DPP

DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 7

Topic :- MAGNETISM AND MATTER

1 **(c)**

Time period of magnet, $T = 2\pi\sqrt{\frac{I}{MB_H}}$

When magnet is cut parallel to its length into four equal pieces. Then new magnet moment, $M' = \frac{M}{4}$

New moment of inertia, $I' = \frac{I}{4}$

∴ New time period, $T' = 2\pi\sqrt{\frac{I'}{M'B_H}}$

$\Rightarrow \qquad T = T' = 4s$

2 **(b)**

Torque(τ) is given by

$\tau = |\mathbf{M} \times \mathbf{B}|$

Where M is magnetic dipole moment of loop given by,

$\boldsymbol{M} = i\boldsymbol{A}$

$\therefore \boldsymbol{M} = (i\pi r^2)\hat{\boldsymbol{k}}$

$\tau = |\mathbf{M} \times \mathbf{B}| = (\pi r^2 i B_x)$

Now, torque of weight will be *mgr.*

$mgr = \pi r^2 i B_x$

$\Rightarrow \quad i = \frac{mg}{\pi r B_x}$

4 **(d)**

As $T = 2\pi\sqrt{\frac{I}{MB}}$ $\therefore T \Rightarrow \frac{1}{\sqrt{2}}$ time.

Initial time period $= 60/30 = 2$ s

$\therefore$ New $T = \frac{2}{\sqrt{2}} = \sqrt{2}$ s

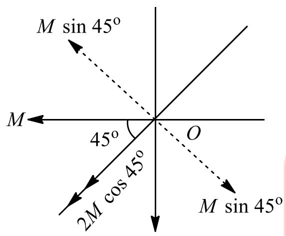
8 **(b)**

$T = 2\pi\sqrt{\frac{1}{MB_H}}$. If Q is an identical bar magnet then time period of system will be

$T' = 2\pi\sqrt{\frac{2I}{(2M)B_H}} = T$

9 **(a)**

Resolving the magnetic moments along OP and perpendicular to OP, figure we find that component OP perpendicular OP cancel out. Resultant magnetic moment along OP is $= M\cos 45° + M\cos 45°$



$= 2\,M\cos 45° = \frac{2M}{\sqrt{2}} = \sqrt{2}\,M$

The point P lies on axial line of magnet of moment

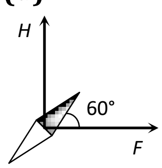
$= \sqrt{2}\,M$

$\therefore B = \frac{\mu_0}{4\pi}\frac{2(\sqrt{2}\,M)}{d^3}$

10 **(c)**

A superconducting material is diamagnetic.

11 **(d)**



From figure, at equilibrium

$\tan 60° = \frac{H}{F}$

$\Rightarrow \sqrt{3} = \frac{H}{F} \Rightarrow \frac{F}{H} = \frac{1}{\sqrt{3}}$

12 **(a)**

The materials for a permanent magnet should have high retentivity (so that the magnet is strong) and high coercivity (so that the magnetism is not wiped out by stray magnetic fields). As the material in this case is never put to cyclic changes of magnetization, hence hysteresis is immaterial.

13 **(a)**

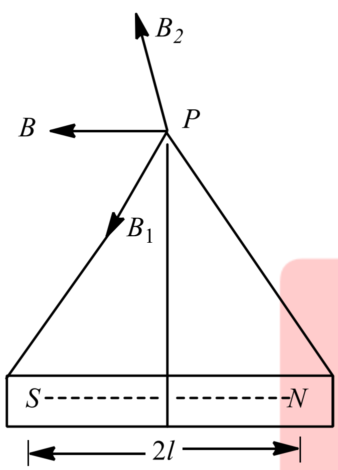
As temperature of a ferro-magnetic material is raised, its susceptibility $\mathcal{X}$ remains constant first and then decreases as shown in Fig. (a).

15 **(d)**

Magnetic field due to a magnet at any point or equatorial line is given by

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

Direction of B is shown in figure.



Hence, in equatorial position, the direction of magnetic field is parallel to magnetic axis in direction from north pole to south pole *ie,* anti-parallel to **M.**

16 **(c)**

When mass is quadrupled, ie, made 4 times.

I becomes four times. As $T \propto \sqrt{I}$.

$\therefore$ T becomes twice, ie, motion remains SHM with time period $= 2T$.

17 **(b)**

$\chi \propto \frac{1}{T}$

$\therefore \chi_1 T_1 = \chi_2 T_2$

Hence $T_2 = \frac{1.2\times10^{-5}\times300}{1.8\times10^{-5}} = 200\ K$

18 **(a)**

Water is dia-magnetic.

19 **(b)**

Consider a point P located on the axial line of a short bar magnet of magnetic length $2l$ and strength m. Let us find **B** at a point P which is at a distance z from the center of magnet.

Magnetic flux density at P due to N pole is

$$B_1 = \frac{\mu_0}{4\pi}\frac{m}{(z-l)^2} \text{ along } NP$$

Similarly, on S pole

$$B_2 = \frac{\mu_0}{4\pi}\frac{m}{(z+l)^2} \text{ along } S$$

Net magnetic flux at P is

$$B = B_1 - B_2 = \frac{\mu_0}{4\pi}\left[\frac{m}{(z-l)^2} - \frac{m}{(z+l)^2}\right]$$

$$= \frac{\mu_0}{4\pi}\left[\frac{4mzl}{(z^2-l^2)^2}\right]$$

$$= \frac{\mu_0}{4\pi}\left[\frac{m \times 2l}{(z^2-l^2)^2}.2z\right]$$

$$= \frac{\mu_0}{4\pi}\left[\frac{2Mz}{(z^2-l^2)^2}\right]$$

$$B = \frac{\mu_0}{4\pi}\frac{2M}{z^3} \qquad (\because z >> l^2)$$

20 **(c)**

Using the formula for total intensity

$$I = \frac{B_H}{\cos\theta} = \frac{B_H}{\cos 45°}$$

$$= \frac{B_0}{1\sqrt{2}} = \sqrt{2}B$$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	C	B	C	D	A	A	A	B	A	C
Q.	11	12	13	14	15	16	17	18	19	20
A.	D	A	A	B	D	C	B	A	B	C