Solution to WS-10

A.1

(i) B_1 due to semicircle of radius R_1

$B_1 = \frac{\mu_o}{4\pi}\frac{\pi I}{R_1}$ $\otimes$

B_2 due to semicircle of radius R_2

$B_2 = \frac{\mu_o}{4\pi}\frac{\pi I}{R_2}$ $\otimes$

$\therefore B_{net} = B_1 + B_2$

$= \frac{\mu_o}{4\pi}\ \pi I\left[\frac{1}{R_1} + \frac{1}{R_2}\right]$

$= \frac{\mu_o I}{4}\left[\frac{1}{R_1} + \frac{1}{R_2}\right]$ $\otimes$

(ii) $B = \frac{\mu_o}{4\pi}\frac{2\pi I}{R} \times \frac{60}{360}$

$= \frac{10^{-7} \times 2\pi \times 9}{\cdot 1 \times 6} = 9.4 \times 10^{-6}$ T $\otimes$

(iii) Magnetic field at point O

$B = \frac{\mu_o}{4\pi}\frac{I\alpha}{R}$ $\otimes$

(iv) Magnetic field at O due to semicircle

$B_1 = \frac{\mu_o}{4\pi}\frac{\pi I}{d/2} = \frac{\mu_o}{4\pi}\frac{2\pi I}{d}$ $\odot$

Magnetic field at O due to wire

$B_2 = \frac{\mu_o}{4\pi}\frac{I}{d/2} = \frac{\mu_o}{4\pi}\frac{2I}{d} = B_3$ $\odot$

$B_{net} = B_1 + B_2 + B_3$

$\frac{\mu_o I}{2d}\left[1 + \frac{2}{\pi}\right]$ $\odot$

(v) Magnetic field due to first arc

$B_1 = \frac{\mu_o}{4\pi}\frac{2\pi I}{r}\frac{\theta}{2\pi}$

$= \frac{\mu_o}{4\pi}\frac{I\theta}{r}$ $\otimes$

Magnetic field due to second arc

$B_2 = \frac{\mu_o}{4\pi}\frac{I\theta}{2r}$ $\odot$

Magnetic field due to third arc

$B_3 = \frac{\mu_o}{4\pi}\frac{I\theta}{3r}$ $\otimes$

$\therefore B_{net} = B_1 - B_2 + B_3$

$= \frac{\mu_o}{4\pi}\frac{I\theta}{r}\left[\frac{6-3+2}{6}\right]$

$B_{net} = \frac{5}{6}\frac{\mu_o}{4\pi}\frac{I\theta}{r}$ $\otimes$

(vi) Magnetic field due to semicircle of radius R_1 $B_1 = \frac{\mu_o}{4\pi}\frac{\pi I}{R_1}$

$B_1 = \frac{\mu_o I}{4R_1}$ $\odot$

Magnetic field due to semicircle of radius R_2 $B_2 = = \frac{\mu_o I}{4R_2}$ $\otimes$

$\therefore B_{net} = B_1 - B_2$

$= \frac{\mu_o I}{4}\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$ $\odot$

(vii) Mag field at O due to QR

$B_1 = \frac{\mu_o}{4\pi}\frac{2\pi I}{R_2}\frac{\alpha}{2\pi}$

Or $B_1 = \frac{\mu_o}{4\pi}\frac{I\alpha}{R_2}$ $\otimes$

Mag. Field at O due to PTS

$B_2 = \frac{\mu_o}{4\pi}\frac{2\pi I}{R_1}\frac{(360 - \alpha)}{2\pi}$

$B_2 = \frac{\mu_o}{4\pi}\frac{I}{R_1}(360 - \propto)$ $\otimes$

$\therefore B_{net} = B_1 + B_2$

$B_{net} = \frac{\mu_o}{4\pi}I\left[\frac{\alpha}{R_2} + \frac{(360-\alpha)}{R_1}\right]$ $\otimes$

(viii) Magnetic field at O due to arc

$B_1 = \frac{\mu_o}{4\pi}\frac{2I}{R}(\pi - \phi)$ $\otimes$

Magnetic field at O due to AB

$B_2 = \frac{\mu_o}{4\pi}\frac{I}{R\cos\phi}[\sin\phi + \sin\phi]$

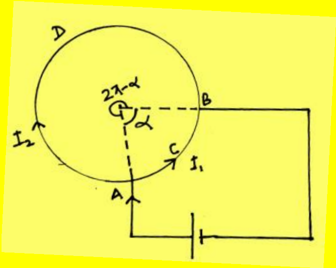
$B_2 = \frac{\mu_o}{4\pi}\frac{I\,2\tan\phi}{R}$ $\otimes$

$\therefore B_{net} = B_1 + B_2$

$$= \frac{\mu_o}{2\pi}\frac{I}{R}[(\pi - \phi) + \tan\phi] \quad \otimes$$

(ix) Magnetic field due to arc ACB

$$B_1 = \frac{\mu_o}{4\pi}\frac{I_1\alpha}{R} \quad \odot$$



Magnetic field due to arc ADB

$$B_2 = \frac{\mu_o}{4\pi}\frac{I_2(2\pi - \alpha)}{R} \quad \otimes$$

$\widehat{ACB}$ and $\widehat{ADB}$ are in parallel

$I_1 R_{ACB} = I_2 R_{ADB}$

$I_1 \alpha R = I_2 (2\pi - \alpha)R$

$I_1\alpha = (2\pi - \alpha)I_2$ –(i)

$\therefore B_{net} = B_1 - B_2$

$$= \frac{\mu_o}{4\pi}\frac{I_1\alpha}{R} - \frac{\mu_o}{4\pi}\frac{I_2(2\pi - \alpha)}{R}$$

Using equation (i), $B_{net} = 0$

A.2. Magnetic field at the center of coil 2 due to current in coil 1

$$B_1 = \frac{\mu_o}{4\pi}\frac{2\pi R^2 I N}{(R^2 + x^2)^{3/2}}$$

$$= \frac{10^{-7} \times 2 \times 3{\cdot}14 \times (0{\cdot}1)^2 \times 5 \times 20}{(.02)^{3/2}}$$

$= 2 \cdot 22 \times 10^{-4}$ T

Magnetic field at the center of coil 2 due to current in coil 2

$$B_2 = \frac{\mu_o}{4\pi}\frac{2\pi NI}{R} = 6.28 \times 10^{-4} \text{ T}$$

(i) When current is in the same direction,

$B_{net} = B_1 + B_2 = 8 \cdot 5 \times 10^{-4}$ T

(ii) When I is in the opp. Direction

$B_{net} = B_2 - B_1 = 4 \times 10^{-4}$ T

A.3. $\vec{B}$ at P due to circular coil.

$$B_1 = \frac{\mu_o}{4\pi}\frac{2M}{(x^2 + R^2)^{3/2}}$$

$$B_2 = \frac{\mu_o}{4\pi}\frac{2M}{(x^2 + R^2)^{3/2}}$$

B_1 and B_2 are at 90^0

$$\therefore B_{net} = \sqrt{B_1^2 + B_2^2}$$

$$= \frac{\mu_o}{2}\frac{I R^2\sqrt{2}}{(x^2 + R^2)^{3/2}}$$

A.4. Magnetic field at the center

$$B = \frac{\mu_o}{4\pi}\frac{2\pi I}{r} \quad \text{\_\_\_\_(1)}$$

Now, we know

$$I = \frac{e}{T} = \frac{e\omega}{2\pi}$$

$\therefore$ Substituting in (1)

$$B = \frac{\mu_o}{4\pi}\frac{e\omega}{r}$$

A.5. $r = 0 \cdot 5 \times 10^{-10}$ m

$V = 4 \times 10^6$ m/s

Magnetic field at the center of circular path

$$B = \frac{\mu_o}{4\pi}\frac{2\pi I}{r} \qquad I = \frac{e}{t} = \frac{e}{2\pi r/v} = \frac{ev}{2\pi r}$$

$$= \frac{\mu_o}{4\pi}\frac{2\pi\, ev}{r^2 2\pi}$$

$$= \frac{10^{-7} \times 1{\cdot}6 \times 10^{-19} \times 4 \times 10^6}{(0{\cdot}5 \times 10^{-10})^2}$$

= 25.6 T

A.6. $r = 0{\cdot}5 \times 10^{-10}$ m

$\nu = 14 \times 10^2$ rps

$$I = \frac{e}{t} = \frac{e}{\frac{1}{\nu}} = e\nu$$

Magnetic field at the center of circular path:

$$B = \frac{\mu_o}{4\pi}\frac{2\pi e\nu}{r}$$

$= \frac{10^{-7} \times 2 \times 3\cdot14 \times 1\cdot6 \times 10^{-19} \times 14 \times 10^{2}}{0\cdot5 \times 10^{-10}}$

$= 2\cdot81 \times 10^{-14}$ T

A.7. $F = \frac{\mu_0}{4\pi}\frac{2I_1I_2}{r}$

$= 10^{-7} \times \frac{2\times8\times5}{4\times10^{-2}}$

$= 20 \times 10^{-5}$ N/M

Force on a 10 cm section of wire A

$= 20 \times 10^{-5} \times 10 \times 10^{-2}$

$= 2 \times 10^{-5}$ N (attractive)

A.8. Magnetic Field at P due to AB

$$B = \frac{\mu_0}{4\pi}\frac{2I}{x}$$

$$= \frac{10^{-7} \times 2 \times 4}{\cdot 2} = 4 \times 10^{-6}\ T$$

Force on proton F = Bqv sin 90

$= (4 \times 10^{-6})(1\cdot6 \times 10^{-19})(4 \times 10^{6})$

$F = 2.56 \times 10^{-18}$ N

Direction – towards the wire

A.9. (i) Force due to AB and CD will be O

Force due to AD due to wire XY

$F_1 = \frac{\mu_0}{4\pi}\frac{2I_1I_2}{r} \times AD$

$= \frac{10^{-7}\times 2\times 20\times 12}{3\times 10^{-2}} \times 27 \times 10^{-2}$

$= 4\cdot3 \times 10^{-4}$ N (Attractive)

Force due to BC due to wire XY

$F_2 = \frac{\mu_0}{4\pi}\frac{2I_1I_2}{r} \times CB$

$= \frac{10^{-7} \times 2 \times 20 \times 12 \times 27 \times 10^{-2}}{15 \times 10^{-2}}$

$= 0\cdot86 \times 10^{-4}$ N (Repulsive)

∴ Net force on the loop = $F_1 - F_2$

$= (4\cdot3 - 0\cdot86) \times 10^{-4}$

$= 3\cdot46 \times 10^{-4}$ N (attractive)

Loop will move towards the wire

(b) The Loop will move away from the wire away from the wire while the magnitude remains same

A.10. $F = \frac{\mu_0}{4\pi}\frac{2I_1I_2}{r} \times$ length of wire

$$= \frac{10^{-7} \times 2 \times 300 \times 300}{1\cdot5} \times 70$$

$F = 1\cdot2$ N/m (Repulsive)

A.11. $l = 1$ m, $m = 4\cdot4 \times 10^{-3}$ Kg

$R = 50 \times 10^{-3}\ \Omega$

$B = 1\cdot8 \times 10^{-3}$ T

a) Fieming's left hand rule

Direction : upwards

b) in equilibrium F = mg

$BIl \sin 90^0 = mg$

$$I = \frac{4\cdot4 \times 10^{-3} \times 10}{1\cdot8 \times 10^{-3} \times 1 \times 1}$$

$I = 220/9$ A

$$V = RI = 50 \times 10^{-3} \times \frac{220}{9}$$

$V = 1\cdot2$ Volt

A.12. B = 2 T

$l = 10 \times 10^{-2}$ m $= 10^{-1}$ m

$I = 5A$

Force on PQ = Force on QR

= Force on PR

$F_1 = F_2 = F_3 = BIl \sin 90°$

$= 2 \times 5 \times \frac{1}{10}$

$= 1$ N

A.13. $v = 3 \times 10^7$ m/s

Magnetic force that acts on the α particle

$F = qvB \sin\theta$ and $\theta = 90°$

$F = 1\cdot6 \times 10^{-19} \times 2 \times 3 \times 10^{7} \times 1$

$= 1\cdot6 \times 6 \times 10^{-12}$

$F = 9\cdot6 \times 10^{-12}$ N (Towards west)

A.14. $\vec{F} = q(\vec{v} \times \vec{B})$

$(4\hat{i} + 3\hat{j}) \times 10^{-10} = (1 \times 10^{-9})(v_1\hat{i} + v_2\hat{j} + v_3\hat{k}) \times (4 \times 10^{-3})\hat{k}\}$

$100\,\hat{i} + 75\,\hat{j} = v_1(-\hat{j}) + v_2\,(\hat{i})$

On comparing, $v_1 = -75 \quad v_2 = 100$

$\therefore \vec{v} = -75\,\hat{i} + 100\,\hat{j}$

A.15. for magnetic repulsion,

current in XY is from Y to X

Force b/w wires (force on XY)

$F = \frac{\mu_o}{4\pi}\frac{2I_1I_2}{r} \times XY$

In equilibrium, $F = mg$

$$\frac{\mu_o}{4\pi}\frac{2I_1I_2}{r} XY = mg$$

$$\frac{\mu_o}{4\pi}\frac{2I_1I_2}{r} = \frac{m}{XY} g$$

$$\frac{10^{-7} \times 2 \times 60 \times I}{4 \times 10^{-3}} = 10^{-2} \times 10$$

I = 33.3A in opposite direction

A.16 $l = 10 \text{ cm} = 10^{-1}$ m

$I = 10$ A

$B = 0\cdot1$ T, $\theta = 53°$

$F = BIL\sin\theta$

$F = 0\cdot1 \times 10 \times 10^{-1} \times \sin 53^o$

$F = 0\cdot1 \times 10^o \times 0\cdot8$

$F = 0\cdot08$ N

A.17. $r = 5 \text{ cm} = 5 \times 10^{-2}$ m

I = 5A, B = 0·50 T

F = BIL sin 90°

$F = \frac{0\cdot5}{10} \times 5 \times 10 \times 10^{-2} \times 1$

$F = 25 \times 10^{-2}$N

A.18. $X = 0$ to $X = \lambda$

$F = BI\lambda$

A.19. $m = 10 \times 10^{-3}$ g

Force due to magnetic field = BIL sin θ

In equilibrium

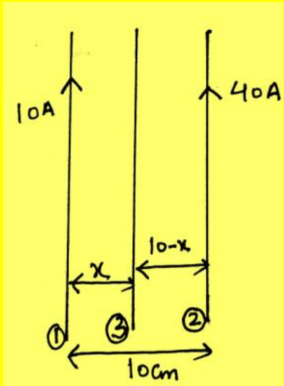
$BIL\sin\theta = mg$

$B = \frac{mg}{IL\sin\theta}$

$B = \frac{10^{-2} \times 10^{-3} \times 9.8}{2 \times 1 \times 1}$

$B = 4.9 \times 10^{-5}$ T

A.20. For wire 3 to not experience any magnetic force. $F_1 = F_2$



$\therefore BI_1L_1\sin\theta = BI_2L_2\sin\theta$

$10\,x = 40\,(10 - x)$

$10x = 400 - 40x$

$x = 8$ cm

A.21. $\frac{\mu_0}{4\pi}\frac{2I_1I_2}{R} = mg$

$L \times \frac{10^{-7} \times 2 \times 50 \times I_2}{5 \times 10^{-3}} = mg$

$2 \times 10^{-3} \times I_2 = \frac{m}{L} \times 9.8$

$$I_2 = \frac{10^{-4} \times 9.8}{2 \times 10^{-3}}$$

$I_2 = 0.49$A ,in opposite direction

A.22. $q = 2 \times 10^{-8}$ C

$m = 2 \times 10^{-10}$ g $= 2 \times 10^{-13}$ kg

$v = 2 \times 10^{3}$ m/s

$B = 0.10\ T.$

$r = \frac{mv}{qB} = \frac{2\times10^{-13}\times2\times10^{3}\times10}{2\times10^{-8}\times0.1}$

$= 0.2\ m = 20cm$

$T = \frac{2\pi r}{v} = \frac{2\times3.14\times.2}{2\times10^{-8}} = 6.3\times10^{-4}s$

A.23. $r_p = 1\ cm = 10^{-2}\ m$

$B = 0{\cdot}1\ T$

$r_p = \frac{mv}{qB} = \frac{mv}{qB} = 1\ cm$

Now,

$r_\alpha = \frac{4mv}{2qB} = 2\ cm$

$[\because \frac{mv}{qB} = 1\ cm]$

A.24. $V = 12\times10^{3}$ volt

$v = 10^{6}$ m/s, B = 0.2 T

W = qV

$\frac{1}{2}mv^2 = qV$

$\frac{1}{2}m(10^6)^2 = q\times12\times10^3$

$\frac{m}{q} = \frac{24\times10^3}{10^{12}} = 24\times10^{-9}$

$r = \frac{mv}{qB} = \frac{24\times10^{-9}\times10^{6}\times10}{0{\cdot}2}$

$= 12\times10^{-2} = 0\cdot12\ m$

A.25. $m_p : m_\alpha = 1:4$

$q_p = q_\alpha = 1:2$

(i) $\frac{r_p}{r_\propto} = \frac{\frac{mv}{qB}}{\frac{4mv}{2qB}} = 1:2$

(ii) $\frac{1}{2}m_p v_p^2 = \frac{1}{2}m_\propto v_\alpha^2$

$\frac{m_p}{m_\propto} = \left(\frac{v_\alpha}{v_p}\right)^2$

$\sqrt{\frac{1}{4}} = \frac{1}{2} = \frac{v_\alpha}{v_p}$

$\frac{r_p}{r_\propto} = \frac{mv_p}{qB}\times\frac{2qB}{4m\times v_\alpha} = \frac{v_p}{2v_\alpha} = \frac{1}{1}$

(iii) $m_p v_p = m_\propto v_\alpha$

$\frac{m_p}{m_\alpha} = \frac{v_\propto}{v_p} = \frac{1}{4}$

$\frac{r_p}{r_\propto} = \frac{m_p v_p}{eB} \Big/ \frac{m_\alpha v_\alpha}{2eB} = \frac{1}{4}\times\frac{4}{1}\times\frac{2}{1} = 2:1$

(iv) W = qV

$\frac{1}{2}mv^2 = qV$

$V = \frac{1}{2}\frac{mv^2}{q}$ or $v = \sqrt{\frac{2qV}{m}}$

$\frac{v_p}{v_\alpha} = \sqrt{\frac{m_\alpha}{q_\propto}\times\frac{q_p}{m_p}} = \frac{\sqrt{2}}{1}$

$\frac{r_p}{r_\propto} = \frac{m_p v_p}{eB} \Big/ \frac{m_\alpha v_\alpha}{2eB} = \frac{1}{4}\times\frac{\sqrt{2}}{1}\times\frac{2}{1}$

$= \frac{\sqrt{2}}{2} = 1:\sqrt{2}$

A.26 $KE_P = KE_D = KE_\propto$

$\frac{1}{2}m_p v_p^2 = \frac{1}{2}m_d v_d^2 = \frac{1}{2}m_\propto v_\propto^2$

$mv_p^2 = 2mv_d^2 = 4mv_\propto^2 = K$ (say)

$v_p = \sqrt{K}$ $v_d = \sqrt{\frac{k}{2}}$ $v_\propto = \frac{\sqrt{k}}{2}$

$r_p : r_d : r_\propto = \frac{m_p v_p}{Be} : \frac{m_d v_d}{Be} : \frac{m_\propto v_\propto}{B2e}$

$= \frac{m\times\sqrt{K}}{B\times e} : \frac{2m\times\sqrt{\frac{K}{2}}}{B\times e} : \frac{4m\times\frac{\sqrt{k}}{2}}{B\times2e}$

$1:\sqrt{2}:1$

A.27. I = 5A

a) 0

b) $\tau = BINA\sin 90^o$

$=\cdot\ 2\times5\times1\times(20\times10\times10^{-4})$

= 0.02 N-m

A.28. $r = 2\ cm = 2\times10^{-2}\ m$

N = 500, I = 1A, $\theta = 30^o$,

B = 0.40 T,

$\tau = BINA \sin\theta$

$\tau = 0\cdot4 \times 1 \times 500 \times \pi r^2 \times \sin 30^o$

$= 0\cdot4 \times 500 \times 3\cdot14 \times 4 \times 10^{-4} \times \frac{1}{2}$

$= 1256 \times 10^{-4} = 12.56 \times 10^{-2}$

$= 13 \times 10^{-2}$ Nm

A.29. Length = L = 2πr

$r = \frac{L}{2\pi}$

a) $\tau = BIA = BI\left(\frac{L}{2\pi}\right)^2$

b) $L = 4x$ (x – side of square)

$x = \frac{L}{4}$

$\tau = BIA = BI\left(\frac{L}{4}\right)^2$

A.30. $N = 200,$

$A = 900\ mm^2 = 900 \times 10^{-6}\ m^2$

$I = 2A, B = 0\cdot5\ T$

(i) M = NIA

$= 200 \times 2 \times 900 \times 10^{-6}$

$= \cdot36 \times 10^4 \times 10^{-6}$

$M = 0.36\ A\ m^2$

(ii) $\tau = BINA \cos\alpha$

$= 0.5 \times 2 \times 200 \times 900 \times 10^{-6} \times \cos 90$

$\tau = 0$

A.31. $l = 10\ cm = 10^{-1}\ m$

$N = 20, I = 12\ A$

$B = 0\cdot 80\ T,\ \theta = 30^o$

$\tau = 20 \times 12 \times (10^{-1})^2 \times 0\cdot8 \times \frac{1}{2}$

$\tau = 0.96$ N-m

A.32. If the wire is formed into a circular coil, L = 2 πr or $r = \frac{L}{2\pi}$

$\tau = BINA \sin\theta$

For maximum torque θ = 90

$\tau = B \times i \times 1 \times \pi r^2 \times 1$

$\tau = Bi\,\pi\left(\frac{L}{2\pi}\right)^2 = \frac{BiL^2}{4\pi}$

A.33. N = 2000, I = 200 × 10^{-3} A

B = 0.2 T

a) Max. Torque = MB sin 90^o

$\tau = 2000 \times 200 \times 10^{-3} \times 8 \times 10^{-2} \times 6 \times 10^{-2} \times 0.2 \times 1$

$\tau = 400 \times 48 \times 10^{-4} \times 0.2$

$\tau = 8 \times 48 \times 10^{-3}$

$\tau = 384 \times 10^{-3}$

$\tau = 0.384$ N-m

When $\vec{B} \perp \vec{M}$, it experience the maximum torque

b) when ∠ b/w $\vec{B}$ & $\vec{M}$ is 0^o, $\tau = 0^o$

For unstable eq'm, $\theta = 0^o$

For unstable eq'm, $\theta = 180^o$

A.34. $l = 50\ cm = 0.5\ m$

$N = 100, I = 2\cdot5\ A$

a) $n = \frac{100}{\cdot5} = 200\frac{\text{turns}}{\text{length}}$

$B = \mu_o\, n\, I$

$= (4\pi \times 10^{-7})(200) \times 2\cdot5$

$= 6.28 \times 10^{-4}T$

b) $B = \frac{\mu_o\, n\, I}{2} = 3.14 \times 10^{-4}T$

A.35. $l = 4\ cm = 4 \times 10^{-2}\ m$

$\theta = 60^o, I = 12\ A$

$B = 0\cdot 25\ T$

F=BIl sin 60 = .25 × 12 × .04 × .866

= 0.104 N

A.36. L = 1m, D = 3 cm, R = 0·015 m

I = 5A, B = ?

N = 850 × 5 = 4250 turns

n = $\frac{N}{L}$ = 4250 turns/m

B = $\mu_o\, n\, I$

B = $4 \times 3 \cdot 14 \times 10^{-7} \times 21250$

$B = 266900 \times 10^{-7}$

B = $2 \cdot 67 \times 10^{-2}\, T$

A.37. $I_g = 5 \times 10^{-4}\, A$

$G = 100\, \Omega$

$V = 5\, V, R = ?$

$I_g = \frac{V}{R+G}$

$R = \frac{V}{I_g} - G$

$R = \frac{5}{5 \times 10^{-4}} - 100$

$R = 10^4 - 10^2$

R = $9900\, \Omega$

A.38. $Ig = 1 \times 10^{-3}\, A$

$G = 100\, \Omega, I = 1A$

S = ?

$S = \frac{I_g\, G}{I - Ig}$

S = $\frac{10^{-3} \times 100}{1 - 10^{-3}}$

$S = \frac{10^{-1}}{1 - 0{\cdot}001}$

$S = \frac{10^{-1}}{0 \cdot 999} = 0 \cdot 1\, \Omega$

A.39. VS = $\frac{CS}{R}$

$(VS)' = \frac{1{\cdot}2\, CR}{1{\cdot}5\, R}$

% dec = $\frac{(VS) - (VS)'}{VS} \times 100$

$= \frac{\cdot 3}{1 \cdot 5} \times 100 = 20\%$

A.40. I_g = 10% of I=0.1I

S = $\frac{I_g\, G}{I - I_g}$

= $\frac{\cdot I \times 99}{I - (\cdot I)}$ = 11Ω

A.41. S = 2 Ω, G = 78 Ω,

$I_g = \frac{1}{10}\frac{mA}{div} = \frac{1}{10}\frac{mA}{div} \times 75 div$

$= 7 \cdot 5$ mA

$S = \frac{I_g\, G}{I - I_g}$

$I = \frac{I_g G + S I_g}{S} = \frac{I_g(G+S)}{S}$

I = $\frac{7.5 \times 10^{-3} \times 80}{2}$ = 0·3A

A.42. G = 100 Ω, V = 10 Volt, n = 20,

$R_v = 2000\, \Omega$

(i) $R_v = R + G$

$R = R_v - G$

R = 1900Ω

(ii) $I_g = \frac{V}{G + R}$

$I_g = \frac{10}{100 + 1900} = 5 \times 10^{-3}$ A

(iii) I = nk

R = $2 \cdot 5 \times 10^{-4}$ A

(iv) S = $\frac{I_g - G}{I - I_g} = \frac{5 \times 10^{-3} \times 100}{1000 - 5}$

$S = 0 \cdot 5\Omega$

A.43. (i) I = $\frac{K}{NBA}\, \alpha$

$\cdot 01 \times 10^{-3} = \frac{K \times \frac{\pi}{6}}{200 \times \cdot 15 \times 3 \times 1 \times 10^{-4}}$

K = 1.72×10^{-6} N-m/rad

(ii) As k is constant for a galvanometer

I = $\frac{K}{NBA}\, \alpha$

Here $\alpha = \frac{\pi}{4}$

$$I = \frac{1.72 \times 10^{-6} \times \frac{\pi}{4}}{200 \times \cdot 15 \times 3 \times 1 \times 10^{-4}}$$

I = 0.15mA