Date / /
Page No.

NCERT Exercise

Chapter - 4 Moving Charges And Magnetism

Q1 Given

$N = 100$

$r = 8\,cm = 8 \times 10^{-2}\,m$

$I = 0.40\,A$

$B = ?$

$$B = \frac{N\mu_0 I}{2r}$$

$$B = \frac{100 \times 4\pi \times 10^{-7} \times 0.40}{2 \times 8 \times 10^{-2}}$$

$$= 2\pi \times 10^{-7} \times 5 \times 10^{2}$$

$$= 10\pi \times 10^{-5}$$

$$B = 3.14 \times 10^{-4}\,T$$

Q2

Soln Given

$I = 35\,A$

$r = 20\,cm = 20 \times 10^{-2}\,m$

$B = ?$

$$B = \frac{\mu_0 I}{2\pi r}$$

$$= \frac{4\pi \times 10^{-7} \times 35}{2\pi \times 20 \times 10^{-2}}$$

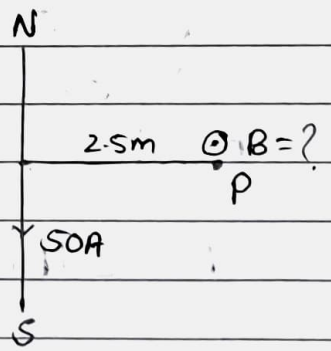
$$B = 3.5 \times 10^{-5}\,T$$

Q3 Given

$I = 50\,A$ (N to S)

$r = 2.5\,m$

$B = ?$



Date / /
Page No.

$$B = \frac{\mu_0 I}{2\pi r}$$

$$= \frac{4\pi \times 10^{-7} \times 500}{2\pi \times 2.5}$$

$$= 40 \times 10^{-7}$$

$$B = 4 \times 10^{-6}\ T$$

Dirⁿ of B → By right hand thumb rule dirⁿ of B is out of the page.

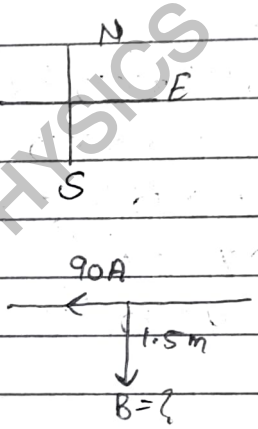
Q4

Solⁿ Given

$I = 90A$

$r = 1.5m$

$B = ?$



$$B = \frac{\mu_0 I}{2\pi r}$$

$$= \frac{4\pi \times 10^{-7} \times 900}{2\pi \times 1.5}$$

$$= 120 \times 10^{-7}$$

$$B = 1.2 \times 10^{-5}\ T$$

Direction → Towards South.

Q5

Solⁿ Given

$I = 8A$

$B = 0.15\ T$

$\theta = 30^\circ$

$\frac{F}{l} = ?$

$F = IlB\sin\theta$

$$\frac{F}{l} = IB\sin\theta$$

$$= 8 \times 0.15 \sin 30^\circ$$

$$= 8 \times 0.15 \times \frac{1}{2}$$

$$\frac{F}{l} = 0.60\ Nm^{-1}$$

Q6

Soln

$l = 30cm = 3\times10^{-2}m$

$I = 10A$

$B = 0.27T$, $\theta = 90^\circ$

$F = ?$

$F = IlB\sin\theta$

$= 10 \times 3\times10^{-2} \times 0.27 \times \sin 90^\circ$

$= 2.7 \times 3\times10^{-2}$

$F = 8.1\times10^{-2}N$

Q7

Soln

Given

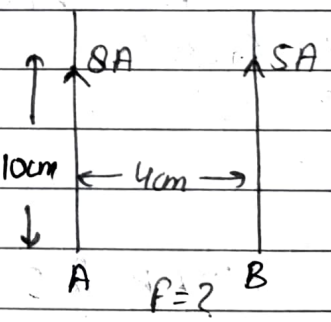
$I_A = 8A$

$I_B = 5A$

$d = 4cm = 4\times10^{-2}m$

$l = 10cm = 10\times10^{-2}m$

$F = ?$



$$F = \frac{\mu_0 I_A I_B}{2\pi d} . l$$

$$= \frac{4\pi\times10^{-7}\times8\times5}{2\pi\times4\times10^{-2}} \times 10\times10^{-2}$$

$$= 2\times2\times5\times10\times10^{-7}$$

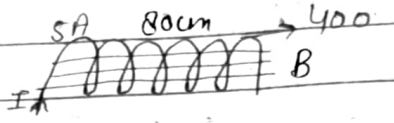
$$= 200\times10^{-7}$$

$F = 2\times10^{-5}N$ [Force of attraction]

Date / /
Page No.

Q8

Soln Given



$l = 80\,cm = 80 \times 10^{-2}\,m$

$N = 5 \times 400$

$I = 8\,A$

$B = ?$

$B = \mu_0 n I$

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

$= \frac{4\pi \times 10^{-7} \times 5 \times 400 \times 8}{80 \times 10^{-2}}$

$= 800\pi \times 10^{-5}$

$= 8 \times 3.14 \times 10^{-3}$

$= 25.12 \times 10^{-3}$

$B = 2.5 \times 10^{-2}$

Q9

Soln Given

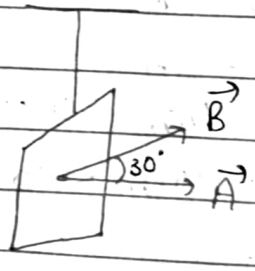
Side of square coil = 10cm

$I = 12\,A$, $N = 20$, $A = (10)^2\,cm^2 = 100 \times 10^{-4}\,m^2 = 10^{-2}\,m^2$

$B = 0.80\,T$

$\theta = 30^\circ$

$\tau = ?$



$\tau = NIAB\sin\theta$

$= \frac{20 \times 12 \times 10^{-2} \times 0.80 \times \sin 30^\circ}{100}$

$= \frac{240 \times 80 \times 10^{-2} \times \frac{1}{2}}{100}$

$= 96 \times 10^{-2}$

$\tau = 0.96\,Nm$

Date / /
Page No.

Q10 Given

M_1	M_2
$R_1 = 10\Omega$, $N_1 = 30$	$R_2 = 14\Omega$, $N_2 = 42$
$A_1 = 3.6 \times 10^{-3} m^2$	$A_2 = 1.8 \times 10^{-3} m^2$
$B_1 = 0.25 T$	$B_2 = 0.50 T$

$K_1 = K_2 = K$

For $\frac{M_2}{M_1}$

a) Current Sensitivity I_S

$$I_S = \frac{NAB}{K}$$

$$\frac{I_{S_2}}{I_{S_1}} = \frac{N_2 A_2 B_2}{N_1 A_1 B_1} = \frac{42 \times 1.8 \times 10^{-3} \times 0.50}{30 \times \frac{3.6}{2} \times 10^{-3} \times 0.25} = 1.4 \text{ Ans}$$

$$V_S = \frac{NAB}{KR} = \frac{I_S}{R}$$

$$\frac{V_{S_2}}{V_{S_1}} = \frac{I_{S_2}}{I_{S_1}} \frac{R_1}{R_2}$$

$$= 1.4 \times \frac{10}{14} = 1.$$

$$\frac{V_{S_2}}{V_{S_1}} = 1 \text{ Ans}$$

Q11

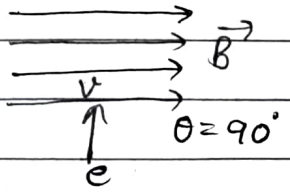
Soln Given

$B = 6.5 G = 6.5 \times 10^{-4} T$

$v = 4.8 \times 10^6 m/s$

$\theta = 90°$

$F = qvB = q(\vec{v} \times \vec{B}) = \vec{F}$



$$qvB = \frac{mv^2}{r}$$

The magnetic force qvB provides the required centripetal force $\frac{mv^2}{r}$ to the electron. Hence it starts moving on circular path.

$$F = qvB = \frac{mv^2}{r}$$

$$\text{Radius } r = \frac{mv}{qB} = \frac{9.1 \times 10^{-31} \times 4.8 \times 10^{6}}{1.6 \times 10^{-19} \times 6.5 \times 10^{-4}}$$

$$= \frac{7 \times 3}{5} \times 10^{-31+6+19+4}$$

$$= \frac{21}{5} \times 10^{-2}$$

$$= 4.2 \times 10^{-2} m$$

$$= 4.20 cm \quad \text{Ans}$$

Q12

Soln Given

$$B = 6.5 G = 6.5 \times 10^{-4} T$$

$$v = 4.8 \times 10^{6} m/s$$

$$\theta = 90^\circ$$

$$e = 1.6 \times 10^{-19} C$$

$$m_e = 9.1 \times 10^{-31} Kg$$

$$\nu = ?$$

$$\nu = \frac{v}{2\pi r} = \frac{4.8 \times 10^{6}}{2 \times \frac{22}{7} \times 4.2 \times 10^{-2}}$$

$$= \frac{2}{11} \times 10^{8}$$

$$= \frac{200}{11} \times 10^{6} \Rightarrow 18.1 \times 10^{6}$$

$$\nu = 18 MHz \quad \text{Ans}$$

Date / /
Page No.

Q13 a) Given

Soln

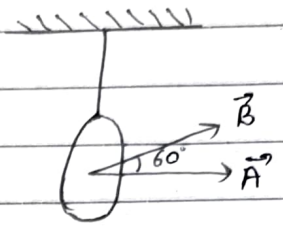
$N = 30$

$r = 8cm = 8 \times 10^{-2} m$

$I = 6A$

$B = 1T$

$\theta = 60°$



Torque $\tau = NIABSin\theta$

Area $A = \pi r^2 = 3.14 \times (8 \times 10^{-2})^2$

$= 3.14 \times 64 \times 10^{-4}$

$= 200.96 \times 10^{-4}$

$= 201 \times 10^{-4} m^2$

So, $\tau = 30 \times 6 \times 201 \times 10^{-4} \times 1 \times Sin60°$

$= \frac{90}{180} \times 201 \times 10^{-4} \times \frac{\sqrt{3}}{2}$

$= 18090 \times 10^{-4} \times 1.732$

$= 1.81 \times 1.732$

$= 31.3492$

$\tau = 31.3 Nm.$ Ans

i.e 31.3 Nm Counter torque is needed.

b) The answer will not change on changing the shape of coil as τ depends on area not on the shape of coil ($\tau = NIABSin\theta$)