PHYSICS

BOOKS - KUMAR PRAKASHAN KENDRA PHYSICS (GUJRATI ENGLISH)

MAGNETISM AND MATTER

Section A Questions Answers 5 1 Introduction

1. Write a brief history of magnet.

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2. Who has first used the properties of showing the direction of the magnet and why ?

Watch Video Solution

3. Give some of the commonly known ideas regarding magnetism.

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Section A Questions Answers 5 2 The Bar Magnet

1. What happens when the small bar magnet kept on the glass and iron filings sprinkled on glass ?

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Section A Questions Answers 5 2 1 The Magnetic Field Lines

1. Draw field lines on a bar magnet, a current carrying finite solenoid and electric dipole.

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2. Write the difference between electric field and magnetic field.

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3. Give the characteristics of magnetic field lines.

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Section A Questions Answers 5 2 2 Bar Magnet As An Equivalent Solenoid

1. What does the analog (similarity) of bar magnet's and solenoid's magnetic field lines suggest ?

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2. Calculate the axial field of a finite solenoid.

Watch Video Solution

3. Write an expression of magnitude of magnetic field at point lies on equatorial line of a bar magnet.

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4. Show the magnetic dipole moment in terms of pole strength.

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Section A Questions Answers 5 2 3 The Dipole In A Uniform Magnetic Field

1. Derive the equation of torque on a magnetic needle in a uniform magnetic field.

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2. Write the equation of torque on the needle placed in a uniform magnetic field and obtain the equation of its periodic time $T = 2\pi\sqrt{\frac{I}{mB}}$.

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3. Derive an expression for magnetic potential energy .for a magnetic dipole kept in a uniform magnetic field.

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Section A Questions Answers 5 2 4 The Electrostatic Analog

1. Write analogy between electrostatic and magnetism.

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2. Write analogy between electrostatic and magnetism.

Watch Video Solution

Section A Questions Answers 5 3 Magnetism And Gauss S Law

1. Give the explanation of Gauss's law for magnetic field.

Watch Video Solution

2. Write the Gauss's law in equation form for electrostatics and magnetism. What is the

difference between them ?

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Section A Questions Answers 5 4 The Earth S Magnetism

1. Give information about Earth's magnetism.

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2. Explain geographic meridian and magnetic meridian.

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3. What are the Earth magnetic elements defined ? And which are they ?

Watch Video Solution

4. Explain magnetic declination.

Watch Video Solution

5. Explain angle of dip.

Watch Video Solution

6. Explain the magnetic fields of the Earth.

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Section A Questions Answers 5 5 Magnetisation And Magnetic Intensity

1. Define magnetisation (M) and give its unit and dimension.

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2. Obtain the relation between magnetisation $\overrightarrow{(m)}$ and magnetic intensity $\overrightarrow{(H)}$ for a solenoid.

Watch Video Solution

3. Explain the magnetic susceptibility (χ) of material. From it explain relative magnetic permeability of material and magnetic permeability of material. Obtain the relation between them.

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Section A Questions Answers 5 6 Magnetic Properties Of Materials

1. What is magnetic substance ? Write its types.

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Section A Questions Answers 5 6 1 Diamagnetism

1. Explain diamagnetism and diamagnetic substance.

Watch Video Solution

2. Give an explanation of superconductor a diamagnetism.

Watch Video Solution

Section A Questions Answers 5 6 2 Paramagnetism

1. Explain paramagnetism and paramagnetic substance.

Watch Video Solution

2. Explain Curie's law.

Watch Video Solution

Section A Questions Answers 5 6 3 Ferromagnetism

1. Explain ferromagnetism and ferromagnetic substance.

Watch Video Solution

2. Explain hard ferromagnetic and soft ferromagnetic materials.

Watch Video Solution

3. Explain Curie temperature.

Watch Video Solution

4. Draw Hysterisis curve $(B \rightarrow H)$ and explain.

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Section A Questions Answers 5 7 Permanent Magnets And Electromagnets

1. What are permanent magnets ? Give the ways for preparing them.

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2. What materials should be used to make permanent magnets ?

Watch Video Solution

3. Give information about electromagnets.

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Try Yourself

1. The name magnet came from which island ?

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2. In which direction does a free hanging magnet get stabilized ?

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3. What is magnetism and what is magnet ?

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4. Show the magnetic field of bar magnet in a panoramic way.

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5. Two magnetic lines intersect ? Why ?

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6. The current is flowing through solenoid, then solenoid acting as what ?

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7. Define the intensity of magnetic field.

Watch Video Solution

8. Write the equation of magnetic field on the axis of current carrying finite solenoid.

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9. Define pole strength of magnet.

Watch Video Solution

10. Write the equation of dipole moment of magnet in the form of electric current.

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11. State the direction of magnetic dipole moment (From S to N pole of magnet).

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12. Write the unit of magnetic dipole moment.

Watch Video Solution

13. Write the unit of pole strength of magnet.

Watch Video Solution

14. Write the equation of torque acting on bar magnet placed in uniform magnetic field.

Watch Video Solution

15. Write the equation of potential energy of bar magnet placed in uniform magnetic field.

Watch Video Solution

16. Give the stability position of bar magnet for $\theta = 0^\circ, 180^\circ$.

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17. Write the equation of periodic time for oscillating bar magnet in uniform magnetic field.

Watch Video Solution

18. What is the magnetism analogy of charge in electricity ?

Watch Video Solution

19. Write the equation of torque acting on bar magnet placed in uniform magnetic field.

Watch Video Solution

20. Derive an expression for magnetic potential energy .for a magnetic dipole kept in a uniform magnetic field.

Watch Video Solution

21. Give the explanation of Gauss's law for magnetic field.

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22. Write the Gauss's law in equation form for electrostatics and magnetism. What is the difference between them ?

Watch Video Solution

23. Write the Gauss's law in equation form for electrostatics and magnetism. What is the difference between them ?

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24. Explain the magnetic fields of the Earth.

Watch Video Solution

25. Tell the proper reason for the earth's magnetic field to occur.

Watch Video Solution

26. What is dynamo effect ?

Watch Video Solution

27. What is the angle between axis of rotation and magnetic axis of earth ?

Watch Video Solution

28. Give the location of magnetic north pole.

Watch Video Solution

29. Give the location of magnetic south pole.

Watch Video Solution

30. The pole near the geographic north pole is called ..... The pole near the geographic south pole is called .....

Watch Video Solution

31. Define geographic meridian.

Watch Video Solution

32. Define magnetic meridian.

Watch Video Solution

33. Explain magnetic declination.

Watch Video Solution

34. The declination is ..... at higher latitudes.

Watch Video Solution

35. The declination in India is .....

Watch Video Solution

36. Explain angle of dip.

Watch Video Solution

37. Write the definition of declination.

Watch Video Solution

38. Name the elements of the earth's magnetic field.

Watch Video Solution

39. What is magnetisation of substance ?

Watch Video Solution

40. Give the unit and dimensional formula of magnetisation.

Watch Video Solution

41. Write the equation of magnetic field obtain in the core of solenoid in the form of $\vec{H}$ and $\vec{M}$.

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42. What does the magnetic susceptibility of a material show ?

Watch Video Solution

43. What is the value of magnetic susceptibility for paramagnetic material ?

Watch Video Solution

44. What is the value of magnetic susceptibility for diamagnetic materials ?

Watch Video Solution

45. Why magnetic susceptibility of diamagnetic materials is negative ?

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46. What is paramagnetic substance ?

Watch Video Solution

47. A small bar of paramagnetic substance placed in a non magnetic field, then in which

direction does it move ?

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48. Explain Curie's law.

Watch Video Solution

49. Explain diamagnetism and diamagnetic substance.

Watch Video Solution

50. A small bar of diamagnetic substance placed in a non-magnetic field then in which direction does it move ?

Watch Video Solution

51. Give the examples of diamagnetic substance.

Watch Video Solution

52. Tell us about the susceptibility of diamagnetic substance.

Watch Video Solution

53. What is Meissner effect ?

Watch Video Solution

54. What magnets are useful in an extremely fast train running magnetically levitate ?

Watch Video Solution

55. What is ferromagnetic substance ?

Watch Video Solution

56. What is domain ?

Watch Video Solution

57. The domain size is .. ..

Watch Video Solution

58. The domain contains about ..... atoms.

Watch Video Solution

59. A small bar of ferromagnetic substance placed in a non-magnetic field then in which direction does it move ?

Watch Video Solution

60. Give some examples of ferromagnetic substance.

Watch Video Solution

61. Give some examples of paramagnetic substance.

Watch Video Solution

62. What is hard ferromagnetic substance ?

Watch Video Solution

63. Alnico is a alloy of which metals ?

Watch Video Solution

64. What are soft ferromagnetic materials ?

Watch Video Solution

65. Write the uses of soft ferromagnetic material.

Watch Video Solution

66. Explain Curie temperature.

Watch Video Solution

67. What is retentivity?

Watch Video Solution

68. What are permanent magnets ? Give the ways for preparing them.

Watch Video Solution

69. What materials should be used to make permanent magnets ?

Watch Video Solution

70. Why steel is suitable to make permanent magnet?

Watch Video Solution

71. What materials should be used to make permanent magnets ?

Watch Video Solution

72. Give information about electromagnets.

Watch Video Solution

73. What type of materials can use to make an electromagnet ?

Watch Video Solution

74. Name the suitable material for electromagnet.

Watch Video Solution

75. How can the magnetic field of solenoid be increased for given current ?

Watch Video Solution

76. What should be the resistivity of materials for electromagnetism ?

Watch Video Solution

77. Give the uses of electromagnets.

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Section B Numericals Numerical From Textual Illustrations

1. In Fig 5.4 (b), the magnetic needle has magnetic moment $6.7 \times 10^{-2} Am^2$ and moment of inertia $I = 7.5 \times 10^{-6} Kgm^{-2}$. It performs 10 complete oscillation in 6.70s. What is the magnitude of the magnetic field?

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2. A short bar magnet placed with its axis at 30^{o} with an external field of 800 G experiences a torque of 0.016 Nm.

(a) What is the magnetic moment of the magnet ?

(b) What is the work done in moving it from its most stable to most unstable position ?

(c) 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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3. (a) What happens if a bar magnet is cut into two pieces: (i) transverse to its length, (ii) along its length ?

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4. (b) A magnetised needle in a uniform magnetic field experiences a torque but no net force. An iron nail near a bar magnet, however,

experiences a force of attraction in addition to a torque. Why ?

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5. (c) Must every magnetic configuration have a north pole and a south pole ? What about the field due to a toroid ?

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6. (d) Two identical looking iron bars A and B are given, one of which is definitely known to be magnetised. (We do not know which one.) How would one ascertain whether or not both are magnetised ? If only one is magnetised, how does one ascertain which one '? [Use nothing else but the bars A and B.]

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7. What is the magnitude of the equatorial and axial fields due to a bar magnet of length 5.0 cm at a distance of 50 cm from its mid-point? The magnetic moment of the bar magnet is 0.40 A m^2, the same as in Example 5.2.

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8. Figure shows a small magnetised needle P placed at a point 0. The arrow shows the direction of its magnetic moment. The other

arrows show different positions (and orientations of the magnetic moment) of another identical magnetised needle Q.

(a) In which configuration the system is not in equilibrium ?

(b) In which configuration is the system in (i) stable, and (ii) unstable equilibrium ?

(c) Which configuration corresponds to the lowest potential energy among all the configurations shown ?

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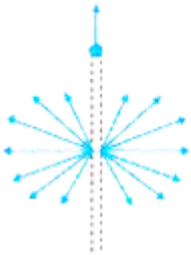
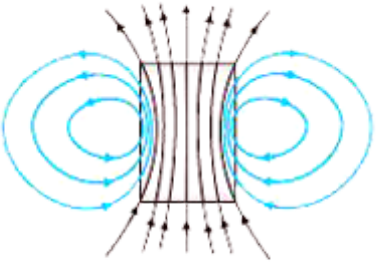
9. Many of the diagrams given in Fig 5.7 show magnetic field lines (thick lines in the figure) wrongly. Point out what is wrong with them. Some of them may describe electrostatic field

lines correctly. Point out which ones.



(a)



(e)

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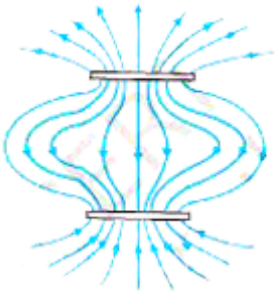
(b)



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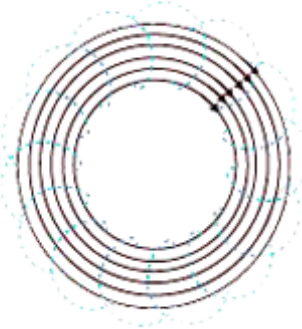

(c)

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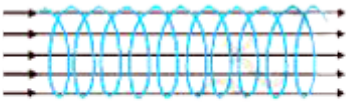

(d)

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10. (a) Magnetic field lines show the direction (at every point) along which a small magnetised needle aligns (at the point). Do the magnetic field lines also represent the lines of force on a moving charged particle at every point ?

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11. (b) Magnetic field lines can be entirely confined within the core of a toroid, but not

within a straight solenoid. Why ?

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12. (c) If magnetic monopoles existed, how would the Gauss's law of magnetism be modified ?

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13. Does a bar magnet exert a torque on itself due to its own field '? Does one element of a

current-carrying wire exert a force on another element of the same wire ?

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14. Magnetic field arises due to charges in motion. Can a system have magnetic moments even though its net charge is zero ?

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15. The earth magnetic field at the equator is approximately 04.G. Estimate the earth's dipole moment.

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

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17. A solenoid has a core of a material with relative permeability 400. The windings of the solenoid are insulated from the core and carry a current of 2A. If the number of turns is 1000 per metre, calculate (a) H, (b) M, (c) B and (d) the magnetising current I_m.

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18. A domain in ferromagnetic iron is in the form of a cube of side length 1μ 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 55 g/mole and its density is $7.9\frac{g}{(cm)^3}$. Assume that each iron atom has a dipole moment of $9.27 \times 10^{-24}\mathrm{Am}^2$.

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Section B Numericals Numerical From Textual Exercise

1. Answer the question regarding earth's magnetism:

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. Answer the question regarding earth's magnetism:

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

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3. Answer the question regarding earth's magnetism:

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. Answer the question regarding earth's magnetism:

In which direction would a compass free to move in the vertical plane point to, if located right on the geomagnetic north or south pole?

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5. Answer the question regarding earth's magnetism:

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 question regarding earth's magnetism:

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. The earth's magnetic field varies from point to point in space. Does it also change with time? If so, on what time scale does it change appreciably?

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8. The earth's core is known to contain tron. 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 even reversed the direction of its field several umes during its

bustory 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 shape substantially at large distances (greater than about 30.000 km). What agencies may be responsible for this distortion?

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12. 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 0.25T. T experiences a torque of magnitude equal to $4.5 \times 10^{-2}J$. What is the magnitude of magntic moment of the magnet?

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14. A short bar magnet of magnetic moment $m = 0.32JT^{-1}$ is placed in a uniform magnetic field of 0.15 T. If the bar is free to rotate in the plane of the field, which orientation would correspond to its (a) stable and (b) unstable equilibrium? What is the potential energy of the magnetic in each case?

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15. A closely wound solenoid of 800 turns and area of cross section $25 \times 10^{-4} m^2$ carries a current of 3.0 A. 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 Exercise 5.5 is free to tum about the vertical direction and a uniform hortzontal magnetic field of 0.25 T is applied, what is the magnitude of torque on the

solenoid when its axis makes an angle of 30° with the direction of 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 0.22 T.

(a) What is the amount of work required by an external torque to turn the magnet so as to align its magnetic 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 4.0 A. 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 is the force and torque on the solenoid if a uniform horizontal magnetic field of $7.5 \times 10^{-2} T$ 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 10 cm carrying a current of 0.75 A rests with its plane normal to an external field of magnitude $5.0 \times 10^{-2} T$. The coil is free to turn about an axis in its plane perpendicular to the field

direction. When the coll is turned slightly and released, it oscillates about its stable equilibrium with a frequency of $2.0s^{-1}$. 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 up 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 held 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 $0.48JT^{-1}$. Give the direction and magnitude of the magnetic field produced by the magnet at a distance of 10 cm from the centre of the magnet on (a) the axis, (b) the

equatorial lines (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 14 cm from the centre of the magnet. The earth's magnetic Meld at the place is 0.36 G and the angle of dip 18 zero. What is the total magnetic feld on

the normal bisector of the magnet at the same distance as the mull-point (i.e., 14 cm) from the centre of the magnet? At rull points, field due to a magnet 1s equal and opposite to the horizontal component of earth's magnetic field.)

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24. If the bar magnet in exercise 5.13 is turned around by 180°, where will the new null points be located?

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25. A short bar magnet of magnetic moment $5.25 \times 10^{-2} JT^{-1}$ is placed with its axis perpendicular to the earth's field direction. At what distance from the centre of the magnet, the resultant field is inclined at 45° with earth's field on (a) its normal bisector and (b) its axis. Magnitude of the earth's field at the place is given to be 0.42 G. Ignore the length of the magnet in comparison to the distances involved.

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Section B Numericals Numerical From Textual Exercise Additional Exercises

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

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2. Why is diamagnetism, In contrast, almost Independent of temperature?

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3. 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?

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

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5. 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?

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

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7. Explain qualitatively on the basis of domain picture the lireversibility in the magnetisation curve of a ferromagnet.

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

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

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

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

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12. A long straight horizontal cable carries a current of 2.5 A in the direction 10° south of west to 10° north of east. The magnetie meridian of the place happens to be 10° west of the geographie meridian. The earth's

magnetic field at the location is 0.33 G, and the angle of dip is zero. Locate the line of neutral points (ignore the thickness of the cable)? (At neutral potnts, magnetic field due to a current-carying cable is equal and opposite to the horizontal component of earth's magnetic field.)

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13. 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^{o}. The magnetic declination is nearly zero. What are the resultant magnetic fields at points 4.0 cm below the cable ?

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14. A compass needle free to turn in a horizontal plane is placed at the centre of 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 A, the needle points west to east.

(a) Determine the horizontal component of the 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.

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

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16. 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 $30cm\left(m_e = 9.11 \times 10^{-31}kg\right)$. [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.)

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17. A sample of 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)

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18. A Rowland ring of mean radius 15 cm has 3500 tums 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?

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19. The magnetic moment vectors μ_s and μ_l associated with the intrinsic spin angular

momentum S and orbital angular momentum l, respectively, of an electron are predicted by quantum theory (and verified experimentally to a high accuracy) to be given by :

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

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

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Section B Numericals Numerical From Darpan Based On Textbook

1. A magnetic needle placed in uniform magnetic field has magnetic moment $6.7 \times 10^{-2} \mathrm{Am}^2$, and moment of inertia of 15×10^{-6} k m^2. It performs 10 complete oscillations in 6.70 s. What is the magnitude of the magnetic field ?

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2. A short bar magnet placed with its axis at 30° with an external field of 800 G experiences

a torque of 0.016 Nm.

(a) What is the magnetic moment of the magnet ?

(b) What is the work done in moving it from its most stable to most unstable position ?

(c) 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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3. The earth magnetic field at the equator is approximately 04.G. Estimate the earth's dipole moment.

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4. A short bar magnet with magnetic dipole moment $1.6\mathrm{Am}^2$ is kept in magnetic meridian in such a way that its north pole is in north direction. In this case, the null (neutral) point is found at a distance of 20 cm from the

centre of the magnet. Find the horizontal component of the Earth's magnetic field.

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5. A magnet is hung horizontally in the magnetic meridian by a wire without any twist. If the supporting wire is given a twist of 180^{o} at the top, the magnet rotates by 30^{o}. Now if another magnet is used, then a twist of 270^{o} at the supporting end of wire also produces a

rotation of the magnet by 30°. Compare the magnetic dipole moments of the two magnets.

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6. A magnetic needle is hung by an untwisted wire, so that it can rotate freely in the magnetic meridian. In order to keep it in the horizontal position, a weight of 0.1 g is kept or one end of the needle. If the magnetic pole strength of this needle is 10 Am, find the value

of the vertical component of the earth's magnetic field. $\left(g = 9.8ms^{-2}\right)$

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7. As shown in figure, plane PSTU forms an angle of α and plane PSVW makes an angle of $(90^{\circ} - \alpha)$ with the magnetic meridian respectively. The value of magnetic dip angle in plane PSTU is ϕ_1 and its value in plane PSVW is ϕ_2. If the actual dip angle at the plane is ϕ,

then $\cot^2\phi = \ldots.$

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8. The region inside a current carrying torodial winding is filled with tungsten of susceptibility 6.8×10^{-5}. What is the percentage increase in the magnetic field in the presence of the material with respect to the magnetic field without it ?

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9. Two small and similar bar magnets have magnetic dipole moment of 1.0 Am^2 each. They are kept in a plane in such a way that their axes are perpendicular to each other. A line drawn through the axis of one magnet passes through the centre of other magnet. If the distance between their centers is 2 m, find the magnetic field at the mid point of the line joining their centers.

 Watch Video Solution

10. A magnetic pole of bar magnet with pole strength of 100 Am is 20 cm away from the centre of a bar magnet. Bar magnet has pole-strength of 200 Am and has a length of 5 cm. If the magnetic pole is on the axis of the bar magnet, find the force on the magnetic pole.

Watch Video Solution

11. The work done for rotating a magnet with magnetic dipole moment m, by 90° from its

magnetic meridian is n times the work done to rotate it by 60°, find value of n.

Watch Video Solution

12. A magnet makes an angle of 45° with the horizontal in a plane making an angle of 30° with the magnetic meridian. The true value of the dip angle at the place is .....

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13. An electron in an atom is revolving round the nucleus in a circular orbit of radius 5.3×10^{-11} m, with a speed of $2 \times 10^{6} ms^{-1}$. The resultant orbital magnetic moment and angular momentum of the electron is .....

Take charge of electron $= 1.6 \times 10^{-19} C$,

mass of electron $= 9.1 \times 10^{-31}$ kg.

Watch Video Solution

Section B Questions

1. The magnetic needle has magnetic moment $3.14 \times 10^{-2} \mathrm{Am}^2$ and moment of inertia $1 = 2 \times 10^{-6}$ kg m^2. It performs 314 complete oscillations in 100 s. What is the magnitude of the magnetic field ?

Watch Video Solution

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

(a) What is the magnetic moment of the magnet ?

(b) What is the work done in moving it from its most stable to most unstable position ?

(c) 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.

 Watch Video Solution

3. What is the magnitude of the equatorial and axial fields due to a bar magnet of length 1.0 cm at a distance of 100 cm from its mid-point? The magnetic moment of the bar magnet is 0.314 Am^2,

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4. At the equator of one imaginary planet, magnetic field is about 0.16 G. If its radius is

8000 km then find its magnetic dipole moment.

Watch Video Solution

5. In the magnetic meridian of a certain place, the horizontal component of the earth's magnetic field is 0.1414 G and the dip angle is 45°. What is the magnetic field of the earth at this location ?

Watch Video Solution

6. A solenoid has a core of a material with relative permeability 200. The windings of the solenoid are insulated from the core and carry a current of IA. If the number of turns is 2000 per metre, calculate (a) H, (b) M, (c) B and (d) the magnetising current I_m.

Watch Video Solution

Section C Ncert Exemplar Solution Multiple Choice Questions Mcqs

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 $xy-$ plane. Its magnetic moment $\vec{m}$.....

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

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

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

the toroid.

D. is pointing radially outwards.

Answer: D

Watch Video Solution

2. The magnetic field of Earth can be modelled by that of a point dipole placed at the centre of the Earth. The dipole axis makes an angle of 11.3° 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

 Watch Video Solution

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: D

Watch Video Solution

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) $\rightarrow$ 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 laws 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 $\oint \overrightarrow{E}. Overset(\rightarrow)(d)l = 0$

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 new magnetisation of $8\mathrm{Am}^{-1}$ when placed in and 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 temperature of 16 K, the magnetisation will be

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

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

C. $6Am^{-1}$

D. $2.4Am^{-1}$

Answer: B

Watch Video Solution

Section C Ncert Exemplar Solution Multiple Choice Questions More Than One Options

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

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

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

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

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

Answer: A::D

Watch Video Solution

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

A. atomic currents.

B. Pauli exclusion principle.

C. polar nature of molecules.

D. intrinsic spin of electron.

Answer: A::D

 Watch Video Solution

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

A. The H field in the solenoid is (nearly) unchanged but the B field decreases drastically.

B. The H and B fields in the solenoid are nearly unchanged.

C. The magnetisation in the core reverses direction.

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

Answer: A::D

Watch Video Solution

4. 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 $\vec{B}$ cannot end on any material and perfect shielding is not possible.

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

Answer: A::C::D

Watch Video Solution

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

A. is always zero.

B. can be zero at specific points.

C. can be positive or negative.

D. is bounded.

Answer: B::C::D

Watch Video Solution

Section C Ncert Exemplar Solution Very Short Answer Type Questions

1. A proton has spin and magnetic moment just like an electron. Why then its effect is neglected in magnetism of materials ?

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

5. 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 ?

Watch Video Solution

Section C Ncert Exemplar Solution Short Answer Type Questions

1. Verify the Gauss's law for magnetic field of a point dipole of dipole moment $\vec{M}$ at the

origin for the surface which is a sphere of radius R.

Watch Video Solution

2. Three identical bar magnets are riveted together at centre in the same plane as shown in 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 figure. Determine the poles of

the remaining two.

View Text Solution

3. 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 $\vec{B}$. Write down a set of conditions on

$\vec{E}, \vec{B}, \vec{M}$ so that the two motions are verified to be identical. (Assume identical initial conditions.)

Watch Video Solution

4. 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 oscillations of the original magnet about an axis through the mid point,

perpendicular to length, in a magnetic field B. What would be the similar period T' for each piece ?

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5. (i) Use:

(i) the Ampere's law for H and

(ii) continuity of lines of 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.

Watch Video Solution

Section C Ncert Exemplar Solution Long Answer Type Questions

1. Verify the Ampere's law for magnetic field of a point dipole of dipole moment $\vec{M} = M\hat{k}$. Take C as the closed curve running clockwise along

(i) the z-axis from $z = a > 0$ to$z = R$,

(ii) along the quarter circle of radius R and centre at the origin, in the first quadrant of x-z plane,

(iii) along the x-axis from x = R to x = a and

(iv) along the quarter circle of radius a and centre at the origin in the first quadrant of x-z plane.

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2. What are the dimensions of χ, the magnetic susceptibility? Consider an H-atom. Guess an expression for χ, upto a constant by constructing a quantity of dimensions of χ, out of parameters of the atom: e, m, v, R and μ_0. Here, m is the electronic mass, v is electronic velocity, R is Bohr radius. Estimate the number so obtained and compare with the value of $|\chi|10^{-5}$ for many solid materials.

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3. Assume the dipole model for earth's magnetic field B which is given by

$B_V =$ vertical component of magnetic field

$$= \frac{\mu_0}{4\pi} \frac{2m \cos\theta}{r^3}$$

$B_H =$ Horizontal component of magnetic field

$$B_H = \frac{\mu_0}{4\pi} \frac{m \sin\theta}{r^3}$$

$\theta = 90^\circ$ - latitude as measured from magnetic equator.

(a) Find loci of points for which

(i) $\left|\vec{B}\right|$ is minimum,

(ii) dip angle is zero,

(iii) dip angle is $\pm 45^\circ$.

Watch Video Solution

4. Consider the plane S formed by the dipole axis and the axis of earth. Let P be point on the magnetic equator and in S. Let Q be the point of intersection of the geographical and magnetic equators. Obtain the declination and dip angles at P and Q.

Watch Video Solution

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

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Section D Multiple Choice Questions Mcqs Mcqs From Darpan Based On Textbook Bar Magnet Bar Magnet As Equivalent Solenoid

1. When a bar magnet is divided into two pieces,

A. both the pieces lose magnetism.

B. both the pieces behave like individual magnets.

C. both the poles get separated.

D. one piece behaves like a magnet and the other does not.

Answer: B

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2. One magnet is cut perpendicular to its axis and divided into two pieces with the lengths in the ratio 2 : 1. Then ratio of their pole strength is .....

A. $2:1$

B. $1:2$

C. $4:1$

D. $1:1$

Answer: D

Watch Video Solution

3. When one magnet is kept in 0.8 T magnetic field, magnetic force on each its two poles is 0.08 N. Then pole strength of each pole would be .....

A. 10 Am

B. 0.1 Am

C. $0.1Am^2$

D. $10Am^2$

Answer: B

Watch Video Solution

4. Magnetic field lines do not intersect because, ...

A. at point of intersection, two values of magnetic field are obtained which is not possible.

B. at point of intersection, two directions of magnetic field are obtained which is not possible.

C. at point of intersection, two values and two directions of magnetic field are obtained, which is not possible.

D. all of above.

Answer: B

 Watch Video Solution

5. Intensity of magnetic field means .....

A. magnetic dipole moment per unit volume.

B. magnetic force per unit pole strength.

C. no. of magnetic field lines passing through unit area.

D. no. of magnetic field lines per unit volume.

Answer: B

Watch Video Solution

6. Magnetic field lines .....

A. always intersect.

B. always form closed loops.

C. are more crowded away from the magnet.

D. can not pass through vacuum.

Answer: B

Watch Video Solution

7. Magnetic field produced by electron in atom or molecule is due to its .....

A. spin motion.

B. orbital motion.

C. spin and orbital motion.

D. none of above.

Answer: C

Watch Video Solution

8. For a short magnet with magnetic dipole moment $\vec{m}$, its magnetic field at distance d from its centre on its equator is .....

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

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

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

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

Answer: A

Watch Video Solution

9. A current carrying loop acts like a .....

A. magnetic pole

B. magnetic substance

C. magnetic dipole

D. all of above

Answer: C

Watch Video Solution

10. Direction of magnetic dipole moment of a magnet is .....

A. from north pole to south pole.

B. from south pole to north pole.

C. possible in any direction.

D. not decided.

Answer: B

Watch Video Solution

11. The magnetism of magnet loses due to .....

A. when it is broken into small pieces

B. on heating a magnet

C. dropping it into cold water

D. applying a reverse field of appropriate strength

Answer: D

Watch Video Solution

12. A non magnetic material is that which is .....

A. not attracted by a magnet

B. repelled by a magnet

C. not affected even by strong magnetic field

D. none of these

Answer: B

 Watch Video Solution

13. A true test of magnetism is .....

A. only attraction

B. only repulsion

C. both attraction as well as repulsion

D. neither attraction nor repulsion

Answer: B

 Watch Video Solution

14. The unit of pole strength of magnet is .....

(where Q is charge and v is velocity)

A. Q_v

B. $\frac{Q}{v}$

C. $\frac{v}{Q}$

D. $\frac{1}{Q_v}$

Answer: A

Watch Video Solution

15. Give the relation between geometric length (l_g) and magnetic length (l_m) of a bar magnet

A. $l_m = \frac{5}{6} l_g$

B. $2l_m = \frac{5}{6} l_g$

C. $l_m = \frac{6}{5} l_g$

D. $l_m = \frac{3}{5} l_g$

Answer: B

Watch Video Solution

16. Pole strength of a magnet is 5 Am and the magnetic length of it is 10 cm. Calculate the magnetic dipole moment of it.

A. $0.5Am^2$

B. $5Am^2$

C. $50Am^2$

D. $20Am^2$

Answer: A

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17. For most stable position of magnetic dipole in a uniform magnetic field the value of potential energy should be .....

A. $-mB$

B. 0

C. any value

D. mB

Answer: A

Watch Video Solution

18. Force acting on a magnetic pole of 7×10^{-2} Am is 31.5N. Magnetic field at that point is ...

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

B. $4.5 \times 10^{-2} T$

C. $3.5 \times 10^{2} T$

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

Answer: B

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19. The force acting on a north pole of magnet of pole strength 3200 Am and 10 cm away from the south pole of a point bar magnet of pole strength 40 Am is ..... N.

A. -1.28

B. 1.28

C. 1.28×10^{-7}

D. 1.28×10^{-7}

Answer: B

Watch Video Solution

20. A magnet of magnetic moment 0.1 Am^2 is placed in a uniform magnetic field 0.36×10^{-4} T. The force acting on its each pole is 1.44×10^{-4} N. The distance between two poles would be ..... cm.

A. 1.25

B. 2.5

C. 5.0

D. 1.8

Answer: B

Watch Video Solution

21. A and B points are present on the axis of a bar magnet of length 3 cm and at 24 cm and 48 cm respectively, from the opposite direction of the centre. The ratio of magnetic fields at these points is ..... .

A. $8:1$

B. $4:1$

C. $3:1$

D. $1:2\sqrt{2}$

Answer: A

Watch Video Solution

22. For a short bar magnet $\frac{\text{B-axial}}{\text{B-equatorial}}$ is .....

A. $1:2$

B. $1:1$

C. $3:2$

D. $2:1$

Answer: D

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23. Magnetic field on t:quatur of Earth is 4×10^{-5} T. Radius of Earth is 6400 km, then magnetic dipole moment of Earth is about ..... Am^{-2}.

A. 10^{23}

B. 10^{20}

C. 10^{16}

D. 10^{10}

Answer: A

Watch Video Solution

24. Two magnetic poles of pole strength 20 Am and 15 Am are kept at a distance of 10cm. The force acting on one of the poles is ....

A. 3×10^{2} N

B. 3×10^{-3} N

C. 2×10^{-3} N

D. 3×10^{-5} N

Answer: B

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25. A bar magnet of length l, pole strength 'p' and magnetic moment $\vec{m}$ is split $\frac{l}{2}$ · to two equal pieces each of length. The magnetic

moment and pole strength of each piece is respectively ..... and ..... .

A. $\vec{m}, \frac{p}{2}$

B. $\frac{\vec{m}}{2}, p$

C. $\frac{\vec{m}}{2}, \frac{p}{2}$

D. $\vec{m}, p$

Answer: B

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26. A system has net charge zero. Can it have magnetic moment ?

A. yes

B. no

C. sometimes yes

D. cannot say

Answer: D

Watch Video Solution

27. When a current carrying loop is replaced by an equivalent magnetic dipole .....

A. the distance l between the poles is fixed

B. the pole strength p of each pole is fixed

C. the dipole moment is reversed.

D. the product pl is fixed.

Answer: D

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Section D Multiple Choice Questions Mcqs Mcqs From Darpan Based On Textbook The Dipole In A Uniform Magnetic Field Torque Potential Energy Periodic Time Gauss S Law

1. Net magnetic flux passing through any closed surface in a magnetic field is always .....

A. zero

B. infinity

C. definite

D. indefinite

Answer: A

Watch Video Solution

2. Unit of magnetic flux is .....

A. Tm^2

B. Wb

C. NmA^{-1}

D. All of these

Answer: D

Watch Video Solution

3. Magnetostatic potential energy of a magnet with magnetic dipole moment $\vec{m}$, in a uniform magnetic field $\vec{B}$ is given as .....

A. $\vec{m}.\ \vec{B}$

B. $\vec{m} \times \vec{B}$

C. $-\left(\vec{m}.\ \vec{B}\right)$

D. $-\left(\vec{m} \times \vec{B}\right)$

Answer: C

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4. When the torque exerted on magnet place in magnetic field, would be maximum ?

A. $\theta = 0^\circ$

B. $\theta = \frac{\pi}{2}$

C. $m = 0$

D. $B = 0$

Answer: B

Watch Video Solution

5. Gauss's law for magnetism is .....

A. $\oint \vec{B}.\, d\vec{l} = 0$

B. $\oint \vec{B}.\, d\vec{l} = \mu_0 \sum I$

C. $\oint \vec{B}.\, d\vec{s} = \mu_0 \sum I$

D. $\oint \vec{B}.\, d\vec{s} = 0$

Answer: D

Watch Video Solution

6. Magnetic dipole moment of current carrying circular coil is ..... length of wire of coil.

A. directly proportional

B. directly proportional to square root of

C. inversely proportional to square of

D. directly proportional to square of

Answer: C

Watch Video Solution

7. What is the direction of magnetic dipole moment'?

A. from mid point to any pole

B. from north pole to south pole

C. from south pole to north pole

D. there is no direction

Answer: C

Watch Video Solution

8. Dimensional formula of magnetic dipole moment is .....

A. $M^0L^1A^1$

B. $M^1L^{-1}A^1$

C. $M^1L^{-1}A^{-2}$

D. $M^0L^2A^1$

Answer: D

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9. When a freely suspended bar magnet is heated, its magnetic dipole moment decreases by 36 %. Then its periodic time would

A. increase by 36 %

B. increase by 25 %

C. decrease by 25 %

D. decrease by 64 %

Answer: B

 Watch Video Solution

10. In order to keep one magnetic needle, perpendicular to two magnetic fields B_1 and B_2, if the torques required are respectively τ_1 and τ_2 then $\frac{B_1}{B_2} = \ldots\ldots\ldots$

A. $\frac{\tau_2}{\tau_1}$

B. $\frac{\tau_1}{\tau_2}$

C. $\frac{\tau_1 + \tau_2}{\tau_1 - \tau_2}$

D. $\frac{\tau_1 - \tau_2}{\tau_1 + \tau_2}$

Answer: B

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11. A straight steel wire of length l has magnetic moment m. If the wire is bent in the form of a semicircle the new value of the magnetic dipole moment is ..... .

A. m

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

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

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

Answer: B

Watch Video Solution

12. A magnet of magnetic dipole moment 5.0 Am^2 is lying in a uniform magnetic field of $7 \times 10^{-4}T$ such that its dipole moment vector makes an angle of 30° with the field. The work done in increasing this angle from 30° to 45° Is about ..... J.

A. 5.56×10^{-4}

B. 24.74×10^{-4}

C. 30.3×10^{-4}

D. 5.50×10^{-3}

Answer: A

Watch Video Solution

13. Two bar magnet oscillating of periodic time is $2:1$. If interial of mass is constant then the ratio of magnetic dipole moment .....

A. $1:2$

B. $1:4$

C. $2:1$

D. $4:1$

Answer: B

Watch Video Solution

14. Magnetic dipole moment of a bar magnet is $3\hat{i}\mathrm{Am}^2$ and the magnetic field intensity is 2×10^{-5} T in y direction calculate the torque on the magnet.

A. $2 \times 10^{-5} \hat{k} Nm$

B. $6 \times 10^{-5} \hat{k} Nm$

C. $6 \times 10^{-5} \hat{k} Nm$

D. $2 \times 10^{-5} \hat{i} Nm$

Answer: B

Watch Video Solution

15. For most stable position of magnetic dipole in a uniform magnetic field the value of potential energy should be .....

A. $-mB$

B. 0

C. any value

D. mB

Answer: A

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16. A magnet is hung horizontally in the magnetic meridian by a wire without any twist. If the supporting wire is given a twist of 180°

at the top, the magnet rotates by 30°. Now if another magnet is used, then a twist of 270° at the supporting end of wire also produces a rotation of the magnet by 30°. Compare the magnetic dipole moments of the two magnets.

A. $\frac{4}{8}$

B. $\frac{8}{5}$

C. $\frac{5}{8}$

D. $\frac{8}{4}$

Answer: C

Watch Video Solution

17. A short bar magnet is placed in an external magnetic field of 600 G. When its axis makes an angle of 30° with the external field, it experiences a torque of 0.012 Nm. What is the magnetic moment of the magnet ?

A. $0.2\mathrm{Am}^2$

B. $0.3\mathrm{Am}^2$

C. $0.4\mathrm{Am}^2$

D. $0.6\mathrm{Am}^2$

Answer: C

Watch Video Solution

18. SI unit of the ratio of Electric flux and Magnetic flux is

A. m

B. ms^{-1}

C. ms^{-2}

D. ms

Answer: B

Watch Video Solution

19. Two magnets of magnetic dipole moments m and 2m are held together as shown in figure. The magnetic moment of the combination is .....

A. m

B. $\sqrt{5}$ m

C. $3m$

D. $\sqrt{7}$ m

Answer: D

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20. Two similar magnets of magnetic moment $\vec{m}$ are arranged as shown in figure. The magnetic dipole moment of this combination is ..... .

A. $2\vec{m}$

B. $\sqrt{2}\vec{m}$

C. $\frac{\vec{m}}{\sqrt{2}}$

D. $\frac{\vec{m}}{2}$

Answer: B

View Text Solution

21. The magnetic dipole moment of steel wire of length L is m. It is bent from the middle and

arranged as 60°. So the new magnetic dipole moment will be .....

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

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

C. m

D. $2m$

Answer: B

Watch Video Solution

22. $1Tesla$ = ... ગૉસ.

A. 10^{-4}

B. 10^{4}

C. 10^{-8}

D. 10^{8}

Answer: B

Watch Video Solution

23. ..... has same dimensions as of $\sqrt{\frac{I}{mB}}$ each sign has its fixed significance.

A. distance

B. speed

C. time

D. frequency

Answer: C

Watch Video Solution

Section D Multiple Choice Questions Mcqs Mcqs From Darpan Based On Textbook The Earth S Magnetism

1. One bar magnet is suspended so as to rotate freely in horizontal magnetic field. Then .....

A. It would become steady along east-west direction.

B. It would become steady along north-south direction.

C. It would become steady along vertical direction.

D. None of these.

Answer: B

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2. That end of bar magnet (suspended so as to rotate freely in horizontal plane) which points towards geographic north direction is known as ..... pole of magnet.

A. positive

B. negative

C. north

D. south

Answer: C

Watch Video Solution

3. Like poles of bar magnet ..... each other and its unlike poles ..... each other.

A. repel, attract

B. attract, attract

C. attract, repel

D. repel, repel

Answer: A

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4. Magnetic north pole of Earth is nearer to geographic ..... pole.

A. East

B. West

C. North

D. South

Answer: D

Watch Video Solution

5. At a place of the Earth, horizontal component of magnetic field is equal to

vertical component then dip angle $(\phi) = \ldots\ldots\ldots\ldots$

A. (A) 60°

B. (B) 90°

C. (C) 45°

D. (D) 30°

Answer: C

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6. At a place horizontal component of earth's magnetic field is $\sqrt{3}$ times its vertical component. The magnetic dip angle at the place is ..... radian.

A. 0

B. $\frac{\pi}{2}\text{rad}$

C. $\frac{\pi}{3}\text{rad}$

D. $\frac{\pi}{6}\text{rad}$

Answer: D

Watch Video Solution

Watch video solution

7. A place where the vertical component of Earth's magnetic field is zero has the angle of dip equal to .....

A. 0°

B. 45°

C. 60°

D. 90°

Answer: A

Watch Video Solution

8. A place where the horizontal component of Earth's magnetic field is zero lies at .....

A. geographic equator

B. geomagnetic equator

C. one of the geographic poles

D. one of the geomagnetic poles

Answer: D

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9. At a certain place, the vertical component of the earth's magnetic field is 0.4×10^{-4} T and horizontal component is 0.3×10^{-4} T. What will be the total intensity of magnetic field of the earth ?

A. 0.5×10^{-4} T

B. 0.5×10^{-2} T

C. 0.5×10^{-1} T

D. 0.5×10^{0} T

Answer: A

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10. The horizontal component of earth's magnetic field is 3×10^{-4} T. The magnetic dip angle is 45°. Find the vertical component.

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

B. 3×10^{-4} T

C. $\frac{1}{\sqrt{3}} \times 10^{-4}$ T

D. 10^{-5} T

Answer: B

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11. The magnetic dip angle at two places are 30° and 45°. Calculate ratio of horizontal components of earth's magnetic field at the two places. Magnetic field at the places is equal to .....

A. (A) $\sqrt{2}:\sqrt{3}$

B. (B) $\sqrt{3}:\sqrt{2}$

C. (C) $1:\sqrt{3}$

D. (D) $\sqrt{3}:1$

Answer: B

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12. At equatorial line horizontal factor of the magnetic field of the earth is ..... .

A. zero

B. maximum

C. minimum

D. none of above

Answer: B

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13. At a place on earth the horizontal component of earth's magnetic field is 73.2 % times then its vertical component. The angle of dip at this place is .....

A. 30°

B. 45°

C. 60°

D. 90°

Answer: A

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14. The total intensity of the magnetic field of the earth at equator is 6.5 unit. What is its value a pole ?

A. 2

B. 4.5

C. 6.5

D. 0

Answer: C

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15. Direction of magnetic field of Earth is .....

A. from north to south

B. from south to north

C. only vertically downwards

D. only vertically upwards

Answer: B

Watch Video Solution

16. The lines of force due to earth's magnetic field are ..... .

A. Parallel, straight and horizontal

B. cylinderical

C. elliptical

D. curved lines

Answer: A

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17. At any place on the earth, the angle between the magnetic meridian and the geographic meridian is called ....

A. magnetic dip angle

B. magnetic latitude

C. magnetic declination

D. magnetic declination

Answer: C

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18. Write the unit of magnetic dipole moment.

A. Am^{-2}

B. Am^{-1}

C. JT^{-1}

D. $J^{-1}T$

Answer: C

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19. What is the maximum value of angle of dip ?

A. 90°

B. 180°

C. 60°

D. 360°

Answer: A

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20. What is the formula of angle of dip ?

A. (A) $\frac{\tan^{-1}(B_h)}{B_v}$

B. (B) $\frac{\tan^{-1}(B_v)}{B_h}$

C. (C) $\frac{\tan^{-1}(B_v)}{B}$

D. (D) $\frac{\tan^{-1}(B_h)}{B}$

Answer: B

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21. At which place magnetic dip angle is maximum ?

A. (A) on magnetic north pole and magnetic south pole

B. (B) only on magnetic north pole

C. (C) only on magnetic south pole

D. (D) on geographic north pole

Answer: A

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22. A place where the vertical component of Earth's magnetic field is zero has the angle of dip equal to ..... .

A. 0°

B. 60°

C. 90°

D. 45°

Answer: A

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23. Static electricity constant $\frac{1}{4\pi\varepsilon_0}$ is similar to the megnetic constant.

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

B. $\frac{\mu_0}{2\pi}$

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

D. μ_0

Answer: A

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Section D Multiple Choice Questions Mcqs Mcqs From Darpan Based On Textbook Magnetisation And Magnetic Properties Of Materials Permanent Magnets And Electromagnets

1. If relative permeability and magnetic susceptibility of paramagnetic substance are μ_r and χ_m respectively then .....

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

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

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

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

Answer: D

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2. Superconductors exhibit .....

A. ferromagnetism

B. paramagnetism

C. non-magnetism

D. diamagnetism

Answer: D

 Watch Video Solution

3. Which of following can not be ferromagnetic ?

A. Solid

B. Metal

C. Gas

D. Alloy

Answer: C

Watch Video Solution

4. Which of following is suitable for making permanent magnet ?

A. Copper

B. Steel

C. Nickel

D. Soft iron

Answer: B

Watch Video Solution

5. Which of following is more appropriate material for making an electromagnet ?

A. Copper

B. Steel

C. Nickel

D. Soft Iron

Answer: D

 Watch Video Solution

6. Material used for making permanent magnet has ..... and .....

A. high retentivity, low coercivity

B. low retentivity, high coercivity

C. low retentivity, low coercivity

D. high retentivity, high coercivity

Answer: D

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7. What type of materials can use to make an electromagnet ?

A. high retentivity, high coercivity.

B. low retentivity, low coercivity.

C. high retentivity, low coercivity.

D. low retentivity, high coercivity.

Answer: B

Watch Video Solution

8. Which of the following has negative magnetic susceptibility ?

A. Ferromagnetic substance

B. Paramagnetic substance

C. Diamagnetic substance

D. None of these

Answer: C

Watch Video Solution

9. The relative permiability of a diamagnetic substance is ....

A. (A) very large

B. (B) small but greater than 1

C. (C) less then 1

D. (D) negative

Answer: C

Watch Video Solution

10. Magnetic properties of which of the following materials do not affected by temperature ?

A. Diamagnetic

B. Paramagnetic

C. Ferromagnetic

D. All of these

Answer: A

 Watch Video Solution

11. A hydrogen atom is paramagnetic. A hydrogen molecule is ..... .

A. (A) Diamagnetic

B. (B) Paramagnetic

C. (C) Ferromagnetic

D. (D) None of above

Answer: A

Watch Video Solution

12. One ferromagnetic substance has magnetic susceptibility χ_m at $27^\circ C$ temperature. At which temperature, it would become half ?

A. $600^\circ C$

B. $300^\circ C$

C. $54^\circ C$

D. $327^\circ C$

Answer: D

Watch Video Solution

13. Hysteresis cycle of a permanent magnet is ..... and .....

A. short and broad

B. long and narrow

C. long and broad

D. short and narrow

Answer: C

Watch Video Solution

14. In non-uniform magnetic field, a diamagnetic substance experiences a resultant force ..... .

A. from the region of strong magnetic field to the region of weak magnetic field

B. perpendicular to the magnetic field

C. from the region of weak magnetic field to the region of strong magnetic field

D. which is zero

Answer: A

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15. When a paramagnetic substance is brought near to north or south pole of a bar magnet, then it .....

A. experiences repulsion

B. experiences attraction

C. does not experience attraction or repulsion

D. would experience attraction or repulsion, depending upon the polarity of pole.

Answer: B

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16. Magnetization for vaccum is .....

A. negative

B. positive

C. infinite

D. zero

Answer: D

Watch Video Solution

17. Water is .....

A. diamagnetic

B. paramagnetic

C. ferromagnetic

D. none of these

Answer: A

Watch Video Solution

18. The intensity of magnetization of a magnet of magnetic dipole moment $1.2\mathrm{Am}^2$ and dimension $0.15m \times 0.02m \times 0.01m$ is..... A/m.

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

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

C. $10^4 A/m$

D. $8 \times 10^4 A/m$

Answer: A

Watch Video Solution

19. Which of the following behaves as paramagnetic substance ?

A. Nickel

B. Iron

C. Aluminium

D. Hydrogen

Answer: C

Watch Video Solution

20. Magnetic susceptibility of paramagnetic substance is ..... .

A. zero

B. negative

C. positive

D. infinite

Answer: C

Watch Video Solution

21. Domain formation is the necessary feature of...

A. ferromagnetism

B. paramagnetism

C. diamagnetism

D. all of these

Answer: A

Watch Video Solution

22. Electromagnet is used in ...

A. electric bells

B. coil

C. galvanometer

D. ameter

Answer: A

Watch Video Solution

23. The magnetic susceptibility of a paramagnetic substance at -73° is 0.0050. Calculate magnetic susceptibility at -173° C.

A. 0.010

B. 0.0025

C. 0.0020

D. 0.0030

Answer: A

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24. Relative permeability of iron is 5500, then its magnetic susceptibility is .....

A. 55000×10^7

B. 5499

C. 5501

D. 5500×10^{-7}

Answer: B

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25. Magnetic field and magnetic intensity are 1 T and 150 Am^{-1} respectively in a iron core, then its relative permeability is .....

(Take $\mu_0 = 4\pi \times 10^{-7} \mu m^{-1}$)

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

B. $\frac{10^3}{4\pi}$

C. $\frac{10^3}{6\pi}$

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

Answer: D

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26. M is intensity of magnetisation and H is magnetic intensity. Give the formula of magnetic susceptibility (χ_m).

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

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

C. $M \times H$

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

Answer: A

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27. Magnetic susceptibility of vacuum is ...

A. 0

B. -1

C. 1

D. $+\infty$

Answer: A

Watch Video Solution

28. μ_0 is permeability of vacuum, χ_m is susceptibility, then permeability of a material...

A. $\mu = \mu_0(1 + \chi_m)$

B. $\mu = \mu_0(\chi_m - 1)$

C. $\mu = \mu_0(1 - \chi_m)$

D. $\mu = \dfrac{\mu_0}{1 + \chi_m}$

Answer: A

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29. According to Curie's law .....

A. $\chi_m \propto T$

B. $\chi_m \propto \dfrac{1}{T}$

C. $\chi_m \propto (T - 273)$

D. $\chi_m \propto \frac{1}{T^2}$

Answer: B

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30. A magnetic needle kept on horizontal surface oscillates in Earth's magnetic field. If the temperature of this needle is raised beyond the Curie temperature of the material of the needle, then ..... .

A. the periodic time of oscillation will decrease.

B. the periodic time of oscillation will increase.

C. the periodic time of the oscillation will not change.

D. the needle will stop oscillating.

Answer: D

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31. Relative permeability of a substance is 0.075. Its magnetic susceptibility is .....

A. 0.925

B. -0.925

C. 1.075

D. -1.075

Answer: B

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32. A toroid wound with 100 turns /m of wire carries a current of 3 A. The core of toroid is made of iron having relative magnetic permeability of $\mu_r = 5000\mu_0$ under given conditions. The magnetic field inside the iron is .....

(Tackle $\mu_0 = 4\pi \times 10^{-7} TmA^{-1}$)

A. 0.15 T

B. 0.47 T

C. $1.5 \times 10^{-2} T$

D. $1.88T$

Answer: D

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Section D Multiple Choice Questions Mcqs Mcqs From Darpan Based On Textbook Miscellaneous Mcqs

1. Magnetic susceptibility of a material of a rod is 499. Find absolute permeability of the material of the rod.

A. $\pi \times 10^{-4} \frac{Tm}{A}$

B. $4\pi \times 10^{-4} \frac{Tm}{A}$

C. $3\pi \times 10^{-4} \frac{Tm}{A}$

D. $2\pi \times 10^{-4} \frac{Tm}{A}$

Answer: D

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2. The variation of magnetic susceptibility χ_m with temperature for a paramagnetic substance is best represented by figure ...

A. 

B. 

C. 

D. 

Answer: D

View Text Solution

3. What is retentivity?

A. The magnitude of B when H is maximum.

B. The magnitude of H when B is maximum.

C. The magnitude of B when His zero.

D. The magnitude of M when H is zero.

Answer: C

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Section D Multiple Choice Questions Mcqs Mcqs From Darpan Based On Textbook Assertion And Reason Type Mcqs

1. Assertion : At neutral point, a compass needle may point out in any arbitrary direction.

Reason : Magnetic field of the earth is balanced by field due to magnet at any neutral point.

A. both are true and the Reason is the correct explanation of the Assertion.

B. both are true but the Reason is not correct explanation of the Assertion.

C. Assertion is true, but the Reason is false.

D. both, Assertion and Reason are false.

Answer: A

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2. A : Magnetic field lines are continuous and posses closed loop.

R : Magnet do not exist with single pole.

A. both are true and the Reason is the correct explanation of the Assertion.

B. both are true but the Reason is not correct explanation of the Assertion.

C. Assertion is true, but the Reason is false.

D. both, Assertion and Reason are false.

Answer: A

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Section D Multiple Choice Questions Mcqs Mcqs Asked In Competitive Exams Mcqs Asked In Aieee And Jee Main

1. What is the direction of magnetic dipole moment'?

A. North to South

B. South to North

C. East to West

D. West to East

Answer: B

Watch Video Solution

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

A. a force and a torque

B. a torque but not a force

C. a force but not a torque

D. neither a force nor a torque

Answer: A

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

A. attract all three of them

B. attract N_1 and N_2 strongly but repel N_3

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

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

Answer: C

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4. Relative permittivity and permeability of a material are $\in_r$ and μ_r, respectively. Which of the following values of these quantities are allowed for a diamagnetic material ?

A. $\in_r = 1.5, \mu_r = 1.5$

B. $\in_r = 0.5, \mu_r = 1.5$

C. $\in_r = 1.5, \mu_r = 0.5$

D. $\in_r = 0.5, \mu_r = 0.5$

Answer: C

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5. The coercivity of a small magnet where the ferromagnet gets demagnetized is $3 \times 10^3 \mathrm{Am}^{-1}$ The current required to be

passed in a solenoid of length 10 cm and number of turns 100, so that the magnet gets demagnetized when inside the solenoid is:

A. $3A$

B. $6A$

C. $30mA$

D. $60mA$

Answer: A

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6. The figure gives experimentally measured B vs H variation in a ferromagnetic material. The retentivity, coercivity and saturation, respectively, of the material are

A. 50 A/m, 1 T, 1.5 T

B. 1.5 T, 50 A/m, 1 T

C. 1 T, 50 A/m, 1.5 T

D. 50 A/m, 1.5 T, 1 T

Answer: C

View Text Solution

7. The dimension of $\frac{B^2}{2\mu_0}$, where B is magnetic field and μ_0 is the magnetic permeability of vacuum is

A. $M^1L^{-1}T^{-2}$

B. $M^1L^2T^{-2}$

C. $M^1L^{-1}T^2$

D. $M^1L^{-2}T^{-1}$

Answer: A

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Section D Multiple Choice Questions Mcqs Mcqs Asked In Competitive Exams Mcqs Asked In Cbse Pmt Aipmt Neet

1. A 250 turn rectangular coil of length 2.1 cm and width 1.25 cm carries a current Of 0.85 μ_A and subjected to a magnetic field of strength 0.85 T. Work done for rotating the coil by 180° against the torque is .....

A. $4.55\mu J$

B. $2.3\mu J$

C. $1.15\mu J$

D. $9.1\mu J$

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 induced electric field due to the changing magnetic field.

B. the current source

C. the lattice structure of the material of the rod

D. the magnetic field

Answer: B

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3. At a point A on the earth's surface the 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: D

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Section D Multiple Choice Questions Mcqs Mcqs Asked In Competitive Exams Mcqs Asked In Aiims

1. For ideal diamagnetic substance, magnetic susceptibility is ..... .

A. -1

B. 0

C. $+1$

D. ∞

Answer: A

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2. Which of the following substance has negative value of χ_m ?

A. Diamagnetic

B. Paramagnetic

C. Ferromagnetic

D. All above

Answer: A

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Section D Multiple Choice Questions Mcqs Mcqs Asked In Competitive Exams Mcqs Asked In Board Exam And Gujcet

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

A. 30°.

B. 45°

C. 60°

D. 0°

Answer: C

Watch Video Solution

2. A substance is placed in a non-uniform magnetic field. It experiences weak force towards the strong field. The substance is ..... type.

A. Ferromagnetic

B. Diamagnetic

C. Paramagnetic

D. None of these

Answer: C

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3. The relation between B_v, B_h and B is ..... .

A. $B = \sqrt{B_h^2 + B_v^2}$

B. $B = B_h . B_v$

C. $B = \frac{B_v}{B_h}$

D. $B = \frac{B_h}{B_v}$

Answer: A

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4. Alnico is an alloy of.....

A. Ai, Ni, Cu, P

B. AI, Ni, Cu, Co

C. AI, Ni, As, P

D. AI, As, P, Pt

Answer: B

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5. Which one of the following represent Curie's law?

A. $M = \frac{C_\chi}{T}$

B. $M = \frac{CB_0}{T}$

C. $M = \frac{C_\chi}{T - T_e}$

D. $M = \frac{CT}{B_0}$

Answer: B

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6. At the place, on the surface of the earth, ratio of horizontal and vertical component of the magnetic field is $\sqrt{3}$ then angle of dip at this place is.....rad

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

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

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

D. zero

Answer: B

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7. Meissner effect is observed in..... substances.

A. ferromagnetic

B. paramagnetic

C. superconducting

D. permanent magnetic

Answer: C

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