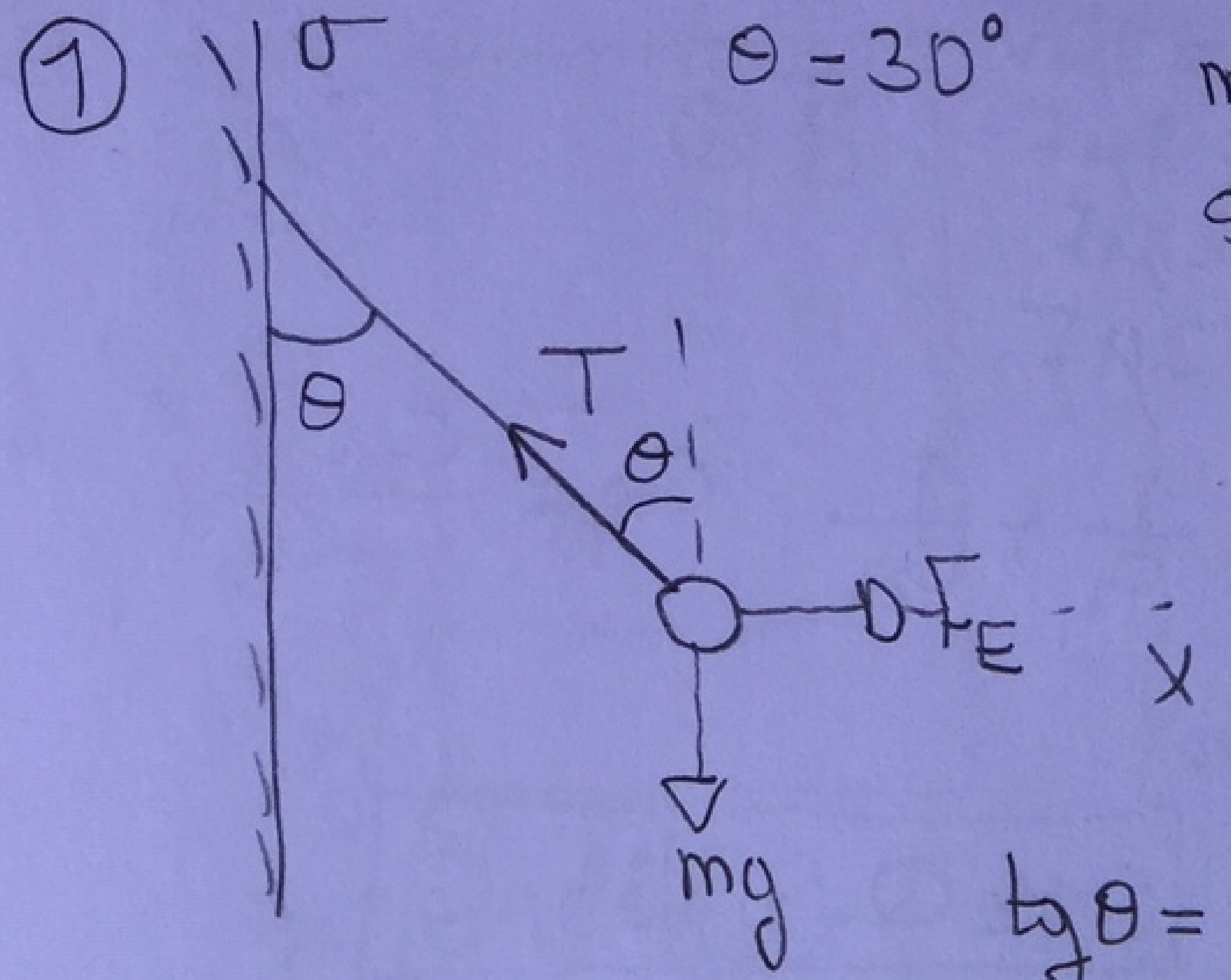
① $\theta = 30^\circ$ $\quad m = 10^{-3}\,g = 10^{-6}\,kg$; $\vec{E} = \frac{\sigma}{2\varepsilon_0}\hat{\imath}$

$q = 1\,nC$



x) $T \operatorname{sen}\theta = F_E = qE$

$T \operatorname{sen}\theta = \frac{\sigma q}{2\varepsilon_0}$

y) $T\cos\theta = mg$

$tg\,\theta = \frac{\sigma q}{2\varepsilon_0 m g} \Rightarrow$

$$\sigma = \frac{2\varepsilon_0 m g}{q} tg\,30^\circ = 1\times 10^{-7}\ C/m^2$$

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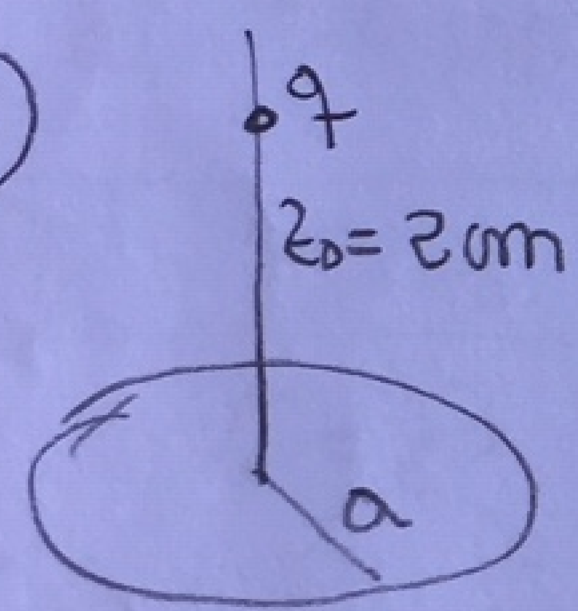
② $a = 1\,cm$ $\quad Q = 1\,nC$ $\quad q = 1\,nC$ $\quad m = 10^{-3}\,g = 10^{-6}\,kg$

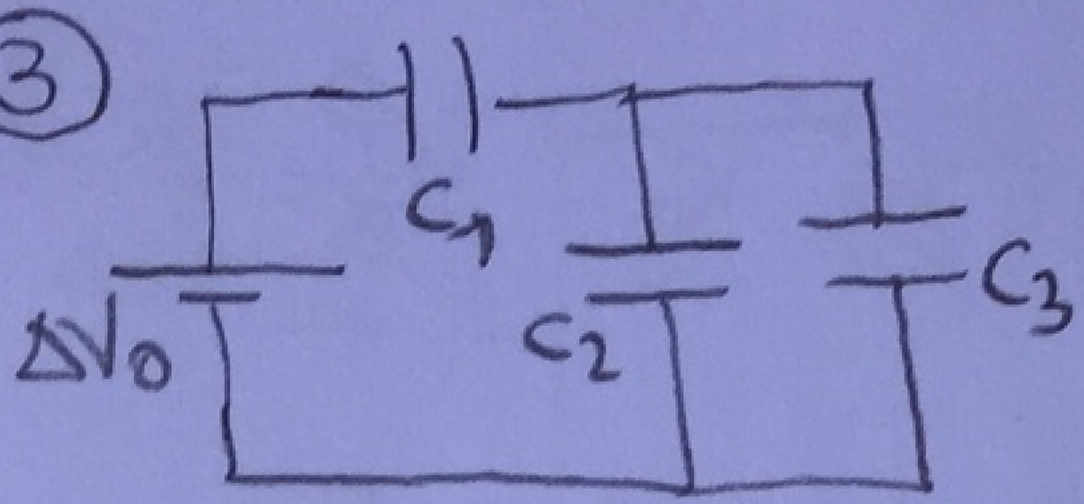


$$V(z) = \frac{kQ}{\sqrt{a^2+z^2}}$$

$$E_i = \frac{1}{2} m v_0^2 + \frac{kQq}{\sqrt{a^2+z_0^2}} = \frac{kqQ}{a}$$

$$\boxed{v_0 \simeq 0'9975\ m/s \text{ hacia el centro del anillo}}$$

③



$\Delta V_0 = 10V$
$C_1 = 1\mu F$
$C_2 = 2\mu F$
$C_3 = 3\mu F$

$C_{23} = C_2 + C_3 = 5\mu F \; ; \; \frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_{23}} \; ; \; C_{eq} = \frac{C_1 C_{23}}{C_1 + C_{23}}$

$C_{eq} = \frac{5}{6} \simeq 0'833\mu F$

$Q_T = C_{eq}\Delta V_0 = 8'33\mu C \; ; \; \boxed{Q_1 = Q_T = 8'33\mu C}$

$Q_{23} = Q_T \Rightarrow \Delta V_{23} = \frac{Q_{23}}{C_{23}} = \frac{8'33\mu C}{5\mu F} = 1'666 V$

$Q_2 = C_2 \Delta V_{23} = \boxed{3'332\mu C = Q_2}$

$Q_3 = C_3 \Delta V_{23} = \boxed{4'998\mu C = Q_3}$

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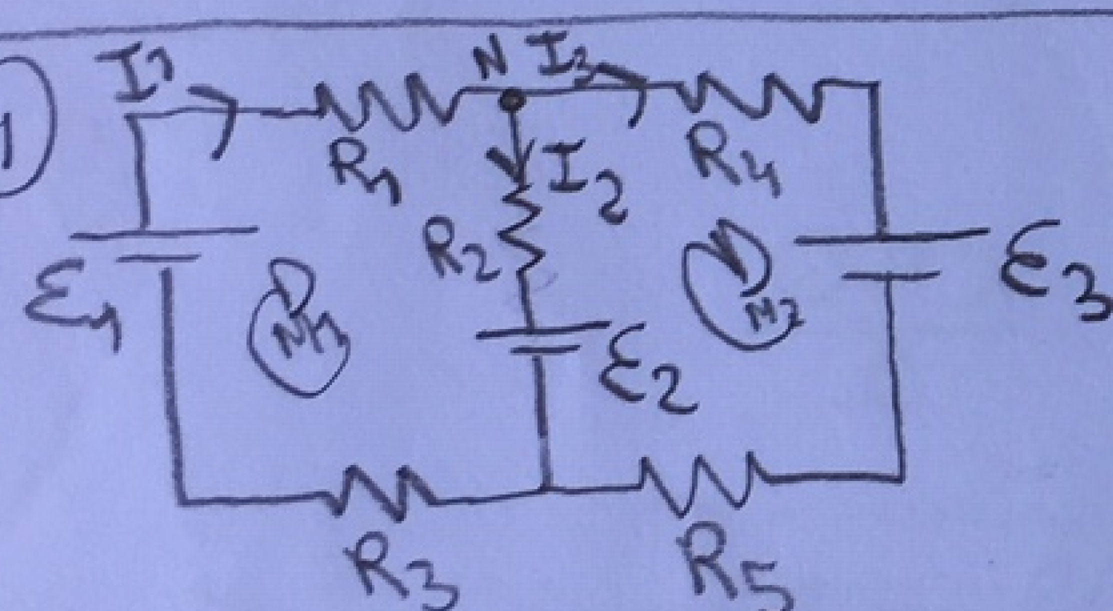
④



$\mathcal{E}_1 = 2V \quad \mathcal{E}_2 = 4V \quad \mathcal{E}_3 = 2V$

$R_1 = R_3 = R_4 = R_5 = 1\Omega \; ; \; R_2 = 4\Omega$

N] $I_1 = I_2 + I_3$

M1] $\mathcal{E}_1 - I_1R_1 - I_2R_2 - \mathcal{E}_2 - I_1R_3 = 0$

M2] $\mathcal{E}_2 + I_2R_2 - I_3R_4 - \mathcal{E}_3 - I_3R_5 = 0$

N] $I_1 = I_2 + I_3$; M1] $-2 - 2I_1 - 4I_2 = 0$; M2] $2 + 4I_2 - 2I_3 = 0$

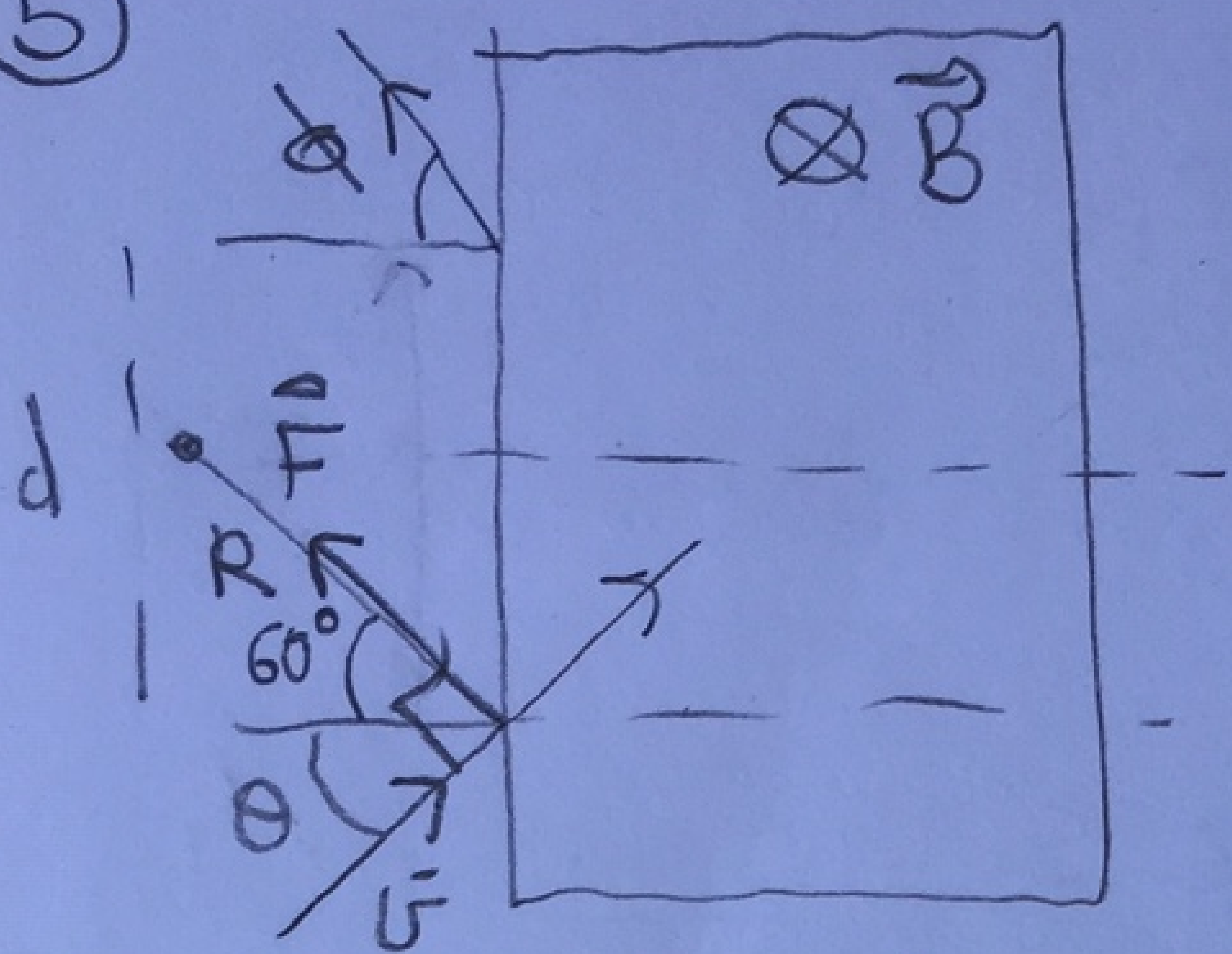
M1] $2 + 2I_2 + 2I_3 + 4I_2 = 0 \; ; \; 2 + 6I_2 + 2I_3 = 0 \; ; \; I_3 = -1 - 3I_2$

M2] $2 + 4I_2 + 2 + 6I_2 = 0 \; ; \; 4 + 10I_2 = 0 \; ; \; \boxed{I_2 = -4/10 = 2/5 = -0'4A}$

$\boxed{I_3 = -1 - 3I_2 = -1 + 1'2 = 0'2A}$

$\boxed{I_1 = I_2 + I_3 = -0'4 + 0'2 = -0'2A}$

5



$q = 1'6 \times 10^{-19}\ C$

$m = 1'67 \times 10^{-27}\ Kg$

$B = 1\ T \qquad v = 10^6\ m/s$

$\theta = 30°$

$\vec{F} = q\,\vec{v} \wedge \vec{B} \Rightarrow F = qvB$

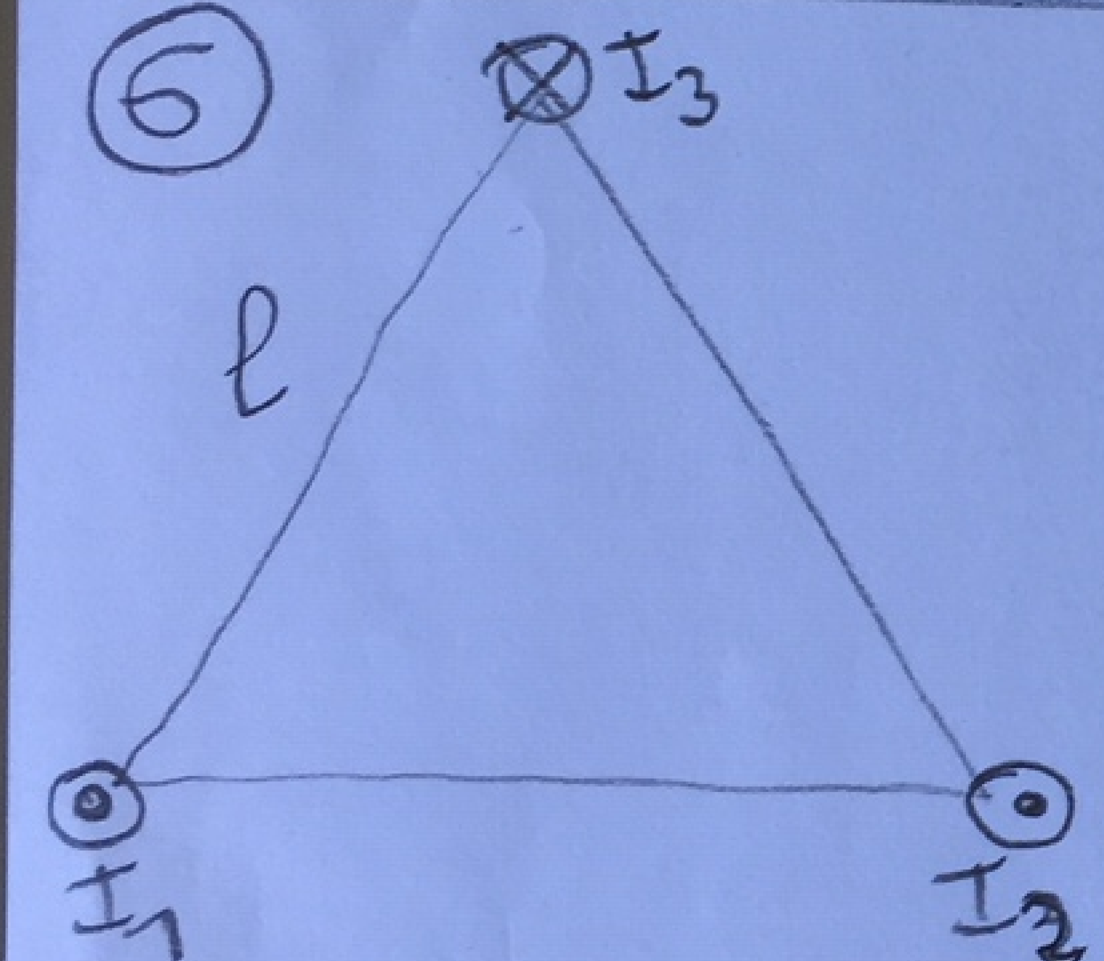
Por simetría $\phi = \theta = 30°$

$qvB = \frac{mv^2}{R}$; $R = \frac{mv}{qB} = \frac{(1'67 \times 10^{-27})(10^6)}{(1'6 \times 10^{-19})(1)}$

$R = 0'01044\ m$; $\operatorname{sen} 60° = \frac{d/2}{R}$

$d = 2R \operatorname{sen} 60° = 2 \times 0'01044 \times \frac{\sqrt{3}}{2} = 0'018\ m$

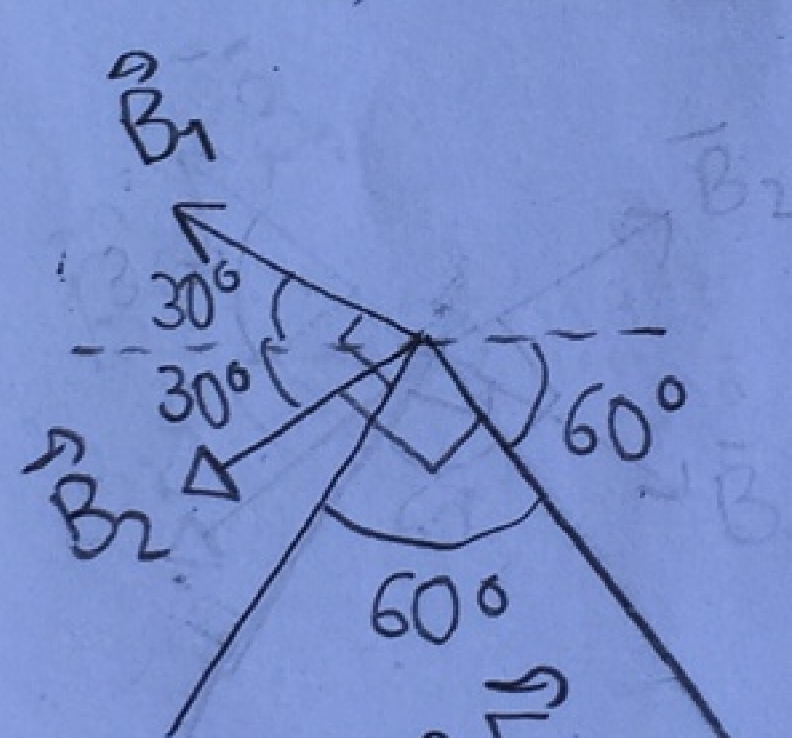
6



$\ell = 0'1\ m \qquad I_i = 15\ A \qquad d\vec{B} \propto d\vec{\ell} \wedge \hat{r}$

¿F_3?

$B_1 = B_2 = \frac{\mu_0 I}{2\pi \ell}$

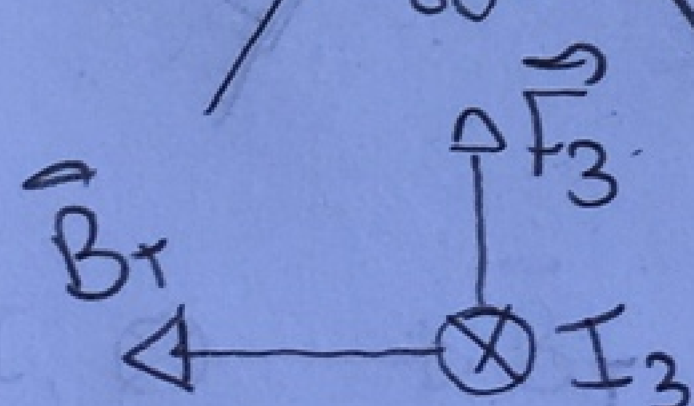


$\vec{B}_T = -2 B_1 \cos\theta\, \hat{\imath}$

$\vec{B}_T = -\frac{2\mu_0 I}{2\pi \ell} \frac{\sqrt{3}}{2}\, \hat{\imath}$

$\vec{B}_T = -\frac{\sqrt{3}\mu_0 I}{2\pi \ell}\, \hat{\imath}$

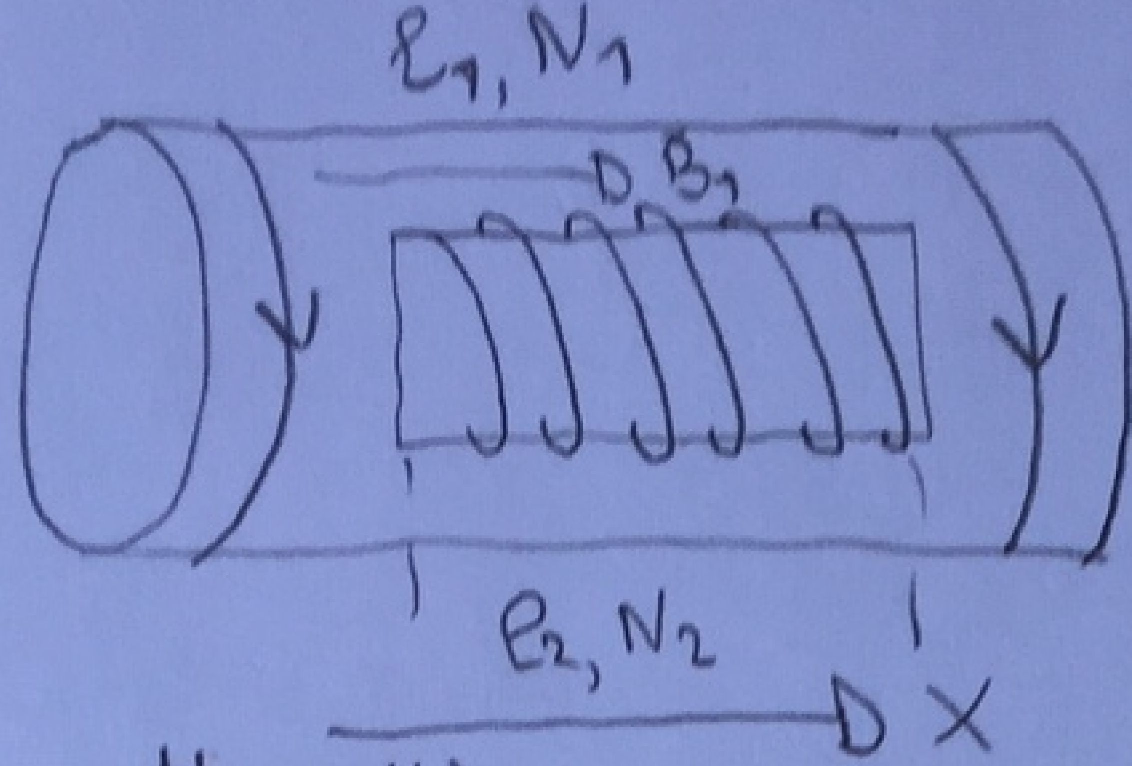
$\vec{F}_3 = I_3\, \vec{L}_3 \wedge \vec{B}_T$



$\vec{F}_3 = I_3 L_3 |B_T|\, \hat{\jmath} \Rightarrow \frac{\vec{F}_3}{L_3} = I |B_T|\, \hat{\jmath}$ hacia arriba

$\frac{\vec{F}_3}{L_3} = \frac{15 \times 4\cancel{\pi} \times 10^{-7} \times 15 \times \sqrt{3}}{2\cancel{\pi} \times 0'1}\, \hat{\jmath} = +7'8 \times 10^{-4}\, \hat{\jmath}\ N/m$

⑦



$S_1 = 20\ cm^2 \quad S_2 = 10\ cm^2$

$\ell_1 = 50\ cm \quad \ell_2 = 25\ cm$

$N_1 = 2000 \quad N_2 = 1000$

$I_1(t) = 2\cos(100\pi t) \quad R_2 = 10\ \Omega$

$$\vec{B}_1 = \frac{\mu_0 I_1(t) N_1}{\ell_1} \ ; \quad \Phi_2 = N_2 B_1 S_2 = \frac{\mu_0 N_1 N_2 S_2}{\ell_1} I_1(t)$$

$$\varepsilon_2 = -\frac{d\Phi_2}{dt} = +\frac{\mu_0 N_1 N_2 S_2}{\ell_1} 2\times 100\pi \operatorname{sen}(100\pi t)$$

$$I_2 = \frac{\varepsilon_2}{R} = \frac{\mu_0 N_1 N_2 S_2}{\ell_1 R} 200\pi \operatorname{sen}(100\pi t)$$

$$\boxed{I_2(t) \simeq 0'316 \operatorname{sen}(100\pi t)\ A}$$ Correcta