Class : XIIth
Date :

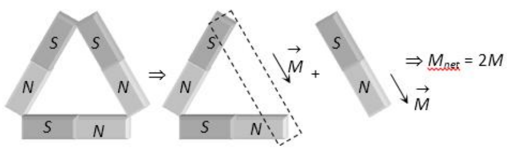
Solutions

Subject : PHYSICS
DPP No. : 2

Topic :- MAGNETISM AND MATTER

2 **(b)**

The resultant magnetic moment can be calculated as follows:



3 **(c)**

$\tan\delta = \frac{V}{H} = \frac{V}{\sqrt{3}V} = \frac{1}{\sqrt{3}}$

$\therefore \delta = 30° = \pi/6$ rad

4 **(a)**

Horizontal component $B_H = B\cos\phi$

Total intensity of earth's magnetic field $B = \frac{B_H}{\cos\phi}$

$$= \frac{1.8\times10^{-5}}{\cos 30°} = \frac{1.8\times10^{-5}}{\sqrt{3}/2} = 2.08\times10^{-5} Wb/m^2$$

5 **(c)**

In C.G.S. $B_{axial} = 9 = \frac{2M}{x^3}$ ...(i)

$$B_{\text{equatorial}} = \frac{M}{\left(\frac{x}{2}\right)^3} = \frac{8M}{x^3} \quad \text{... (ii)}$$

From equation (i) and (ii), $B_{\text{equatorial}} = 36\ gauss$

6 **(b)**

$$B = \frac{\mu_0}{4\pi}.\frac{2M}{d^3} \Rightarrow B = 10^{-7}\times\frac{2\times1.2}{(0.1)^3} = 2.4\times10^{-4}T$$

8 **(b)**

In pole for pole combination,

$M_1 = 3M$ and $M_2 = M$

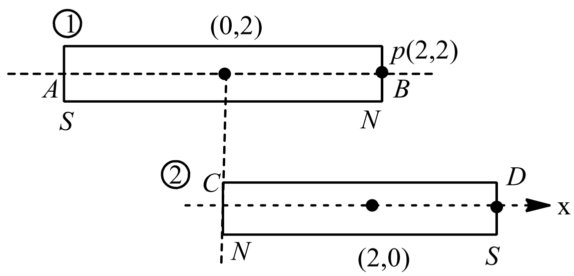
$T_2 = ?$

$$\frac{T_2}{T_1} = \sqrt{\frac{M_1}{M_2}} = \sqrt{\frac{3\,M}{M}} = \sqrt{3}$$

$T_2 = \sqrt{3}T_1 = 3\sqrt{3}$ s

9 **(a)**

As shown in figure,



$$B = B_1 + B_2 = \frac{\mu_0}{4\pi}\left(\frac{2M_1}{r_1^3} + \frac{M_2}{r_2^3}\right)$$

$$100 \times 10^{-7} = 10^{-7}\left(\frac{2M_1}{8} + \frac{M^2}{8}\right)$$

$\Longrightarrow\; 2M_1 + M_2 = 800 \qquad ..(i)$

If the poles of the magnet CD are reversed, then

$$50 \times 10^{-7} = 10^{-7}\left(\frac{2M_1}{8} - \frac{M_2}{8}\right)$$

$\Longrightarrow\; 2M_1 - M_2 = 400 \qquad ...(ii)$

Solving Eqs. (i) and (ii), we obtain

$M_1 = 300\text{ Am}^2, M_2 = 200\text{ Am}^2$

10 **(b)**

$$i \propto \tan\theta \Rightarrow \frac{i_1}{i_2} = \frac{\tan\theta_1}{\tan\theta_2} \Rightarrow \frac{\sqrt{3}}{3} = \frac{\tan 30°}{\tan\theta_2} \Rightarrow \theta = 45°$$

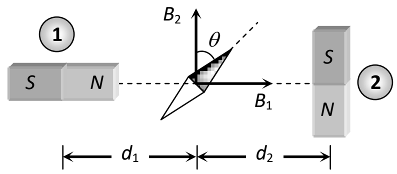
11 **(b)**

$\tan\phi = \frac{\tan\phi}{\cos\beta}$; where ϕ = Apparent angle of dip, ϕ = True angle of dip, β = Angle made by vertical plane with magnetic meridian

$$\Rightarrow \tan\phi = \frac{\tan 60°}{\cos 30°} = 2 \Rightarrow \phi = \tan^{-1}(2)$$

13 **(c)**

In equilibrium $B_1 = B_2\tan\theta$



$\Rightarrow \frac{\mu_0}{4\pi}.\frac{2M}{d_1^3} = \frac{\mu_0}{4\pi}.\frac{M}{d_2^3}\tan\theta$

$\Rightarrow \frac{d_1}{d_2} = (2\cot\theta)^{1/3}$

14 **(c)**

A bar magnet is equivalent to a current carrying solenoid due to the following facts:

(i) Both rest in north-south direction when suspended freely

(ii) Both have two poles: north pole and the south pole.

(iii) The like poles of both repel each other while the unlike poles attract each other.

15 **(a)**

In SI unit of pole strength is Amp-meter. Here, the pole strength is given in Weber, which is the unit of $(\mu_0 m)$.

$\therefore \mu_0 m = 10^{-3}\text{Wb}$

$m = \frac{10^{-3}}{\mu_0}$

Magnetic moment of magnet

$M = m \times 2l = \frac{10^{-3}}{\mu_0}(0.1) = \frac{10^{-4}}{\mu_0}.$

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

$= \frac{10^{-4}}{4\pi\times10^{-7}}(4\pi \times 10^{-3}) \times \frac{1}{2} = 0.5 \text{ Nm}$

16 **(b)**

Repulsion is the sure test of magnetism

17 **(a)**

Frequency $v \propto \sqrt{B_H}$

18 **(c)**

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

$\Rightarrow \; T \propto \frac{1}{\sqrt{M}}$

$\Rightarrow \; \frac{T_1}{T_2} = \sqrt{\frac{M_2}{M_1}}$

If $M_1 = 100$ then $M_2 = (100 - 19) = 81$

So, $\frac{T_1}{T_2} = \sqrt{\frac{81}{100}} = \frac{9}{10}$

$\Rightarrow \ T_2 = \frac{10}{9} T_1 = 1.11\, T_1$

$\Rightarrow$ Time period increase by 11%

20 **(d)**

Susceptibility of ferromagnetic material is inversely proportional to temperature

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

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

Given , $T_1 = 30°$ C, $T_2 = 333°$C, $X_1 = X$

$\therefore \ X_2 = \frac{T_1}{T_2} X = \frac{30}{333} X = 0.09\, X$

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