DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

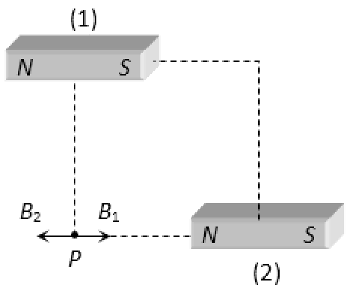
Subject : PHYSICS
DPP No. : 3

Topic :- MAGNETISM AND MATTER

1 **(d)**
From the characteristic of B-H curve

2 **(b)**
Diamagnetic will be feebly repelled. Paramagnetic will be feebly attracted. Ferromagnetic will be strongly attracted

3 **(a)**
Point P lies on equatorial lines of magnet (1) and axial line of magnet (2) as shown



$$B_1 = \frac{\mu_0}{4\pi} \cdot \frac{M}{d^3} = 10^{-7} \times \frac{1000}{(0.1)^3} = 0.1T$$
$$B_2 = \frac{\mu_0}{4\pi} \cdot \frac{2M}{d^3} = 10^{-7} \times \frac{2 \times 1000}{(0.1)^3} = 0.2T$$
$$\therefore B_{net} = B_2 - B_1 = 0.1\ T$$

4 **(d)**
The bar magnet has coercivity $4 \times 10^3\ Am^{-1}$, $i.e.$, it requires a magnetic intensity $H = 4 \times 10^3\ Am^{-1}$ to get demagnetised. Let i be the current carried by solenoid having n number of turns per metre length, then by definition $H = ni$. Here $H = 4 \times 10^3 amp\ turn\ metre^{-1}$
$$n = \frac{N}{l} = \frac{60}{0.12} = 500\ turn\ metre^{-1}$$
$$\Rightarrow i = \frac{H}{n} = \frac{4 \times 10^3}{500} = 8.0\ A$$

5 **(b)**
Here, $B = 1.7 \times 10^{-5}$T, $H = ?$

$$H = \frac{B}{\mu_0} = \frac{1.7 \times 10^{-5}}{4\pi \times 10^{-7}} = 13.53 \text{ Am}^{-1}$$

6 **(b)**

$\tau = MB \sin\theta$

$\tau = 200 \times 0.25 \times \sin 30° = 25\, N \times m$

7 **(c)**

$M = ni\, A = 50 \times 2 \times 1.25 \times 10^{-3} = 0.125 \text{ Am}^2$

If normal to the face of the coil makes an angle θ with the magnetic induction B, then in 1st case, torque $= MB\cos\theta = 0.04$, and in second case,

Torque $= MB\sin\theta = 0.03$

$\therefore MB = \sqrt{(0.04)^2 + (0.03)^2} = 0.05$

$B = \frac{0.05}{M} = \frac{0.05}{0.125} = 0.4\text{T}$

8 **(a)**

Given that, the horizontal component of earth's magnetic field $B_H = 0.34 \times 10^{-4}$ T

$\theta = 30°$

We know that, for tangent galvanometer

$B = B_H \tan\theta$

$\Rightarrow B = 0.34 \times 10^{-4} \times \tan 30°$

$= 1.96 \times 10^{-5}$ T

9 **(b)**

$$T = 2\pi\sqrt{\frac{I}{MB}} = 2\pi\sqrt{\frac{wl^2/12}{\text{Pole strength} \times 2l \times B}}$$

$\therefore T \propto \sqrt{Wl}$

$$\therefore \frac{T_2}{T_1} = \sqrt{\frac{w_2}{w_1} \times \frac{l_2}{l_1}} = \sqrt{\frac{w_1/2}{w_2} \times \frac{l_1/2}{l_1}} = \frac{1}{2}$$

$\Rightarrow T_2 = \frac{T_1}{2} = 0.5\, sec$

10 **(c)**

Let M_1 and M_2 be the magnetic moments of magnets and H the horizontal component of earth's field. We have $\tau = MH\sin\theta$. If ϕ is the twist of wire, then $\tau = C\phi$, C being restoring couple per unit twist of wire

$\Rightarrow C\phi = MH\sin\theta$

Here $\phi_1 = (180° - 30°) = 150° \times \frac{\pi}{180} rad$

$\phi_2 = (270° - 30°) = 240° = 240 \times \frac{\pi}{180} rad$

So, $C\phi_1 = M_1 H \sin\theta$ [For deflection $\theta = 30°$ of I magnet]

$C\phi_2 = M_2 H \sin\theta$ [For deflection $\theta = 30°$ of II magnet]

Dividing $\frac{\phi_1}{\phi_2} = \frac{M_1}{M_2}$

$$\Rightarrow \frac{M_1}{M_2} = \frac{\phi_1}{\phi_2} = \frac{150 \times \left(\frac{\pi}{180}\right)}{240 \times \left(\frac{\pi}{180}\right)} = \frac{15}{24} = \frac{5}{8}$$

$\Rightarrow M_1 : M_2 = 5 : 8$

11 **(c)**

Magnetic substance when kept in a magnetic field is feebly repelled or thrown out if the substance is diamagnetic.

12 **(b)**

Here, $n_1 = 10$ oscillations per min

$\delta_1 = 45°, T_1 = 0.707$ CGS units

$n_2 = ?, \delta_2 = 60°, R_2 = 0.5$ CGS units

$$\frac{n_2}{n_1} = \sqrt{\frac{H_2}{H_1}} = \sqrt{\frac{R_2 cos\delta_2}{R_1 cos\delta_1}}$$

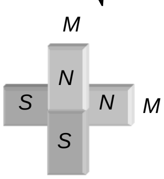
$$\frac{n_2}{10} = \sqrt{^\circ \frac{0.5\cos60°}{0.707\cos45°}} = \sqrt{\frac{0.5 \times 1/2}{0.5 \times \sqrt{2} \times 1/\sqrt{2}}} = \frac{1}{\sqrt{2}}$$

$$n_2 = \frac{10}{\sqrt{2}} = 7.07$$

13 **(c)**

Time period of combination

$$T = 2\pi \sqrt{\frac{2I}{\sqrt{2}M.H}} \quad \text{... (i)}$$



and time period of each magnet

$$T' = 2\pi \sqrt{\frac{I}{MH}} \quad \text{... (ii)}$$

From (i) and (ii), we get

$$T' = \frac{T}{2^{1/4}} = 2^{-1/4} T$$

14 **(c)**

$$B_1 = \frac{2M}{d^3}, B_2 = \frac{M}{d^2}; \therefore \frac{B_1}{B_2} = 2 : 1$$

15 **(d)**

$\theta_1 = 90°, \theta_2 = 270°,$

$W = -MB[\cos270° - \cos90°]$ =zero

16 **(a)**

The volume of the cubic domain is

$V(10^{-6} m)^3 = 10^{-18}\ m^3$

Net dipole moment $m_{net} = 8 \times 10^{10} \times 9 \times 10^{-24}$ A m^2

$= 72 \times 10^{-14}$ A m^2

Magnetization, $M = \frac{m_{net}}{\text{Domain volume}}$

$= \frac{72 \times 10^{-14} A\, m^2}{10^{-18}\, m^3} = 72 \times 10^4\ A\, m^{-1} = 7.2 \times 10^5\ A\, m^{-1}$

17 **(b)**

Points of zero magnetic field *ie*, neutral points lie on equatorial line of magnetic *ie*, along east and west.

18 **(d)**

This luminous electrical discharge is visible frequently in regions of earth's magnetic poles.

19 **(b)**

Ferromagnetic substance have strong tendency to get magnetized (induced magnetic moment) in the same direction as that of applied magnetic field, so magnet attract N_1 strongly. Paramagnetic substances get weakly magnetized (magnetic moment induced is small) in the same direction as that of applied magnetic field, so magnet attracts N_2 weakly. Diamagnetic substances also get weakly magnatised when placed in an external magnetic field but in opposite direction and hence, N_3, is weakly repelled by magnet.

20 **(d)**

The potential energy of a magnetic dipole of magnetic moment M placed in magnetic field H is given as

$U_\theta = -\mathbf{M}.\mathbf{H} = -MH\cos\theta$

Where θ is angle between the vector **M** and **H**. Initially the dipole possesses minimum potential energy U_0, therefore work requires to turn through angle θ is

$W = U_\theta - U_0$

$= -MH\cos\theta - (-MH\cos\theta)$

$= -MH\cos\theta + MH$

$W = MH(1 - \cos\theta)$

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

A.	C	B	C	C	D	A	B	D	B	D