

## DPP

DAILY PRACTICE PROBLEMS

Class : XII<sup>th</sup>

Date :

### Solutions

Subject : PHYSICS

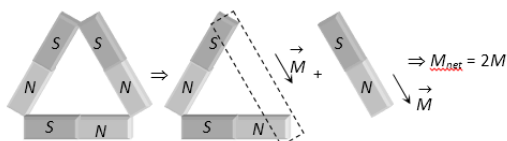
DPP No. : 2

### Topic :- MAGNETISM AND MATTER

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(b)

The resultant magnetic moment can be calculated as follows:



3

(c)

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

$$\therefore \delta = 30^\circ = \pi/6 \text{ rad}$$

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(a)

Horizontal component  $B_H = B \cos \phi$

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

$$= \frac{1.8 \times 10^{-5}}{\cos 30^\circ} = \frac{1.8 \times 10^{-5}}{\sqrt{3}/2} = 2.08 \times 10^{-5} \text{ Wb/m}^2$$

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(c)

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

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

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

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(b)

$$B = \frac{\mu_0}{4\pi} \cdot \frac{2M}{d^3} \Rightarrow B = 10^{-7} \times \frac{2 \times 1.2}{(0.1)^3} = 2.4 \times 10^{-4} \text{ T}$$

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(b)

In pole for pole combination,

$$M_1 = 3M \text{ and } M_2 = M$$

$$T_2 = ?$$

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

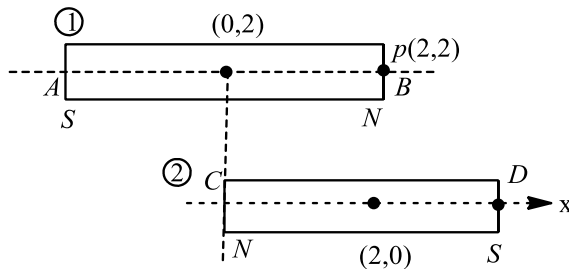


$$T_2 = \sqrt{3}T_1 = 3\sqrt{3} \text{ s}$$

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(a)

As shown in figure,



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

$$100 \times 10^{-7} = 10^{-7} \left( \frac{2M_1}{8} + \frac{M_2}{8} \right)$$

$$\Rightarrow 2M_1 + M_2 = 800 \quad \dots (i)$$

If the poles of the magnet  $CD$  are reversed, then

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

$$\Rightarrow 2M_1 - M_2 = 400 \quad \dots (ii)$$

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

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

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(b)

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

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(b)

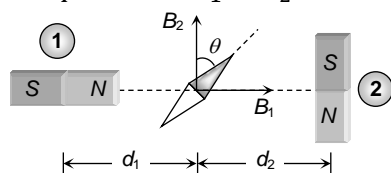
$\tan \phi = \frac{\tan \theta}{\cos \beta}$ ; where  $\phi$  = Apparent angle of dip,  $\theta$  = True angle of dip,  $\beta$  = Angle made by vertical plane with magnetic meridian

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

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(c)

In equilibrium  $B_1 = B_2 \tan \theta$



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

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

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**(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.

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**(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,  $\tau = MB \sin \theta$

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

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**(b)**

Repulsion is the sure test of magnetism

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**(a)**

$$\text{Frequency } \nu \propto \sqrt{B_H}$$

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**(c)**

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

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

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

$$\text{If } M_1 = 100 \text{ then } M_2 = (100 - 19) = 81$$

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

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

$\Rightarrow$  Time period increase by 11%

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**(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,  $T_1 = 30^\circ \text{C}$ ,  $T_2 = 333^\circ \text{C}$ ,  $X_1 = X$

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



**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



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