ncert File Additional Exercise

1. Why is diamagnetism, in contrast, almost independent of temperature?

Watch Video Solution

2. If a toroid uses bismuth for its core, will the field in the core be (slightly) greater or (slightly) less than when the core is empty?

Watch Video Solution

3. Is the permeability of a ferromagnetic material independent of the magnetic field ? If not, is it more for lower or higher fields ?

Watch Video Solution

4. Magnetic field lines are always nearly normal to the surface of a ferromagnet at every point. (This fact is analogous to the static electric field lines being normal to the surface of a conductor at every point.) Why?

Watch Video Solution

5. Would the maximum possible magnetization of a paramagnetic sample be of the same order of magnitude as the magnetization of a ferromagnet?

Watch Video Solution

6. Explain qualitatively on the basis of a domain picture the irreversibility in the magnetization curve of a ferromagnet.

Watch Video Solution

7. The hysteresis loop of a soft iron piece has a much smaller area than that of a carbon steel piece. If the material is to go through repeated cycles of magnetization, which piece will dissipate greater heat energy?

Watch Video Solution

8. A system displaying a hysterisis loop such as a ferromagnet, is a device for storing memory?' Explain the meaning of this statement.

Watch Video Solution

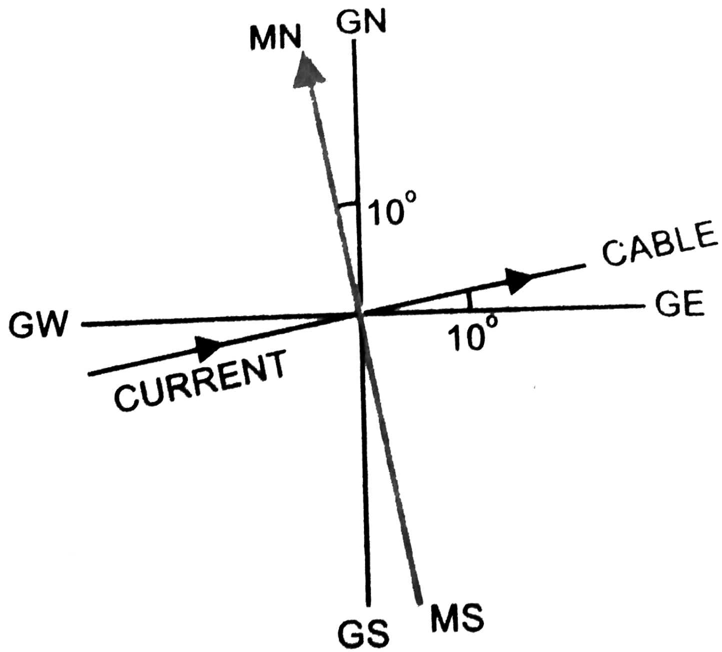
9. What kind of a ferromagnetic material is used for coating magnetic tapes in a cassette player or for building 'memory stores' in a modern computer?

Watch Video Solution

10. A certain region of space is to be shielded from magnetic fields. Suggest a method.

Watch Video Solution

11. A long straight horizontal cable carries a current of $2.5 amp$. In the direction 10° south of west to 10° north of east, figure. The magnetic meridian of the place happens to be 10° 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 fied due to a current cable is equal and opposite to the horizontal component of earth's magnetic field.]



Watch Video Solution

12. A telephone cable at a place has four long straight horizontal wires carrying a current of

1.0 A in the same direction east to west. The earth's magnetic field at the place is 0.39 G, and the angle of dip is 35°. The magnetic declination is nearly zero. What are the resultant magnetic field at points 4.0 cm above and below the cable ?

Watch Video Solution

13. 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° with the magnetic meridian when the current in the coil is $0.35 amp.$, 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° in the anticlockwise sense looking from above. Predict the direction of the needle. Take the magnetic declination at the places to be zero.

Watch Video Solution

14. 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?

Watch Video Solution

15. A monoenergetic (18 keV) electron beam initially in the horizontal direction is subjected to a horizontal magnetic field of 0.04 G normal to the initial direction. Estimate the up or down deflection of the beam over a distance of 30 cm (me $= 9.11 \times 10^{-31} kg)$. [Note: Data in this exercise are so chosen that the answer will give you an idea of the effect of earth's magnetic field on the motion of the electron beam from the electron gun to the screen in a TV set.]

Watch Video Solution

16. A sample of a paramagnetic salt contains 2.0×10^{24} atomic dipoles each of dipole moment $1.5 \times 10^{-23} JT^{-1}$. The sample is placed under a homogeneous magnetic field of 0.64 T and cooled to a temperature of 4.2 K. The degree of magnetic saturation achieved is equal to 15%. What is the total dipole moment of the sample for a magnetic field of 0.98 T and a temperature of 2.8 K ? (Assume Curie's law)

Watch Video Solution

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

Watch Video Solution

18. The magnetic moment vectors $\overrightarrow{\mu}_s$ and $\overrightarrow{\mu}_l$ associated with the intrinsic spin angular momentum $\overrightarrow{S}$ and orbital angular momentum $\overrightarrow{l}$ respectively, of an electron are predicted by quantum theory (and verified experimentally to a high accuracy to be given by

$\overrightarrow{\mu}_s = -\left(\frac{e}{m}\right)\overrightarrow{S}$ and $\overrightarrow{\mu}_l = -\left(\frac{e}{2m}\right)\overrightarrow{l}$

Which of these relations is in accordance with the result expected classically? Outline the derivation of the classical result.

Watch Video Solution

Higher Order Thinking Kills And Advanced Level

1. Tangent galvanometer is placed at a location where horizontal component of earth's magnetic field is $B_H = 3.0 \times 10^{-5}$ T. Radius of the coil used in galvanometer is 25 cm and number of turns are 100. Find the current flowing through the galvanometer if deflection is 60°

Watch Video Solution

2. Two magnets of different masses and geometry are tied together length wise. When

this system is made to oscillate in a uniform magnetic field then time period of oscillation is found to be 4s. Now one of the magnets is reversed and then again tied together length wise. Time period of oscillation in same magnetic field is found to be 3s. Calculate ratio of magnetic moments of magnets.

Watch Video Solution

3. There is one short magnet of magnetic moment $2.16 Am^2$, which is placed on horizontal surface with its North Pole pointing towards north. Locate null point on horizontal surface if horizontal component of earth's magnetic field is $27\mu t$.

Watch Video Solution

4. Show that the magnetic field at a point due to a magnetic dipole is perpendicular to the magnetic axis if the line joining the point with the centre of the dipole makes an angle of $\tan^{-1}(\sqrt{2})$ with the magnetic axis.

Watch Video Solution

5. Mean radius of a toroid carrying current of 2A is $30 / \pi$ cm. Total number of turns in toroid is 600. A paramagnetic substance is used to prepare a ring to make the core of toroid and its temperature is kept at 300K. If intensity of magnetization in the core is 6.0×10^{-2}A/m. find the magnetic susceptibility of the material at 300K. How the intensity of magnetization will change when temperature of core is changed to 450K?

Watch Video Solution

6. A long cylinder of iron having cross sectional area $6cm^2$. It is kept inside a long solenoid having 4000 turns per metre. Current flowing in the solenoid is 1.5 A. Magnetic field developed inside the core is 3.14 T. Calculate pole strength developed in the core.

Watch Video Solution

7. Bar magnet produces a magnetic field of $1.5 \times 10^{-4} T$ at a point on its axis, which is at a distance 15 cm away from the centre of magnet. If length and area of cross section of magnet are 1 cm and $1 cm^2$ respectively then find intensity of magnet.

Watch Video Solution

8. Assume that each iron atom has a permanent magnetic moment equal to 2 Bohr magnetons (1 Bohr magneton equals $9.27 \times 10^{-24} Am^2$). The density of atoms in iron is 8.52×10^{28} atoms m^{-3}. (a) Find the maximum magnetization I in a long cylinder of iron. (b) Find the maximum magnetic field B on the axis inside the cylinder.

Watch Video Solution

Revision Exercise Very Short Answer Question

1. What do you mean by natural magnet ?

Watch Video Solution

2. What is the directional property of a magnet?

Watch Video Solution

3. Which of the following equations indicates that magnetic monopole does not exist ?

Watch Video Solution

4. What are magnetic field lines? List two characteristic properties of these lines.

Watch Video Solution

5. What is the direction of magnetic field outside a magnet?

Watch Video Solution

6. What is the direction of magnetic field lines inside a magnet?

Watch Video Solution

7. Why don't two magnetic field lines intersect each other?

Watch Video Solution

8. What do you mean by a magnetic dipole?

Watch Video Solution

9. What is the magnetic dipole moment of a magnet? State its unit.

Watch Video Solution

10. Define magnetic length.

Watch Video Solution

11. What is the direction of the magnetic dipole moment in a bar magnet?

Watch Video Solution

12. SI unit of magnetic pole strength is

Watch Video Solution

13. How does the magnetic moment and pole strength of the two parts of a magnet change if it is cut into two pieces transverse to its length?

Watch Video Solution

14. How does the magnetic moment and pole strength of the two parts of a magnet change if a magnet is cut into two pieces along its length?

Watch Video Solution

15. Write an expression for magnetic field intensity at any point an axial line of a bar magnet.

Watch Video Solution

16. Give the expression for magnetic field at a point on the equatorial line of a magnetic dipole.

Watch Video Solution

17. The susceptibility of a magnetic material is 0.9853 . Identify the type of magnetic material . Draw the modification of the field pattern on keeping a piece of this material in a uniform magnetic field .

Watch Video Solution

18. What is the potential energy of a magnetic dipole when it is placed perpendicular to the magnetic field?

Watch Video Solution

19. What is the potential energy of a dipole when it is perpendicular to a magnetic field?

Watch Video Solution

20. What is Gauss's law in magnetism? What does it signify?

Watch Video Solution

21. What is Geomagnetism ?

Watch Video Solution

22. What is the strength of earth's magnetic field at the surface of earth?

Watch Video Solution

23. Give the location of earth's magnetic dipole.

Watch Video Solution

24. State the elements of Earth's magnetic field .

Watch Video Solution

25. The angle of declination at London is $10^\circ W$ What do you mean by this statement ?

Watch Video Solution

26. What is a geographic meridian ?

Watch Video Solution

27. At what place on the earth, the magnetic inclination has the smallest value?

Watch Video Solution

28. What is ment by magnetic declination ?

Watch Video Solution

29. What is magnetic inclination at a place?

Watch Video Solution

30. What is meant by horizontal component of Earth's magnetic field.

Watch Video Solution

31. What is the value of the horizontal component of the earth's magnetic field at the poles?

Watch Video Solution

32. What is the angle of dip at a place where horizontal and vertical components of earth's field are equal?

Watch Video Solution

33. What is intensity of magnetization? State its unit.

Watch Video Solution

34. If a magnetic material is having magnetic susceptibility $(\chi) = -1$ thent he relative magnetic permeability (μ_r) and type of mangnetic material is

Watch Video Solution

35. What is the basic difference between electric and magnetic field lines?

Watch Video Solution

36. What is the unit of magnetic permeability μ_0 of vacuum?

Watch Video Solution

37. What is magnetising intensity?

Watch Video Solution

38. What is the unit of magnetic induction or magnetic flux density in SI?

Watch Video Solution

39. What is magnetic susceptibility of super conductors.

Watch Video Solution

40. What is the relation between relative magnetic permeability and magnetic susceptibility?

Watch Video Solution

41. DIAMAGNETIC SUBSTANCES

Watch Video Solution

42. An example of diamagnetic substance is

43. Define :

(1) ferromagnetic

(2) paramagnetic

(3) diamagnetic substances

44. What is Meissner effect?

45. Show diagrammatically the behaviour of magnetic field lines in the presence of :

(i) Paramagnetic and

(ii) Diamagnetic substance, How does one explain this distinguishing feature ?

Watch Video Solution

46. चुंबकीय क्षेत्र रेखाएँ वायु की अपेक्षा लौह चुंबकीय पदार्थों में से गुजरना अधिक पसंद करती है, क्यों ?

Watch Video Solution

47. Why is diamagnetism independent of temperature?

Watch Video Solution

48. Write one important property of a paramagnetic material.

Watch Video Solution

49. Give some examples of paramagnetic substances.

Watch Video Solution

50. How are magnetic susceptibility 'x' and relative magnetic permeability (μ_r) related ?

Watch Video Solution

51. चुंबकीय क्षेत्र की अनुपस्थिति में अनुचुंबकीय पदार्थ कैसा व्यवहार दर्शाते हैं ?

Watch Video Solution

52. What are ferromagnetic substances ?

Watch Video Solution

53. Give some examples of ferromagnetic substances.

Watch Video Solution

54. What is curie temperature?

Watch Video Solution

55. An iron bar magneti is heated to $1000^\circ C$ and then cooled in a magnetic field free space. Will it retain magnetism?

Watch Video Solution

56. What is the effect of rise of temperature on the susceptibility of a ferromagnetic substance?

Watch Video Solution

57. शैथिल्य (hysteresis) प्रदर्शित करते है

Watch Video Solution

58. धारणशीलता (retentivity) से आप क्या समझते है ?

Watch Video Solution

59. What is meant by coercivity ?

Watch Video Solution

60. What is the basic use of hysteresis curve?

Watch Video Solution

61. PERMANENT MAGNET

Watch Video Solution

62. The material for making permanent magnets should have:

Watch Video Solution

63. Why is soft-iron not used for making a permanent magnet?

Watch Video Solution

64. Which material is used to make electromagnets and why?

Watch Video Solution

65. Write the usage of electromagnets.

Watch Video Solution

Revision Exercise Additional Question

1. Angle of dip is 90° at:

A. poles

B. equator

C. both (a) and (b)

D. none of these

Answer: A

Watch Video Solution

2. Which of the following equations indicates that magnetic monopole does not exist ?

Watch Video Solution

3. The formula of magnetic flux is ____

Watch Video Solution

4. The magnetic susceptibility of a diamagnetic material is

A. Small and negative

B. Small and positive

C. Large and positive

D. Large and negative

Answer: A

Watch Video Solution

5. The material of permanent magnet has

A. high retentivity and low coercivity

B. low retentivity and high coercivity

C. low retentivity and low coercivity

D. high retentivity and high coercivity.

Answer: D

Watch Video Solution

Revision Exercise Fill In The Blanks

1. A current carrying coil is equivalent to

Watch Video Solution

2. The .... in a bar magnet plays the role, same as that of positive charge in an electric dipole.

Watch Video Solution

3. Magnetic dipole moment is a vector directed from

Watch Video Solution

4. A bar magnet is placed inside a uniform magnetic field, What does in experience?

Watch Video Solution

5. The axis of earth's magnetic field is inclined with the geographical axis at an angle of about :

Watch Video Solution

6. SI unit of magnetic pole strength is

Watch Video Solution

7. What is the difference between geographic axis and geographic meridian?

Watch Video Solution

Revision Exercise Short Answer Question

1. Can ever there be a magnet (a) with no pole (b) with two similar poles (c) with three poles?

Watch Video Solution

2. (a) What is a natural magnet?

(b) What is an artificial magnet?

Watch Video Solution

3. Depict the field-line pattern due to a current carrying solenoid of a finite length.

(i) The permeability of material is measured to be $0.12TA^{-1}m$. Find the relative permeability and susceptibility?

(ii) A magnet weighs 75 g and its magnetic moment is $2 \times 10^{-4}Am^2$. If the density of the material of the magnet is $7.5 \times 10^3 kgm^{-3}$. Calculate the intensity of magnetism.

Watch Video Solution

4. Draw magnetic field lines around a bar magnet.

Watch Video Solution

5. चुम्बकीय क्षेत्र रेखाओं तथा विद्युत् क्षेत्र रेखाओं में दो अन्तर लिखिए।

Watch Video Solution

6. Write an expression for magnetic field intensity at any point an axial line of a bar magnet.

Watch Video Solution

7. Write an expression for magnetic potential energy of a magnetic dipole kept in a uniform magnetic field and explain the terms.

Watch Video Solution

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

Reason Isolated magnetic poles are not known to exist.

Watch Video Solution

9. Explain the cause of the earth's magnetism.

Watch Video Solution

10. Explain with the help of diagram the terms (i) magnetic declination and (ii) angle of dip at a given place.

Watch Video Solution

11. At a place, the horizontal component of earth's magnetic field is B and angle of dip is 60°. What is the value of horizontal component of earth's magnetic field at equator?

Watch Video Solution

12. What are isogonic, isoclinic and isodynamic lines?

Watch Video Solution

13. Define magnetic susceptibility of a material.Name two elements one having positive susceptibility and the other having negative susceptibility. What does negative susceptibility signify?

Watch Video Solution

14. State and explain Gauss's law in magnetism.

Watch Video Solution

15. Explain paramagnetism with suitable example .

Watch Video Solution

16. Distinguish between paramagnetic and ferromagnetic substances.

Watch Video Solution

17. Distinguish between diamagnetic and paramagnetic substances.

Watch Video Solution

18. Give two points to distinguish between a paramagnetic and a diamagnetic substance.

Watch Video Solution

19. Depict the behaviour of magnetic field lines when (i) diamagnetic and (ii) a paramagnetic material is placed in an external magnetic field. Mention briefly the properties of these materials which explain this distinguishing behaviour.

Watch Video Solution

20. What is the basic difference between the atom/molecule of a diamagnetic and a paramagnetic material? Why are elements with even atomic number more likely to be diamagnetic?

Watch Video Solution

21. How will a dia, para and a ferromagnetic material behave when kept in a non-uniform external magnetic field? Give on example of each of these materials.

Watch Video Solution

22. Electrons in a paramagnetic compound are

Watch Video Solution

23. The magnetic moments of the domains in a ferromagnetic substance-

Watch Video Solution

24. When a ferromagnetic material is heated to temperature above its Curie tamperature, the material

Watch Video Solution

25. What difference between soft ferromagnetic materials and hard ferromagnetic materials.

Watch Video Solution

26. Differentiate between the properties of soft iron and steel.

Watch Video Solution

27. Why is soft iron preferred for making the core of a transformer?

Watch Video Solution

28. A bar magnet of magnetic moment 6 J/T is aligned at 60° with a uniform external magnetic field of 0.44 T. Calculate (a) the work done in turning the magnet to align its magnetic moment (i) normal to the magnetic field, (ii) opposite to the magnetic field, and (b) the torque on the magnet in the final orientation in case (ii).

Watch Video Solution

29. What are dia, para and ferro magnetic materials? Discuss their important properties.

Watch Video Solution

30. At a place, the horizontal component of earth's magnetic field is B and angle of dip is 60°. What is the value of horizontal component of earth's magnetic field at equator?

Watch Video Solution

31. Write two properties of a material suitable for making

(a) a permanent magnet , and (b) an electromagnet

Watch Video Solution

32. How does the magnetic brake of a train work?

Watch Video Solution

33. A short bar magnet placed with its axis at 30° with a uniform external magnetic field of 0.25 T experiences a torque of magnitude equal to $4.5 \times 10^{-2} J$. What is the magnitude of magnetic moment of the magnet ?

Watch Video Solution

34. The vertical and horizontal components of earth's magnetic at a place are 0.2 G and

0.3464 G respectively . Calculate the angle of dip and earth's magnetic field at that place .

Watch Video Solution

35. शैथिल्य लूप (hysteresis loop) का क्षेत्रफल व्यक्त करता है-

Watch Video Solution

Revision Exercise Long Answer Question

1. Define magnetisation and magnetic intensity. Deduce the relation among relative magnetic permeability, permeability of vacuum and magnetic susceptibility. What is the value of susceptibility of a super conductor?

Watch Video Solution

2. Write the SI unit of magnetic dipole moment .

Watch Video Solution

3. Define the term retentivity and coercivity.

Watch Video Solution

4. Compare paramagnetic , diamagnetic and ferromagnetic substances on the basis of magnetic permeability and magnetic susceptibility .

Watch Video Solution

5. A small compass needle of magnetic moment M is free to turn about an axis perpendicular to the direction of uniform magnetic field B. The moment of inertia of the needle about the axis is I. The needle is slightly displaced from its stable position and then released. Prove that it executes simple harmonic motion. Hence deduce the expression for its time period.

Watch Video Solution

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

A. will oscillate

B. will be aligned to north-south direction.

C. will be aligned to east-west direction

D. will be aligned to random direction

Answer: D

Watch Video Solution

2. The permanent magnetic moment of the atoms of a material is zero. The material

A. may be ferromagnetic

B. must be ferromagnetic

C. may be paramagnetic

D. must be diamagnetic

Answer: D

Watch Video Solution

3. A magnetised steel wire of length L has a magnetic moment of $3.14Am^2$. If the wire is bent into a semicircular arc, then what would be its new magnetic moment? (assume that the poles are situated at the ends of the wire.)

A. $2M / \pi$

B. $M / 2\pi$

C. M / π

D. M

Answer: A

Watch Video Solution

4. The angle of dip at the magnetic equator is

A. $\delta_1 = \pi / 2, \delta_2 = 0$

B. $\delta_1 = 0, \delta_2 = 0$

C. $\delta_1 = \pi / 2, \delta_2 = \pi / 2$

D. $\delta_1 = 0, \delta_2 = \pi/2$

Answer: A

Watch Video Solution

5. A paramagnetic material is placed in a magnetic field. Consider the following statements : (A) If the magnetic field is increased, the magnetization is increased. (B) If the temperature is increased, the increased the magnetization is increased.

A. Statement A is correct and statement B is incorrect

B. Statement A is incorrect and statement B is correct

C. Both the statements are correct

D. Both the statements are incorrect

Answer: A

Watch Video Solution

6. Points A and B are located along a line perpendicular to the axis of a small bar magnet. Line joining the points A and B is passing through the centre of bar magnet. Point A is at a distance x from the centre of magnet on one side and point B is on the other side of magnet at a distance 3x from the centre of magnet. If B_1 and B_2 are the magnetic field intensities at A and B respectively then find approximate value of $B_1 : B_2$

A. $1:9$

B. $9:1$

C. $1:27$

D. $27:1$

Answer: D

Watch Video Solution

7. A sample of paramagnetic material is placed in an external magnetic field to get magnetized. Intensity of external magnetic field is slowly increased to a value that magnetization in sample of material becomes constant. Now temperature of this magnetized sample is decreased. What will be the effect on magnetization of sample due to decrease in temperature?

A. Magnetization will increase

B. Magnetization will decrease

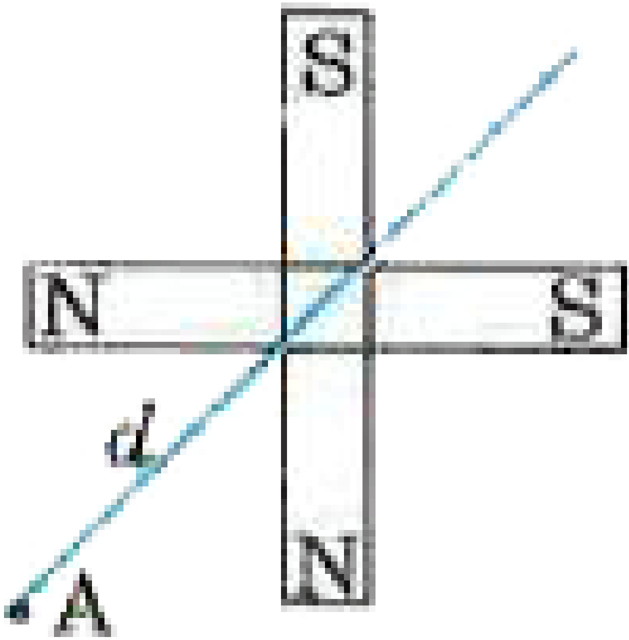
C. Magnetization remains unaffected

D. Magnetization may increase or decrease

Answer: C

View Text Solution

8. Two short bar magnets are taken and fastened together perpendicularly by their centres as shown in figure. Magnetic moment of each magnet is M and A is a point on bisector of this system at a distance d from the centre as N A S shown in figure. Magnetic field intensity at point A is



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

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

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

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

Answer: D

Watch Video Solution

9. A dip circle is taken to geomagnetic equator. The needle is allowed to move in a vertical plane perpendicular to the magnetic meridian. The needle will stay

A. At an angle 30° with the horizontal

B. At an angle 45° with the vertical

C. Vertical

D. Horizontal

Answer: C

Watch Video Solution

10. Explain what is meant by neutral points? How will you calculate magnetic moment of a bar magnet by locating the neutral points?

A. two

B. four

C. eight

D. infinite

Answer: D

Watch Video Solution

11. 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 thecorners 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. $B = \frac{\mu_0}{4\pi} \frac{M\sqrt{5}}{a^3}$

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

C. $B = \frac{\mu_0}{4\pi} \frac{M}{a^3}$

D. $B = \frac{\mu_0}{4\pi} \frac{3M}{a^3}$

Answer: C

Watch Video Solution

12. A magnetised wire of moment M is bent into an arc of a circle subtending an angle of 60^(@) at the centre. The new magnetic moment is

A. $3M / \pi$

B. $2M / \pi$

C. M / π

D. none of these

Answer: A

Watch Video Solution

13. At a certain place , the horizontal component of earth's magnetic field is $\frac{1}{\sqrt{3}}$ times of its vertical component . The angle of dip at that place is

A. 30°

B. 60°

C. 45°

D. none of these

Answer: B

Watch Video Solution

14. When current is doubled deflection is also doubled in

A. moving coil galvanometer

B. tangent galvanometer

C. both

D. none

Answer: A

Watch Video Solution

15. Suggest a material that can be used to make a permanent magnet.

A. low retentivity and low coercive force

B. low retentivity and high coercive force

C. high retentivity and low coercive force

D. high retentivity and high coercive force

Answer: D

Watch Video Solution

16. Length of a very long bar magnet is kept along the axis of a circular loop of radius r in such a manner that North Pole of magnet lies at the centre of circular loop. Magnitude of magnetic field due to magnet at any point on the circumference of loop is B. Current i flows through the loop. Magnetic force acting on circular loop is

A. $2\pi irB$ along the plane of loop

B. $2\pi irB$ along the axis of loop

C. $2irB$ along the axis of loop

D. Zero

Answer: B

View Text Solution

17. If a bar magnet of pole strength m and magnetic moment M is cut equally 5 times parallel to its axis and again 3 times perpendicular to its axis, then the pole strength and magnetic moment of each piece are respectively.

A. m,M

B. $m/2, M$

C. $m. M/2$

D. $m/2, M/2$

Answer: C

Watch Video Solution

18. When a ferromagnetic material is heated above its Curie temperature , the material

A. it behaves like a diamagnetic material

B. it behaves like a paramagnetic material

C. it remains ferromagnetic

D. it becomes non-magnetic

Answer: B

Watch Video Solution

19. If at a certain place B_H and B_V are horizontal and vertical components of earth's magnetic field respectively and δ is the angle of dip at the same place then

A. $B_V = B_H \tan \delta$

B. $B_H = B_V \tan \delta$

C. $B_V = B_H \sin \delta$

D. $B_H = B_V \cos \delta$

Answer: A

Watch Video Solution

Watch Video Solution

20. The magnetic moments of two bar magnets of same size are in the ratio $1:2$. When they are placed one over the other with their similar poles together, then their perlod of oscillation in a magnetic field is 3s. If one of the magnets is reversed, then the period of oscillation in the same field will be q

A. 2s

B. $2\sqrt{3}s$

C. $2\sqrt{2}s$

D. $2\sqrt{5}s$

Answer: B

Watch Video Solution

21. The magnetic field B and the magnetic intensity H in a material are found to be $1 \cdot 6T$ and $1000Am^{-1}$, respectively. Calculate the relative permeability μ_r and suspectibility of the material. What is the nature of the material?

A. $\frac{B}{H}$

B. $\frac{B}{H}-1$

C. $\frac{B}{\mu_0 H}$

D. $\frac{B}{\mu_0 H}-1$

Answer: D

Watch Video Solution

22. A bar magnet is pivoted at its centre and placed in such a manner that it can freely rotate in horizontal plane. Time period of oscillation for this magnet in earth's magnetic field is measured at two different places. Time period of oscillation is 3s at a place where angle of dip is 30° and time period is 4s at a place where angle of dip is 60° . Let B_1 and B_2 are the net magnetic fields due to earth at two places in same order. Then B_1 / B_2

A. $\dfrac{16}{9\sqrt{3}}$

B. $\dfrac{16\sqrt{3}}{9}$

C. $\dfrac{9}{16\sqrt{3}}$

D. $\dfrac{9\sqrt{3}}{16}$

Answer: A

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Competition File Objective Type Question B Multiple Choice Question Aipmt Neet And Other State For Medical Entrance

1. 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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2. A thin diamagnetic rod is placed vertically between the poles of an electromagnet . When the current in the electromagnet is switched on , then the diamagnetic rod is pushed up , out of the horizontal magnetic field . Hence the rod gains gravitational potential energy . The work required to do this comes from

A. The lattice structure of the material of the rod

B. The magnetic field

C. The current source

D. The induced electric field due to the changing magnetic field

Answer: C

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

A. Low retentivity and low coercive force

B. High retentivity and low coercive force

C. Low retentivity and high coercive force

D. High retentivity and high coercive force

Answer: A

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4. The pole strength of a bar magnet is 48 ampere-metre and the distance between its poles is 25 cm. The amount of the coupled force by which it can be placed at an angle 30° with the uniform magnetic intensity of flux density 0.15 newton/ampere-metre will be

A. 0.9 newton x metre

B. 12 newton x metre

C. 12 newton x metre

D. None of these

Answer: A

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5. At a point A on the earth's surface of angle of dip, $\delta = +25^\circ$. At a point B on the earth's surface the angle of dip, $\delta = -25^\circ$. We can interpret that.

A. A and B are both located in the southern hemisphere.

B. A and B are both located in the northern hemisphere.

C. A is located in the southern hemisphere and B is located in the northern hemisphere.

D. A is located in the northern hemisphere and B is located in the southern hemisphere.

Answer: C

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6. 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. 12J

B. 6J

C. 2J

D. 0.6J

Answer: B

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7. 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. 3s

B. 4s

C. 1s

D. 2s

Answer: B

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8. 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. B is a paramagnetic material

B. C is a diamagnetic material

C. D is a ferromagnetic material

D. A is a non-magnetic material

Answer: A

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

A. will stay in east-west direction only

B. will become rigid showing no movement

C. will stay in any position

D. will stay in north-south direction only

Answer: C

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10. 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.

B.

C.

D.

Answer: C

Watch Video Solution

11. The magnetic susceptibility is negative for

A. paramagnetic material only

B. ferromagnetic material only

C. paramagnetic and ferromagnetic materials

D. diamagnetic material only

Answer: D

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Competition File Objective Type Question B Multiple Choice Question Jee Main And Other State Board For Engineering Entrance

1. A circular coil having N turns and radius r carries a current I. It is held in the XZ plane in a magnetic field $B\hat{i}$. The torque on the coil due to the magnetic field is :

A. $\frac{Br^2I}{\pi N}$

B. zero

C. $\frac{B\pi r^2 I}{N}$

D. $B\pi r^2 N$

Answer: D

Watch Video Solution

2. Two short bar magnets of length $1cm$ each have magnetic moments $1.20Am^2$ and $1.00Am^2$ respectively. They are placed on a horizontal table parallel to each other with their N poles pointing towards the south. They have a common magnetic equator and are separted by a distance of $20.0cm$. The value of the resultant horizontal magnetic induction at the mid - point O of the line joining their centres is close to (Horizontal component of earths magnetic induction is $3.6 \times 10.5Wh/m^2$

A. $2.56 \times 10^{-4}Wb/m^2$

B. $3.50 \times 10^{-4}Wb/m^2$

C. $5.80 \times 10^{-4}Wb/m^2$

D. $3.6 \times 10^{-5} Wb/m^2$

Answer: A

Watch Video Solution

3. 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. 6A

B. 30mA

C. 60 mA

D. 3A

Answer: D

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4. Hysteresis loops for two magnetic materials

A and B are given below:

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

A. A for electric generators and transformers.

B. A for electromagnets and B for electric generators.

C. A for transformers and B for electric generators.

D. B for electromagnets and transformers.

Answer: D

View Text Solution

5. A bar magnet of moment of inertia $9 \times 10^{-5} kgm^2$ placed in a vibration magnetometer and oscillating in a uniform magnetic field $16\pi^2 \times 10^{-5} T$ makes 20 oscillations in 15 s. The magnetic moment of the bar magnet is:

A. $3Am^2$

B. $2Am^2$

C. $5Am^2$

D. $6Am^2$

Answer:

Watch Video Solution

6. Two magnetic dipoles X and Y are placed at a separation d, with their axes perpendicular to each other. The dipole moment of Y is twice that of X. A particle of charge q is passing through their midpoint P, at angle θ = 45 with the horizontal line as shown in the figure. What would be the magnitude of force on the particle at that instant? (d is much larger than the dimensions of the dipole)

A. $\left(\frac{\mu_0}{4\pi}\right)\frac{M}{(d/2)^3} \times q^{v}$

B. 0

C. $\left(\frac{\mu_0}{4\pi}\right)\frac{2M}{(d/2)^3} \times q^{v}$

D. $\sqrt{2}\left(\frac{\mu_0}{4\pi}\right)\frac{M}{(d/2)^3} \times q^{v}$

Answer: B

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7. If a bar magnet of pole strength m and magnetic moment M is cut equally 5 times parallel to its axis and again 3 times perpendicular to its axis, then the pole strength and magnetic moment of each piece are respectively.

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

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

C. $\frac{m}{6}, \frac{M}{24}$

D. $\frac{m}{5}, \frac{M}{24}$

Answer: C

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8. A short bar magnet having magnetic moment $4Am^2$, placed in a vibrating magnetometer, vibrates with a time period of 8 s. Another short bar magnet having a magnetic moment $8 Am^2$ vibrates with a time period of 6 s. If the moment of inertia of the second magnet is$9 \times 10^{-2} kgm^2$, the moment of inertia of the first magnet is (assuming that both magnets are kept in the same uniform magnetic induction field):

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

B. $8 \times 10^{-2} kgm^2$

C. $5.33 \times 10^{-2} kgm^2$

D. $12.2 \times 10^{-2} kgm^2$

Answer: B

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9. In a deflection magnetometer which is adjusted in the usual way. When a magnet is introduced, the deflection observed is θ and the period of oscillation of the needle in the magnetometer is T. When the magnet is removed, the period of oscillation is T_0. The relation between T and T_0 is

A. $T^2 = T_0^2 \cos\theta$

B. $T^2 = \dfrac{T_0^2}{\cos\theta}$

C. $T = T_0 \cos\theta$

D. $T = \dfrac{T_0}{\cos\theta}$

Answer: A

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10. The B-H curve for a ferromagnet is shown in the figure. The ferromagnet is placed inside a long solenoid with 1000 turns/cm. The current that should be passed in the solenoid to demagnetise the ferromagnet completely is:

A. 2mA

B. $20\mu A$

C. $1mA$

D. $40\mu A$

Answer: C

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11. x_1 and x_2 are susceptiblility of a Paramagenetic material at temperatures T_1, K and T_2K respectively, then

A. $x_1 = x_2$

B. $x_1T_1 = x_2T_2$

C. $x_1T_2 = x_2T_1$

D. $x_1\sqrt{T_1} = x_2\sqrt{T_2}$

Answer: B

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12. If a magnetic dipole of moment M situated in the direction of a magnetic field B is rotated by 180°, then the amount of work done is

A. MB

B. 2MB

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

D. zero

Answer: B

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13. If there is no torsion in the suspension thread, then the time period of a magnet executing oscillation is:

A. $T = \frac{1}{2\pi}\sqrt{\frac{MB}{1}}$

B. $T = \frac{1}{2\pi}\sqrt{\frac{1}{MB}}$

C. $T = 2\pi\sqrt{\frac{I}{MB}}$

D. $T = 2\pi\sqrt{\frac{MB}{I}}$

Answer: C

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

A. 0.0045

B. 0.003

C. 0.015

D. 0.0075

Answer: C

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15. A magnetic compass needl oscillates 30 times per minute at a place where the dip is 45° and 40 times per minute where the dip is 30° if B_1 and B_2 are respectively the total magnetic field due to the earth at the two places then the ratio B_1 / B_2 is best given by

A. 3.6

B. 1.8

C. 2.2

D. 0.7

Answer: D

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16. A short bar magnet is placed in the magnetic meridian of the earth with its north pole pointing north. Neutral points are found at a distance of 30 cm from the magnet on the East-West line drawn through the mid point of the magnet. What is the magnetic moment of the magnet in Am^2? (Given $m = 10^{-7}$ in SJ units and $B_H =$ horizontal component of earth's magnetic field $= 3.6 \times 10^{-5}$ tesla)

A. 9.7

B. 4.9

C. 19.4

D. 14.6

Answer: A

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17. A magentic dipole in a constant magnetic field has

A. Maximum potential energy when the torque is maximum

B. Zero potential energy when the torque is minimum

C. Zero potential energy when the torque is maximum.

D. Minimum potential energy when the torque is maximum

Answer: C

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18. A magnetic needle of magnetic moment $6.7 \times 10^{-2} A. m^2$ And moment of inertia $7.5 \times 10^{-6} \text{kg}. m^2$ Is performing simple harmonic oscillations in a magnetic field of

0.01 T. time taken for 10 complete oscillations is

A. 6.65 s

B. 8.89 s

C. 6.98 s

D. 8.76 s

Answer: A

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Competition File Objective Type Question B Multiple Choice Question Jee Advanced For Iit Entrance

1. The magnet field lines due to a bar magnet are correctly shown in

A.

B.

C.

D.

Answer: D

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2. A current loop is placed in a uniform magnetic field in four different orientation, I, II, III and IV, arrange them in the decreasing order of potential energy

A. I gt III gt II gt IV

B. I gt IV gt II gt III

C. IgtIIgtIII gt IV

D. III gt IV gt I gt II

Answer: C

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Competition File Objective Type Question C Multiple Choice Question

1. Mark the correct option

A. Diamagnetism is due to difference in magnetic moments of paired electrons in presence of external magnetic field.

B. Property of diamagnetism occurs in all materials.

C. Magnetic field due to induced magnetic moment is opposite to external field applied.

D. Intensity of magnetization of paramagnetic materials is proportional to magnetizing field intensity.

Answer: A::B::C::D

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2. अनुचुम्बकीय पदार्थ के प्रत्येक परमाणु का स्थायी चुम्बकीय आघूर्ण होता है

A. must be ferromagnetic

B. must be paramagnetic

C. must be diamagnetic

D. may be paramagnetic

Answer: D

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3. Select the correct option(s).

A. A bar magnet is equivalent to a current loop

B. Magnetic field can be produced by electric charges only

C. North Pole is equivalent to anticlockwise current

D. South Pole is equivalent to clockwise current

Answer: A::B::C::D

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4. Select the correct option(s).

A. All atoms possess net magnetic moment

B. All nuclei possess net magnetic moment

C. Every electron has net magnetic moment

D. Every proton has net magnetic moment

Answer: C::D

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5. To measure the magnetic moment of a bar magnet, one may use

A. Deflection magnetometer

B. Oscillation magnetometer

C. Tangent galvanometer

D. Moving coil galvanometer

Answer: A::B::C::D

Watch Video Solution

6. A bar magnet of magnetic moment M is placed in a uniform magnetic field B in such a manner that is angle between M and B. Select the correct option(s)

A. Minimum potential energy is -MB

B. Maximum potential energy is MB

C. Bar magnet is in stable equilibrium when

$\theta = 0^\circ$

D. Bar magnet is in unstable equilibrium

when $\theta = 180^\circ$

Answer: A::B::C::D

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7. Which one of the following quantities has dimensions ?

A. Magnetizing field vector H and intensity of magnetization I

B. Magnetic susceptibility and specific gravity

C. Magnetic field B and magnetizing field vector H

D. Magnetic field B and Intensity of magnetization I

Answer: A::B

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8. Magnetic susceptibility is positive for

A. Non-magnetic materials

B. Paramagnetic materials

C. Ferromagnetic materials

D. Diamagnetic materials

Answer: B::C

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9. Select the correct option(s).

A. Ferromagnetic material may be used to make permanent magnets.

B. Ferromagnetic materials may be used to make core of transformers.

C. Ferromagnetic material has positive susceptibility

D. Paramagnetic material has negative susceptibility

Answer: A::B::C

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10. The ratio of the vertical component to the horizontal component of earth's magnetic field at a place is 1 . What is the angle of dip at that place ?

A. $B_V = B_H \tan \delta$

B. $B = H_B \sec \delta$

C. $B = B_V \sec \delta$

D. $B = B_V \cos ec\delta$

Answer: A::B::D

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Competition File Objective Type Question D Multiple Choice Question Based On A Given Passage Comprehension

1. There is one tightly wound long solenoid carrying current 2 A. Solenoid have 100 turns per cm. H_1 is the magnetic intensity and B_1 is the magnetic field at the centre of solenoid. Now an iron core is inserted inside the solenoid. Intensity of magnetization in the core is 4×10^6 A/m. New values of magnetic intensity and magnetic field at the centre becomes H_2 and B_2

$Value of$H_1` is

A. $2 \times 10^4 A/m$

B. $3 \times 10^4 A/m$

C. $2 \times 10^6 A/m$

D. $3 \times 10^6 A/m$

Answer: A

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2. There is one tightly wound long solenoid carrying current 2 A. Solenoid have 100 turns per cm. H_1 is the magnetic intensity and B_1 is the magnetic field at the centre of solenoid. Now an iron core is inserted inside the solenoid. Intensity of magnetization in the core is 4×10^6 A/m. New values of magnetic intensity and magnetic field at the centre becomes H_2 and B_2

Value of H_2 / H_1 is

A. infinity

B. 4×10^{6}

C. 2×10^{3}

D. 1

Answer: D

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3. There is one tightly wound long solenoid carrying current 2 A. Solenoid have 100 turns per cm. H_1 is the magnetic intensity and B_1 is the magnetic field at the centre of solenoid.

Now an iron core is inserted inside the solenoid. Intensity of magnetization in the core is 4×10^6 A/m. New values of magnetic intensity and magnetic field at the centre becomes H_2 and B_2

Value of B_1 is

A. 25mT

B. 50 mT

C. $100\mu T$

D. $200mT$

Answer: A

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4. There is one tightly wound long solenoid carrying current 2 A. Solenoid have 100 turns per cm. H_1 is the magnetic intensity and B_1 is the magnetic field at the centre of solenoid. Now an iron core is inserted inside the solenoid. Intensity of magnetization in the core is 4×10^6 A/m. New values of magnetic intensity and magnetic field at the centre becomes H_2 and B_2

Value of B_2 is

A. 10.1 T

B. 5.05 T

C. 2.05T

D. 15T

Answer: B

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5. We can define two planes for a particular location on the surface of earth. One is called magnetic meridian and the other is called geographic meridian. Magnetic meridian for a point on the surface of earth is defined as a plane passing through this point and containing magnetic axis of earth. Similarly geographic meridian for a point on the surface of earth is defined as plane passing through this point and containing geographic axis of rotation. If we draw these two planes for a point on the surface of earth then in general these are found at some angle. Angle between these two planes is called declination for that place. Importance of magnetic meridian at a point is that net magnetic field vector of earth for that point lies on this plane. Usually net magnetic field of earth is inclined at some angle with the horizontal and this angle is called angle of dip for that place. Which of the following planes pass through the centre of earth?

A. Geographic meridian only

B. Magnetic meridian only

C. Geographic and magnetic meridian both

D. neither geographic nor magnetic meridian

Answer: C

Watch Video Solution

6. We can define two planes for a particular location on the surface of earth. One is called magnetic meridian and the other is called geographic meridian. Magnetic meridian for a point on the surface of earth is defined as a plane passing through this point and containing magnetic axis of earth. Similarly geographic meridian for a point on the surface of earth is defined as plane passing through this point and containing geographic axis of rotation. If we draw these two planes for a point on the surface of earth then in general these are found at some angle. Angle between these two planes is called declination for that place. Importance of magnetic meridian at a point is that net magnetic field vector of earth for that point lies on this plane. Usually net magnetic field of earth is inclined at some angle with the horizontal and this angle is called angle of dip for that place.

How many points are there on the surface of earth where declination is zero ?

A. 2

B. 4

C. 8

D. infinite

Answer: D

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7. We can define two planes for a particular location on the surface of earth. One is called magnetic meridian and the other is called geographic meridian. Magnetic meridian for a point on the surface of earth is defined as a plane passing through this point and containing magnetic axis of earth. Similarly geographic meridian for a point on the surface of earth is defined as plane passing through this point and containing geographic axis of rotation. If we draw these two planes for a point on the surface of earth then in general these are found at some angle. Angle between these two planes is called declination for that place. Importance of magnetic meridian at a point is that net magnetic field vector of earth for that point lies on this plane. Usually net magnetic field of earth is inclined at some angle with the horizontal and this angle is called angle of dip for that place.

How many points are there on surface of earth where angle of dip is 90° ?

A. 2

B. 4

C. 8

D. infinite

Answer: A

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8. We can define two planes for a particular location on the surface of earth. One is called magnetic meridian and the other is called geographic meridian. Magnetic meridian for a point on the surface of earth is defined as a plane passing through this point and containing magnetic axis of earth. Similarly geographic meridian for a point on the surface of earth is defined as plane passing through this point and containing geographic axis of rotation. If we draw these two planes for a point on the surface of earth then in general these are found at some angle. Angle between these two planes is called declination for that place. Importance of magnetic meridian at a point is that net magnetic field vector of earth for that point lies on this plane. Usually net magnetic field of earth is inclined at some angle with the horizontal and this angle is called angle of dip for that place. How many points are there on surface of earth where angle of dip is zero ?

A. 2

B. 4

C. 8

D. infinite

Answer: D

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Competition File Assertion Reason Type Question

1. Assertion: If an electron, while coming vertically from outerspace, enter the earth's magnetic field, it is deflected towards west.

Reason: Electron has negative charge.

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

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

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: A

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2. 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. If both assertion and reason are correct and reason is a correct explanation of the assertion.

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

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: A

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3. 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. If both assertion and reason are correct and reason is a correct explanation of the assertion.

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

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: C

Watch Video Solution

4. When a bar magnet is placed in a non-uniform magnetic field, it performs

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

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

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: A

Watch Video Solution

5. Assertion: For making permanent magnets, steel preferred over soft iron.

Reason: As retentivity of steel is smaller.

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

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

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: A

Watch Video Solution

6. Assertion" When diamagnetic material is placed in a non-uniform magnetic Held, 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 correct and reason is a correct explanation of the assertion.

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

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: D

Watch Video Solution

7. Assertion: To protect any instrument from external magnetic field, it is put inside an iron body.

Reason: Iron is a magnetic substance.

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

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

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: C

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8. A dip circle is taken to geomagnetic equator. The needle is allowed to move in a vertical plane perpendicular to the magnetic meridian. The needle will stay

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

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

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: A

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9. At magnetic poles of earth, angle of dip is

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

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

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: B

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10. A: Diamagnetism is exhibited by all the substances.

R: Diamagentism is due to paired electrons.

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

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

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: A

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Competition File Integer Type Questions

1. A bar magnet is placed with its north pole pointing north and its south pole pointing south. Draw a figure to show the location of neutral points .

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2. A current of 2 A flows in an air core solenoid of length 1 m and number of turns 1000. What is the magnetic flux density inside the solenoid?

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3. Find the locus of the points where the intensity of the magnetic field due to a magnetic dipole will be perpendicular to its axis.

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4. 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

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5. Work done required to turn a magnet by 90° from magnetic meridian is n times to that when it is rotated by 60° angle. What is the value of n?

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6. There are two wires of same length and they are shaped as square and circle. Same current flows through them. If ratio of magnetic moment of square to that with circle is found to be $\frac{\pi}{n}$. What is the value of n?

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7. There is one moving coil galvanometer with coil resistance 25 Ω . Its current sensitivity changes from 72 divisions/ampere to 12 divisions/ampere when shunt is used. What is resistance of shunt is ohm?

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Competitionfile Exemplar Problem Objective Question Multiple Choice Question Type I

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 $\overrightarrow{M}$

A. non-zero and points in the Z-direction by symmetry.

B. pointing along the axis of the toroid $\left(\overrightarrow{m} = m\overrightarrow{\psi}\right)$

C. zero, otherwise there would be a field falling as $\frac{1}{r^3}$ at large distances outside the toroid.

D. pointing radially outwards.

Answer: C

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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 $11 \cdot 3^{\circ}$ with the axis of Earth. At Mumbai, declination is nearly zero. Then,

A. the declination varies between 11.3° W to 11.3° E

B. the least declination is 0°

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

D. declination averaged over Earth must be always negative.

Answer: A

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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: C

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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 $L > > R$, radius of cross-section. In (i) $\overrightarrow{E}$ 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 magnetic fields.

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

D. case (ii) contradicts $\oint \overrightarrow{H}.\overrightarrow{d}l = I_{\text{en}}$

Answer: B

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5. A paramagnetic sample shows a net magnetization of $8Am^{-1}$ when placed in an external magnetic field of 0.6 T at a temperature of 4 K When the same sample is placed in an external magnetic field of 0.2 T at a temperature of 16 K, the magnetization 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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6. S is the surface of a lump of magnetic material.

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

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

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

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

Answer: A::D

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

A. atomic currents.

B. the Pauli exclusion principle

C. polar nature of molecules.

D. intrinsic spin of electron.

Answer: A::D

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8. 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 $\overrightarrow{H}$ field in the solenoid is (nearly) unchanged but the $\overrightarrow{B}$ field decreases drastically.

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

C. The magnetization in the core reverses direction.

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

Answer: A::D

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9. 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 $\vec{B}$ 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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10. 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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11. A proton has spin and magnetic moment just like an electron. Why then its effect is neglected in magnetism of materials?

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12. A permanent magnet in the shape of a thin cylinder of length $10cm$ has $M = 10^6 A/m$. Calculate the magnetisation current I_M. (Here M is the intensity of magnetisation).

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13. Explain quantitatively the order of magnitude difference between the diamagnetic susceptibility of $N_2(-5 \times 10^{-9})$ (at STP) and $Cu(-10^{-5})$.

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14. From molecular view point, discuss the temperature dependence of susceptibility for diamagnetism, paramagnetism and ferromagnetism.

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15. A ball of superconducting material is dipped in liquid nitrogen and placed near a bar magnet. (i) In which direction will it move? (ii) What will be the direction of it's magnetic moment?

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16. Verify the Gauss's law for magnetic field of a point dipole of dipole moment M at the origin for the surface which is a sphere of radius R.

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17. Three identical bar magnets are rivetted together at centre in the same plane as shown in the given figure. This system is placed at rest in a slowly varying magnetic field. It is found that the system of magnets does not show any motion. The north-south poles of one magnet is shown in the given figure. Determine the poles of the remaining two.

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18. Suppose we want to verify the analogy between electrostatic and magnetostatic by an explicit experiment. Consider the motion of (i) electric dipole $\vec{p}$ in an electrostatic field $\vec{E}$ and (ii) magnetic dipole $\vec{M}$ in a magnetic field

$\overrightarrow{B}$. Write down a set of conditions on $\overrightarrow{E}$, $\overrightarrow{B}$, $\overrightarrow{p}$, $\overrightarrow{M}$ so that the two motions are verified to be identical. (Assume identical initial conditions).

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19. 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?

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20. Use (i) the Ampere's law for $\vec{H}$ and (ii) continuity of lines of $\vec{B}$, to conclude that inside a bar magnet, (a) lines of $\vec{H}$ run from the N pole to S pole, while (b) lines of $\vec{B}$ must run from the S pole to N pole

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Chapter Practice Test For Board Examination

1. दो चुम्बकीय क्षेत्र रेखाएं परस्पर प्रतिच्छेद क्यों नहीं करती है ?

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2. The magnetic dipole moment of a bar magnet is directly proportional to volume of the bar magnetic . You are given a bar magnet of length l , magnetic pole strength m and magnetic dipole moment M . What will be the effect on dipole moment and pole strength if the bar magnet is cut into the two equal pieces ?

(i) Along it length ?

(ii) Transverse to its length ?

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3. What is the nature of magnetic susceptibility and relative magnetic permeability (μ_r) in case of paramagnetic substances?

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4. Can a magnetic dipole experience a torque or net force in (i) a uniform magnetic field and (ii) a non-uniform magnetic field?

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5. Why is steel preferred for making permanent magnets?

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6. What is the horizontal component of Earth's magnetic field? If the horizontal and vertical components of Earth's magnetic field are equal then what is the angle of dip?

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7. What are the conditions for stable and unstable equilibrium of a magnet suspended in a uniform magnetic field?

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8. How does the intensity of magnetization depend on an applied magnetic field?

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9. What is ment by magnetic declination ?

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10. Write the relation between relative permeability and susceptibility.

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11. Define magnetic susceptibility of a material.Name two elements one having positive susceptibility and the other having negative susceptibility. What does negative susceptibility signify?

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12. In what way is the behaviour of a diamagnetic material different from that of a paramagnetic material, when kept in an external magnetic field?

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13. Derive an expression for potential energy of a bar magnet when placed in an external magnetic field.

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14. What is the basic difference between the atom/molecule of a diamagnetic and a paramagnetic material? Why are elements with even atomic number more likely to be diamagnetic?

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15. An electron is moving with 10^{12} rps in an orbit of radius 0.53 Å. What will be the magnetie moment associated with the electron?

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16. Give the expression for magnetic field at a point on the axis of a short magnetic dipole.

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