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Q3) $\theta = 30°$

$B = 0.25\ T$

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

$\tau = MB\sin\theta$

$= 4.5 \times 10^{-2} \times 0.25 \times \sin 30°$

$= 4.5 \times 10^{-2} \times 0.25 \times 1/2$

$= \boxed{0.36\ J^{-1}}$

Q4) $M = 0.32\ J^{-1}$

$B = 0.15\ T$

(a) $U = -MB\cos\theta$

$= -0.32 \times 0.15 \times 1$

$= \boxed{-0.0480\ J}$

(b) $U = MB\cos\theta$

$= 0.32 \times 0.15 \times \cos 180°$

$= \boxed{0.0480\ J}$

Q5) $N = 800$

$Area = 2.5 \times 10^{-4}$

$I = 3A$

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

$= 2400 \times 2.5 \times 10^{-4}$

$= 6000 \times 10^{-2}$

$= \boxed{0.6\ JT^{-1}}$

Q7) $M = 1.5\ JT^{-1}$

$B = 0.22\ T$

$\theta_1 = 0°$

$\theta_2 = 90°$

(a)(i) $W = -MB(\cos\theta_2 - \cos\theta_1)$

$= -1.5 \times 0.22(\cos 90° - \cos 0°)$

$= -0.33(0-1)$

$= \boxed{0.33\ J}$

(ii) $W = -MB(\cos\theta_2 - \cos\theta_1)$ $\theta_1 = 0°, \theta_2 = 180°$

$= -1.5 \times 0.22 (\cos 180° - \cos 0°)$

$= -0.33(-1-1)$

$= -0.33 \times (-2)$

$= \boxed{0.66\ J}$

(b)(i) $\tau = MB\sin\theta$

$= 1.5 \times 0.22 \times \sin 90°$

$= \boxed{0.33 J}$

(ii) $\tau = MB\sin\theta$

$= 1.0$

$= \boxed{0}$

(8) $N = 2000$

$A = 1.6 \times 10^{-4}\ m^2$

$I = 4A$

(a) $M = NIA$

$= 2000 \times 4 \times 1.6 \times 10^{-4}$

$= 8000 \times 1.6 \times 10^{-4}$

$= 1280000 \times 10^{-7}$

$= 12.8 \times 10^{-1} = \boxed{1.28}$

(b) $\tau = MB\sin\theta$

$= 12.8 \times 7.5 \times 10^{-2} \times \sin 30°$

$= 12.8 \times 7.5 \times 10^{-2} \times \frac{1}{2}$ (6-4)

$= 0.048\ Nm$

→ Due to uniform magnetic field force is zero.

09) $N = 16$

$R = 10$

$I = 6.75\ A$

$M = NIA$

$= NI\pi r^2$

$= 16 \times 6.75 \times 3.14 \times (10)^2$

$= 16 \times 6.75 \times 3.14 \times 100$

$= 16 \times 6.75 \times 314$

$= 108.$

$$\omega = \frac{1}{2\pi}\sqrt{\frac{mB}{g}}$$

$$(\omega)^2 = \frac{1}{2\pi} \cdot \frac{m \cdot B}{I}$$

$$I = \frac{mB}{4\pi^2(\omega)^2} = \frac{NIAB}{4\pi^2\omega^2} = \frac{16 \times 0.75 \times (0.10)^2 \times 5 \times 10}{4\pi^2 \times (1)^2}$$

$$= \frac{16 \times 0.75 \times 0.01 \times 5 \times 10^{-2}}{4\pi \times 4}$$

$$= \frac{75 \times 5 \times 10^{-3}}{\pi} = \boxed{1.2 \times 10^{-4}}$$

013) $H = 0.36\ G.$

$$B_1 = \frac{\mu_0}{4\pi}\frac{2M}{r^3} = 0.36$$

$B_2 = \frac{\mu_0}{4\pi}\frac{M}{r^3} = \frac{H}{2} = 0.18.$

$\therefore$ The total magnetic field is $0.54\ G$

$=$ Total magnetic field $\Rightarrow B = H + H/2$

$= 0.36 + 0.18 = \boxed{0.54\ G}$

Q10) $I = 2.5\ A$

$\theta = 0^\circ$

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

$H_H = H \cos\delta$

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

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

$\therefore R = \frac{\mu_0 I}{2\pi H_H} = \frac{4\pi \times 10^{-7} \times 2.5}{2\pi \times 0.33 \times 10^{-4}}$

$= 15.15 \times 10^{-3}\ m = \boxed{1.51\ cm}$

Q11) $B_H = 0.16\ G$

$\theta = 60^\circ$

$B_H = B \cos\theta$

$\Rightarrow B = B_H / \cos\theta$

$\Rightarrow B = \frac{0.16}{\cos 60^\circ} = \frac{0.16}{\frac{1}{2}} = 0.16 \times 2 = \boxed{0.32\ G}$