DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 6

Topic :- MAGNETISM AND MATTER

1 **(b)**
For permanent magnet we prefer a material with high retentivity (so as to make a stronger magnet) and high coercivity (so that magnetization may not be wiped out easily). For electromagnet we prefer high saturated magnetism, low coercivity and least possible area of hysteresis loop so that electromagnet develops high magnetization, is easily demagnetized and energy loss in a magnetization cycle is least. Therefore, P is suitable for making permanent magnet and Q for making electromagnet.

2 **(b)**
$X_m \propto \frac{1}{T}$, Therefore,

$$\frac{X_2}{X_1} = \frac{T_1}{T_2}$$

$$\frac{X_2}{0.0060} = \frac{273 - 73}{273 - 173} = \frac{200}{100} = 2$$

Or $X_2 = 2 \times 0.0060 = 0.0120$

3 **(b)**
Torque, $\tau = 0.64 \text{ J}, B = 0.32 \text{ T}, \theta = 30°$

Torque, $\tau = MB \sin\theta$

$$0.64 = M \times 0.32 \sin 30°$$

$$0.64 = M \times 0.32 \times \frac{1}{2}$$

$$M = \frac{2 \times 0.64}{0.32} = 4 \text{ Am}^2$$

4 **(c)**

For null deflection $\frac{M_1}{M_2} = \left(\frac{d_1}{d_2}\right)^3 = \left(\frac{40}{50}\right)^3 = \frac{64}{125}$

5 **(b)**

Current in coil of tangent galvanometer

$$i = \frac{2rB_H}{\mu_0 n}\tan\theta$$

$$\Rightarrow n = \frac{2rB_H}{\mu_0 i}\tan\theta$$

$$\therefore \quad n = \frac{2 \times 16 \times 10^{-2} \times 0.36 \times 10^{-4}}{4\pi \times 10^{-7} \times 20 \times 10^{-3}}\tan 45°$$

$$= 458$$

6 **(a)**

In the usual setting of deflecting magnetometer, field due to magnet (F) and horizontal component (H) of earth's field are perpendicular to each other. Therefore, the net field on the magnetic needle is $\sqrt{F^2 + H^2}$

$\therefore T = 2\pi\sqrt{\frac{I}{M\sqrt{F^2+H^2}}}$ ...(i)

When magnet is removed,

$T_0 = 2\pi\sqrt{\frac{I}{MH}}$ ...(ii)

Also, $\frac{F}{H} = \tan\theta$

Dividing Eq. (i) by Eq.(ii), we get

$$\frac{T}{T_0} = \sqrt{\frac{H}{\sqrt{F^2 + H^2}}}$$

$$= \sqrt{\frac{H}{\sqrt{H^2\tan^2\theta + H^2}}} = \sqrt{\frac{H}{H\sqrt{\sec^2\theta}}}$$

$= \sqrt{\cos\theta}$ or $\frac{T_2^2}{T_0^2} = \cos\theta$

$T^2 = T_0^2\cos\theta.$

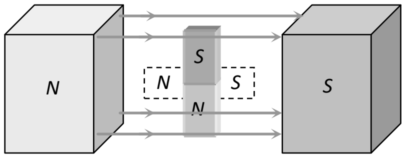
7 **(c)**

$$K = \frac{2rB_H}{\mu_0 n}$$

or $n = \frac{2rB_H}{\mu_0 K} = \frac{2\times0.1\times3.6\times10^{-5}}{4\pi\times10^{-7}\times10\times10^{-3}} = \frac{1.8\times10^3}{3.14} = 570$

8 **(a)**

A diamagnetic rod set itself perpendicular to the field if free to rotate between the poles of a magnet as in this situation the field is strongest near the poles



9 **(b)**

Here, $n_1 = 10$ oscillation per min

$\delta_1 = 45°, B_1 = 0.707$ CGS units

$n_2 = ?, \delta_2 60°, B_2 = 0.5$ CGS units

$$\frac{n_2}{n_1} = \sqrt{\frac{H_2}{H_1}} = \sqrt{\frac{B_2 \cos \delta_2}{B_1 \cos \delta_1}}$$

$$\frac{n_2}{n_1} = \sqrt{\frac{0.5 \cos 60°}{0.707 \ \cos 45°}} = \sqrt{\frac{0.5 \times 1/2}{0.5 \times \sqrt{2} \times \frac{1}{\sqrt{2}}}}$$

$$\frac{n_2}{10} = \frac{1}{\sqrt{2}} \Longrightarrow n_2 = \frac{10}{\sqrt{2}} = 7.07 \approx 7$$

10 **(b)**

For no deflection in tan A position

$$\frac{\mu_0}{4\pi}\frac{2M_1}{d_1^3} = \frac{\mu_0}{4\pi}\frac{2M_2}{d_2^3}$$

$$\therefore \quad \frac{M_1}{M_2} = \left(\frac{d_1}{d^2}\right)^3$$

Or $\quad \frac{1}{2} = \left(\frac{20}{d^2}\right)^3$

Or $\ d_2 = 20 \times (2)^{1/3}$ cm

11 **(b)**

In a vibration magnetometer,

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

$\therefore 4\pi^2 \frac{I}{T^2} = MH = 36 \times 10^{-4}$ ....(i)

In a deflection magnetometer,

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

$\frac{4\pi d^3}{2\mu_0} = \frac{M}{H} = \frac{10^8}{36}$ ....(ii)

Multiplying Eq. (i) and Eq. (ii), we get

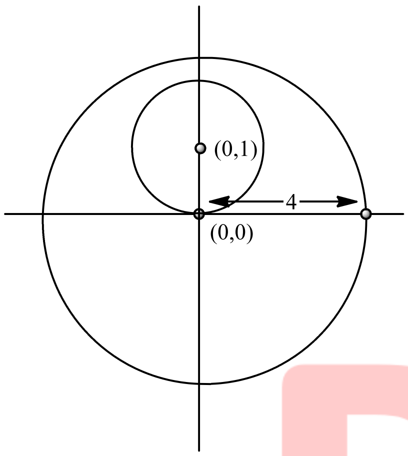
$$M^2 = 36 \times 10^{-4} \times \frac{10^8}{36} = 10^4$$

$$M = 10^2 = 100 \text{ A-m}$$

14 **(c)**

Pole strength of original magnet, $m = \frac{M}{14}$

Effective distance between the poles $= AB$



$$M' = m.2l = \frac{M}{14} \times 10 = \frac{M}{1.4}$$

15 **(b)**

From $B = \frac{\mu_0 i}{2r}$

$$7 \times 10^{-5} = \frac{4\pi \times 10^{-7} \times i}{2 \times 5 \times 10^{-2}}$$

$$i = \frac{7\times10^{-5}}{4\pi\times10^{-6}} = 5.6 \text{ A}$$

16 **(b)**

The time period of vibration magnetometer is given by

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

Where I is moment of inertia, M the magnetic moment and B_H the horizontal component of earth's magnetic field.

Also, $I = mr^2$

Where m is mass and r the radius.

When mass is increased four times

$I' = 4I$

$\therefore T' = 2\pi\sqrt{\frac{4I}{MB_H}}$ T

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

17 **(a)**

The deflection magnetometer is most sensitive in the null method *ie*, when $\theta = 0°$.

18 **(a)**

A bar magnet having *N*-*S* pole, strength m and length 2I be placed in a uniform magnetic field of strength B making an angle θ with the direction of the magnetic field. Force on *N*-pole of the magnet=mB (along the direction of magnetic field B.)

Force on *S*-pole of the magnet $= mB$ (along the direction of magnetic field B.)

Force on *S*-pole of the magnet $= mB$ (opposite to the direction of magnetic field B).

Therefore, net magnetic force on the dipole is zero.

19 **(c)**

The property of paramagnetism is found in these substances whose atoms have an excess of electrons spinning in the same direction. Hence atoms of paramagnetic substances have a net non-zero magnetic moment of their own

20 **(d)**

$\frac{M_1}{M_2} = \frac{\tan\theta_1}{\tan\theta_2} \Rightarrow \frac{m_1 L_1}{m_2 L_2} = \frac{\tan\theta_1}{\tan\theta_2}$

$\Rightarrow \frac{m_1}{m_2} = \frac{2}{1} \times \frac{\tan 45°}{\tan 30°} = \frac{2\sqrt{3}}{1}$

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