classmate
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Ch-5 - Magnetism and Matter

3) $B = 0.25\ T$

$\tau = 4.5 \times 10^{-2}\ J$

Angle between the bar magnet and external magnetic field, $\theta = 30^\circ$

$\tau = MB \sin\theta$

$\therefore M = \frac{\tau}{B \sin\theta}$

$\Rightarrow \frac{4.5 \times 10^{-2}}{0.25 \times \sin 30^\circ} = \boxed{0.36\ JT^{-1}}$

4) $M = 0.32\ JT^{-1}$

$B = 0.15\ T$

a) The bar magnet is aligned along the magnetic field. This system is considered as being in a stable equilibrium.

Potential energy of the system $= -MB\cos\theta$

$= -0.32 \times 0.15 \cos 0^\circ$

$\Rightarrow -4.8 \times 10^{-2}\ J$

b) Potential energy $= -MB\cos\theta$

$= -0.32 \times 0.15 \cos 180^\circ$

$= 4.8 \times 10^{-2}\ J$

5) $n = 800$

$A = 2.5 \times 10^{-4}\ m^2$

$I = 3.0\ A$

A current carrying solenoid behaves as a bar

Magnet become a magnetic field develops along the

$\therefore M = NIA$

$= 800 \times 3 \times 2.5 \times 10^{-4}$

$= 0.63 T^{-1}$

8) a) $M = NAI$

$= 2000 \times 1.8 \times 10^{-4} \times 4$

$= 1.28 \, Am^2$

b) $B = 7.5 \times 10^{-2} T$

$\tau = MB \sin\theta$

$= 1.28 \times 7.5 \times 10^{-2} \sin 30°$

$= 4.8 \times 10^{-2} \, NM.$

a) $N = 16$

$r = 10 cm = 0.1 m$

$A = \pi r^2 = \pi \times (0.1)^2 \, m^2$

$I = 0.75 A$

$B = 5.0 \times 10^{-2} T$

$\nu = 2.0 s^{-1}$

$\therefore M = NIA = NI\pi r^2$

$= 16 \times 0.75 \times \pi \times (0.1)^2$

$= 0.3771 T^{-1}$

$\therefore$ Frequency is given by the relation:-

$$\nu = \frac{1}{2\pi}\sqrt{\frac{MB}{I}}$$

Where,

I = Moment of inertia of the coil

$\therefore I = \frac{MB}{4\pi^2 \nu^2}$

$\Rightarrow \frac{0.377 \times 5 \times 10^{-2}}{4\pi^2 \times (2)^2}$

$= 1.19 \times 10^{-4}$ kg m^2

11) $\theta = 12^\circ$

Angle of dip, $\delta = 60^\circ$

$B_H = 0.16$ G

$B_H = B \cos\delta$

$\therefore B = \frac{B_H}{\cos\delta}$

$= \frac{0.16}{\cos 60^\circ} = 0.32$ G

$\therefore$ The magnitude is 0.32 G

13) $H = 0.36$ G

$B_1 = \frac{\mu_0}{4\pi} \frac{2M}{d^3} = H$ ---(i)

where,

μ_0 = permittivity of free space

M = Magnetic moment.

$\Rightarrow$ Total magnetic field, $B = B_1 + B_2$

$= H + \frac{H}{2}$

$\Rightarrow 0.36 + 0.18 = 0.54$ G

18) $I = 2.5\,A$

$\delta = 0^\circ$

$H = 0.33\,G = 0.33 \times 10^{-4}\,T$

$H_H = H\cos\delta$

$= 0.33 \times 10^{-4} \times \cos 0^\circ = 0.33 \times 10^{-4}\,T$

$\Rightarrow H_H = \frac{\mu_0 I}{2\pi R}$

$\therefore R = \frac{\mu_0 I}{2\pi H_H}$

$\Rightarrow \frac{4\pi \times 10^{-7} \times 2.5}{2\pi \times 0.33 \times 10^{-4}} = 15.15 \times 10^{-5}\,m = 1.51\,cm$

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