PHYSICS

BOOKS - DISHA PUBLICATION PHYSICS (HINGLISH)

MAGNETISM AND MATTER

Jee Main 5 Years At A Glance

1. The B-H curve for a ferromagnet is shown in the figure. The ferromagnet is placed inside a

long solenoid with 1000 turns/cm . The current that should be passed in the solenoid to demagnetise the ferromagnet completely is :

A. 2 mA

B. 1 mA

C. $40\mu A$

D. $20\mu A$

Answer: b

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2. A magentic dipole in a constant magnetic field has

A. maximum potential energy when the torque is maximum.

B. zero potential energy when the torque is minimum.

C. zero potential energy when the torque is maximum.

D. minimum potential energy when the torque is maximum.

Answer: c

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

0.01 T. time taken for 10 complete oscillations is

A. $6.98s$

B. $8.76s$

C. $6.65s$

D. $8.89s$

Answer: c

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4. A magnetic dipole is acted upon by two magnetic fields with inclined to each other at an angle of 75°. One of the fields has a magnitude of 15 mT. The dipole attains stable equilibrium at an angle of 30° with this field. The magnitude of the other field (in mT) is close to

A. 1

B. 11

C. 36

D. 1060

Answer: b

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5. Hysteresis loops for two magnetic materials a and B are given below:

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

A. A for transformers and B for electric generators.

B. B for electromagnets and transformers.

C. A for eletric generators and trasformers.

D. A for electromagnets and B for electric generators.

Answer: b

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6. A $25cm$ long solenoid has radius $2cm$ and 500 total number of turns. It carries as current of $15A$.If it is equivalent to a magnet of the same size and magnetization $\overline{M}$ (magnetic moment//volume) then $\left|\overline{M}\right|$ is:

A. $30000\pi Am^{-1}$

B. $3\pi Am^{-1}$

C. $30000Am^{-1}$

D. $300Am^{-1}$

Answer: c

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7. Suppose that the source of earth's magnetism is a magnetic dipole at the earth. Find the moment of this magnetic dipole if the strength of earth's magnetic field at the equator is 4×10^{-5} T . Given , radius of the earth

$6.4 \times 10^{6} m$ and $\frac{\mu_0}{4\pi} = 10^{-7} T.\, m.\, A^{-1}.$

A. $10^{23} Am^2$

B. $10^{20} Am^2$

C. $10^{16} Am^2$

D. $10^{10} Am^2$

Answer: a

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8. An implies that a perfect diamagnet is a superconductor. This implies that when a super conductor is put in a magnetic field of intensity B, the magnetic field B_s inside the superconductor will be such that :

A. $B_s = -B$

B. $B_s = 0$

C. $B_s = B$

D. $B_s < B$ but Bs $\neq 0$

Answer: b

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

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

A. 30 mA

B. 60 mA

C. 3A

D. 6A

Answer: c

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Exercise 1 Concept Builder Topicwise

1. The ratio of the magnetic fields due to small bar magnet in end position an broad side on position is (at equal distance from the magnet)

A. $1/4$

B. $1/2$

C. 1

D. 2

Answer: d

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2. A curve between magnetic moment and temperature of magnet is

A. 

B. 

C. 

D. 

Answer: c

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3. The major contribution of magnetism in substance is due to

A. orbital motion of electrons

B. spin motion of electrons

C. equally due to orbital and spin motions of electrons

D. hidden magnets

Answer: b

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4. Magnetic dipole moment is a vector directed from

A. south pole to north pole

B. north pole to south pole

C. east to west

D. west to east

Answer: a

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5. The magnetic potential at a point at a distance of 10 cm from mid point of magnetic dipole on a line making an angle of 60° with axis is $1.5 \times 10^{-7} Wb/m$.The magnetic moment of the dipole is

A. $300ab - amp \times cm^2$

B. $600ab - amp \times cm^2$

C. $30ab - amp \times cm^2$

D. $60ab - amp \times cm^2$

Answer: b

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6. The magnetic dipole moment of a coil is 5.4×10^{-6} joule/tesla and it is lined up with an external magnetic field whose strength is

$0.80T$. Then the work done in rotating the coil (for $\theta = 180^\circ$) is

A. $4.32\mu J$

B. $2.16\mu J$

C. $8.6\mu J$

D. None of these

Answer: c

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7. A bar magnet of length 'l' and magnetic dipole moment 'M' is bent in the from of arc as shown in figure . The new magnetic dipole moment will be

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

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

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

D. M

Answer: a

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8. A short bar magnet pleaced with its axis at 30° with a uniform external magnetic field of 0.16 Tesla expriences a torque of magnitude 0.032 Joule. The magnetic moment of the bar magnet will be

A. 4

B. 0.2

C. 0.5

D. 0.4

Answer: d

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9. A bar magnet has a length of 8cm. The magnetic field at a point at a distnace 3cm from the centre in the broadside-on position is found to be $4 \times 10^{-6} T$. Find the pole strength of the magnet.

A. $6 \times 10^{-5} Am$

B. $5 \times 10^{-5} Am$

C. $2 \times 10^{-4} Am$

D. $3 \times 10^{-4} Am$

Answer: a

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10. A bar magnet having centre O has a length of $4cm$. Point P_1 is in the broad side-on and P_2 is in the end side-on position with

$OP_1 = OP_2 = 10 metres.$ The ratio of magnetic intensities H at P_1 and P_2 is

A. $H_1 : H_2 = 16 : 100$

B. $H_1 : H_2 = 1 : 2$

C. $H_1 : H_2 = 2 : 1$

D. $H_1 : H_2 = 100 : 16$

Answer: b

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11. The magnetic moment of a magnet is $0.1amp \times m^2$. It is suspended in a magnetic field of intensity $3 \times 10^{-4}\text{weber}/m^2$. The couple acting upon it when deflected by 30° from the magnetic field is

A. $1 \times 10^{-5}Nm$

B. $1.5 \times 10^{-5}Nm$

C. $2 \times 10^{-5}Nm$

D. $2.5 \times 10^{-5}Nm$

Answer: b

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12. Two identcal magnetic dipole of magnetic moment $1.0A - m^2$ each, placed at a separation of 2 m with their axis perpendicular to each other. The resultant magnetic field at a point midway between the dipole is

A. $5 \times 10^{-7}T$

B. $\sqrt{5} \times 10^{-7}T$

C. $10^{-7}T$

D. $2 \times 10^{-7} T$

Answer: b

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13. Force between two identical bar magnets whose centres are r metre apart is $4.8N$, when their axes are in the same line. If separation is increased to $2r$, the force between them is reduced to

A. $4N$

B. $2N$

C. $1N$

D. $0.5N$

Answer: d

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14. A bar magnet having a magnetic moment of $2 \times 10^4 JT^{-1}$ is free to rotate in a horizontal plane. A horizontal magnetic field $B = 6 \times 10^{-4} T$ exists in the space. The work

done in taking the magnet slowly from a direction parallel to the field to a direction 60° from the field is

A. 12 J

B. 6J

C. 2J

D. $0.6J$

Answer: b

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15. 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

A. pole strength

B. magnetic moment

C. intensity of magnetisation

D. moment of inertia

Answer: c

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16. A thin bar magnet of length 2 l and breadth 2 b pole strength m and magnetic moment M is divided into four equal parts with length and breadth of each part being half of original magnet.

Then, the magnetic moment of each part is

A. m

B. $m/2$

C. $2m$

D. $m/4$

Answer: b

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17. Point A and B are situated along the extended axis of $2cm$ long bar magnet at a distance x and $2xcm$ respectively. From the pole nearer to the points, the ratio of the magnetic field at A and B will be

A. $4:1$ exactly

B. $4:1$ approximately

C. $8:1$ approximately

D. $1:1$ approximately

Answer: c

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18. The net magnetic moment of two identical magnets each of magnetic moment M_0, inclined at 60° with each other is

A. M_0

B. $\sqrt{2}M_0$

C. $\sqrt{3}M_0$

D. $2M_0$

Answer: c

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19. A magnet of magnetic moment M amd pole strenth m is divided in two equal parts, then magnetic moment of each part will be

A. M

B. $M/4$

C. $\sqrt{2}M$

D. $m/3$

Answer: d

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

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

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

C. $\frac{3M}{\pi}$

D. $\frac{4M}{\pi}$

Answer: b

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21. A steel wire of length l has a magnetic moment M. It is bent in L-shape (Figure). The

new magnetic moment is

A. M

B. $\frac{M}{\sqrt{2}}$

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

D. $2M$

Answer: b

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22. A circular coil of 16 turns and radius 10cm carrying a current of 0.75A rests with its plane normal to an external field of magnitude $5 \cdot 0 \times 10^{-2} T$. The coil is free to turn about an axis in its plane perpendicular to the field direction. When the coil is turned slightly and released, it oscillates about its stable equilibrium with a frequency of $2 \cdot 0 s^{-1}$. What is the moment of inertia of the coil about its axis of rotation?

A. $3.4 \times 10^{-5} kgm^2$

B. $1.2 \times 10^{-4} kgm^2$

C. $2.6 \times 10^{-4} kgm^2$

D. $4.7 \times 10^{-5} kgm^2$

Answer: b

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

A. Convective current in earth 's core .

B. Diversive current in earth's core.

C. Rotational motion of earth.

D. Translation motion of earth .

Answer: a

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24. A compass needle whose magnetic moment is $60Am^2$, is directed towards geographical north at any place experiencing moment of force of $1.2x \times 10^{-3}$ Nm. At that

place the horizontal component of earth field is 40 micro W/m^2. What is the value of dip angle at that place?

A. 30°

B. 60°

C. 45°

D. 15°

Answer: a

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25. The horizontal component of the earth's magnetic field is $3.6 \times 10^{-5} T$ where the dip is 60°. Find the magnitude of the earth's magnetic field.

A. 2.8×10^{-4} tesla

B. 2.1×20^{-4} tesla

C. 7.2×10^{-5} tesla

D. 3.6×10^{-5} tesla

Answer: c

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

A. $1/2$

B. 2

C. $1/4$

D. 1

Answer: b

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27. A short magnet of length 4 cm is kept at a distance of 20 cm to the east of a compass box such that is axis is perpendicular to the magnetic meridian. If the deflection produced is 45°, find the pole strength $\left(H = 30Am^1\right)$

A. $17.7Am$

B. $44.2Am$

C. $27.7Am$

D. $37.7Am$

Answer: d

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28. A short bar magnet with its north pole facing north forms a neutral point at P in the horizontal plane. If the magnet is rotated by 90° in the horizontal plane, the net magnetic

induction at P is (Horizontal component of earth's magnetic field $= B_H$)

A. 0

B. $2B_H$

C. $\frac{\sqrt{5}}{2}B_H$

D. $\sqrt{5}B_H$

Answer: d

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29. At the magnetic north pole of the earth, the value of horizontal component of earth's magnetic field and angle of dip are, respectively

A. zero, maximum

B. maximum, minimum

C. maximum, maximum

D. minimum, minimum

Answer: a

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30. At a certain place , horizontal component of earth's field is $\sqrt{3}$ times the vertical component of earth's field . The angle of dip at this place is

A. 0

B. $\pi/3$

C. $\pi/6$

D. $\pi/8$

Answer: c

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31. At a certain place the angle of dip is 30° and the horizontal component of earth's magnetic field is 0.50 oersted. The earth's total magnetic field is

A. $\sqrt{3}$

B. 1

C. $\frac{1}{\sqrt{3}}$

D. $\frac{1}{2}$

Answer: c

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32. A bar magnet is oscillating in the earth's magnetic field with a period T. What happens to its period and motion if its mass is quadrupled

A. Motion remains simple harmonic with new period $= T/2$

B. Motion remains simple harmonic with new period $= 2T$

C. Motion remains simple harmonic with new period $= 4T$

D. Motion remains simple harmonic and the period stays nearly constant

Answer: b

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33. Horizontal component of earth's field at a height of 1 m from the surface of earth is H. Its value at a height of 10 m from surface of earth is

A. $H/10$

B. $H/9$

C. $H/100$

D. H

Answer: d

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34. The earth's magnetic field lines resemble that of a dipole at the centre of the earth . If the magnetic moment of this dipole is close to $8 \times 10^{22} Am^2$, the value of earth's magnetic field near the equator is closed to (radius of the earth $= 6.4 \times 10^6 m$)

A. 0.6 Gauss

B. 1.2 Gauss

C. 1.8 Gauss

D. 0.32 Gauss

Answer: a

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35. A current carryingcoil is placed with its axis perpendicular to N-S direction. Let horizontal component of earth's magnetic field be H_0 and magnetic field inside the loop is H. If a magnet is suspended inside the loop, it makes angle θ with H. Then θ=

A. $\tan^{-1}\left(\frac{H_0}{H}\right)$

B. $\tan^{-1}\left(\frac{H}{H_0}\right)$

C. $\cos ec^{-1}\left(\frac{H}{H_0}\right)$

D. $\cot^{-1}\left(\frac{H_0}{H}\right)$

Answer: a

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36. The B-H curve (i) and (ii) shown in fig associated with

A. (i) diamagnetic and

(ii) paramagnetic substance

B. (i) paramagnetic and

(ii) ferromagnetic substance

C. (i) soft iron and (ii) steel

D. (i) steel and (ii) soft iron

Answer: c

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37. The mensicus of a liquid contained in one of the limbs of a narrow U-tube is held in an electromagnetic with the mensicus in line with the field . The liquid is seen to rise . This indicates that the liquid is

A. ferromagnetic

B. paramagnetic

C. diamagnetic

D. non-magnetic

Answer: b

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38. If a diamagnetic solution is poured into a U-tube and one aem of this U-tube placed between the poles of a strong magnet with the meniscus in a line with the field, then the level of the solution will

A. rise

B. fall

C. oscillate slowly

D. remains as such

Answer: b

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

A. 

B. 

C. 

D. 

Answer: b

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40. If a diamagnetic substance is brought near north or south pole of a bar magnet, it is

A. attracted by poles

B. repelled by pole

C. replaced by north pole and attracted by south pole

D. attracted by north pole and repelled by south pole

Answer: b

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41. If μ_0 is absolute permeability of vacum and μ_r is relative magnetic permeability of another medium , then permeability μ of the medium

A. $\mu_0\mu_r$

B. μ_0 / μ_r

C. μ_r / μ_0

D. $1 / \mu_0\mu_r$

Answer: a

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42. The ferromagnetic core of electromagnets should have

A. a broad hysteresis loop

B. high permeability and high retentivity

C. low permeability and low retentivity

D. high permeability and low retentivity

Answer: d

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43. The material suitable for making electromagnets should have

A. high retentivity and low coercivity

B. low retentivity and low coercivity

C. high retentivity and high coercivity

D. low retentivity and high coercivity

Answer: b

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44. The relative permeability of iron is 6000. Its magnetic susceptibility is

A. 5999

B. 6001

C. 6000×10^{-7}

D. 6000×10^{7}

Answer: a

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45. Which of the following is not correct about relative magnetic permeability (μ_r)?

A. It is a dimensionless pure ratio.

B. For vacuum medium its value is one .

C. For ferromagnetic materials $\mu_r > > 1$

D. For paramagnetic materials $\mu_r > 1$.

Answer: d

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46. The basic magnetization curve for a feromagnetic materials is shown in figure . Then , the value of relative permeability is

highest for the point

A. P

B. Q

C. R

D. S

Answer: b

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47. When a piece of a ferromagnetic sobstance is put in a uniform magnetic field, the flux density inside it is four times the flux density away from the piece. The magnetic permeability of the material is

A. 1

B. 2

C. 3

D. 4

Answer: d

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48. The permanent magnet is made fron which one of the following substances?

A. Diamagnetic

B. Paramagnetic

C. Ferromagnetic

D. Electromanetic

Answer: c

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49. Demagnetisation of magnets can be done by

A. rough handling

B. heating

C. magnetising in the opposite direction

D. All the above

Answer: d

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50. Nickel shows ferromagnetic property at room temperature. If the temperature is increased beyond curie temperature, then it will show

A. anti ferromagnetism

B. no magnetic property

C. diamagnetism

D. paramagnetism

Answer: d

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51. If a diamagnetic substance is brought near north or south pole of a bar magnet, it is

A. repelled by the north pole and attracted by the south pole

B. attracted by the north pole and repelled by the south pole

C. attracted by north poles

D. repelled by both the poles

Answer: d

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

A. increases in proportion to T

B. decreases in proportion to $\frac{1}{T}$

C. increases in proportion to T^2

D. decreases in proportion to $\frac{1}{T^2}$

Answer: b

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

A. is permanently magnetizd

B. remains ferromagnetic

C. behaves like a diamagnetic material

D. behaves like a paramagnetic material

Answer: d

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54. The magnetic moment of a magnet $(15cm \times 2cm \times 1cm) is 1.2A - m^2$. Calculate its intensity of magnetisation

A. $4 \times 10^4 Am^{-1}$

B. $2 \times 10^4 Am^{-1}$

C. $10^4 Am^{-1}$

D. None of these

Answer: a

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55. Needles $N_1, N_2,$ and N_3 are made of a ferromagnetic, a paramagnetic and a

diamagnetic substance respectively . A magnet when brought close to them will

A. attract N_1 and N_2 strongly but repel N_3

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

C. attract N_1 strongly, but repel N_2 and N_3 weaklt

D. attract all three of them

Answer: b

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56. Three identical bars A, B and C are made of different magnetic materials. When kept in a uniform magnetic field, the field lines around them look as follows:

Make the correspondence of these bars with their material being diamagnetic (D), ferromagnetic (F) and paramagnetic (P):

A. $A \Rightarrow D, B \Rightarrow P, C \Rightarrow F$

B. $A \Rightarrow F, B \Rightarrow D, C \Rightarrow P$

C. $A \Rightarrow P, B \Rightarrow F, C \Rightarrow D$

D. $A \Rightarrow F, B \Rightarrow P, C \Rightarrow D$

Answer: b

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57. Relative permitivity and permeability of a material ε_r and μ_r, respectively . Which of the following values of these quantities are allowed for a diamagnetic material?

A. $\varepsilon_r = 0.5, \mu_r = 1.5$

B. $\varepsilon_r = 1.5, \nu_r = 0.5$

C. $\varepsilon_r = 0.5, \mu_r = 0.5$

D. $\varepsilon_r = 1.5, \mu_r = 1.5$

Answer: b

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58. IF the current is doubled, the deflection is also doubled in

A. a tangent galvanometer

B. a moving-coil galvanometer

C. both

D. None of these

Answer: b

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

A. a deflection glavanometer if the earth's horizontal field is known

B. an oscillation magnetometer if the earth's horizontal field is known

C. both deflection and oscillation magnetometer if the earth's horizontal field is not known

D. all of the above

Answer: d

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

A. $3Am^2$

B. $1Am^2$

C. $5Am^2$

D. $4Am^2$

Answer: d

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61. If the period of oscillaion of freely suspended bar magnet in earth's horizontal field H is 4 sec. When another magnet is brought near it, the period of oscillation is reduced to 2s. The magnetic field of second bar magnet is

A. 4H

B. 3H

C. 2H

D. $\sqrt{3}H$

Answer: B

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62. A thin rectangular magnet suspnded freely has a period of oscillation of 4s . If it is broken

into one of the pieces is suspened similarly .

The period of its oscillation will be

A. 4s

B. 2s

C. $0.5s$

D. $0.25s$

Answer: b

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63. The time period of oscillation of a freely suspended bar magnet with usual notations is given by

A. $T = 2\pi\sqrt{\frac{I}{MB_H}}$

B. $T = 2\pi\sqrt{\frac{MB_H}{I}}$

C. $T = \sqrt{\frac{I}{MB_H}}$

D. $T = 2\pi\sqrt{\frac{B_H}{MI}}$

Answer: a

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64. Two tangent galvanometers having coils of the same radius are connected in series. A current flowing in them produces deflections of 60° and 45° respectively. The ratio of the number of turns in the coils is

A. $4/3$

B. $\frac{\sqrt{3}+1}{1}$

C. $\frac{\sqrt{+1}}{\sqrt{-1}}$

D. $\frac{\sqrt{3}}{1}$

Answer: d

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65. The perio of oscillation of a magnet in vibration magnetometer is 2 sec. The period of oscillation of a magnet whosr magnetic moment is four times that of the first magnet is

A. 1 sec

B. 5 sec

C. 8 sec

D. 0.5 sec

Answer: a

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66. Two magnets of magnetic moments M and 2M are placed in a vibration magnetometre, with the identical poles in the same direction . The time period of viberation is T. If the

magnets are placed with opposite poles together and vibrate with time period T_2 then

A. T_2 is infinite

B. $T_2 = T_1$

C. $T_2 > T_1$

D. $T_2 < T_1$

Answer: c

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67. Two tangent galvanometers A and B have coils of radii $8cm$ and $16cm$ respectively and resistance $8ohm$ each. They are connected in parallel to a cell of emf $4V$ and negligible internal resistance. The deflections produced are 30° and 60° respectivley. A has 2 turns. What is the number of turns in B?

A. 18 turns

B. 12 turns

C. 6 turns

D. 2 turns

Answer: b

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68. The magnetic needle of a tangent galvanometer is deflected at an angle 30° due to a magnet. The hoeizontal component of earth's magnetic field $0.34 \times 10^{-4} T$ is along the plane of the coil. The magnetic intensity is

A. $1.96 \times 10^{-4} T$

B. $1.96 \times 10^{-5} T$

C. $1.96 \times 10^{-4} T$

D. $1.96 \times 10^{5} T$

Answer: b

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69. If θ_1 and θ_2 are two solutions of the equation $a \cos 2\theta + b \sin 2\theta = c$ then $\tan\theta_1 + \tan\theta_2$

A. $2:1$

B. $1:2$

C. $1:1$

D. None of these

Answer: a

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Exercise 2 Concept Applicator

1. In a vibration magnetometer, the time period of a bar magnet oscillating in horizontal componnt of earth's magnetic field is $2\,\mathrm{sec}$. When a magnet is brought near and parallel to it, the time period reduces to $1\,\mathrm{sec}$. The ratio H/F of the horizontal component H and the field F due to magnet will be

A. 3

B. $1/3$

C. $\sqrt{3}$

D. $1/\sqrt{3}$

Answer: b

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2. A bar magnet 8 cm long is placed in the magnetic merdian with the N-pole pointing towards geographical north . Two netural points separated by a distance of 6 cms are obtained on the equatorial axis of the magnet . If horizontal component of earth's field

$= 3.2 \times 10^{-5} T$, then pole strength of magnet is

A. $5ab - amp \times cm$

B. $10ab - amp \times cm$

C. $2.5ab - amp \times cm$

D. $20ab - amp \times cm$

Answer: a

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3. Two magnets are held together in a vibration magnetometer and are allowed to oscillate in the earth's magnetic field with like poles togather, 12 oscillations per minute are made but for unlike poles togather only 4 oscillations per minute are axecuted. The ratio of their magnetic miments is

A. $3:1$

B. $1:3$

C. $3:5$

D. $5:4$

Answer: d

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4. A dip needle lies initially in the magnetic merdian when it shows an angle of dip θ at a place. The dip circle is rotated through an angle x in the horizontal plane and then it shows an angle of dip θ'. Then $\frac{\tan\theta'}{\tan\theta}$ is

A. $\frac{1}{\cos x}$

B. $\frac{1}{\sin x}$

C. $\frac{1}{\tan x}$

D. $\cos x$

Answer: a

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5. A coil in the shape of an equilateral triangle of side l is suspended between the pole pieces of a permanent magnet such that $\vec{B}$ is in the plane of the coil. If due to a current i in the

triangle a torque τ acts on it, the side l of the triangle is

A. $\frac{2}{\sqrt{3}}\left(\frac{\tau}{B.\, i}\right)^{1/2}$

B. $2\left(\frac{\tau}{\sqrt{3}B.\, i}\right)$

C. $\frac{2}{\sqrt{3}}\left(\frac{\tau}{B.\, i}\right)$

D. $\frac{1}{\sqrt{3}}\frac{\tau}{B.\, i}$

Answer: b

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6. The length of a magnet is large compared to its width and breadth. The time period of its oscillation in a vibration magnetometer is $2s$. The magnet is cut along its length into three equal parts and these parts are then placed on each other with their like poles together . The time period of this combination will be

A. $2\sqrt{3}s$

B. $\frac{2}{3}s$

C. $2s$

D. $\frac{2}{\sqrt{3}}s$

Answer: b

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7. The figure shown the various positions (labelled by subscripts) of small magnetised needles P and Q . The arrows show the direction of their magnetic moment . Which configuration corresponds to the lowest potential energy among all the configurations

shown ?

A. PQ_3

B. PQ_4

C. PQ_5

D. PQ_6

Answer: d

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8. Two identical short bar magnets, each having magnetic moment M, are placed a distance of $2d$ apart with axes perpendicular to each other in a horizontal plane. The magnetic induction at a point midway between them is

A. $\frac{\mu_0}{4\pi}(\sqrt{2})\frac{M}{d^3}$

B. $\frac{\mu_0}{4\pi}(\sqrt{3})\frac{M}{d^3}$

C. $\left(\frac{2\mu_0}{\pi}\right)\frac{M}{d^3}$

D. $\frac{\mu_0}{4\pi}(\sqrt{5})\frac{M}{d^3}$

Answer: d

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9. A very small magnet is placed in the magnetic meridian with its south pole pointing north. The null point is obtained 20 cm away from the centre of the magnet. If the earth's magnetic field (horizontal component) at this point be 0.3 Gauss, the magnetic moment of the magnet is

A. $8.0 \times 10^2 e.m.u$

B. $1.2 \times 10^3 e.m.u$

C. $2.4 \times 10^3 e.m.u$

D. $3.6 \times 10^3 e.m.u$

Answer: b

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10. A vibration magnetometer placed in magnetic meridian has a small bar magnet. The magnet executes oscillations with a time

period of 2 sec in earth's horizontal magnetic field of 24 microtesla. When a horizontal field of 18 microtesla is produced opposite to the earth's field by placing a current carrying wire, the new time period of magnet will be

A. 1s

B. 2s

C. 3s

D. 4s

Answer: d

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11. A thin rectangular magnet suspended freely has a period of oscillation equal to T. Now it is broken into two equal halves (each having half of the original length) and one piece is made to oscillate freely in the same field. If its period of oscillation is T', then ratio $\frac{T'}{T}$ is

A. 4s

B. 2s

C. $0.5s$

D. $0.25s$

Answer: b

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12. A magnet makes 40 oscillations per minute at a place having magnetic field intensity of $0.1 \times 10^{-5}T$. At another place, it takes 2.5 sec to complete one vibrating. The value of earth's horizontal field at that place is

A. $0.25 \times 10^{-6}T$

B. $0.36 \times 10^{-6}T$

C. $0.66 \times 10^{-8}T$

D. $1.2 \times 10^{-6}T$

Answer: b

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13. Two short bar magnets of length $1cm$ each have magnetic moments $1.20Am^2$ and $1.00Am^2$ respectively. They are placed on a horizontal table parallel to each

other with their N poles pointing towards the south. They have a common magnetic equator and are separted by a distance of $20.0cm$. The value of the resultant horizontal magnetic induction at the mid - point O of the line joining their centres is close to (Horizontal component of earths magnetic induction is $3.6 \times 10.5Wh/m^2$

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

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

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

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

Answer: b

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14. A bar magnet of length $10cm$ and having the pole strength equal to 10^{-3} weber is kept in a magnetic field having magnetic induction (B) equal to $4\pi \times 10^{-3}$ Tesla. It makes an angle of 30° with the direction of mwgnetic induction. The value of the torque acting on

the magnet is

$(\mu_0 = 4\pi \times 10^{-7} weber / amp \times m)$

A. $2\pi \times 10^{-7} N \times m$

B. $2\pi \times 10^{-5} N \times m$

C. $0.5N \times m$

D. $0.5 \times 10^2 N \times m$

Answer: a

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15. A thin rectangular magnet suspended freely has a period of oscillation equal to T. Now it is broken into two equal halves (each having half of the original length) and one piece is made to oscillate freely in the same field. If its period of oscillation is T', then ratio $\frac{T'}{T}$ is

A. $\frac{1}{2\sqrt{2}}$

B. $\frac{1}{2}$

C. 2

D. $\frac{1}{2}$

Answer: b

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16. Two solenoids acting as short bar magnets P and Q are arranged such that their centres are on the X-axis and are separated by a large distance . The magnetic axes of P and Q are along X and Y-axes, respectively. At a point R, midway between their centres , if B is the

magnitude of induction due to Q , then the magnitude of total induction at R due to the both magnets is

A. 3B

B. $\sqrt{5}B$

C. $\frac{\sqrt{5}}{2}B$

D. B

Answer: b

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17. A domain in a ferromagnetic substance is in the form of a cube of side length 1 μm. If it contains 8×10^{10} atoms and each atomic dipole has a dipole moment of $9 \times 10^{-24} Am^2$, then magnetization of the domain is

A. $7.2 \times 10^5 Am^{-1}$

B. $7.2 \times 10^3 Am^{-1}$

C. $7.2 \times 10^9 Am^{-1}$

D. $7.2XX10^{12} aM^{-1}$

Answer: a

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

A. 14.6

B. 19.4

C. 9.7

D. 4.9

Answer: c

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19. A long straight horizontal cable carries a current fo 2.5 A in the direction 10° south of west to 10° north of east . The magnetic

meridian of the plane happens to be 10° west of the geographic meridian . The earth's magnetic field at the location is 0.33 G , and the angle of dip is zero. Locate the line of neutral points.

A. $1.5cm$

B. $2.5cm$

C. $3.5cm$

D. $2.0cm$

Answer: a

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20. The magnetic moment of a magnet is $0.1amp \times m^2$. It is suspended in a magnetic field of intensity $3 \times 10^{-4}\text{weber}/m^2$. The couple acting upon it when deflected by 30° from the magnetic field is

A. $1 \times 10^{-5} Nm$

B. $1.5 \times 10^{-5} Nm$

C. $2 \times 10^{-5} Nm$

D. $2.5 \times 10^{-5} Nm$

Answer: b

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21. Two bar magnets of the same length and breadth but having magnetic moments M and $2M$ are joined with like poles together and suspended by a string. The time of oscillation of this assembly in a magnetic field of strength B is 3 sec. What will be the period of oscillation, if the polarity of one of the

magnets is changed and the combination is again made to oscillate in the same field ?

A. $\sqrt{3}$ sec

B. $3\sqrt{3}$ sec

C. 3 sec

D. 6 sec

Answer: b

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22. A dip circle is so set that the dip needle moves freely in the magnetic meridian. In this position the angle of dip is 39°. 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 -

A. 40°

B. 30°

C. more than 40°

D. less than 40°

Answer: d

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23. Ratio of magnetic intensities for an axial point and a point on broad side-on position at equal distance d from the centre of magnet will be or The magnetic field at a distance d from a short bar magnet in longitudinal and transverse positions are in the ratio

A. $1:1$

B. $2:3$

C. $2:1$

D. $3:2$

Answer: c

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24. A magnetic dipole is under the influence of two magnetic fields. The angle between the two field directions is 60° and one of the

fields has a magnitude of $1.2 \times 10^{-2} T$. If the dipole comes to stable equilibrium at an angle of 15° with this field, what is the magnitude of the other field?

A. 4.4×10^{-3} tesla

B. 5.2×10^{-3} tesla

C. 3.4×10^{-3} tesla

D. 7.8×10^{-3} tesla

Answer: a

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

A. 0.12×10^{-4}T

B. 0.21×10^{-4}T

C. 0.34×10^{-4}T

D. $0.87 \times 10^{-7} T$

Answer: c

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26. A vibration magnetometer consists of two identical bar magnets placed one over the other such that they are perpendicular and bisect each other. The time period of oscillation in a horizontal magnetic field $2^{\frac{5}{4}} s$. One of the magnets is removed and if the

other magnet oscillates in the time field, then the time period in second is

A. $2^{1/4}$

B. $2^{1/2}$

C. 2

D. $2^{3/4}$

Answer: c

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27. Torques τ_1 and τ_2 are required for a magnetic needle to remain perpendicular to the magnetic fields at two different places. The magnetic field at those places are B1 and B2 respectively, then $\frac{B_1}{B_2}$ is

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

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

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

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

Answer: b

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28. The mass of a speciment of a ferromagnetic material is 0.6 kg. and its density is $7.8 \times 10^3 kg/m^3$. If the area of hysteresis loop of alternating magnetising field of frequency 50 Hz is $0.722 MKS$ units then the hysteresis loss per second will be

A. 277.7×10^{-5} joule

B. 277.7×10^{-6} joule

C. 277.7×10^{-4} joule

D. 27.77×10^{-4} joule

Answer: a

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29. The time period of oscillation of a magnet in a vibration magnetometer is 1.5 seconds. The time period of oscillation of another of another magnet similar in size, shap and mass but having one-fourth magnetic moment than

that of first magnet, oscillating at same place will be

A. $0.75\,\text{sec}$

B. $1.5\,\text{sec}$

C. $3.0\,\text{sec}$

D. $6.0\,\text{sec}$

Answer: c

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30. Two short magnets have equal to pole strength but one is twice as long as the other. The shorter magnet is placed 20 cm in tan A position from the compass needle. The longer magnet must be placed on the other side of the magnetometer for no deflection at a distance equal to:

A. 20 cms

B. $20(2)^{1/3}$ cms

C. $20(2)^{2/3}$ cms

D. $20(2)^{3/3}$ cms

Answer: b

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31. At a place on earth, horizontal component of earth's magnetic field is B_1 and vertical component of earth's magnetic field is B_2. If a magnetic needle is kept vertical, in a plane making angle α with the horizontal component of magnetic field, then square of

time period of oscillation of needle when slightly distributed is proportional to

A. $\frac{1}{\sqrt{B_1 \cos \alpha_1}}$

B. $\frac{1}{\sqrt{B_2}}$

C. $\frac{1}{\sqrt{B_1 \cos \alpha^2 + B_2^2}}$

D. infinite

Answer: c

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