PHY-112

Assignment-03

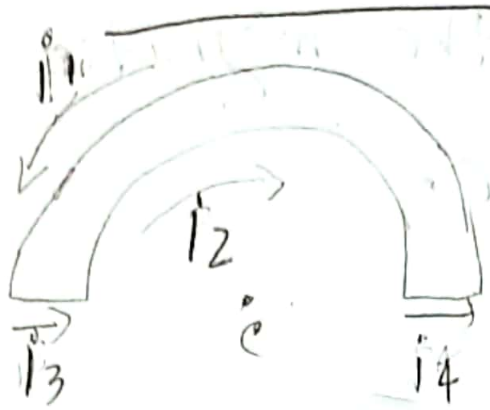
Name: MD Ikramul Kayes

ID : 21301576

sec : 11

Ans: to: que: no: 1

a) Ans:



Here,
Magnitude of $i_1 = i_2 = i_3 = i_4$

~~Here~~ from i_3 the direction of c ~~from it~~ is 0° so $B_3 = 0$ and from i_4 direction of c ~~from it~~ is 180°, so $B_4 = 0$.

So, magnitude $B_{net} = B_1 + B_2$

$$\cancel{= + \frac{\mu_0 i \pi}{4\pi R_1}}$$

$$= -\frac{\mu_0 i \pi}{4\pi R_2} + \frac{\mu_0 i \pi}{4\pi R_1}$$

$$= -\frac{4\pi \times 10^{-7} \times 0.281}{4 \times 7.8 \times 10^{-2}} + \frac{4 \times 10^{-7} \times 0.281}{4 \times 3.15 \times 10^{-2}}$$

$$= 1.67 \times 10^{-6}\ T$$

(Ans)

b) Direction of the megnatic field is into the page.

Ans: to que: no: 2

a) The net megnatic field of the wires is

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

$$= \frac{\mu_0 i_1}{2\pi R_1} + \frac{\mu_0 i_2}{2\pi R_2}$$

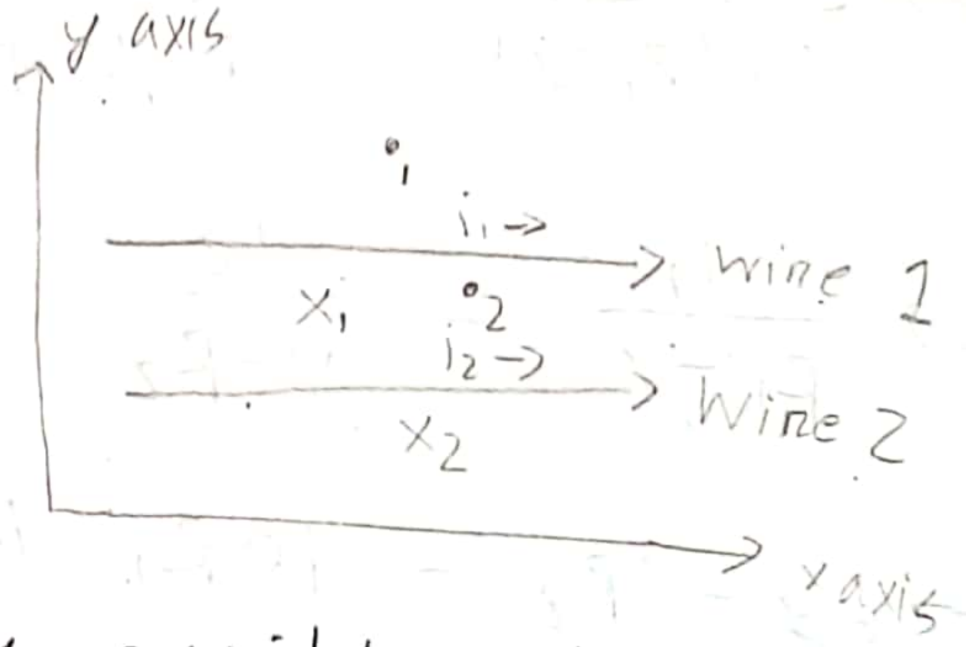
$$= \frac{4\pi \times 10^{-7} \times 6}{2\pi \times 10 \times 10^{-2}} + \frac{4\pi \times 10^{-7} \times 10}{2\pi \times 5 \times 10^{-2}}$$

$$= 5.2 \times 10^{-5}\ T$$

As B_1, B_2 both in outward (-z) direction

so, ~~net~~ B_{net} in -z direction

$\therefore \overrightarrow{B_{net}} = -5.2 \times 10^{-5} \, T \, \hat{k}$



b) As from the given condition we can say that ~~to~~ $B_{net} = 0$ is only possible between two of the wires only. So, the cordinate y will be where $B_{net} = 0$ & $R_2 < y < R_1$,

$\therefore B_1 - B_2 = 0$

$$\Rightarrow \frac{\mu_0 i_1}{2\pi(R_1-y)} = \frac{\mu_0 i_2}{2\pi(y-R_2)}$$

$$\Rightarrow \frac{i_1}{R_1-y} = \frac{i_2}{y-R_2}$$

$$\Rightarrow 6y - 6R_2 = 10R_1 - 10y$$

$$\Rightarrow 16y = 10R_1 + 6R_2$$

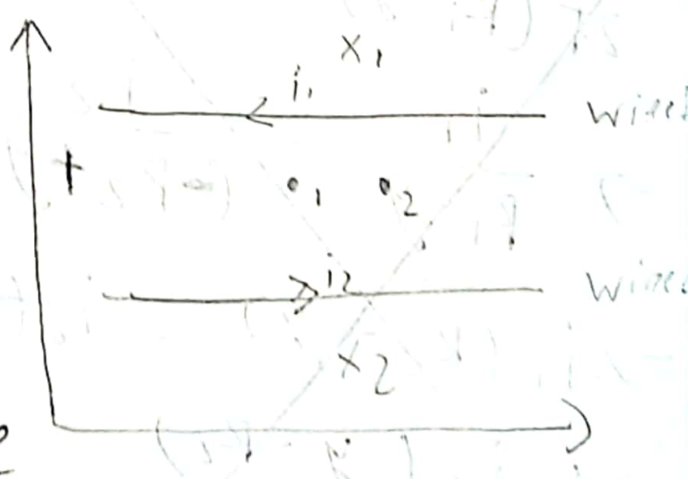
$$\Rightarrow y = 0.08125\,m$$

~~(Ans)~~

At $y = 0.08125\,m$ the $\vec{B} = 0$

(Ans)

c) Ans: if i_1 get reversed, As wire B is the one which carrying larger i a, $i_2 > i_1$ so the $B_{net} = 0$ will be



in the upward direction R_1 . ~~we~~

$\therefore$ We can write $y > R_1 > R_2$. when $\vec{B} = 0$,

As,

$$B_2 - B_1 = 0$$

$$\Rightarrow B_2 = B_1$$

$$\Rightarrow \frac{\mu_0 i_2}{2\pi(y - R_2)} = \frac{\mu_0 i_1}{2\pi(y - R_1)}$$

$$\Rightarrow \frac{i_2}{y - R_2} = \frac{i_1}{y - R_1}$$

$$\Rightarrow i_2(y - R_1) = i_1(y - R_2)$$

$$\therefore y = 0.0175\ m$$

~~(Ans)~~

At $y = 0.0175\ m$ the $\vec{B} = 0$

(Ans)

Ans: to que: no: 3

(a) Ans:

Given that $B = 4t^2 y$

we know,

$$\partial \phi_B = \oint B \cdot dA$$

$$= (4t^2 y).(\lambda dy \quad \left[As \frac{\partial A}{\partial y} = 1 \right]$$

$$\therefore \phi_B = \int_0^\lambda (4t^2 y \lambda) \partial y$$

$$= \frac{1}{2}\left[4t^2 y^2 \lambda\right]_0^\lambda$$

$$= 2t^2 \lambda^2 . \lambda - 0$$

$$= 2t^2 \lambda^3$$

$$\therefore As, \mathcal{E} = -N \frac{\partial \phi_B}{\partial t}$$

$$\frac{\phi_B}{\partial t} = 4t\lambda^3$$

$N = 1$

$$\therefore |\mathcal{E}| = \left|-N \frac{\partial \phi_B}{\partial t}\right| = 4t\lambda^3$$

For $t = 2.5$, $\therefore \varepsilon = 4(2.5)(2\times10^{-2})^3$

$= 8\times10^{-5}$ V

b) Ans: The direction of the emf induced in the loop is clock wise.