1 $F = ma$

$= 1.67 \times 10^{-27} \times 2 \times 10^{13}$

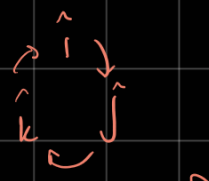
$= 3.34 \times 10^{-14}\ N$

$F = qvB$

$B = \dfrac{F}{qv}$

$= \dfrac{3.34 \times 10^{-14}}{1.609 \times 10^{-19} \times 1 \times 10^{7}}$

$= 20\ mT$



$\hat{i} \times \hat{k} = -\hat{j}$

∴ Direction is −ve y axis

2

$F = ma$

$|q| vB \sin 90° = \dfrac{mv^2}{r}$

$|q| B = m\omega$

$\omega = \dfrac{|q|B}{m}$

$\omega = \dfrac{1.609 \times 10^{-19} \times 0.8}{1.67 \times 10^{-27}}$

$= 77.08 \times 10^{6}\ rad/s$

$v = \omega r = 77.08 \times 10^{6} \times 0.35$

$= 26.98 \times 10^{6}\ m/s$

$K = \dfrac{1}{2} mv^2$

$= \frac{1}{2} \times 1.67 \times 10^{-27} \times (26.98 \times 10^6)^2$

$= 6.08 \times 10^{-13}$ J

$= \frac{6.08 \times 10^{-13}}{1.6 \times 10^{-19}}$

$= 3.8 \times 10^6$ eV

$\frac{3.8 \times 10^6 \text{ eV}}{2 \times 600 \text{ eV}}$

$= 3.167 \times 10^3$ revolutions

$\theta = \omega t$

$t = \frac{\theta}{\omega}$

$= \frac{3.167 \times 10^3}{77.08 \times 10^6} \times 2\pi$

$= 2.58 \times 10^{-4}$ s

$qE = qvB$

$E = vB$

$v = \sqrt{\frac{2K}{m}}$

$E = \sqrt{\frac{2 \times 750 \times 1.6 \times 10^{-19}}{9.11 \times 10^{-31}}} \times 15 \times 10^{-3}$

$= 243.5 \times 10^3$ V/m

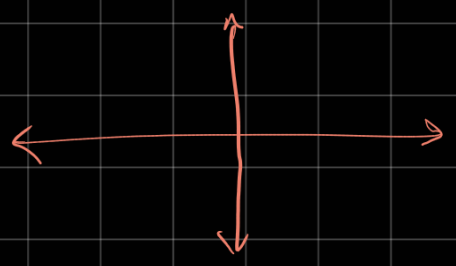
4 $F = ILB$ $F = mg$

$ILB = mg$

$B = \frac{mg}{}$

$$= \frac{0.05 \times 9.81}{2 \times 1}$$

$$= 245 \text{ mT}$$



Direction of Magnetic Field : Eastwards

5. $r = 5 \times 10^{-2}$ m

$T = 3 \times 10^{-3}$ T

$I = 5$ A

$$\tau = 5 \times (\pi \times 5 \times 10^{-2})^2 \times 3 \times 10^{-3}$$

$$= 1.18 \times 10^{-4} \text{ Nm}$$

$$= 117.8 \ \mu\text{Nm}$$

$$U_B = -\mu \cdot B$$

$$= \frac{-\tau}{\cancel{\beta} \sin\theta} \cancel{B}$$

$$= \underline{117.8 \ \mu\text{J}}$$

1. $B_R = -B_1 - B_2$

$$= -\frac{\mu_0 I_1}{2\pi a} - \frac{\mu_0 I_2}{2\pi a}$$

$$= \frac{-4\pi \times 10^{-7}}{2\pi \times 5 \times 10^{-2}} (I_1 + I_2)$$

$$= -240 \ \mu\text{T}$$

$B_R = B_1 - B_2$

$$= \frac{\mu_0 I_1}{2\pi a_1} - \frac{\mu_0 I_2}{2\pi a_2}$$

$$= \frac{4\pi \times 10^{-7}}{2\pi} \left(\frac{5}{10 \times 10^{-2}} - \frac{5}{20 \times 10^{-2}} \right)$$

$$= 5 \ \mu T$$

$$B_R = B_2 - B_1$$

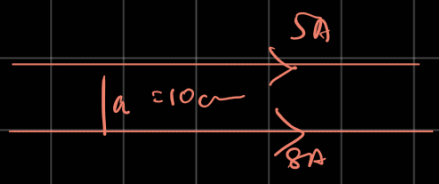
$$= \frac{\mu_0 I_2}{2\pi a_2} - \frac{\mu_0 I_1}{2\pi a_1}$$

$$= \frac{4\pi \times 10^{-7}}{2\pi} \left(\frac{5}{20 \times 10^{-2}} - \frac{5}{30 \times 10^{-2}} \right)$$

$$= 1.67 \ \mu T$$

$$B = -\frac{\mu_0 I}{2\pi a} = -\frac{4\pi \times 10^{-7} \times 5}{2\pi \times 10 \times 10^{-2}}$$

$$= -10 \ \mu T$$



$$\frac{F}{\ell} = \frac{\mu_0 I_1 I_2}{2\pi a}$$

$$\frac{F}{1m} = \frac{4\pi \times 10^{-7} \times 5 \times 8}{2\pi \times 10 \times 10^{-2}}$$

$$= 80 \ \mu N$$

$$B = \frac{\mu_0 I}{2\pi a} = \frac{4\pi \times 10^{-7} \times 8}{2\pi \times 10 \times 10^{-2}} = 16 \ \mu T$$

$$F = 80 \ \mu N$$

$$F = F_1 + F_2 = \frac{\mu_0 I_1 I_2 \ell}{2\pi} \left(\frac{1}{C+a} - \frac{1}{C} \right)$$

$$= \frac{\mu_0 I_1 I_2 l}{2\pi}\left(\frac{-a}{c(c+a)}\right)$$

$$= \frac{4\pi \times 10^{-7} \times 5 \cdot 10 \times 0 \cdot 45}{2\pi}\left(\frac{-0 \cdot 15}{0 \cdot 1(0 \cdot 1+0 \cdot 15)}\right)$$

$$= -27\ \mu N$$

4. $r = 0 \cdot 05\ m$

$l = 0 \cdot 75\ m$

$$B = \frac{\mu_0 N I}{l}$$

$$N = \frac{75}{0 \cdot 1} = 750$$

$$I = \frac{Bl}{N\mu_0} = \frac{8 \times 10^{-3} \times 0 \cdot 75}{750 \times 4\pi \times 10^{-7}}$$

$$= 6 \cdot 37\ A$$

$$R = \frac{\rho l}{A}$$

$$P = I^2 R$$

$$= \left(\frac{8 \times 10^{-3} \times 0 \cdot 75}{750 \times 4\pi \times 10^{-7}}\right)^2 \times \left(\frac{1 \cdot 7 \times 10^{-8} \times 0 \cdot 25}{\pi \times (0 \cdot 05)^2}\right)$$

$$= 206 \cdot 695\ W$$

1.

Square	Solenoid
$N = 1$	$l = 0 \cdot 2\ m$ $r = 0 \cdot 03\ m$
$r = 0 \cdot 01\ m$	$N = 100$

$B = \mu_0 n I$

$= 4\pi \times 10^{-7} \times \frac{100}{0.2} \times 3$

$= 1.884\ mT$

$\Phi_B = BA\cos\theta$

$= 1.884 \times 10^{-3} \times 0.01^2$

$= 188\ nTm^2$

$\mathcal{E} = \frac{d\Phi_B}{dt}$

$= \frac{(0 - 188 \times 10^{-9})}{3}$

$= \frac{+\ 188 \times 10^{-9}}{3}$

$= 6.267 \times 10^{-8}\ V$