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C.U.Q

MAGNETIC MOMENT AND RESULTANT MAGNETIC MOMENT

1. **The dimensional formula for magnetic moment is**

   1) $M^0L^2T^0A^1$ 2) $M^0L^1T^0A^2$

   3) $M^0L^2T^0A^2$ 4) $M^0L^0T^1A^1$

2. If two bar magnets of different magnetic lengths have equal moments, then the pole strength is

1) equal for both the magnets
2) less for shorter magnet
3) more for longer magnet
4) more for shorter magnet

3. A bar magnet of moment M is bent into arc, its moment

1) decreases 2) increases
3) does not change 4) may change

4. A bar magnet is cut into two equal halves by a plane parallel to the magnetic axis of the following physical quantities the one which remains unchanged is

1) pole strength 2) magnetic moment
3) intensity of magnetisation 4) moment of inertia

5. Two magnets of magnetic moments of M_1, M_2 are placed one over the other with like poles touching, the resultant magnetic moment is

1) $M_1 + M_2$ 2) $M_1 - M_2$
3) $\sqrt{M_1^2 + M_2^2}$ 4) $\sqrt{M_1^2 - M_2^2}$

6. A bar Magnet consists of

1) two poles of different nature and different strength
2) equal poles in magnitude
3) equal and opposite magnetic poles
4) opposite poles

7. A small hole is made at the centre of the magnet then its magnetic moment

1) decreases 2) increases
3) remains same
4) depends on the nature of the magnetic material

8. A magnetised wire of magnetic length '$2l$', pole strength 'm' and magnetic moment 'M' is bent at angle is 'θ' radian at the centre of the circle, then

1) Its pole strength remains same
2) Its length decreases and becomes $\left[\dfrac{4l\sin\left(\dfrac{\theta}{2}\right)}{\theta}\right]$
3) Its new magnetic moment becomes $\left[\dfrac{2M\sin\left(\dfrac{\theta}{2}\right)}{\theta}\right]$
4) All the above are correct

MAGNETIC FIELD

9. S.I. unit of Magnetic flux is

1) ampere-meter 2) amp. m^2
3) weber 4) weber/m^2

10. The Source of magnetic field is

1) isolated Magnetic pole
2) static electric charge
3) current loop 4) moving light source

11. The earth's magnetic field

1) varies in direction but not in magnitude
2) varies in magnitude but not in direction
3) varies in both magnitude and direction
4) is centred exactly about the centre of the earth

12. The electric and magnetic field lines differ in that

1) electric lines of force are closed curves while magnetic field lines are not
2) magnetic field lines are closed while electric lines are not
3) electric lines of force can give direction of the electric field while magnetic lines can not
4) magnetic lines can give direction of magnetic field while electric lines can not.

13. The incorrect statement regarding the lines of force of the magnetic field B is

1) Magnetic intensity is a measure of lines of force passing through unit area held normal to it
2) Magnetic lines of force form a closed curve
3) Inside a magnet, its magnetic lines of force move from north pole of a magnet towards its south pole
4) Magnetic lines of force never cut each other

14. Two bar magnets are placed on a piece of cork which floats on water. The magnets are so placed that their axis are mutually perpendicular. Then the cork

1) rotates 2) moves a side
3) oscillates 4) neither rotates nor oscillates

15. When a bar magnet of magnetic moment $\overline{M}$ is placed in a magnetic field of induction field strength $\overline{B}$, each pole experiences a force of $\overline{F}$ then the distance between the South and North pole of the magnet measured inside it is

1) MBF 2) $\dfrac{MB}{F}$ 3) $\dfrac{F}{MB}$ 4) $\dfrac{FB}{M}$

16. Lines of force due to earth's horizontal magnetic field are

1) parallel and straight 2) elliptical
3) concentric circles 4) curved lines

17. Magnetic lines of force are

1) continuous 2) discontinuous

3) some times continuous and some times discontinuous 4) nothing can be said

18. In case of a bar magnet, lines of magnetic induction

1) start from the north pole and end at the south pole.

2) run continuously through the bar magnet and outside.

3) emerge in circular paths from the middle of the bar

4) are produced only at the north pole like rays of light from a bulb

19. The total number of magnetic lines of force originating or terminating on a pole of strength 'm' is

1) $\frac{\mu_0 m}{4\pi}$ 2) $\frac{m}{\mu_0}$ 3) m^2 4) $\mu_0 m$

COUPLE ACTING ON THE BAR MAGNET

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

1) a force and a torque

2) a force but not a torque

3) torque but not a force

4) neither a torque nor a force

21. A magnetic field is produced and directed along y-axis. A magnet is placed along x-axis .The direction of the torque on the magnet is

1) in the x-y plane 2) along z-axis

3) along y-axis 4) torque will be zero

22. A bar magnet of moment $\overline{M}$ is in a magnetic field of induction $\overline{B}$. Then the couple is

1) $\overline{M} \times \overline{B}$ 2) $\overline{B} \times \overline{M}$

3) $\overline{M} \cdot \overline{B}$ 4) $\overline{B} \cdot \overline{M}$

23. If a bar magnet of moment is suspended in a uniform magnetic field $\overline{B}$ it is given an angular deflection, w.r.t equilibrium position. Then the restoring torque on the magnet is

1) MB sin θ 2) M B cos θ

3) MB tan θ 4) MB^2 sin θ

24. The effect due to uniform magnetic field on a freely suspended magnetic needle is as follows

1) both torque and net force are present

2) torque is present but no net force

3) both torque and net force are absent

4) net force is present but no torque

25. 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

1) translatory motion only

2) rotational motion only

3) both translatory and rotational motion

4) vibrational motion only

26. There is no. couple acting when two bar magnets are placed co-axially separated by a distance because

1) there are no forces on the poles.

2) the forces are parallel and their lines of action do not coincide

3) the forces are perpendicular to each other

4) the forces act along the same line

27. Find the wrong statement among the following. Two unlike isolated magnetic poles are at some distance apart in air.

1) the resultant induction at a point beween the poles is $B_1 + B_2$ on the line joining them

2) The resultant induction is $B_1 \sim B_2$ at any point out side the poles on the line joining them

3) No neutral point is formed on the line joining them if the pole strengths are equal.

4) A neutral point is formed in between the poles and nearer to weak pole on the line joining them.

28. A magnetic field is produced and directed along y-axis. A magnet is placed along y-axis. The direction of torque on the magnet is

1) in the x-y plane 2) along y-axis

3) along z-axis 4) Torque will be zero

FIELD OF A BAR MAGNET

29. The magnetic intensities at points lying at the same distance from the magnetic pole are

1) same both in magnitude and direction

2) same in magnitude and different in direction

3) different in magnitude but same in direction

4) different both in magnitude and direction

SUPERPOSITION OF MAGNETIC FIELDS

30. When N-pole of the given bar magnet is placed on a table pointing geographic north, the null points are formed due to the superposition of the magnetic field of the bar magnet and the earth's magnetic field. The two null points are located

1) on the axial line at equidistant on either sides

2) on the equitorial line at equidistant on either sides

3) on the axial line only on one side of the magnet

4) on the equitorial line only on one side of the magnet

31. **When S-pole of the given bar magnet is placed on a table pointing geographical N-pole**
1) two null points are located on the axial line at equidistant on either sides
2) two null points are located on the equitorial line at equidistant on either sides
3) two null points are located on the axial line only on one side of the magnet
4) two null points are located on the equitorial line only on one side of the magnet

32. **A very long magnet is held vertically with its south pole on a table. A single neutral point is located on the table to the**
1) East of the magnet 2) North of the magnet
3) West of the magnet 4) South of the magnet

33. **The null points are on the axial line of a bar Magnet when it is placed such that its south pole points**
1) South 2) East 3) North 4) West

34. **The null point on the equatorial line of a bar magnet when the north pole of the magnet is pointing**
1) North 2) South 3) East 4) West

35. **When the N - pole of a bar magnet points towards the south and S- pole towards the north, the null points are on the**
1) magnetic axis 2) magnetic centre
3) perpendicular division of magnetic axis
4) N and S pole

TIME PERIOD OF SUSPENDED MAGNET IN THE UNIFORM MAGNETIC FIELD

36. **The restoring couple for a magnet oscillating in the uniform magnetic field is provided by**
1) horizontal component of earth's magnetic field
2) gravity
3) torsion in the suspended thread
4) magnetic field of magnet

37. **Vibration of suspended magnet works on the principle of**
1) torque acting on the bar magnet and rotational inertia
2) force acting on the bar magnet and rotational inertia
3) both the force and torque acting on the bar magnet
4) neither force nor torque

38. **The factors on which the period of oscillation of a bar magnet in uniform magnetic field depend**
1) nature of suspension fibre
2) length of the suspension fibre
3) vertical component of earth's magnetic induction
4) moment of inertia of the magnet

39. **The time period of a freely suspended magnetic needle does not depend upon**
1) length of the magnet 2) pole strength
3) horizontal component of earth's magnetic field
4) length of the suspension fibre

40. **A magnetic needle suspended by a silk thread is oscillating in the earth's magnetic field. If the temperature of the needle is increased by 500^0C, then**
1) the time period decreases
2) the time period increases
3) the time period remain unchanged
4) the needle stops vibrating

TYPES OF MAGNETIC MATERIALS

41. **The following instrument i.e. used to measure magnetic field**
1) Thermometer 2) Pyrometer
3) Hygrometer 4) Fluxmeter

42. **A watch glass containing some powdered substance is placed between the pole pieces of a magnet. Deep concavity is observed at the centre. The substance in the watch glass is (assume poles are far)**
1) iron 2) chromium 3) carbon 4) wood

43. **Permanent magnets are made from**
1) diamagnetic substances
2) paramagnetic substance
3) ferromagnetic substances 4) wood

44. **Out of dia, para and ferromagnetism, the universal property of all substances is**
1) diamagnetism 2) paramagnetism
3) ferromagnetism 4) antiferromagnetism

45. **The following one is a diamagnetic**
1) Liquid oxygen 2) Air
3) Water 4) Copper sulphate

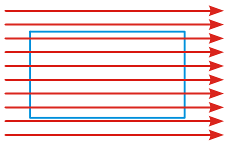
46. **The following one is para-magnetic**
1) Bismuth 2) Antimony
3) Water 4) Chromium

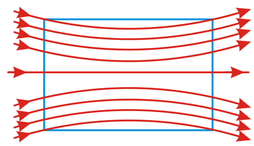
47. **Ferromagnetic ore properties are due to**
1) filled inner sub-shells
2) vacant inner sub-shells
3) partially filled inner sub-shells
4) all the sub-shells equally filled

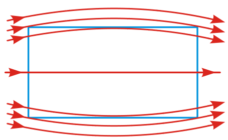
48. **The major contribution of magnetism in substances is due to**
1) orbital motion of electrons
2) spin motion of electrons
3) equally due to orbital and spin motions of electrons
4) hidden magnets

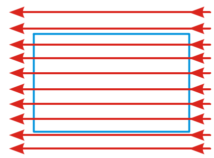
49. **If the magnetic moment of the atoms of a substances is zero, the substance is called**
1) diamagnetic 2) ferromagnetic
3) paramagnetic 4) antiferromagnetic

50. A uniform magnetic field exists in certain space in the plane of the paper and initially it is directed from left to right. When a rod of soft iron is placed parallel to the field-direction, the magnetic lines of force passing within the rod will be represented by figure

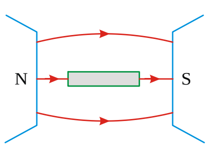
1) 

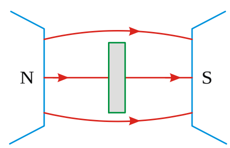
2) 

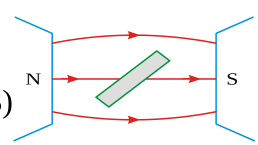
3) 

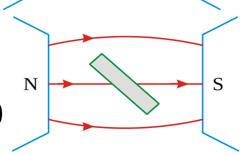
4) 

51. A rod of a paramagnetic substance is placed in a non-uniform magnetic field. Which of the following figure shows its alignment in the field ?

1) 

2) 

3) 

4) 

52. The relative permeability of silicon is 0.99837 and that of palladium is 1.00692, choose the correct options of the following

1) silicon is paramagnetic and palladium is ferromagnetic
2) silicon is ferromagnetic and palladium is paramagnetic
3) silicon is diamagnetic and palladium is paramagnetic
4) Both are paramagnetic

53. The relative permeability is represented by μ_r and susceptibility is denoted by χ for a magnetic substance then for a paramagnetic substance.

1) $\mu_r < 1, \chi < 0$ 2) $\mu_r < 1, \chi > 0$
3) $\mu_r > 1, \chi < 0$ 4) $\mu_r > 1, \chi > 0$

54. Two like poles of strengths m_1 and m_2 are at far distance apart. The energy required to bring them r_0 distance apart is

1) $\frac{\mu_0}{4\pi}\frac{m_1 m_2}{r_0}$ 2) $\frac{\mu_0}{8\pi}\frac{m_1 m_2}{r_0}$
3) $\frac{\mu_0}{16\pi}\frac{m_1 m_2}{r_0}$ 4) $\frac{\mu_0}{2\pi}\frac{m_1 m_2}{r_0}$

55. Curie temperature is the temperature above which

1) a paramagnetic material becomes ferro magnetic
2) a ferromagnetic material becomes paramagnetic
3) a paramagnetic material becomes diamagnetic
4) a ferromagnetic material becomes diamagnetic

56. For a paramagnetic material, the dependence of the magnetic susceptibility χ on the absolute temperature T is given by

1) $\chi \alpha T$ 2) $\chi \alpha$ constant$\times T$
3) $\chi \alpha \frac{1}{T}$ 4) $\chi =$ constant

57. The area enclosed by a hysteresis loop is a measure of

1) retentivity 2) susceptibility
3) permeability 4) energy loss per cycle

58. A material produces a magnetic field which helps the applied magnetic field, then it is

1) diamagnetic 2) paramagnetic
3) electro magnetic 4) all the above

59. A material produces a magnetic field which oppose the applied magnetic field, then it is

1) diamagnetic 2) para magnetic
3) electro magnetic 4) ferro magnetic

60. The permeability of a material is 0.9. The material is

1) diamagnetic 2) para magnetic
3) ferro magnetic 4) non-magnetic

61. The susceptibility of a diamagnetic substance is

1) ∞ 2) zero
3) small but negative 4) small but positive

62. Liquids and gases never exhibit

1) diamagnetic properties
2) para magnetic properties
3) ferro magnetic properties
4) electro magnetic properties

63. Alnico is used for making permanent magnets because it has

1) High coercivity and high retentivity
2) high coercivity and low retentivity
3) low coercivity and low retentivity
4) low coercivity and high retentivity

64. A mariners compass is used

1) to compare magnetic moments
2) for determination of H
3) for determination of direction
4) for determination of dip at a place

65. **The hysteresis cycle for the material of a permanent magnet is**
1) Short and wide 2) tall and narrow
3) tall and wide 4) short and narrow

66. **The relation between μ_r and χ is**
1) $\mu_r = 1 + \chi$ 2) $\chi = \mu_r + 1$
3) $\chi = \mu_0 \mu_r$ 4) $\chi = \mu_r / \mu_0$

67. **The curie weiss law is obeyed by iron**
1) at all temperatures
2) above the curie temperature
3) below the curie temperature
4) at the curie temperature

68. **Which of the following quantities: (I) magnetic declination (II) dip is used to determine the strength of earths magnetic field at a point on the earths surface**
1) Both I & II 2) Neither I nor II
3) I Only 4) II Only

69. **Domain formation is the necessary feature of**
1) ferro magnetism 2) paramagnetism
3) diamagnetism 4) electro magnetism

70. **The magnetic force required to demagnetise the material is**
1) retentivity 2) coercivity
3) energy loss 4) hysterisis

71. **Substances in which the magnetic moment of a single atom is zero**
1) dia magnetic 2) ferro magnetic
3) para magnetic 4) electro magnetic

72. **Property possessed by ferro magnetic substance only is**
1) attracting magnetic substance 2) hysterisis
3) directional property
4) susceptibility independent of temperature

73. **Needles N_1, N_2, N_3 are made of a ferromagnetic, paramagnetic and a diamagnetic substance respectively. A magnet when brought close to them will** 1) attract all three of them
2) attract N_1 and N_2 strongly but repel N_3 weakly
3) attract N_1 strongly, N_2 weakly and repel N_3 weakly
4) attract N_1 strongly, but repel N_2, N_3 weakly

74. **The substance used for preparing electro magnets is**
1) soft iron 2) steel 3) nickel 4) copper

75. **Relative permitivity and permeability of a material are ε_r and μ_r. respectively. Which of the following values of these quantities are allowed for a diamagnetic material**
1) $\varepsilon_r = 1.5,\ \mu_r = 0.5$ 2) $\varepsilon_r = 0.5,\ \mu_r = 0.5$
3) $\varepsilon_r = 1.5,\ \mu_r = 1.5$ 4) $\varepsilon_r = 0.5,\ \mu_r = 1.5$

76. **Susceptibility is large and positive for**
1) para magnetic 2) diamagnetic
3) ferro magnetic 4) electromagnetic

77. **For soft iron, in comparison with steel**
1) hysteresis loss is more
2) hysteresis loss is same
3) hysteresis loss is less
4) hysteresis loss is negligible

78. **χ_1 and χ_2 are susceptibilities of diamagnetic substance at temperatures $T_1 K$ and $T_2 K$ respectively, then**
1) $\chi_1 T_1 = \chi_2 T_2$ 2) $\chi_1 = \chi_2$
3) $\chi_1 \sqrt{T_1} = \chi_2 \sqrt{T_2}$ 4) $\chi_1 T_2 = \chi_2 T_1$

79. **Ferromagnetic materials have their properties due to**
1) vacant inner subshells
2) partially filled inner subshells
3) filled inner subshells
4) completely filled outer shells

80. **When a diamagnetic liquid is poured into a U-tube and one arm of the U-tube is placed between the two poles of strong magnet with the meniscus along the lines of the field, then the level of the liquid in the arm where magnetic field is applied will**
1) fall 2) rise 3) oscillate 4) remain unchanged

81. **At Curie temperature, in ferromagnetic materials**
1) the atomic dipoles get aligned
2) the atomic dipoles lose alignment
3) the atomic dipoles lose alignment
4) magnetism is zero

82. **A sensitive magnetic instrument can be shielded very effectively from outside magnetic fields by placing it inside a box of**
1) wood 2) plastic
3) metal of high conductivity
4) soft iron of high permeability

83. **The value of susceptibility for super conductor is**
1) 0 2) ∞ 3) $+1$ 4) -1

84. In a permanent magnet at room temperature
1) magnetic moment of each molecules is zero
2) the individual molecules have non-zero magnetic moments which are all perfectly aligned
3) domains are partially aligned
4) domains are all perfectly aligned

TERRESTRIAL MAGNETISM

85. The angle of dip at a place on the earth's surface gives
1) direction of earth's magnetic field
2) horizontal component of earth's magnetic field
3) vertical component of earth's magnetic field
4) location of geographic poles

86. A point near the equator has
1) $B_V >> B_H$ 2) $B_H >> B_V$
3) $B_V = B_H$ 4) $B_V = B_H = 0$

87. If I is the intensity of earth's magnetic field, H its horizontal component and V the vertical component, then these are related as
1) $I = V + H$ 2) $I = \sqrt{H^2 + V^2}$
3) $I = \sqrt{H^2 - V^2}$ 4) $I^2 = V^2 - H^2$

88. A line joining places of zero declination is called
1) agonic 2) isoclinic
3) isodynamic 4) isogonal

89. A line joining places of equal declination is called
1) aclinic 2) isoclinic
3) isodynamic 4) isogonal

90. The needle of a dip circle when place at a geomagnetic pole stays along
1) south north direction only
2) east west direction only
3) vertical direction
4) horizontal direction

91. The value of angle of dip is zero at the magnetic equator because on it
1) V and H are equal
2) the value of V and H are zero
3) the value of V is zero
4) the value of H is zero

92. Earth's magnetic field always has a horizontal component except at
1) equator 2) magnetic pole
3) a latitude of 60^0 4) an inclination of 60^0

93. The core of electromagnet is made of soft iron, because
a) the susceptibility of soft iron is very high
b) coercivity of soft iron is very low
1) only a is correct
2) only b is correct
3) both a and b are correct
4) both a and b are wrong

94. The angles of dip at the poles and the equator respectively are
1) $30^0, 60^0$ 2) $90^0, 0^0$
3) $30^0, 90^0$ 4) $0^0, 0^0$

95. Select the correct answer.
a) When 'n' identical magnets are arranged in the form of closed polygon with unlike poles nearer, the resultant magnetic moment is zero.
b) If one magnet is removed from the polygon, the resultant magnetic moment becomes 'M'.
c) If one magnet is reversed in the polygon, the resultant magnetic moment of combination becomes 2M
1) *a*, *b* and *c* are correct
2) *a* and *b* are correct but *c* is wrong
3) only *a* is correct
4) *a*, *b* and *c* are wrong

96. Arrange the following in the descending order of their resultant magnetic moments consider two magnets of same moment
a) They are kept one upon the other with like poles in contact
b) They are kept one upon the other with unlike poles in contact
c) They are arranged in perpendicular directions
d) They are inclined 60^0 with like poles in contact
1) a, c, d, b 2) a, b, c, d
3) a, d, c, b 4) d, b, c, a

97. Among the following statements:
A) A magnet of moment M is bent into a semicircle, then its magnetic moment decreases
B) Magnetic moment is directed parallel to axial line from south pole to north pole
1) A is true & B is false
2) A is false & B is true
3) A and B are true
4) A and B are false

98. When a bar magnet is suspended freely in a uniform magnetic field, identify the correct statements

a) The magnet experiences only couple and undergoes only rotatory motion

b) The direction of torque is along the suspension wire

c) The magnitude of torque is maximum when the magnet is normal to the field direction

1) only *a* and *c* are correct
2) only *a* and *b* are correct
3) only *b* and *c* are correct
4) a, b, c are correct

99. Among the following statements:

(A) The resultant induction at a point on the axial line of a bar magnet is parallel to magnetic moment.

(B) The resultant induction at a point on the equatorial line is antiparallel to magnetic moment

1) A is true & B is false 2) A is false & B is true
3) A and B are true 4) A and B are false

100. (i) Soft iron conducts electricity

(ii) Soft iron is magnetic material

(iii) Soft iron is used for permanent magnets

(iv) Soft iron is used as electro magnet

Out of the statements given above

1) (i) and (ii) are correct
2) (i) ,(ii) and (iii) are correct
3) (ii) and (iv) are correct
4) (i), (ii) and (iv) are correct

101. Match the following:

Physical quantity	*Unit*
a) Magnetic moment	**e) Amp-m**
b) Magnetic flux density	**f) Amp/m**
c) Intensity of magnetic field	**g) N-m³/wb**
d) Pole strength	**h) Gauss**

1) a-e, b-f, c-g, d-h 2) a-g, b-h, c-f, d-e
3) a-g, b-f, c-h, d-e 4) a-e, b-f, c-h, d-g

102. Some physical quantities are given in the list I the related units are given in the list II. Match the correct pairs in the lists

List-I	*List-II*
a) Magnetic field intensity	**e) Wb m^{-1}**
b) Magnetic flux	**f) Wb m^{-2}**
c) Magnetic potential	**g) Wb**
d) Magnetic induction	**h) Am^{-1}**

1) a-e, b-f, c-g, d-h 2) a-h, b-g, c-e, d-f
3) a-h, b-e, c-g, d-f 4) a-f, b-g, c-e, d-h

103. When a bar magnet is suspended in an uniform magnetic field, then the torque acting on it will be

List-I	*List-II*
a) maximum	**e)** $\theta = 45^0$ **with the field**
b) half of the maximum value	**f)** $\theta = 60^0$ **with the field**
c) $\sqrt{3}/2$ **times the maximum**	**g)** $\theta = 30^0$ **with the field**
d) $1/\sqrt{2}$ **times the maximum**	**h)** $\theta = 90^0$ **with the field**

1) a-h, b-g, c-f, d-e 2) a-e, b-f, c-g, d-h
3) a-f, b-e, c-g, d-h 4) a-h, b-g, c-f, d-e

104. Match the following

LIST - 1	**LIST- 2**
a) Magnetic moment	**d)** Am^2
b) Pole strength	**e)** Am
c) Relative permeability	**f) weber**
	g) $\frac{Wb}{Am}$
	h) $\frac{H}{m}$

1) $a \to e \quad b \to d \quad c \to g$
2) $a \to g \quad b \to e \quad c \to d$
3) $a \to d \quad b \to e, f \quad c \to g, h$
4) $a \to f \quad b \to e \quad c \to d$

ASSERTION & REASON

1) Both A and R are true and R is the correct explanation of A.
2) Both A and R are true and R is not correct explanation of A.
3) A is true, But R is false
4) A is false, But R is true

105. Assertion (A) : The net magnetic flux coming out of a closed surface is always zero.
Reason (R) : Unlike poles of equal strength exist together

106. Assertion (A): A magnet remains stable, If it aligns itself with the field
Reason (R): The P.E. of a bar magnet is minimum, if it is parallel to magnetic field.

107. Assertion (A) : To protect any instrument from external magnetic field, it is put inside an iron box
Reason (R) : Iron is a ferro magnetic substance

108. Assertion(A): $\chi - T$ graph for a diamagnetic material is a straight line parallel to $T-$ axis
Reason (R): This is because susceptibility of a diamagnetic material is not affected by temperature

109. Assertion(A): If one arm of a U-tube containing a dia magnetic solution is placed in between the poles of a strong magnet with the level in line with the field, the level of the solution falls,
Reason(R): Diamagnetic substances are repelled by the magnetic field

110. *Assertion(A):* The ferro magnetic substances do not obey curie's law
Reason(R) : At curie point ferro magnetic substances start behaving as a para magnetic substances

111. *Assertion(A):* Earth's magnetic field inside a closed iron box is less as compared to the out side
Reason(R) : The magnetic permeability of iron is low

112. Assertion: Magnetic moment of an atom is due to both, the orbital motion and spin motion of every electron.
Reason: A charged particle at rest produces a magnetic field.

113. Assertion: Electromagnetis are made of soft iron.
Reason: Coercivity of soft iron is small.

114. Assertion: Time period of vibrations of a pair of magnets in sum position is always smaller than in difference position.
Reason: $T = 2\pi\sqrt{I / MB_H}$, where symbols have their standard meaning

115. Assertion: Magnetism is relativistic
Reason: When we move along with the charge, so that there is no motion relative to us, we find no magnetic field associated with the charge

116. Assertion: Steel is attracted by a magnet
Reason: Steel is not a magnetic substance

117. Assertion: When radius of a circular wire carrying current is doubled, its magnetic moment becomes four times
Reason: Magnetic moment is directly proportional to area of the loop

118. Assertion: It is not necessary that every magnet has one north pole and one south pole.
Reason: It is a basic fact that magnetic poles occur in pairs

119. Assertion: Relative magnetic permeability has no units and no dimensions
Reason: $\mu_r = \mu / \mu_0$, where the symbols have their standard meaning.

120. Assertion: A magnet suspended freely in an uniform magnetic field experiences no net force, but a torque that tends to align the magnet along the field when it is deflected from equilibrium position
Reason: Net force $mB - mB = 0$, but the forces on north and south poles being equal, unlike and parallel make up a couple that tends to align the magnet, along the field.

121. Assertion: Basic difference between an electric line and magnetic line of force is that former is discontinuous and the latter is continuous or endless.
Reason: No electric lines of forces exit inside charged conductor but magnetic lines do exist inside magnet.

122. Assertion: The earth's magnetic field is due to iron present in its core.
Reason: At a high temperature magnet losses its magnetic property or magnetism.

123. Assertion: The properties of paramagnetic and ferromagnetic substances are not affected by heating.
Reason: As temperature rises, the alignment of molecular magnets gradually decreases.

124. Assertion: A soft iron core is used in a moving coil galvanometer to increase the strength of magnetic field.
Reason: From soft iron more number of the magnetic lines of force passes.

C.U.Q - KEY

1) 1	2) 4	3) 1	4) 3	5) 1	6) 3
7) 1	8) 4	9) 3	10) 3	11) 3	12) 2
13) 3	14) 4	15) 2	16) 4	17) 1	18) 2
19) 4	20) 1	21) 2	22) 1	23) 1	24) 2
25) 3	26) 4	27) 4	28) 4	29) 2	30) 2
31) 1	32) 2	33) 3	34) 1	35) 1	36) 1
37) 1	38) 4	39) 4	40) 2	41) 4	42) 1
43) 3	44) 1	45) 3	46) 4	47) 3	48) 2
49) 1	50) 2	51) 1	52) 3	53) 4	54) 1
55) 2	56) 3	57) 4	58) 2	59) 1	60) 1
61) 3	62) 3	63) 1	64) 3	65) 3	66) 1
67) 2	68) 1	69)1	70) 2	71) 1	72) 2
73) 3	74) 1	75) 1	76) 3	77) 3	78) 2
79) 2	80) 1	81) 3	82) 4	83) 4	84) 3
85) 1	86) 2	87) 2	88) 1	89) 4	90) 3
91) 3	92) 2	93) 3	94) 2	95) 1	96) 3
97) 3	98) 4	99) 3	100) 4	101) 2	102) 2
103) 1	104) 3	105) 1	106) 1	107) 1	108) 1
109) 1	110) 2	111) 3	112) 3	113) 1	114) 1
115) 1	116) 3	117) 1	118) 4	119) 1	120) 1
121) 1	122) 4	123) 4	124) 1		

LEVEL - I (C.W)

MAGNETIC MOMENT AND RESULTANT MAGNETIC MOMENT

1. The geometric length of a bar magnet is 24 cm. The length of the magnet is

1) 24cm 2) 28.8cm 3) 20cm 4) 30cm

2. The magnetic moment of a bar magnet is 3.6×10^{-3} A.m^2. Its pole strength is 120 milli amp. m. Its magnetic length is

1) 3cm 2) 0.3cm 3) 33.33cm 4) 3×10^{-2} cm

3. Two magnets have their lengths in the ratio 2 : 3 and their pole strengths in the ratio 3 : 4. The ratio of their magnetic moment is

1) 2 :1 2) 4 :1 3) 1 : 2 4) 1 : 4

4. The length of a magnet is 16 cm. Its pole strength is 250 milli. amp. m. When it is cut into four equal pieces parallel to its axis, the magnetic length, pole strength and moments of each piece are: (respectively)

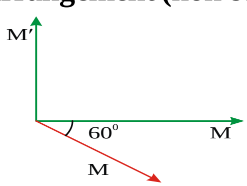
1) 4 cm; 62. 5 milli Am; 250 milli amp. cm^2
2) 8 cm ; 500 milli Am; 400 milli amp. cm^2
3) 16 cm; 250 milli Am; 4000 milli amp. cm^2
4) 16 cm; 62.5 milli Am; 0.01 A.m^2

5. A bar magnet of magnetic moment M_1 is axially cut into two equal parts. If these two pieces are arranged perpendicular to each other, the resultant magnetic moment is M_2.

Then the value of $\frac{M_1}{M_2}$ is (2007M)

1) $\frac{1}{2\sqrt{2}}$ 2) 1 3) $\frac{1}{\sqrt{2}}$ 4) $\sqrt{2}$

6. The resultant magnetic moment for the following arrangement (non coplanar vectors)



1) M 2) 2M 3) 3M 4) 4M

7. Two magnets of moments $4Am^2$ and $3Am^2$ are joined to form a cross (+), then the magnetic moment of the combination is

1) $4Am^2$ 2) $1Am^2$ 3) $7Am^2$ 4) $5Am^2$

8. A magnet of magnetic moment M and length 2l is bent at its mid-point such that the angle of bending is 60^0. The new magnetic moment is.

1) M 2) $\frac{M}{2}$ 3) 2M 4) $\frac{M}{\sqrt{2}}$

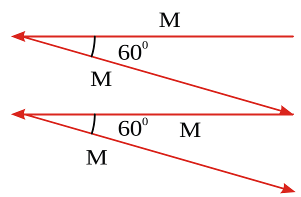
9. A bar magnet of magnetic moment M is bent in ‘⊔’ shape such that all the parts are of equal lengths. Then new magnetic moment is

1) M/3 2) 2M 3) $\sqrt{3}M$ 4) $3\sqrt{3}M$

10. A thin bar magnet of length 'ℓ' and magnetic moment 'M' is bent at the mid point so that the two parts are at right angles. The new magnetic length and magnetic moment are respectively

1) $\sqrt{2}\ell, \sqrt{2}M$ 2) $\frac{\ell}{\sqrt{2}}, \frac{M}{\sqrt{2}}$ 3) $\sqrt{2}\ell, \frac{M}{\sqrt{2}}$ 4) $\frac{\ell}{\sqrt{2}}, \sqrt{2}M$

11. The resultant magnetic moment for the following arrangement is



1) M 2) 2M 3) 3M 4) 4M

12. Three magnets of same length but moments M,2M and 3M are arranged in the form of an equilateral triangle with opposite poles nearer, the resultant magnetic moment of the arrangement is

1) 6M 2) zero 3) $\sqrt{3}M$ 4) $\frac{\sqrt{3}}{2}M$

13. A bar magnet of moment M is cut into two identical pieces along the length. One piece is bent in the form of a semi circle. If two pieces are perpendicular to each other, then resultant magnetic moment is

1) $\left(\frac{M}{\pi}\right)^2+\left(\frac{M}{2}\right)^2$ 2) $\sqrt{\left(\frac{M}{\pi}\right)^2+\left(\frac{M}{2}\right)^2}$

3) $\sqrt{\left(\frac{M}{\pi}\right)^2-\left(\frac{M}{2}\right)^2}$ 4) $\frac{M}{\pi}+\frac{M}{2}$

MAGNETIC FIELD

14. A magnetic pole of pole strength 9.2 A m. is placed in a field of induction 50×10^{-6} tesla. The force experienced by the pole is

1) 46N 2) 46×10^{-4}N 3) 4.6×10^{-4}N 4) 460N

15. The magnetic induction at distance of 0.1 m from a strong magnetic pole of strength 1200 Am is

1) 12×10^{-3} T 2) 12×10^{-4} T
3) 1.2×10^{-3} T 4) 24×10^{-3} T

16. If area vector $\bar{A}=3\bar{i}+2\bar{j}+5\bar{k}\ m^2$ flux density vector $\bar{B}=5\bar{i}+10\bar{j}+6\bar{k}\,(web/m^2)$. The magnetic flux linked with the coil is

1) 31Wb 2) 9000Wb
3) 65Wb 4) 100Wb

17. **P and Q are two unlike magnetic poles. Induction due to 'P' at the location of 'Q' is B, and induction due to 'Q' at the location of P is B/2. The ratio of pole strengths of P and Q is**

1) 1 : 1 2) 1 : 2 3) 2 : 1 4) $1:\sqrt{2}$

18. **Two north poles each of pole strength m and a south pole of pole strength m are placed at the three corners of an equilateral triangle of side a. The intensity of magnetic induction field strength at the centre of the triangle is**

1) $\frac{\mu_0}{4\pi}\frac{m}{a^2}$ 2) $\frac{\mu_0}{4\pi}\frac{6m}{a^2}$ 3) $\frac{\mu_0}{4\pi}\frac{9m}{a^2}$ 4) $\frac{\mu_0}{4\pi}\frac{m}{2a^2}$

19. **The pole strength of a horse shoe magnet is 90 Am and distance between the poles is 6 cm. The magnetic induction at mid point of the line joining the poles is,**

1) $10^{-2}T$ 2) Zero 3) $2\times10^{-2}T$ 4) $10^{-4}T$

20. **The force acting on each pole of a magnet when placed in a uniform magnetic field of 7 A/m is $4.2\text{x}10^{-4}$ N. If the distance between the poles is 10 cm, the moment of the magnet is**

1) $\frac{15}{\pi}$ 2) $\frac{\pi}{15}$ Am^2
3) 7.5 x 10^{-12} Am^2 4) $6\text{x}10^{-6}$ Am^2

21. **An iron specimen has relative permeability of 600 when placed in uniform magnetic field of intensity 110 amp /m. Then the magnetic flux density inside is....... tesla.**

1) 18.29 x 10^{-3} 2) 8.29 x 10^{-2}
3) 66 x 10^3 4) 7.536 x 10^{-4}

COUPLE ACTING ON THE BAR MAGNET

22. **A magnetic needle of pole strength 'm' is pivoted at its centre. Its N-pole is pulled eastward by a string. Then the horizontal force required to produce a deflection of θ from magnetic meridian (B_H horizontal componet of earths magnetic field)**

1) $mB\cos\theta$ 2) $mB\sin\theta$ 3) $2mB\tan\theta$ 4) $mB\cot\theta$

23. **Two identical bar magnets are joined to form a cross. If this combination is suspended freely in a uniform field the angles made by the magnets with field direction are respectively**

1) 60°, 30° 2) 37°, 53° 3) 45°, 45° 4) 20°, 70°

24. **A bar magnet of length 16 cm has a pole strength of 500 milli amp.m. The angle at which it should be placed to the direction of external magnetic field of induction 2.5 gauss so that it may experience a torque of $\sqrt{3}\text{x}10^{-5}$ Nm is**

1) π 2) $\pi/2$ 3) $\pi/3$ 4) $\pi/6$

25. **A bar magnet is at right angles to a uniform magnetic field. The couple acting on the magnet is to be one fourth by rotating it from the position. The angle of rotation is**

1) $\sin^{-1}(0.25)$ 2) $90^0-\sin^{-1}(0.25)$
3) $\cos^{-1}(0.25)$ 4) $90^0-\cos^{-1}(0.25)$

26. **A bar magnet of moment $\overline{M} = \hat{i} + \hat{j}$ is placed in a magnetic field induction $\vec{B} = 3\hat{i}+4\hat{j}+4\hat{k}$. The torque acting on the magnet is**

1) $4\hat{i}-4\hat{j}+\hat{k}$ 2) $\hat{i}+\hat{k}$
3) $\hat{i}-\hat{j}$ 4) $\hat{i}+\hat{j}+\hat{k}$

27. **A bar magnet of magnetic moment 1.5 J/T is aligned with the direction of a uniform magnetic field of 0.22 T. The work done in turning the magnet so as to align its magnetic moment opposite to the field and the torque acting on it in this position are respectively.**

1) 0.33J, 0.33N-m 2) 0.66J, 06.66N-m
3) 0.33J, 0 4) 0.66J, 0

28. **The work done in turning a magnet of magnetic moment M by an angle of 90^0 from the meridian is n times the corresponding work done to turn it through an angle of 60^0, where n is given by**

1) $\frac{1}{2}$ 2) 2 3) $\frac{1}{4}$ 4) 1

29. **A bar magnet of moment $4Am^2$ is placed in a nonuniform magnetic field. If the field strength at poles are 0.2 T and 0.22 T then the maximum couple acting on it is**

1) 0.04Nm 2) 0.84Nm 3) 0.4 Nm 4) 0.44Nm

30. **A magnet of length 10 cm and pole strength $4\text{x}10^{-4}$ Am is placed in a magnetic field of induction $2\text{x}10^{-5}$ weber m^{-2}, such that the axis of the magnet makes an angle 30^0 with the lines of induction. The moment of the couple acting on the magnet is**

1) $4\text{x}10^{-10}$ Nm 2) $8\text{x}10^{-10}$ Nm
3) $4\text{x}10^{-6}$ Nm 4) $\sqrt{3}\text{x}10^{-11}$Nm

31. **A bar magnet of magnetic moment $2Am^2$ is free to rotate about a vertical axis passing through its center. The magnet is released from rest from east - west position. Then the KE of the magnet as it takes N-S position is $(B_H = 25\mu T)$**

1) $25\mu J$ 2) $50\mu J$ 3) $100\mu J$ 4) $12.5\mu J$

32. A bar magnet of length 10cm and pole strength 2 Am makes an angle 60^0 with a uniform magnetic field of induction 50T. The couple acting on it is

1) $5\sqrt{3}$Nm 2) $\sqrt{3}$Nm
3) $10\sqrt{3}$Nm 4) $20\sqrt{3}$Nm

FIELD OF A BAR MAGNET

33. The magnetic induction field strength due to a short bar magnet at a distance 0.20 m on the equatorial line is 20×10^{-6} tesla. The magnetic moment of the bar magnet is
1) $3.2Am^2$ 2) $6.4Am^2$ 3) $1.6Am^2$ 4) $16Am^2$

34. The magnetic induction field strength at a distance 0.3 m on the axial line of a short bar magnet of moment 3.6 Am^2 is
1) 4.5×10^{-4} T 2) 9×10^{-4} T
3) 9×10^{-5} T 4) 2.6×10^{-5} T

35. A magnet of length 10 cm and magnetic moment $1Am^2$ is placed along the side of an equilateral triangle of the side AB of length 10 cm. The magnetic induction at third vertex C is
1) 10^{-9} T 2) 10^{-7} T 3) 10^{-5} T 4) 10^{-4}T

36. The length of a magnet of moment $5Am^2$ is 14 cm. The magnetic induction at a point, equidistant from both the poles is 3.2×10^{-5} Wb/m^2. The distance of the point from either pole is
1) 25 cm 2) 10 cm 3) 15 cm 4) 5 cm

37. A pole of pole strength 80 Am is placed at a point at a distance 20cm on the equatorial line from the centre of a short magnet of magnetic moment $20Am^2$. The force experienced by it is
1) 8×10^{-2}N 2) 2×10^{-2}N
3) 16×10^{-2}N 4) 64×10^{-2}N

38. A short bar magnet produces magnetic fields of equal induction at two points one on the axial line and the other on the equatorial line. The ratio of their distances is
1) 2:1 2) $2^{1/2}$:1 3) $2^{1/3}$:1 4) $2^{1/4}$:1

SUPERPOSITION OF MAGNETIC FIELDS

39. Two short bar magnets with magnetic moments $8Am^2$ and $27Am^2$ are placed 35cm apart along their common axial line with their like poles facing each other. The neutral point is
1) midway between them
2) 21 cm from weaker magnet
3) 14 cm from weaker magnet
4) 27 cm from weaker magnet

40. A short magnetic needle is pivoted in a uniform magnetic field of induction 1T. Now, simultaneoulsy another magnetic field of induction $\sqrt{3}T$ is applied at right angles to the first field; the needle deflects through an angle θ where its value is (EAM 2010)
1) 30^0 2) 45^0 3) 90^0 4) 60^0

41. Two magnetic poles of pole strengths 324 milli amp.m. and 400 milli amp m are kept at a distance of 10 cm in air. The null point will be at a distance of ...... cm, on the line joining the two poles, from the weak pole if they are like poles.
1) 4.73 2) 5 3) 6.2 4) 5.27

TIME PERIOD OF SUSPENDED MAGNET IN THE UNIFORM MAGNETIC FIELD

42. With a standard rectangular bar magnet, the time period in the uniform magnetic field is 4 sec. The bar magnet is cut parallel to its length into 4 equal pieces. The time period in the uniform magnetic field when the piece is used (in sec) (bar magnet breadth is small)
1) 16 2) 8 3) 4 4) 2

43. A bar magnet of moment of inertia $1\times10^{-2}kgm^2$ vibrates in a magnetic field of induction 0.36×10^{-4} tesla. The time period of vibration is 10 s. Then the magnetic moment of the bar magnet is (Am^2)
1) 120 2) 111 3) 140 4) 160

44. Two bar magnets are placed together suspended in the uniform magnetic field vibrates with a time period 3 second. If one magnet is reversed, the combination takes 4s for one vibration. The ratio of their magnetic moments is
1) 3 : 1 2) 5 : 18 3) 18 : 5 4) 25 : 7

45. A bar magnet of length ‘l’ breadth ‘b’ mass ‘m’ suspended horizontally in the earths magnetic field, oscillates with period T. If ‘l’, m, b are doubled with pole strength remaining the same, the new period will be
1) 8T 2) 4T 3) T/2 4) 2T

46. The time period of a suspended magnet is T_0. Its magnet is replaced by another magnet whose moment of inertia is 3 times and magnetic moment is 1/3 of that of the initial magnet. The time period now will be
1) $3T_o$ 2) T_o 3) $\frac{T_o}{\sqrt{3}}$ 4) $\frac{T_o}{3}$

47. A magnetic needle is kept in a uniform magnetic field of induction 0.5 x 10^{-4} tesla. It makes 30 oscillations per minute. If it is kept in a field of induction 2 x 10^{-4} tesla. Then its frequency is

1) 1 oscillation/s 2) 60 oscillations/s
3) 15 oscillations/min 4) 15 oscillations/s

48. A magnet is suspended horizontally in the earth's field. The period of oscillation in the place is T. If a piece of wood of the same moment of inertia as the magnet is attached to it, the new period of oscillation would be

1) $\frac{T}{\sqrt{2}}$ 2) T/2 3) T/3 4) $\sqrt{2}T$

49. A magnet freely suspended makes 30 vibrations per minute at one place and 20 vibrations per minute at another place. If the value of B_H at first place is 0.27 tesla. The value of B_H at other place is

1) 0.12 T 2) 2.1 T 3) 5.4 T 4) 0.61 T

TYPES OF MAGNETIC MATERIALS

50. A magnet has a dimensions of 25 cm x 10 cm x 5 cm and pole strength of 200 milli ampm The intensity of magnetisation due to it is

1) 6.25A/m 2) 62.5A/m 3) 40A/m 4) 4A/m

51. The mass of iron rod is 110g, its magnetic moment is 20 Am^2. The density of iron is 8g/cm^3. The intensity of magnetization is nearly

1) $2x10^5$ Am^{-1} 2) $2.26x10^6$ Am^{-1}
3) $1.6x10^6$ Am^{-1} 4) 1.4 x 10^6 Am^{-1}

52. Relative permeability of iron is 5500, then its magnetic susceptibility will be:

1) 5500×10^{7} 2) 5500×10^{-7}
3) 5501 4) 5499

53. A specimen of iron is uniformly magnetised by a magnetising field of $500Am^{-1}$. If the magnetic induction in the specimen is 0.2 Wbm^{-2}. The susceptibility nearly is

1) 317.5 2) 418.5 3) 217.5 4) 175

54. The magnetic susceptibility of a rod is 499. The absolute permeability of vacuum is $4\pi\times10^{-7}H/m$. The absolute permeability of the material of the rod is

1) $\pi\times10^{-4}H/m$ 2) $2\pi\times10^{-4}H/m$
3) $3\pi\times10^{-4}H/m$ 4) $4\pi\times10^{-4}H/m$

LEVEL - I (C. W) KEY

1) 3	2) 1	3) 3	4) 4	5) 4	6) 2
7) 4	8) 2	9) 1	10)2	11) 2	12) 3
13) 2	14) 3	15)1	16) 3	17) 3	18) 2
19) 3	20) 1	21) 2	22) 3	23) 3	24) 3
25) 2	26) 1	27) 4	28) 2	29) 2	30) 1
31) 2	32) 1	33) 3	34) 4	35) 4	36) 1
37) 2	38) 3	39) 3	40) 4	41) 1	42) 3
43) 2	44) 4	45) 4	46) 1	47) 1	48) 4
49) 1	50) 3	51) 2	52) 4	53) 1	54) 2

LEVEL-I (C. W) HINTS

1. $2l=\frac{5}{6}[geometric\ length]$

2. $2l=\frac{M}{m}$

3. $\frac{M_1}{M_2}=\frac{m_1}{m_2}\times\frac{(2l)_1}{(2l)_2}$

4. Magnetic length remains same

Pole strength $m^1=\frac{m}{4}$

Magnetic moment $=M^1=\frac{M}{4}$

5. $\frac{M_1}{M_2}=\frac{M}{M/\sqrt{2}}$

6. $M_{res}=\sqrt{\left(\sqrt{3}M\right)^2+M^2}$

7. $M=\sqrt{M_1^2+M_2^2}$

8. $M^1=M\sin\frac{\theta}{2}$

9. $M^1=m\times(2l)^1$, $(2l)^1=\frac{2l}{3}$

10. $M^1=M\sin\frac{\theta}{2}$, $2l^1=(2l)\sin\frac{\theta}{2}$

11. $M_R=\sqrt{M_1^2+M_2^2+2M_1M_2\cos\theta}$

12. $M_R=\sqrt{M_1^2+M_2^2+2M_1M_2\cos\theta}$

13. $M_1=\frac{2}{\pi}\left(\frac{M}{2}\right),M_2=\frac{M}{2}$

$M^1=\sqrt{M_1^2+M_2^2}$

14. $F=mB$

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

16. $\phi = \overline{B}.\overline{A}$

17. $B \propto m$

18. $B_{res} = 2B$ where $B = \frac{\mu_0}{4\pi}\frac{m}{\left(a/\sqrt{3}\right)^2}$

19. $B = \frac{\mu_0}{4\pi}\frac{8m}{d^2}$

20. $F = \frac{M}{2l}\left(\mu_0 H\right)$

21. $B = \mu_0 \mu_r H$

22. $\tau = MB\sin\theta$

23. $\tau = MB\sin\theta, \tau_1 = \tau_2$

24. $C = MB\sin\theta$

25. $C = MB\sin\theta$

26. $\vec{\tau} = \vec{M}\times\vec{B}$

27. $\tau = \text{MB}\ \sin\theta$, $W = MB(\cos\theta_1 - \cos\theta_2)$

28. $W = MB(\cos\theta_1 - \cos\theta_2)$

29. $C_{\max} = MB_{avg}$

30. $C = MB\sin\theta$

31. $W = MB\left(\cos\theta_1 - \cos\theta_2\right)$

32. $C = MB\sin\theta$

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

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

35. $B_e = \frac{\mu_0}{4\pi}\frac{M}{x^3}$ where $x = \sqrt{d^2 + l^2}$

36. $B_e = \frac{\mu_0}{4\pi}\frac{M}{x^3}$ where $x = \sqrt{d^2 + l^2}$

37. $B_e = \frac{\mu_0}{4\pi}\frac{M}{d^3}$, $F = mB_e$

38. $\frac{B_1}{B_2} = 2\left(\frac{d_2}{d_1}\right)^3$

39. from weaker pole $x = \frac{d}{\left(\frac{M_2}{M_1}\right)^{1/3} + 1}$

40. $B = B_H Tan\theta$

41. $\frac{m_1}{x^2} = \frac{m_2}{(d-x)^2}$

42. $T = 2\pi\sqrt{\frac{I}{MB}}$, $I = \frac{m}{12}\left(l^2 + b^2\right)$

43. $M = 4\pi^2\frac{I}{T^2 B}$

44. $\frac{M_1}{M_2} = \frac{T_2^2 + T_1^2}{T_2^2 - T_1^2}$

45. $T = 2\pi\sqrt{\frac{I}{MB}}$, $I = \frac{m}{12}\left(l^2 + b^2\right)$

46. $T \propto \sqrt{\frac{I}{M}}$

47. $n \alpha \sqrt{B}$

48. $T \alpha \sqrt{I}$

49. $n \propto \sqrt{B}$

50. $I = \frac{M}{V} = \frac{m}{a}$

51. $I = \frac{M}{V}; Mass = dV$

52. $\chi = \mu_r - 1$

53. $B = \mu H = \mu_0 \mu_r H$; $\chi = \mu_r - 1$

54. $\mu = \mu_o\left[1 + \chi\right]$

LEVEL - I (H.W)

MAGNETIC MOMENT AND RESULTANT MAGNETIC MOMENT

1. **If a bar magnet of pole strength ‘m’ and magnetic moment ‘M’ is cut equally 4 times parallel to its axis and 5 times perpendicular to its axis then the pole strength and magnetic moment of each piece are respectively**

   1) $\frac{m}{20}, \frac{M}{20}$ 2) $\frac{m}{4}, \frac{M}{20}$ 3) $\frac{m}{5}, \frac{M}{20}$ 4) $\frac{m}{5}, \frac{M}{4}$

2. **Three identical bar magnets each of magnetic moment M are arranged in the form of an equilateral triangle such that at two vertices like poles are in contact. The resultant magnetic moment will be**

   1) Zero 2) 2M 3) $\sqrt{2}$ M 4) $M\sqrt{3}$

3. **If two identical bar magnets, each of length 'l', pole strength 'm' and magnetic moment 'M' are placed perpendicular to each other with their unlike poles in contact, the magnetic moment of the combination is**

1) $\frac{M}{\sqrt{2}}$ 2) $lm\left(\sqrt{2}\right)$ 3) $2lm\left(\sqrt{2}\right)$ 4) $2M$

4. **A magnetised wire of magnetic moment 'M' and length 'l' is bent in the form of a semicircle of radius 'r'. The new magnetic moment is**

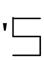
1) $\frac{M}{\pi}$ 2) $\frac{2Mr}{l}$ 3) $\frac{M}{2\pi}$ 4) $\frac{M}{4\pi}$

5. **A long thin magnet of moment M is bent into a semi circle. The decrease in the Magnetic moment is**

1) $2M/\pi$ 2) $\pi M/2$
3) $M(\pi-2)/\pi$ 4) $M(2-\pi)/2$

6. **A magnet of magnetic moment M is in the form of a quadrant of a circle. If it is straightened, its new magnetic moment will be**

1) $\frac{M\pi}{\sqrt{2}}$ 2) $\frac{M}{\sqrt{2}}$ 3) $\frac{\sqrt{2}M}{\pi}$ 4) $\frac{M\pi}{2\sqrt{2}}$

7. **A bar magnet of moment 'M' is bent into a shape''. If the length of the each part is same, its new magnetic moment will be**

1) $\frac{M}{\sqrt{3}}$ 2) $\frac{M}{\sqrt{5}}$ 3) $\frac{M}{\sqrt{2}}$ 4) $\frac{2}{3}M$

8. **Four magnets of magnetic moments M, 2M, 3M and 4M are arranged in the form of a square such that unlike poles are in contact. Then the resultant magnetic moment is**

1) $2\sqrt{2}M$ 2) $\sqrt{2}M$ 3) 10M 4) 2M

COUPLE ACTING ON THE BAR MAGNET

9. **A torque of 2×10^{-4} Nm is required to hold a magnet at right angle to the magnetic meridian. The torque required to hold it at 30^0 to the magnetic meridian in N-m is**

1) 0.5×10^{-4} 2) 1×10^{-4} 3) 4×10^{-4} 4) 8×10^{-4}

10. **A bar magnet of 5 cm long having a pole strength of 20 A.m. is deflected through 30^0 from the magnetic meridian. If H = $\frac{320}{4\pi}$ A/m, the deflecting couple is**

1) 1.6×10^{-4} Nm 2) 3.2×10^{-5} Nm
3) 1.6×10^{-5} Nm 4) 1.6×10^{-2} Nm

11. **A short bar magnet placed with its axis at 30^0 with a uniform external magnetic field of 0.16 T experience a torque of magnitude 0.032 N m. If the bar magnet is free to rotate, its potential energies when it is in stable and unstable equilibrium are respectively**

1) -0.064J, +0.064J 2) -0.032J, +0.032J
3) +0.064J, -0.128J 4) 0.032J, -0.032J

12. **When a bar magnet is placed at 90^0 to uniform magnetic field, it is acted upon by a couple which is maximum. For the couple to be half of the maximum value, it is to be inclined to the magnetic field at an angle is**

1) 30^0 2) 45^0 3) 60^0 4) 90^0

13. **A magnet of moment $4Am^2$ is kept suspended in a magnetic field of induction $5\times10^{-5}T$. The workdone in rotating it through 180^0 is**

1) $4\times10^{-4}J$ 2) $5\times10^{-4}J$ 3) $2\times10^{-4}J$ 4) $10^{-4}J$

14. **The work done in rotating the magnet from the direction of uniform field to the opposite direction to the field is W. The work done in rotating the magnet from the field direction to half the maximum couple position is**

1) $2W$ 2) $\frac{\sqrt{3}W}{2}$ 3) $\frac{W}{4}\left(2-\sqrt{3}\right)$ 4) $\frac{W}{2}\left(1-\sqrt{3}\right)$

15. **The work done in rotating a magnet of pole strength 1 A-m and length 1 cm through an angle of 60^0 from the magnetic meridian is (H=30 A/m)**

1) 9.42×10^{-8} J 2) 3.14×10^{-8} J
3) 18.84×10^{-8} J 4) 10×10^{-8} J

16. **The work done in turning a magnet normal to field direction from the direction of the field is 40×10^{-6} J. The kinetic energy attained by it when it reaches the field direction when released is**

1) Zero 2) 30×10^{-6}J
3) 10×10^{-6} J 4) 40×10^{-6} J

17. **A magnet is parallel to a uniform magnetic field. The work done in rotating the magnetic through $60^0$is 8×10^{-5} J. The work done in rotating through another 30^0 is**

1) 4×10^{-5}J 2) 6×10^{-5}J
3) 8×10^{-5}J 4) 2×10^{-5}J

FIELD OF A BAR MAGENT

18. **The magnetic induction field strength at a distance 0.2 m on the axial line of a short bar magnet of moment $3.6Am^2$ is**

1) $4.5\times10^{-4}T$ 2) $9\times10^{-4}T$
3) $9\times10^{-5}T$ 4) $4.5\times10^{-5}T$

19. A short bar magnet produces magnetic fields of equal induction at two points on the axial line and the other on the equatorial line. Then the ratio of the distance is

1) $1:2^{1/3}$ 2) $1/2$ 3) $2^{1/3}:2$ 4) $2^{1/3}:1$

SUPERPOSITION OF MAGNETIC FIELDS

20. A short bar magnet of magnetic moment $1.2Am^2$ is placed in the magnetic meridian with its south pole pointing the north. If a neutral point is found at a distance of 20 cm from the centre of the magnet, the value of the horizontal component of the earth's magnetic field is

1) $3\times10^{-5}T$ 2) $3\times10^{-4}T$ 3) $3\times10^{3}T$ 4) $3\times10^{-2}T$

21. A very long magnet of pole strength 4 Am is placed vertically with its one pole on the table.The distance from the pole, the neutral point will be formed is $\left(B_H = 4\times10^{-5}T\right)$

1) 0.5 m 2) 0.1 m 3) 0.15 m 4) 6.66 m

TIME PERIOD OF SUSPENDED MAGNET IN THE UNIFORM MAGNETIC FIELD

22. A bar magnet of magnetic moment M and moment of inertial I is freely suspended such that the magnetic axis is in the direction of magnetic meridian. If the magnet is displaced by a very small angle (θ), the angular acceleration is (Magnetic induction of earth's horizontal field = B_H)

1) $\frac{MB_H\theta}{I}$ 2) $\frac{IB_H\theta}{M}$ 3) $\frac{M\theta}{IB_H}$ 4) $\frac{I\theta}{MB_H}$

23. If the moments of inertia of two bar magnets are same, and if their magnetic moments are in the ratio 4 : 9 and if their frequencies of oscillations are same, the ratio of the induction field strengths in which they are vibrating is

1) 2 : 3 2) 3 : 2 3) 4 : 9 4) 9 : 4

24. If the strength of the magnetic field is increased by 21% the frequency of a magnetic needle oscillating in that field.

1) Increased by 10%
2) Decreases by 10%
3) Increases by 11%
4) Decreased by 21%

25. A bar magnet has a magnetic moment equal to 5 x 10^{-5} weber x metre. It is suspended in a magnetic field which has a magnetic induction (B) equal to $8\pi\times10^{-4}$ tesla. The magnet vibrates with a period of vibration equal to 15 seconds. The moment of inertia of the magnet is:

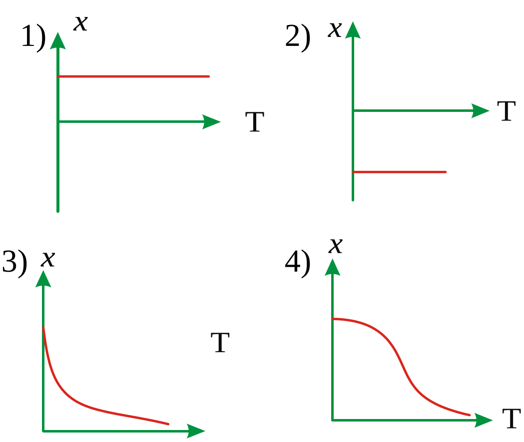
1) 9×10^{-13} kg m^2 2) 11.25 x 10^{-13} kg m^2
3) 5.62 x 10^{-13} kg m^2 4) 0.57 x 10^{-13} kg m^2

26. Two bar magnets are suspended and allowed to vibrate. They make 20 oscillations /minute when their similar poles are on the same side and they make 15 oscillations per minute with their opposite poles lie on the same side. The ratio of their moments

1) 9:5 2) 25:7 3) 16:9 4) 5:4

TYPES OF MAGNETIC MATERIALS

27. The variation of magnetic susceptibility (χ) with temperature for a diamagnetic substance is best represented by



28. The magnetic induction and the intensity of magnetic field inside an iron core of an electromagnet are 1 Wbm^{-2} and $150\,Am^{-1}$ respectively. The relative permeability of iron is : $\left(\mu_0 = 4\pi\times10^{-7}\,Henry/m\right)$

1) $\frac{10^6}{4\pi}$ 2) $\frac{10^6}{6\pi}$ 3) $\frac{10^5}{4\pi}$ 4) $\frac{10^5}{6\pi}$

29. The mass of an iron rod is 80 gm and its magnetic moment is 10 Am^2. If the density of iron is $8gm/c.c.$ Then the value of intensity of magnetisation will be

1) $10^6\ A/m$ 2) $10^4\ A/m$
3) $10^2\ A/m$ 4) $10\ A/m$

30. A rod of cross sectional area $10cm^2$ is placed with its length parallel to a magnetic field of intensity 1000 A/M the flux through the rod is 10^4webers. Then the permeability of material of rod is

1) $10^4\ wb/Am$ 2) $10^3\ wb/Am$

3) $10^2\ wb/Am$ 4) $10\ wb/Am$

31. A bar magnet of magnetic moment $10\,Am^2$ has a cross sectional area of $2.5\times10^{-4}m^2$ .If the intensity of magnetisation of the magnet is $10^6\ A/m$, then the length of magnet is

1) 0.4m 2) 0.04cm 3) 0.04m 4) 40 cm

LEVEL - I (H. W) - KEY

1) 3	2) 2	3) 2	4) 2	5)3	6) 4
7) 2	8) 1	9) 2	10)3	11) 1	12) 1
13) 1	14) 3	15)3	16) 4	17) 3	18)3
19) 4	20) 1	21) 2	22) 1	23) 4	24) 1
25) 1	26) 2	27)2	28) 4	29) 1	30) 1
31) 3					

LEVEL - I (H. W) - HINTS

1. $m^1=\frac{m}{5},\ M^1=\frac{M}{5\times4}$

2. $M_R=\sqrt{M_1^2+M_2^2+2M_1M_2\cos\theta}$

3. $M_R=\sqrt{M_1^2+M_2^2}$

4. For semi circle , $M^1=\frac{2M}{\pi}$ here $l=\pi r$

5. For semi circle , $M^1=\frac{2M}{\pi}$

decrease in M , $\Delta M=M-M^1$

6. $M\theta=2M^1\sin\frac{\theta}{2};\theta=\frac{\pi}{2}$

7. $(2l)^1=\frac{2l}{\sqrt5}$

$M^1=\frac{M}{\sqrt5}$

8. $M_R=\sqrt{M_1^2+M_2^2+2M_1M_2\cos\theta}$

9. $C=MB_H\sin\theta$

10. $C=M\mu_oH\sin\theta$

11. $P.E=-\overline{M}.\overline{B}$

12. $C\alpha\sin\theta$

13. $W=MB[\cos\theta_1-\cos\theta_2]$

14. $W=MB[\cos\theta_1-\cos\theta_2]$

15. $W=m\times2l\ B[\cos\theta_1-\cos\theta_2]$

16. K . E = Work done

17. $W=MB[\cos\theta_1-\cos\theta_2]$

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

19. $\frac{2M}{d_1^3}=\frac{M}{d_2^3}$

20. $B_H=\frac{\mu_o}{4\pi}\frac{2M}{d^3}$

21. $B_H=\frac{\mu_o}{4\pi}\frac{m}{d^2}$

22. $I\alpha=MB_H\theta$

23. MB = constant

24. $n\alpha\sqrt{B}$

$$\left(\frac{n_2}{n_1}-1\right)\times100=\left(\sqrt{\frac{B_2}{B_1}}-1\right)\times100$$

25. $I=\frac{MBT^2}{4\pi^2}$

26. $\frac{M_1}{M_2}=\frac{n_1^2+n_2^2}{n_1^2-n_2^2}$

27. For diamagentic material

χ is - ve & independent of temperature

28. $\mu_r=\frac{B}{\mu_oH}$

29. $I=\frac{M}{V},\ V=\frac{mass}{density}$

30. $\mu=\frac{\phi}{AH}$

31. $(2l)=\frac{M}{I\times A}$