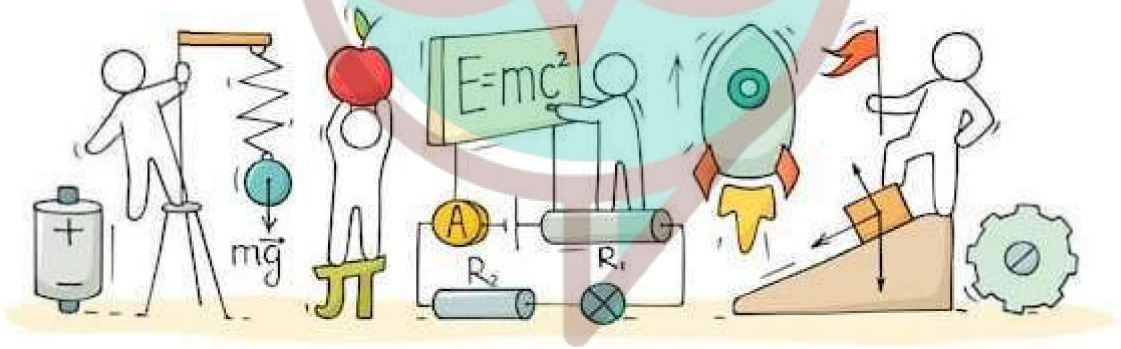
PHYSICS



Important Questions

Multiple Choice questions-

1. The earth behaves as a magnet with magnetic field pointing approximately from the geographic

(a) North to South

(b) South to North

(c) East to West

(d) West to East

2. The strength of the earth's magnetic field is

(a) constant everywhere.

(b) zero everywhere.

(c) having very high value.

(d) vary from place to place on the earth's surface.

3. Which of the following is responsible for the earth's magnetic field?

(a) Convective currents in earth's core

(b) Diversive current in earth's core.

(c) Rotational motion of earth.

(d) Translational motion of earth.

4. Which of the following independent quantities is not used to specify the earth's magnetic field?

(a) Magnetic declination (θ).

(b) Magnetic dip (δ).

(c) Horizontal component of earth's field (BH).

(d) Vertical component of earth's field (BV).

5. 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 is

(a) always zero

(b) positive, negative or zero

(c) unbounded

(d) always negative

6. The angle of dip at a certain place where the horizontal and vertical components of the

earth's magnetic field are equal is

(a) 30°

(b) 75°

(c) 60°

(d) 45°

7. The vertical component of earth's magnetic field. at a place is √3 times the horizontal component

the value of angle of dip at this place is

(a) 30°

(b) 45°

(c) 60°

(d) 90°

8. At a given place on earth's surface the horizontal component of earth's magnetic field is 2 × 103-5 T and resultant magnetic field is 4 × 103-5 T. The angle of dip at this place is

(a) 30°

(b) 60°

(c) 90°

(d) 45°

9. Which of the following property shows the property of ferromagnetic substances?

(a) The ferromagnetic property depends on tem-perature. '

(b) The ferromagnetic property does not depend on temperature.

(c) At high enough temperature ferromagnet becomes a diamagnet.

(d) At low temperature ferromagnet becomes a paramagnet.

10. The primary origin of magnetism lies in

(a) atomic current and intrinsic spin of electrons.

(b) polar and non-polar nature of molecules.

(c) pauli exclusion principle.

(d) electronegative nature of materials.

9. The magnetic moment of a current I carrying circular coil of radius r and number of turns N varies as

(a) $\frac{1}{r_2}$

(b) $\frac{1}{r}$

(c) r

(d) r^2

10. A short bar magnet has a magnetic moment of 0. 65 J T^{-1}, then the magnitude and direction of the magnetic field produced by the magnet at a distance 8 cm from the center of magnet on the axis is

(a) 2.5×10^{-4} T, along NS direction

(b) 2.5×10^{-4} T along SN direction

(c) 4.5×10^{-4} T, along NS direction

(d) 4.5×10^{-4} T, along SN direction

Very Short:

1. Under what condition is the force acting on a charge moving through a uniform magnetic field minimum?

2. What Is the nature of the magnetic field in a moving coil galvanometer?

3. State two properties of the material of the wire used for suspension of the coil in a moving coil galvanometer.

4. Write one condition under which an electric charge does not experience a force in a magnetic field.

5. Mention the two characteristic properties of the material suitable for making the core of a transformer. (CBSE AI 2012)

6. Write the expression, in a vector form, for the Lorentz magnetic force due to a charge moving with velocity $\vec{V}$ in a magnetic field $\vec{B}$. What is the direction of the magnetic force? (CBSE Delhi 2014)

7. Write the condition under which an electron will move undeflected in the presence of crossed electric and magnetic fields. (CBSE Al 2014C)

8. What can be the cause of the helical motion of a charged particle? (CBSE Al 2016)

9. Write the underlying principle of a moving coil galvanometer. (CBSE Delhi 2016)

10. A proton and an electron traveling along parallel paths enter a region of the uniform magnetic field, acting perpendicular to their paths. Which of them will move in a circular path with a higher frequency? (CBSEAI and Delhi 2018)

Short Questions:

1.

(a) Define the term magnetic susceptibility and write its relation in terms of relative magnetic permeability.

(b) Two magnetic materials A and B have relative magnetic permeabilities of 0. 96 and 500. Identify the magnetic materials A and B. (CBSE Al, Delhi 2018C)

2. A magnetic needle free to rotate in a vertical position orient itself with its axis vertical at a certain place on the earth. What are the values of?

(a) the angle of dip and

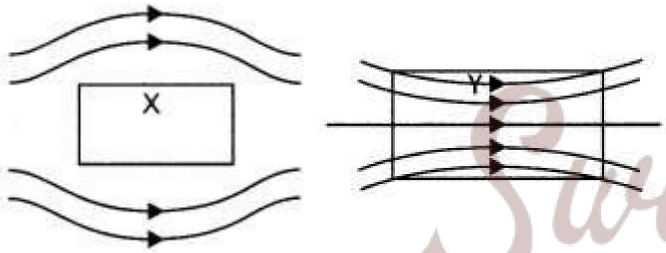
(b) the horizontal component of the earth's magnetic field at this place? Where will this place be on the earth?

3. Out of the two magnetic materials 'A' has relative permeability slightly greater than unity while 'B' has less than unity. Identify the nature of the material's 'A' and 'B'. Will their susceptibilities be positive or negative? (CBSE Delhi 2014)

4. A magnetic needle free to rotate in a vertical plane parallel to the magnetic meridian has its northern tip down at 60° with the horizontal. The horizontal component of the earth's magnetic field at the place is known to be 0.4 G. Determine the magnitude of the earth's magnetic field at the place. (CBSE Delhi 2011)

5. The susceptibility of a magnetic material is -0.085. Identify the type of magnetic material. A specimen of this material is kept in a non-uniform magnetic field. Draw the modified field pattern.

6. A uniform magnetic field gets modified as shown below when two specimens X and Y are placed in it.



(a) Identify the two specimens X and Y.

(b) State the reason for the behavior of the field lines in X and Y.

7. Three identical specimens of magnetic materials nickel, antimony, and aluminum are kept in a non-uniform magnetic field. Draw the modification in the field lines in each case. Justify your answer.

8. Define neutral point. Draw lines of force when two identical magnets are placed at a finite distance apart with their N-poles facing each other. Locate the neutral points.

Long Questions:

1. Write the expression for the magnetic dipole moment for a closed current loop. Give its SI

unit. Derive an expression for the torque experienced by a magnetic dipole in a uniform magnetic field.

2.

(a) State Gauss's law for magnetism. Explain Its significance.

(b) Write the four Important properties of the magnetic field lines due to a bar magnet. (CBSE Delhi 2019).

Assertion and Reason Questions-

1. Two statements are given-one labelled Assertion(A) and the other labelled Reason (R). Select the correct answer to these questions from the codes(a), (b), (c) and (d) as given below.

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

b) Both A and R are true but R is NOT the correct explanation of A.

c) A is true but R is false.

d) A is false and R is also false.

Assertion (A): There is only one neutral points on a horizontal board when a magnet is held vertically on the board.

Reason (R): At the neutral point the net magnetic field due to the magnetic and magnetic field of the earth is zero.

2. Two statements are given-one labelled Assertion(A) and the other labelled Reason (R). Select the correct answer to these questions from the codes(a), (b), (c) and (d) as given below.

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

b) Both A and R are true but R is NOT the correct explanation of A.

c) A is true but R is false.

d) A is false and R is also false.

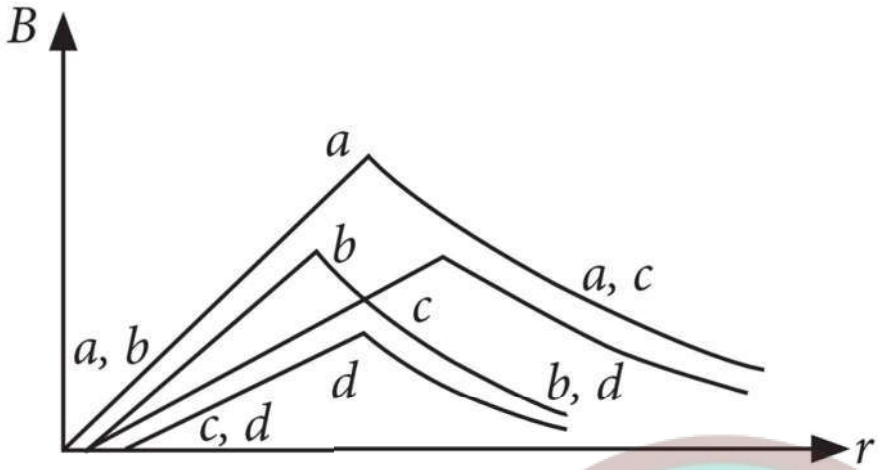
Assertion (A): The true geographic north direction is found by using a compass needle.

Reason (R): The magnetic meridian of the earth is along the axis of rotation of the earth.

Case Study Questions-

1. The field of a hollow wire with constant current is homageneous.

Curves in the graph shown give, as functions of radius distance r, the magnitude B of the magnetic field inside and outside four long wires a, b, c and d, carrying currents that are uniformly distributed across the cross sections of the wires. Overlapping portions of the plots are indicated by double labels.



(i) Which wire has the greatest magnitude of the magnetic field on the surface?

a) a
b) b
c) c
d) d

(ii) The current density in a wire a is:

a) Greater than in wire c.
b) Less than in wire c.
c) Equal to that in wire c.
d) Not comparable to that of in wire c due to lack of information.

(iii) Which wire has the greatest radius?

a) a
b) b
c) c
d) d

(iv) A direct current I flows along the length of an infinitely long straight thin walled pipe, then the magnetic field is:

a) Uniform throughout the pipe but not zero.
b) Zero only along the axis of the pipe.
c) Zero at any point inside the pipe.
d) Maximum at the centre and minimum at the edges.

(v) In a coaxial, straight cable, the central conductor and the outer conductor carry equal currents in opposite direction. The magnetic field is zero.

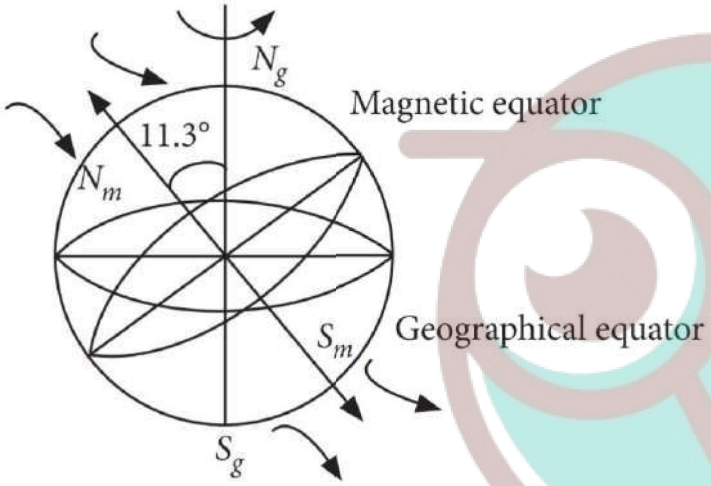
a) Outside the cable.

b) Inside the inner conductor.

c) Inside the outer conductor.

d) In between the two conductor.

2. The magnetic field lines of the earth resemble that of a hypothetical magnetic dipole located at the centre of the earth. The axis of the dipole is presently tilted by approximately 11.3° with respect to the axis of rotation of the earth.



The pole near the geographic North pole of the earth is called the North magnetic pole and the pole near the geographic South pole is called South magnetic pole.

(i) Magnetization of a sample is:

a) 10^5T

b) 10^{-6}T

c) 10^{-5}T

d) 10^8T

(ii) A bar magnet is placed North-South with its North-pole due North. The points of zero magnetic field will be in which direction from centre of magnet?

a) North-South

b) East- West

c) North-East and South-West

d) None of these.

(iii) The value of angle of dip is zero at the magnetic equator because on it:

a) V and Hare equal.

b) The values of V and H zero.

c) The value of V is zero.

d) The value of His zero.

(iv) The angle of dip at a certain place, where the horizontal and vertical components of the earth's magnetic field are equal, is:

a) 30º

b) 90º

c) 60º

d) 45º

(v) At a place, angle of dip is 300. If horizontal component of earth's magnetic field is H, then the total intensity of magnetic field will be.

a. $\frac{H}{2}$

b. $\frac{2H}{\sqrt{3}}$

c. $H\sqrt{\frac{3}{2}}$

d. $2H$

✓ Answer Key:

Multiple Choice Answers-

1. Answer: b
2. Answer: d
3. Answer: a
4. Answer: d
5. Answer: b
6. Answer: d
7. Answer: c
8. Answer: b
9. Answer: a
10. Answer: a

Very Short Answers:

1. Answer: At the potes
2. Answer: 450

3. Answer: it decreases with the increase in temperature.
4. Answer: It should be anti-parallel to the applied magnetic field.
5. Answer:

   Using the expression $\tan \delta = \frac{B_V}{B_H} = \frac{1}{\sqrt{3}}$

   Therefore, $\delta = 30°$
6. Answer: Poles.
7. Answer: Magnetic equator
8. Answer: It is an arrangement that has a permanent dipole moment, e.g. bar magnet.
9. Answer: Zero.
10. Answer: No, the magnetic field is also produced by alternating current.

Short Questions Answers:

1. Answer:

   (a) It refers to the ease with which a substance can be magnetized. It is defined as the ratio of the intensity of magnetization to the magnetizing field. The required relation is $\mu_r = 1 + \chi_m$

   (b)

   A: Paramagnetic,

   B: Ferromagnetic
2. Answer: The angle of dip is 90° and the horizontal component of the earth's magnetic field is zero. This place is the magnetic pole of the earth.
3. Answer:
   - 'A' is paramagnetic and 'B' is diamagnetic.
   - 'A' will have positive susceptibility while
   - 'B' will have negative susceptibility.
4. Answer:

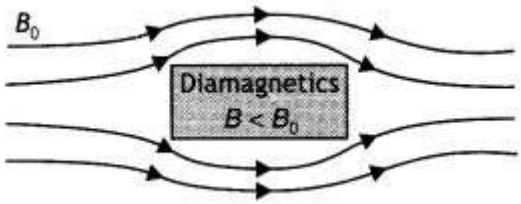
   Given $\delta = 30°$, BH = 0.4 G, B = ?

   Using the expression

   BH = Bcos δ we have

   $B = \frac{B_H}{\cos \delta} = \frac{0.4}{\cos 30°} = \frac{0.4}{\sqrt{3}/2} = \frac{0.8}{\sqrt{3}}$ G

5. Answer: The material is a diamagnetic material as diamagnetic materials have negative susceptibility. The modified field pattern is as shown below.

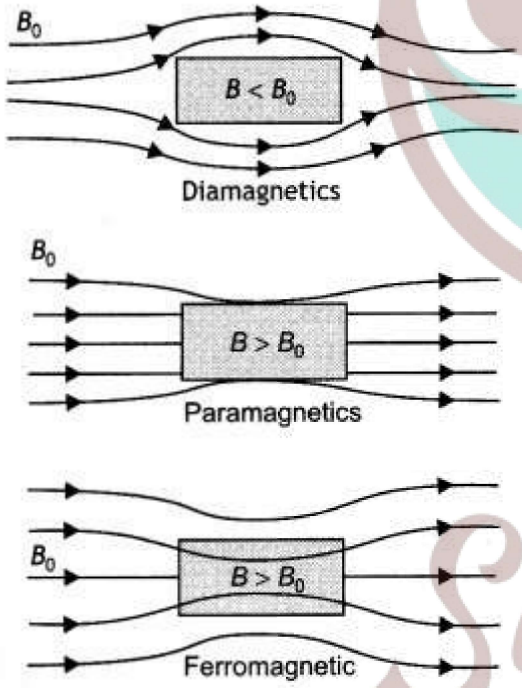


6. Answer:

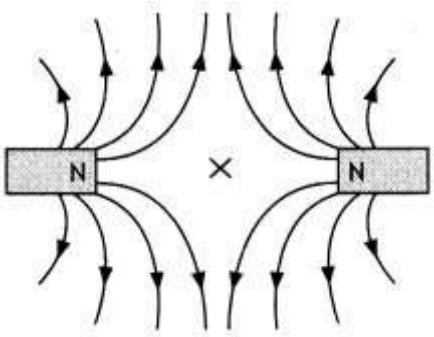
   (a) X is a diamagnetic substance and Y is a paramagnetic substance.

   (b) This is because the permeability of a diamagnetic substance is less than one and that of a paramagnetic substance is greater than one.

7. Answer: Nickel is ferromagnetic, antimony is diamagnetic, and aluminium is paramagnetic. Therefore, they will show the behaviour as shown in the following figures.



8. Answer: It is a point near a magnet where the magnetic field of the earth is completely balanced by the magnetic field of the magnet. The figure is as shown below.



The cross indicates the neutral point.

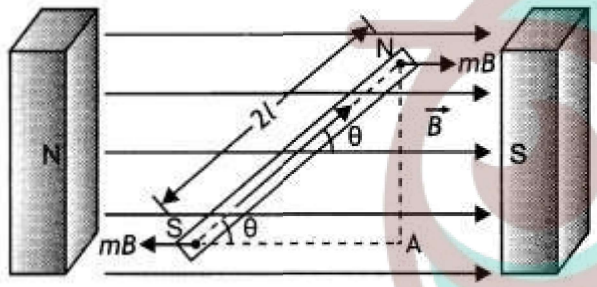
Long Questions Answers:

1. Answer:

   The required expression is m = nIA.

   It is measured in A m^2.

   Consider a uniform magnetic field of strength B. Let a magnetic dipole be suspended in it such that its axis makes an angle 6 with the field as shown in the figure below. If 'm' is the strength of each pole, the two poles experience two equal and opposite force 'B' each. These forces constitute a couple that tends to rotate the dipole. Suppose the couple exerts a torque of magnitude τ.



   Then

   τ = either force × arm of the couple

   = mB × AN = mB × 2 L sin θ

   or

   Since m × 2L is the magnetic dipole moment of the magnet.

   Therefore τ = MB sin θ in vector form

   we have $\vec{\tau} = \vec{M} \times \vec{B}$

2. Answer:

   (a) Gauss's Law for magnetism states that "The total flux of the magnetic field, through any closed surface, is always

   zero, i.e. $\oint \vec{B}.\vec{dL} = 0$

   This law implies that magnetic monopoles do not exist" or magnetic field lines form closed loops.

   (b) Four properties of magnetic field lines are as follows:

- Magnetic field lines always form continuous closed loops.
- The tangent to the magnetic field line at a given point represents the direction of the net magnetic field at that point.
- The larger the number of field lines crossing per unit area, the stronger is the magnitude of the magnetic field.
- Magnetic field lines do not intersect.

Assertion and Reason Answers-

1. (b) Both A and Rare true but R is NOT the correct explanation of A.

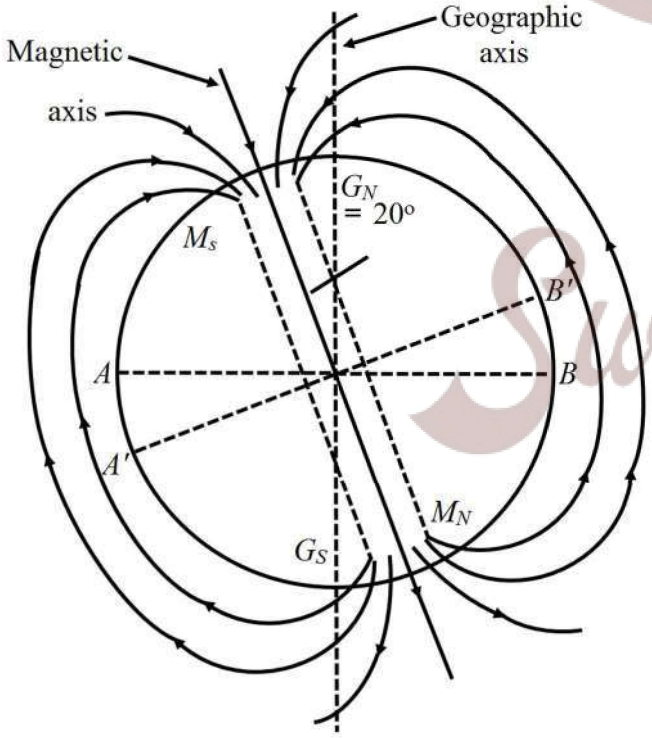
Explanation:

There will be only one neutral point on the horizontal board. This is because field of earth magnetic field is from south to north; and the field of pole on the board is radially outwards. At any point towards south of magnetic pole, field of earth and field of pole will cancel out to give a neutral point.

2. (d) A is false and R is also false.

Explanation:

From the compass we are able to know the poles. The north of compass points towards the magnetic south pole.



If we know the magnetic declination at that particular place (which is angle between geographic meridian and magnetic meridian) we can easily find out the true geographic north-south direction. Imaginary lines drawn along the earth's surface in the direction of the

horizontal component of the magnetic field of the earth at all points passing through the north and south magnetic poles. This is similar to the longitudes of the earth, which pass through the geographic north and south poles.

Case Study Answers-

1. Answer :

(i) (a) a

Explanation:

It can be seen that slop of curve for wire a is greater th an wire c.

(ii) (b) Less than in wire c.

Explanation:

Inside the wire

$$B(r) = \frac{\mu_0}{2\pi}\frac{I}{R^2}r \Rightarrow \frac{dB}{dr} = \frac{\mu_0}{dr} = \frac{I}{R^2}r$$

$$\text{i.e. slope} \propto \frac{I}{\pi R^2} \propto \text{Current density}$$

(iii) (c) c

Explanation:

Wire c has the greatest radius.

(iv) (c) Zero at any point inside the pipe.

(v) (a) Outside the cable.

2. Answer :

(i) (c) 10^{-5}T

(ii) (b) East- West

(iii) (c) The value of V is zero.

Explanation:

At equator vertical component of magnetic fields is zero.

(iv) (d) 45º

Explanation:

$$\text{Given, } V = H$$

$$\therefore \tan\delta = \frac{V}{H} = 1 \text{ or } \delta = 45^\circ$$

(v) (b) $\frac{2H}{\sqrt{3}}$

Explanation:

Given: Biot-Savart law can be expressed alternatively as Ampere circuital law.