DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 4

Topic :- MAGNETISM AND MATTER

1 **(b)**

$\tau = MB\sin\theta = 0.1 \times 3 \times 10^{-4}\sin 30°$

$= 1.5 \times 10^{-5}$ N-m

2 **(a)**

$$T = 2\pi\sqrt{\frac{1}{MB}} \Rightarrow \frac{T}{T'} = \sqrt{\frac{B'}{B}} = \sqrt{\frac{B}{B_H}}$$

$$\frac{T}{T'} = \sqrt{\frac{1}{\cos\phi}} = \sqrt{\frac{1}{\cos 60°}} = \sqrt{2} \Rightarrow T' = \frac{T}{\sqrt{2}}$$

3 **(c)**

$$T \propto \frac{1}{\sqrt{B_H}} \propto \frac{1}{\sqrt{B\cos\phi}} \Rightarrow \frac{T_1}{T_2} = \sqrt{\frac{B_2\cos\phi_2}{B_1\cos\phi_1}}$$

$$\Rightarrow \frac{B_1}{B_2} = \frac{T_2^2}{T_1^2} \times \frac{\cos\phi_2}{\cos\phi_1} = \left(\frac{3}{2}\right)^2 \times \left(\frac{\cos 60°}{\cos 30°}\right) \Rightarrow \frac{B_1}{B_2} = \frac{9}{4\sqrt{3}}$$

4 **(b)**

Magnetic moment of circular loop carrying current

$$M = IA = I(\pi R^2) = I\pi\left(\frac{L}{2\pi}\right)^2 = \frac{IL^2}{4\pi} \Rightarrow L = \sqrt{\frac{4\pi M}{I}}$$

5 **(a)**

This magnetising field is a measure of coercivity of the material.

6 **(b)**

$$F \propto \frac{m_1 m_2}{r^2}$$

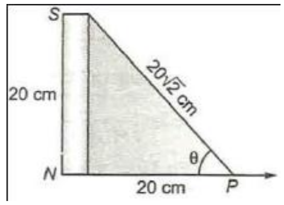
7 **(d)**

$$\frac{M_1}{M_2} = \left(\frac{d_1}{d_2}\right)^3 \Rightarrow \frac{27}{8} = \left(\frac{d_1}{0.12}\right)^3$$

$$\Rightarrow \frac{3}{2} = \frac{d_1}{0.12} \Rightarrow 0.18\ m$$

8 **(a)**

NS is a magnet held vertically with its north pole on the table. P is neutral point, where $NP = 20$ cm, figure. Clearly,



9 **(d)**

$W = mB\cos\theta$

$= mB\cos 60°$

$= mB \times \frac{1}{2}$

$\tau = mB\sin\theta$

$= mB\sin 60°$

$= \sqrt{3}\ W \qquad [\because mB = 2W]$

10 **(c)**

The energy lost per unit volume of a substance in a complete cycle of magnetization is equal to the area of the hysteresis loop

11 **(a)**

$$E = nAVt = nA\frac{m}{d}t = \frac{50 \times 250 \times 10 \times 3600}{7.5 \times 10^3} = 6 \times 10^4 J$$

12 **(d)**

For a temporary magnet the hysteresis loop should be long and narrow

13 **(a)**

The effective length of magnet $2l = 31.4$ cm $= 0.314$ m

Pole strength $m = 0.5$ Am

So, the magnetic moment, $M = m \times 2l$

$= (0.5 \times 0.314)\text{Am}^2$

$= 0.157\ \text{Am}^2$

When magnet is bent in the form of semicircle (of diameter d), then length of magnet $= \pi\frac{d}{2}$

$\therefore\ 31.4 = \frac{\pi d}{2}$

$$\Rightarrow \quad d = \frac{31.4 \times 2}{3.14} = 20 \text{ cm}$$

$\therefore$ Effective length of magnet

$2l' = d = 20 \text{ cm} = 0.2 \text{ cm}$

Hence, its magnetic moment will be

$M' = m \times 2l'$

$\quad = 0.5 \times 0.2 = 0.1 \text{ Am}^2$

14 **(b)**

Since, B and H are perpendicular to each other and the resultant field is inclined at an angle 45° with.

So, $B = H$

$$\frac{\mu_0}{4\pi}\frac{2M}{r^3} = H$$

$$\therefore r^3 = \frac{\mu_0}{4\pi}\frac{2M}{H} = 0.5 \text{ m}$$

15 **(d)**

Permeability is given by

$$\mu = \frac{B}{H}$$

When B is magnetic flux density and H the auxiliary field strength.

Given, $B = 4H$,

$$\therefore \mu = \frac{4H}{H} = 4\text{NA}^{-2}$$

16 **(c)**

The number of atoms per unit volume in a specimen

$$n = \frac{\rho N_A}{A}$$

For iron, $\rho = 7.8 \times 10^3 kgm^{-3}$,

$N_A = 6.02 \times 10^{26}/kgmol, A = 56$

$$\Rightarrow n = \frac{7.8 \times 10^3 \times 6.02 \times 10^{26}}{56} = 8.38 \times 10^{28} m^{-3}$$

Total number of atoms in the bar is

$N_0 = nV = 8.38 \times 10^{28} \times (5 \times 10^{-2} \times 1 \times 10^{-2} \times 1 \times 10^{-2})$

$N_0 = 4.19 \times 10^{23}$

The saturated magnetic moment of bar

$= 4.19 \times 10^{23} \times 1.8 \times 10^{-23} = 7.54\ Am^2$

18 **(b)**

When pole strength becomes 4 times, magnetic moment M becomes four times.

As $T \propto \frac{1}{\sqrt{M}}$

$\therefore T$ becomes $\frac{1}{\sqrt{4}} = \frac{1}{2}$ times

$T = \frac{2}{2}$ =1 s.

19 **(c)**

For short bar magnet in tan A position

$$\frac{\mu_0}{4\pi}\frac{2M}{d^3} = H \tan \theta \qquad \text{...(i)}$$

When distance is doubled, then new deflection θ' is given by

$$\frac{\mu_0}{4\pi}\frac{2M}{(2d)^3} = H \tan \theta' \qquad \text{....(ii)}$$

$$\therefore \quad \frac{\tan \theta'}{\tan \theta} = \frac{1}{8}$$

$$\Rightarrow \quad \theta' = \frac{\tan\theta}{8} = \frac{\tan 60°}{8} = \frac{\sqrt{3}}{8}$$

$$\Rightarrow \quad \theta' = \tan^{-1}\left[\frac{\sqrt{3}}{8}\right]$$

20 **(c)**

$$T_{Sum} = 2\pi\sqrt{\frac{(I_1 + I_2)}{(M_1 + M_2)B_H}}$$

$$T_{diff} = 2\pi\sqrt{\frac{I_1 + I_2}{(M_1 - M_2)B_H}}$$

$$\Rightarrow \frac{T_s}{T_d} = \frac{T_1}{T_2} = \sqrt{\frac{M_1 - M_2}{M_1 + M_2}} = \sqrt{\frac{2M - M}{2M + M}} = \frac{1}{\sqrt{3}}$$