PHYSICS

BOOKS - MODERN PUBLICATION

MAGNETIC DIPOLE & EARTH'S MAGNETISM

EXAMPLE

1. Two poles , one of which is 3 times as strong as the other, exert on each other a force equal to $3 \times 10^{-3} N$, when placed 10 cm apart in air. Find the strength of each plane.

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2. A planar loop of irregular shape encloses an area of $7.5 \times 10^{-4} m^2$, and carries a current of 12A. The sense of flow of current appears to be clockwise to an observer. What is the magnitude and direction of the magnetic moment vector associated with the current loop?

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3. A bar magnet of length 0.1 m has a pole strength of 50 A m. Calculate the magnetic field at distance of 0.2 m from tis centre on its axial line

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4. A bar magnet of length 0.1 m has a pole strength of 50 A m. Calculate the magnetic field at distance of 0.2 m from tis centre on its equitorial line.

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5. The pole strength of a bar magnet is 48 ampere-metre and the distance between its poles is 25cm. The moment of the couple by which it can be placed at an angle of 30° with the uniform magnetic intensity of flux density $0.15 \text{newton} / \text{ampere-metre}$

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6. Calculate the work done in rotating a bar magnet of magnetic moment $3JT^{-1}$ through an angle of 60° from its position

along a magnetic field of strength $0.34 \times 10^{-4} T$

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7. The vertical component of earth's magnetic field is $\sqrt{3}$ times the horizontal component. What is the value of dip at this place?

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8. A bar magnet 30 cm long is placed in the magnetic meridian with its north towards south of the earth. If the neutral point is obtained 30 cm from the magnet, find magnetic dipole moment and pole strength of the magnet.

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9. A bar magnet of length 10cm is placed in the magnetic meridian with its north pole pointing towards the geographical north. A neutral point is obtained at a distance of 12cm from the centre of the magnet. Find the magnetic moment of the magnet, when H=0.34 gauss.

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10. Two equal and unlike poles placed 5cm apart in air attract each other with a force of 14.4×10^4 N.How far from each other should they be placed so that the force of attraction will be $1.6 \times 10^4 N$.

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

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12. A circular coil of 50 turns and radius 0.2 cm carries a current of 12 A. Find magnetic field at the centre of the coil.

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13. A circular coil of 50 turns and radius 0.2 cm carries a current of 12 A. Find magnetic moment associated with it.

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14. An electron in an atom revolves around the nucleus in an orbit of radius $0.53\overset{\circ}{A}$. If the frequency of revoluation of an electron is9×10^9 MHz. calculate the orbital angular momentum.

[Given : Charge on an electron =$1.6 \times 10^{-19}C$, Gyromagnetic ratio $8.8 \times 10^{10}C/kg, \pi = 3.142$]

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15. A short bar magnet has a magneti momenet 0.24 JT^{-1}. Calculate the magnitude of the magnetic field produced by the magnet at a distance of 10 cm form the centre of the magnet on the axis of the magnet.

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16. A short bar magnet has a magnetic moment of $0.2JT^{-1}$. Calculate the magnitude of the magnetic field produced by the magnet at a distance of 8 cm from the centre of the magnet on the equitorial line of the magnet.

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17. Two identical short bar magnets each of magnetic moment `12.5Am^2 are placed at a separation of 10cm between their centres, such that their axes are perpendicular to each other. Find the magnetic field at a point midway between the two magnets.

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18. A bar magnet placed in a uniform magnetic field of strength 0.3T with its axis at 30° to the field experiences a torque of 0.06Nm. What is the magnetic moment of the bar magnet?

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

What is the magnetic moment of the magnet ?

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20. Each atom of an iron bar $(5cm \times 1cm \times 1cm)$ has a magnetic moment $1.8 \times 10^{-23} Am^2$. Knowing that the density of iron is 7.78×10 ^3 kgm -3 , atomic weight is 56 amu and

avogadro's number is 6.02×10^ 23What will be the magnetic moment of the bar in the state of magnetic saturation.

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21. Each atom of an iron bar $(5cm \times 1cm \times 1cm)$has a magnetic moment $1.8 \times 10^{-23} Am^2$.

What will be the torque required to place this magnetised bar perpendicular to magnetic field of 15000 gauss?

Density of iron =$7.8 \times 10^3 kg/m^3$, Atomic wt. of iron =56,

Avogadro's number =$6.023 \times 10^{23}/gm$mole.

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22. A magnet having magnetic moment of$2.0 \times 10^4 \frac{J}{T}$is free to rotate in a horizontal plane where magnetic field is$6 \times 10^{-5} T$.

Find the work done to rotate the magnet slowly from a direction parallel to field to a direction 60° from the field .

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

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24. The declination at a place is $12^\circ C$ west of north. Find in what direction, a ship should stear so that it reaches a place due east?

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25. A ship is sailing due east according to Mariner's compass. If the declination of that plae is $18^{\circ} C$ east of north, what is the true directio of the ship?

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26. The vertical component of the earth's magnetic field at a given place is $\sqrt{3}$ times its horizontal component. If total intensity of earth's magnetic field at the place is 0.4G, find the vale of angle of dip

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27. The vertical component of the earth's magnetic field at a given place is $\sqrt{3}$ times its horizontal component. If total

intensity of earth's magnetic field at the place is 0.4G, find the vale of the horizontal component of earth's magnetic field.

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28. If δ_1 and δ_2 be the apparent values of dip observd in two planes at right angles to each otherand δ is the true angle of dip, prove that $\cot^2\delta_1 + \cot^2\delta_2 = \cot^2\delta$

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29. The true value of dip at a place is 45° If the plane of the dip circle is turned through 60° from the magnetic meridian, what will be the apparaent value of the dip?

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

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31. A small magnet of magnetic moment M is placed at broad side on position of a magnet of magnetic M', length 2l' in such a way that the axis of former coincides with the perpendicular bisector of the latter. The separation between their centres is d. Calculate the nature of interaction (force or couple) among them. What is its limiting value, when d becomes very large ?

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32. A bar magnet of length 10cm is placed in the magnetic meridian with its north pole pointing towards the geographical north. A neutral point is obtained at a distance of 12cm from the centre of the magnet. Find the magnetic moment of the magnet, when H=0.34 gauss.

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33. A coil in the shape of an equilateral triangle of side 0.02 m is suspended from a vertex such that it is hanging in a vertical plane between the pole pieces of a permanent magnet producing a horizontal magnetic field of $5 \times 10^{-2} T$. Find the couple acting on the coil when a current of 0.1 A is passed through it and the magnetic field is parallel to its plane.

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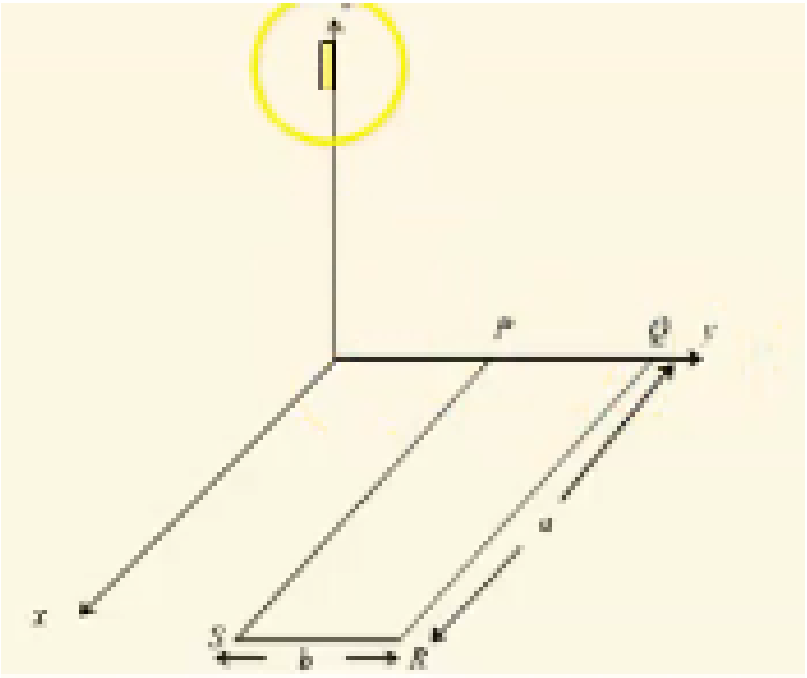
34. A rectangular loop PQRS made from a uniform wire has length a, width b and mass m. It is free to rotate about the arm PQ, which remains hinged along a horizontal line taken as the y-axis (see figure). Take the vertically upward direction as the z-axis. A uniform magnetic field $\overrightarrow{B} = \left(3\hat{i} + 4\hat{k}\right)B_0$exists in the region. The loop is held in the x-y plane and a current I is passed through it. The loop is now released and is found to stay in the horizontal position in equilibrium

What is the direction of the current I in PQ?



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35. A magnet is suspended in the magnetic meridian with an untwisted wire. The upper end of wire is rotated through 180° to deflect the magnet by 30° from magnetic meridian. When this magnet is replaced by another magnet, the upper end of wire is

rotated through 270° to deflect the magnet 30° from magnetic meridian. The ratio of magnetic moment of magnets

A. 1:5

B. 1:8

C. 5:8

D. 8:5

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36. A magnet of magnetic moment M is freely suspended in a constant uniform magnetic field B. Calculate the work done indeflecting the magnet through an angle θ from the direction of B.

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37. A circular coilof radius 0.157 m has 50 number of turns. It is placed such that its axis is in magnetic meridian. A dip needle is supported at the centre of the coil with its axis of rotation horizontal, and in the plane of the coil. The angle of dip is 30° when a current flows through the coil. The angle of dip becomes 60° on reversing the current. Find the current in the coil assuming that the magnetic field due to the coil is smaller than the horizontal component of earth's magnetic field, $H = 3 \times 10^{-5} T$.

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38. A small magnet of magnetic moment $\pi \times 10^{-3} Am^2$ is placed on the Y-axis at a distance of 0.1 from the origin with its axis parallel to the X-axix. A coil have 169 turns and radius 0.05 m

is placed on the X-axis at a distance of 0.12 m from the origin with the axis of the coil coinciding with the X-axis. Find the magnitude and direction of the current in the coil for a compass needle placed at the origin, to point in the north-south direction.

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39. A vibration magnetometer consists of two identical bar magnets, placed one over the other, such that they are mutually perpendicular and bisect each other. The time period of oscillation in a horizontal magnetic field is 4 second. If one of the magnets is taken away, find the period of oscillation of the other in the same field.

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40. What is a magnet?

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41. What do you mean by directive property of a magnetic dipole?

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42. What will happen to the dipole moment, if a bar magnet is cut into equal pieces parallel to its length?

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43. What happens if a bar magnet is cut into places tranverse to its length.

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44. Why ordinarily a piece of iron does not behave as a magnet?

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45. What is the source of magnetism?

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46. Does an isolated magnetic pole exist like an isolate electric charge?

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47. Write SI unit of

magnetic pole of strength?

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48. Define the term electric dipole moment. Is it a scalar or a vector quantity?

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49. What is the unit of magnetic dipole moment?

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50. What is the direction of magnetic dipole moment?

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51. How does a current loop behave like a magnetic dipole?

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52. Define Bohr magneton and write its value.

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53. What is the magnetic moment of an electron due to its orbital motion?

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54. Find out the vlaue of 1 Bohr magneton. Givne $h = 6.62 \times 10^{-34} Js, e = 1.6 \times 10^{-19} C$ and $m_e = 9.1 \times 10^{-31} kg$

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55. what is the torque experienced by a magn etic dipole of magnetic moment M placed with its axis at an angle θ with a uniform external magnetic field B?

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56. A short bar magnet, placed with its axis making an angle θ with a uniform magntic field $\vec{B}$, expriences a torque $\vec{\tau}$. What is the magnetic moment of the magnet?

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57. General instructions same as iin chapter 1.

Assertion:A bar magnet exerts a torque on itself due to its own field.

Reaons: Magnetic field due to a magnet is uniform.

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

A. translatory motion only

B. rotaional motion only

C. both translatory and rotational motion

D. vibrational motion only

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59. What should be orientation of a magnetic dipole in a uniform magnetic field so that its potential energy is maximum?

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60. Compare the magnetic fields due to a solenoid and a bar magnet.

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61. What should be orientation of a magnetic dipole in a uniform magnetic field so that its potential energy is maximum?

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62. What is the basic difference between magnetic lines of force and electric lines of force?

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63. Why two magnetic lines of forces never intersect each other?

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64. Answer the following questions:The earth's core Is known to contain Iron. Yet geologists do not regard this as a source of the earth's magnetism. Why?

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65. Why does a bar magnet always stand in N-S direction,when suspended freely?

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66. Define magnetic axis, geographic axis, magnetic meridian and geographical meridian.

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67. Magnetic meridian is a

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68. What are the elements of the earth's magnetic field? Define them.

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69. What are the elements of the earth's magnetic field? Define them.

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70. What are the elements of the earth's magnetic field? Define them.

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71. 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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72. Define angle of magnetic inclination at a plane.

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73. Explain with the help of diagram the terms magnetic declination

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74. Explain with the help of diagram the terms:

angle of dip at a given place.

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75. At a certain location in Africa, a compass needle points 15° west of the geogrphic north. What is the angle of declination at the point ?

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76. How does the knowledge of declination at a place help in navigation?

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77. A small magnet is pivoted to move freely in the magnetic meridian. At what place on the earth's surface, will the magnet be vertical?

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78. In which direction would a compass needle allign if taken to geographic : North Pole.

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79. Answer the following questions regarding earth's magnetism:

In which direction would a compass free point to, If located right on the geomagnetic north or south pole?

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80. Define angle of magnetic inclination at a plane.

Watch Video Solution

81. Explain with the help of diagram the terms:

angle of dip at a given place.

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82. The angle of dip at the magnetic equator is

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83. Answer the following questions 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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84. What is the expected value of dip at magnetic poles of the earth?

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85. What is the maximum and minimum value of dip?

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86. The horizontal component of the earth's magnetic field at a place is B_H and angle of dip is 60° What is the value of vertical component of earth's magnetic field at equator?

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87. What is a neutral point in a magnetic field of a bar magnet.

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88. What is a neutral point in a magnetic field of a bar magnet.

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89. It is found that the neutral points lie along the axis of a magnet placed on a table. What is the orientation of the magnet w.r.t. the earth's magnetic field.

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90. A magnet is placed with its north pole towards north of the earth. Predict the position of the neutral points.

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91. A magnet is placed with its north pole towards south of the earth. Predict the position of the neutral points.

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92. State four properties of a bar magnet.

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93. What happens if a bar magnet is cut into places tranverse to its length.

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94. What happens if a bar magnet is cut into pieces along its length?

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95. 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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96. Two identical looking iron bars A and B are given, one of which definitely known to be magnetised. 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 two bars A and B.

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97. A steel wire of length l has a magnetic moment M. It is then bent into semicircular arc. What is the new magnetic moment?

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98. An iron bar is magnetised with the help of another magnet or by subjecting it to a magnetising field. The magnetism acquired by the magnet is assumed due to the alignment of molecular magnet. Does the length to the iron bar undergo a change during the magnetisation process?

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99. The poles of a magnet cannot be separated. How does this statement derive support from the magnetic dipole bahaviour of a current loop?

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100. A circular coil of N turns and radius R carries a current I. It is unwound and rewound to make another coil of radius R/2, current I remaining the same. Calculate the ratio of the magnetic moments of the new coil and the orginal coil

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101. What is the unit of magnetic dipole moment?

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102. Magnetic dipole moment is a quantity directed from

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103. A magnetic needle suspended freely in uniform magnetic field experience a torque but no net force. An iron nail near a bar magnet however experience a force of attraciton in addition to torque. Why?

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104. Why does a configuration of charges possess potential energy?

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105. A bar magnet of magnetic moment M is aligned parallel to the direction of a uniform magnetic field B. Calculate work done to align the magnetic moment opposite to the field .

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106. A bar magnet of magnetic moment M is aligned parallel to the direction of a uniform magnetic field B. Calculate work done to align the magnetic moment normal to field direction?

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107. Magnetic field lines can be entirely confined within the core of a toroid, but not within a straight solenoid. Why?

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108. 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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109. What is probable cause of earth's magnetism?

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110. Answer the following questions:The earth's core Is known to contain Iron. Yet geologists do not regard this as a source of the earth's magnetism. Why?

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111. Answer the following questions: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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112. Answer the following questions regarding earth's magnetism:The earth's field, It Is claimed, roughly approximates the field due to a dipole of magnetic moment $8 \times 10^{22} J$ "T1 located at Its centre. Check the order of magnitude of this number In some way.

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113. Answer the following questions regarding earth's magnetism: f 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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114. Answer the following questions: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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115. Answer the following questions: 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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116. Answer the following questions:The earth may have even reversed the direction of Its field several times during its history of 4 to 5 billion years. How can geologists know about the earth's field in such distant past?

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117. Answer the following questions 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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118. Answer the following questions: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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119. What do you mean by magnetic lines of force? Why two such lines do not cross each other?

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120. What are maganetic elements at a place. Define them.

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121. What are the elements of the earth's magnetic field? Define them.

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122. Define the term angle of dip and magnetic declination. The angle of dip at a place in Kerala is 18°. Will its value be more or less at a place in Kashmir? Give reason.

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123. Define the term angle of dip and magnetic declination. The angle of dip at a place in Kerala is 18°. Will its value be more or less at a place in Kashmir? Give reason.

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124. What is the angle of dip at a place where the horizontal and vertical component of earth magnetic field are equal?

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125. Define the terms magnetic inclination and horizontal component of earth's magnetic field at a place. Establish the relationship between the two with help of a diagram.

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126. Define the terms angle of dip. Derive the relation between angle of dip and the resultant magnetic field of earth at a place.

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127. Horizontal and vertical components of earth's magnetic field at a place are 0.22 tesla and 0.38 tesla respectively. Find the resultatnt intensity of earth's magnetic field.

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

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

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130. Horizontal component of earth's magnetic field at a place is $\sqrt{3}$ times the vertical component. What is the value of angle of dip at this place?

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131. The ratio of the horizontal component to the resultant magnetic field of earth at a given place is $1/\sqrt{2}$. What is the

angle of dip at that place?

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132. The horizontal component of earths's magnetic field at a place is $0.3 \times 10^{-4} T$. If the angle of dip is 60°, what is the total earth's magnetic field?

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133. The horzinontal component of earth's magnetic field is 0.2 gauss and total magnetic field is 0.4 gauss. Find angle of dip.

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134. If a compass needle be placed on the magnetic north pole of the earth, then how does it be have ? If a dip needle be placed at the same place, then what will be its behaviour?

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135. An unmagnetised piece of iron is attracted to a bar magnet. Explain the origin of this attractive force.

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136. If magnetic monopoles existed, how would Gauss's law of magnetism be modified.

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137. Can you think of a magnetic field configuration with three poles?

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138. Must every magnetic field configuration have a north pole and a south pole? What about the field due to a toroid?

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139. Magnetic lines of force should better be called as field lines. Explain.

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

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141. An electron in the ground state of hydrogen atom is revolving in anti-clock wise direction in a circular orbit. The atom is placed in a magnetic filed such that the normal to the electron orbit makes an angle of 30° with the magnetic field. Find the torque experienced by the orbiting electron.

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142. Two particles , each of mass m and charge q, are attached to the two ends of a light rigid rod of length 2 R . The rod is rotated at constant angular speed about a perpendicular axis passing through its centre. The ratio of the magnitudes of the magnetic moment of the system and its angular momentum about the centre of the rod

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143. A magnetic dipole is free to rotate in a uniform magnetic field. For what orientation of the magnet with respect to the field torque is maximum?

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144. What should be orientation of a magnetic dipole in a uniform magnetic field so that its potential energy is maximum?

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145. A magnetic dipole is free to rotate in a uniform magnetic field. For what orientation of the magnet with respect to the field rate of change of torque with deflection is maximum?

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146. A magnetic needle is placed on a cork floating on a still lake in the northern hemisphere. Does this needle together with the cork move towards the north of the lake?

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147. A magnetic needle is placed on a cork floating on a still lake in the northern hemisphere. Does this needle together with the cork move towards the north of the lake?

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148. A dip needle with a circular scale is mounted on a horizontal axis. How can the direction of the magnetic meridian be found with the help of this needle?

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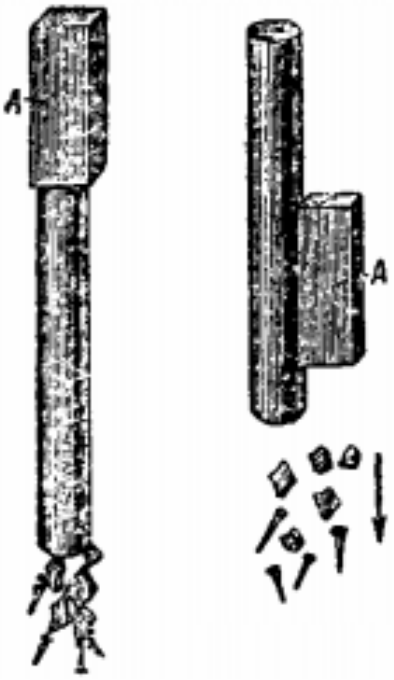
149. A long rod made of soft iron is fixed in a vertical position. If a strong magnet A is brought into contact with its upper end, as shown in Fig., then the rod becomes so strongly magnetised

that its lower end can support several small objects. If the same magnet is brought in contact with the side of the rod, quite close to the lower end (Fig,), then there is no such strong magnetisation, and the same objects cannot be supported at the lower end of the rod. Explain why magnet A acts differently in the two cases.



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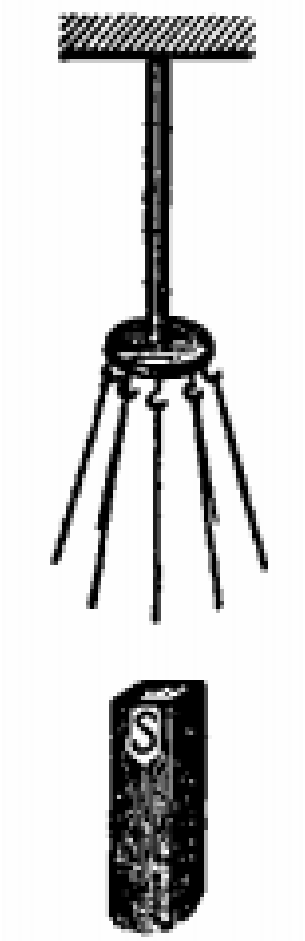
150. Several steel needles are suspended freely from hooks on a small brass disk, as shown in Fig.. If the pole of a strong magnet is slowly raised from below, the needles begin to separate, and then, when the magnet is quite close, they return to a vertical position. When the magnet is moved away, the needles again separate, forming a conical pencil. Discuss this behaviour of the

needles.



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151. A small magnet A makes 10 vibrations in 90 seconds in earth's field. When another magnet B of short length is placed 0.1 m due south of the direction of earth's field, the magnet A makes 10 vibrations in 45 seconds . Calculate the magnetic moment of magnet B. Given $B_H = 0.3G$

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EXERCISE

1. State four properties of bar magnet.

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2. Explain the magnetism on the basis of atomic theory.

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3. Define magnetic pole.

Watch Video Solution

4. What is a magnetic dipole? Define magnetic dipole moment. Give its SI unit?

Watch Video Solution

5. A current loop behaves as a mgnetic dipole. Obtain expression for magnetic dipole moment of a current loop.

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6. In a hydrogen atom, an electron of charge e revolves in an orbit of radius r with a speed v. Prove that the magnetic mometn associated with the electron is given bye evr/2.

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7. Explain how an atom behaves as a magnetic dipole. derive an expression for the magnetic dipole of the atom. Also define Bohr magneton.

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8. Deduce the expression for the magnetic dipole moment of an electron orbitting around the central nucleus.

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9. Derive an expression for the magnetic dipole moment of an atom.

Watch Video Solution

10. Deduce the expression for the magnetic dipole moment of an electron orbitting around the central nucleus.

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11. What is the relationship between the current and the magnetic moment of a current carrying circular loop? Use the expression to derive the relation between the magnetic moment of an electron moving in a circle and its related angular momentum?

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12. Derive an expression for the magnetic dipole moment of an atom.

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13. Explain how an atom behaves as a magnetic dipole. derive an expression for the magnetic dipole of the atom. Also define Bohr magneton.

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14. What do you understand by magnetic field ? Define its strength and SI unit. Also, give its dimensional formula.

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15. Define magnetic field intensity at a point and derive an expression for it at a point on the axial line of magnetic dipole. Also deduce the expression for small dipole.

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16. Obtain an expression for electric field intensity at any point on equitorial line of electric dipole. What is the direction of electric field?

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17. What is magnetic dipole? Derive an expression for magnetic field intensity at a point on the equitorial line of a bar magnet.

Watch Video Solution

18. Derive an expression for the magnetic field due to magnetic dipole in broad-side on position at a distance r from its centre. The length of the dipole is 2 l and its magnetic moment is M.

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19. Derive an expression for the torque expereinced by a amgnetic dipole suspened in a uniform magneic field.

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20. Derive an expression for torque acting on a bar magnet placed in a uniform magnetic field.

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21. Find an expression for the torque experienced by a magnetic dipole placed in a uniform magnetic field. Also give the SI unit of magnetic dipole moment.

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22. Derive an expression for the torqe experienced by magnetic dipole in a uniform magnetic field and hence define magnetic dipole moment.

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23. Derive an expression for torque acting on a bar magnet placed in a uniform magnetic field.

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24. Derive an expression for potential energy of a bar magnet, when placed uniform magnetic field. When it is maximum and minimum?

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25. Magentic field lines are.....

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26. What do you mean by magnetic lines of force? Why two such lines do not cross each other?

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27. What is the cause of earth's magnetism?

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28. What is the cause of earth's magnetism?

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29. Define magnetic elements of Earth.

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30. Define parameters of earth's magnetic field.

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31. What are the elements of the earth's magnetic field? Define them.

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32. Explain three magnetic elements of earth's magnetic field at a given place.

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33. Define the terms magnetic dip and magnetic declination with the help of relevant diagram.

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34. Explain three magnetic elements of earth's magnetic field at a given place.

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35. Explain the terms Declination

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36. Explain the terms magnetic Dip

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37. Explain the terms the magnetic field due to earth at a point.

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38. Explain three magnetic elements of earth's magnetic field at a given place.

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39. What are the elements of the earth's magnetic field? Define them.

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40. What are the elements of the earth's magnetic field? Define them.

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41. Explain how an atom behaves as a magnetic dipole. derive an expression for the magnetic dipole of the atom. Also define Bohr magneton.

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42. Define magnetic field intensity at a point and derive an expression for it at a point on the axial line of magnetic dipole. Also deduce the expression for small dipole.

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43. What is magnetic dipole? Obtain the an expression for strength of magnetic field at a distance r from its centre on the axial line of the dipole.

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44. What is magnetic dipole? Derive an expression for magnetic field intensity at a point on the equitorial line of a bar magnet.

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45. What is a magnetic dipole? Obtain for the strength of magnetic field at a point at distance r from its centre on axial line.

Find the strength of the field in special case, when the length of the magnet is very small as compared to the distance r.

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46. What is a magnetic dipole? Obtain for the strength of magnetic field at a point at distance r from its center on eqitorial line.

Find the strength of the field in special case, when the length of the magnet is very small as compared to the distance r.

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47. How will you represent diagrammatically uniform and non-uniform magnetic field?

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48. Derive an expression for torque acting on a bar magnet placed in a uniform magnetic field.

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49. Find the amount of work done in rotating a magnet through an angle θ against the torque acting due to uniform magnetic field. What happens to the work done?

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50. Derive an expression for torque acting on a bar magnet placed in a uniform magnetic field.

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51. Compare the magnetic fields due to a solenoid and a bar magnet.

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52. Explain three magnetic elements of earth's magnetic field at a given place.

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53. What is probable cause of earth's magnetism?

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54. Define magnetic elements of Earth.

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55. What is a neutral point in a magnetic field of a bar magnet.

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56. What is a neutral point in a magnetic field of a bar magnet.

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57. A bar magnet has a magnetic moment of $10Am^2$. If its magnetic length is 5 cm, calculate its pole strength.

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58. Two equal magnetic poles placed 25 cm apart in air exert a fore o $4 \times 10^{-3}N$ on each other. What should be the distance between them, so that force exerted by them on each other becomes 0.1 N?

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59. Two magnetic poles, one of which is four times stronger than the other exert a force of 5 gf on each other, whe placed at distance of 10 cm in air. Find the strength of each pole.

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60. Two like magnetic poles of strenth 25 A m and 64 A m are situated 1.0 m apart in air. At what point on the line, joining the two poles, the magnetic field will be zero?

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61. Two identical magnetic with a length 10 cm and weight 50 g of each are arranged freely with their like poles facing in a

inverted vertical glass tube. The upper magnet hangs in the air above the lower one so that the distance between the nearest pole of the magnet is 3mm. Pole strength of the poles of each magnet will be

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62. A magnetised steel wire 31.4cm long has a pole strength of 0.2Am. It is bent in the form of a semicircle. Calcualte its magnetic moment.

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63. Two thin bar magnets of pole strengths 4Am and 7Am respectively and length 0.21m and 0.12m respectively are placed at right angles to each other with the N-pole of first angles to

each other with the N-pole of first touching the S-pole of the second. Find the magnetic moment of the system.

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64. A planar loop of irregular shape encloses an area of $7.5 \times 10^{-4} m^2$, and carries a current of 12A. The sense of flow of current appears to be clockwise to an observer. What is the magnitude and direction of the magnetic moment vector associated with the current loop?

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65. A circular coil of 300 turns and diameter 14 cm carries a current of 15 A. what is the magnitude of magnetic moment associated with the coil?

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66. A circular coil of 200 turns and radius 0.2 m carries a current of 14 A. What is the magntitude of magnetic moment associated with the coil?

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67. An electron in an atom revolves around the nucleus in an orbit of radius $0.53\overset{\circ}{A}$. Calculate the equivalent magnetic moment, if the frequency of revolution of electron is $6.8 \times 10^9 MHz$.

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68. In a hydrogen atom, the electron moves in an orbit of radius $0.5\overset{\circ}{A}$ making 10^{16} r.p.s. Calculate the magnetic moment associated with the orbtial motion of electron.

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69. In hydrogen atom, an electron is making $6.6 \times 10^{15} r.\, p.\, s$ around the nucleus in an orbit of raidius $0.523\overset{\circ}{A}$. Caluculate the equivalent magnetic dipole moment.

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70. The electron in the hydrogen atom is moving with a speed of $2.3 \times 10^{6} ms^{-1}$ in anorbit of raidisu $0.53\overset{\circ}{A}$. Calculate the magnetic moment of the revolving electron.

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71. A muon is a particle that has the same charge as that of an electron but is 200 times revolves round a proton instead of an electron then what will be the orbital magnetic moment of the muon in the ground state of such an atom ?

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72. What is the magnitude of axial field due to a bar magnet of length 5 cm at a distance of 50 cm from its mid-point if its magnetic moment is $0.40Am^2$?

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73. A bar magnet is 0.1 m long and its pole strength is 12 Am. Find the magnetic induction at a point on its axis at a distance of 0.2 m from its centre.

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74. Two short magnets of magnetic moment$2Am^2$ and $5Am^2$ are placed along two lines drawn at right angle to each other on the sheet of paper as shown in the figure. What is the magnetic field at the point of intersection of their axis?

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75. A magnetised needle of magnetic moment $4.8 \times 10^{-2} JT^{-1}$ is placed at 30° with the direction of uniform magnetic field of

magnitude $3 \times 10^{-2} T$. Calculate the torque acting on the needle.

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76. A short bar magnet placed with its axis at 30° with a uniform external magnetic field of 0.35 T experiences a torque of magnitude equal to $4.5 \times 10^{-2} Nm$. The magnitude of magnetic moment of the given magnet.

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77. A short bar magnet experiences a torque of 0.012 Nm, with its axis placed at 60° with a uniform magnetic field of 0.4 T. What orientation of the magnet corresponds to its stable equilibrium

in the magnetic field? Calculate the Potential energy in this position.

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78. Calculate the work done in rotating a bar magnet of magnetic moment $3JT^{-1}$ through an angle of 60° from its position along a magnetic field of strength $0.34 \times 10^{-4}T$

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79. A bar magnet having a magnetic moment of $1.0 \times 10^4 JT^{-1}$ is free to rotate in a horizontal plane. A horizontal magnetic field $B = 4 \times 10^{-5}$ T exists in the space. Find the work done in rotating the magnet slowly from a direction parallel to the field to a direction 60° from the field.

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80. A circular coil of 100 turns has an effective radius of 0.05 m and carries a current of 0.1 A. How much work is required to turn it in an external magnetic field of $1.5 Wbm^{-2}$through 180° about an axis perpendicular to the magnetic field. The plane of the coil is initially perpendicular to the magnetic field.

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81. A ship is sailing due east according to Mariner's compass. If the declination of that plae is $18^{\circ} C$ east of north, what is the true directio of the ship?

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82. The horizontal and vertical components of earth's magnetic field at a place are 0.22 G and 0.38G respectively. Calculate the angle of dip.

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83. Horizontal component of earth's magnetic field at a place is $\sqrt{3}$ times the vertical component. What is the value of angle of dip at this place?

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84. At 52° from the magnetic meridian, a magnetic needle in a vertical plane makes an angle of 45° with the horizontal plane. Find the actual angle fo dip at that place.

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85. A dip circle is adjusted so that its needle moves freely in the magnetic meridian. In this position, the angle of dip ia 45°. Now the dip circle is rotated so that the plane in which the needle moves makes an angle of 30° with the magnetic meridian. In this position the needle will dip by an angle

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86. A small bar magnet has a magnetic moment$5Am^2$. The neutral point is obtained on axial line when it is placed in magnetic meridian with its N pole pointing S of earth and neutral point is obtained on equatorial line, when it is placed with its N pole pointing towards north of earth. If horizontal

component of earth's field is 0.38G, find the position of neutral points in the two cases.

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87. A short bar magnet is placed in a horizontal plane with its axis in the magnetic merdian . Null points are found on its equitorial line (i.e., its normal bisector) at 12.5 cm and the earth's magnetic field at the place is 0.38 G the angle of dip is zero.

(i) What is the total magnetic field at points on the axis of the magnet located by the same distance (12.5 cm) as the null-points from the centre?

(ii) Locate the null points when the magnet is turned around by 180° .

Assume that the length of the magnet is negligible as compared to the distance of the null-point from the centre of the magnet.

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88. The earth's magnetic field may be considered to be due to a short magnet placed at the centre of the earth and oriented along the magnetic south-north direction. the ratio of the magnitude of the magnetic field on the earth's surface of magnetic equator to that at the magnetic poles

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89. A short magnet of magnetic moment 2.0 Weber-metre is lying in a horizontal plane with its north pole pointing 60° east of north. Find the net magnetic field at a point north of the magnet 0.2 m away from it. Horizontal component of earth's magnetic field $= 0.3 \times 10^{-4} T$.

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90. A bar magnet with poles 25 cm apart and of strength 14.4 amp - m rests with centre on a frictionless pivot. It is held in equilibrium aat an angle of 60° with respect to a uniform magnetic field of induction $0.25 Wb/m^2$, by applying a force F at right angles to its axis at a point 10 cm from pivot. Calculate F.

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91. A small coil of radius 0.002 m is placed on the axis of a magnet of magnetic moment $10^5 JT^{-1}$ and length 0.1 m at a distance of 0.15 m from the centre of the magnet. The plane of the coil is perpendicular to the axis of the magnet. Find the force on the when a current of 2.0 A is passed through it.

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92. A magnetic needle free to rotate about the vertical direction (compass) point 3.5 west of the geographic north . Another magnetic needle free to rotate in a vertical plane parallel to the magnetic meridian has its north tip pointing down at 18° with the horizontal . The magnitude of the horizontal component of the earth ' magnetic field at the place is known to be 0.40 G . what is the direction and magnitude of the earth's magnetic field at the place ?

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

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