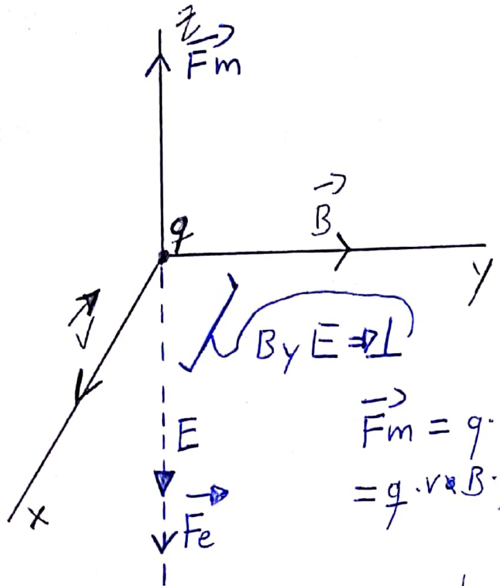
Tema 4 Fundamentos de magne

1)

$E = 200\ N/C$] $\perp$ entre si y $\perp$ a la partícula
$B = 0{,}5\ T$



Para que la partícula no se mueva $\vec{F_m} = \vec{F_E}$

$q \cdot v \times B = q \cdot E$

$\cancel{q} \cdot v \cdot B = \cancel{q} \cdot E$

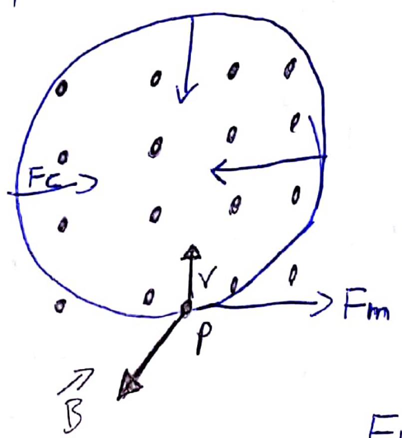
$v = \frac{E}{B} = \frac{200}{0{,}5} = 400$

$v = 400\ m/s$

$\vec{F_m} = q \cdot v \times B =$
$= q \cdot v \cdot B \cdot \cancel{\operatorname{sen} 90^\circ}^{1}$

La $\vec{F_e}$ va en el mismo sentido que el E.

2) $p \perp B$



$B = 0{,}4 \cdot 10^{-4}\ T$

$R = 0{,}21\ m$

a) T del movimiento

$F_c = F_m$

$F_m = q\, v \times B = q\, v \cdot B \cdot \cancel{\operatorname{sen} 90^\circ}^{1} = q v B$

$\frac{mv^2}{R} = q v B \Rightarrow R = \frac{mv}{qB}$

$T = \frac{2\pi}{w} = \frac{2\pi}{v/R} = \frac{2\pi R}{v} = \frac{2\pi}{v} \cdot \frac{mv}{qB} = \frac{2\pi m}{qB} =$

$v = w \cdot R \Rightarrow w = v/R$

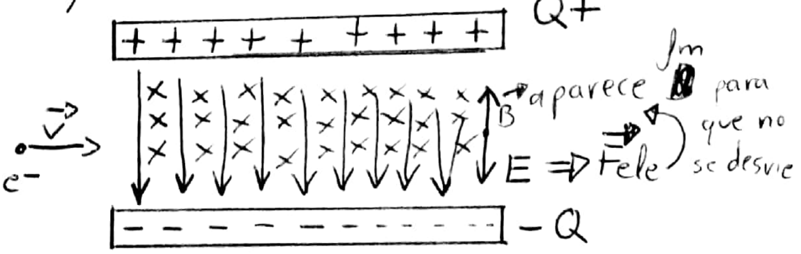
$= \frac{2\pi \cdot 1{,}67 \cdot 10^{-27}}{1'6 \cdot 10^{-19} \cdot 0{,}4 \cdot 10^{-4}} = 1'64 \cdot 10^{-3}\ s$

b) velocidad del protón

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

$$v = \frac{qB \cdot R}{m} = \frac{1'6 \cdot 10^{-19} \cdot 0,4 \cdot 10^{-4} \cdot 0,21}{1'67 \cdot 10^{-27}} = 804,79 \, m/s$$

3)



$S = 1 \, m^2$

$= 26,55 \, nC = 2,65 \cdot 10^{-8} \, C$

$V_e = 10^6 \, m/s$

$q_e = 1'6 \cdot 10^{-19} \, C$

$m_e = 9,1 \cdot 10^{-31} \, Kg$

$\varepsilon_0 = 8,85 \cdot 10^{-12} \, C^2/N \cdot m^2$

$$\sigma = \frac{Q}{S} = \frac{2,655 \cdot 10^{-8}}{1} = 2,65 \cdot 10^{-8} \, C/m^2$$

$$\vec{E} = \frac{\sigma}{\varepsilon_0} = \frac{2,65 \cdot 10^{-8}}{8,85 \cdot 10^{-12}} = 2994,35 \, N/C$$

Para ~~la~~ que la partícula no se desvie $\Rightarrow F_m = F_e$.

$$\left.\begin{array}{l} F_e = q \cdot E \\ F_m = q v \times B \end{array}\right] \Rightarrow \vec{F_e} = \vec{F_m}$$

$$\cancel{q} \cdot E = \cancel{q} \, v \cdot B \cdot \cancel{\operatorname{sen} \frac{\pi}{2}}^{1}$$

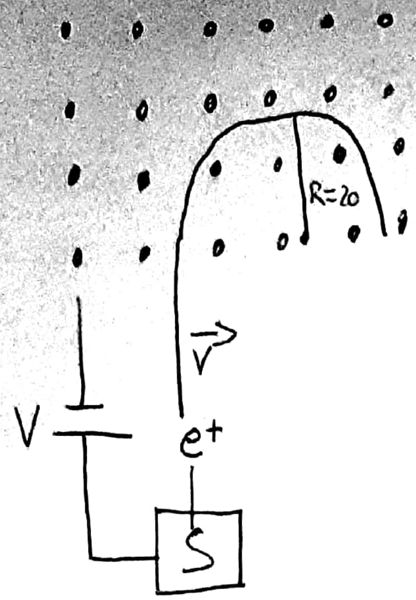
$$B = \frac{E}{v} = \frac{2994,35}{10^6} = 2,994 \cdot 10^{-3} =$$

$$B = 3 \cdot 10^{-3} \, T$$

4)

ddp = 5 kV = 5000 V

R = 20 cm = 0,2 m



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$$F_e = q \cdot E = q \frac{\lambda}{2\pi \varepsilon_0 R}$$

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

$$F_m = q\, \vec{v} \times \vec{B} = q\, v B \cdot \overset{1}{\cancel{\operatorname{sen} 90^\circ}} =$$

$$= q v \frac{\mu_0 I}{2\pi R}$$

$$F_e = F_m$$

$$\cancel{q} \frac{\lambda}{\cancel{2\pi} \varepsilon_0 \cancel{R}} = \cancel{q} v \frac{\mu_0 I}{\cancel{2\pi R}}$$

$$\left[\frac{\lambda}{\varepsilon_0} = v \mu_0 I \right]$$

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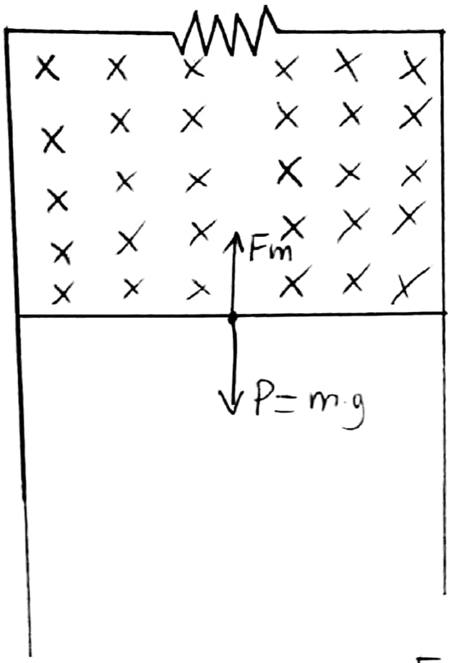

$\lambda = 0{,}04\ kg/m$

$B = 0{,}5\ T$

$\vec{F}_m = I\vec{l} \times \vec{B}$

$F_m = I l \cdot B$

$P = F_m$

$m \cdot g = I l B$

$I = \dfrac{m \cdot g}{l \cdot B} = \lambda \dfrac{g}{B} = 0{,}04\ \dfrac{9{,}8}{0{,}5} =$

$= 0{,}784$

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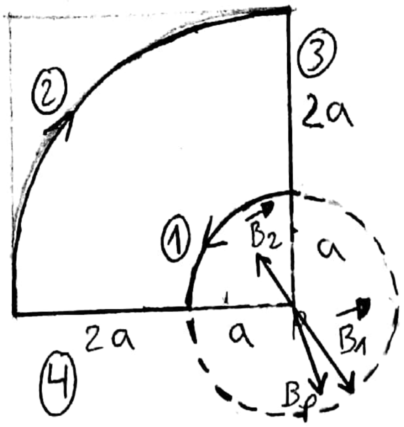
10)

$$d\vec{B} = \frac{\mu_0}{4\pi}\cdot\frac{I\, d\vec{l}\times\vec{u}_r}{R^2}$$



Tramo 1

$$B_1 = \frac{1}{4}\,\frac{\mu_0 I}{2R} = \frac{\mu_0 I}{4\cdot 2\cdot a} = \frac{\mu_0 I}{8a}$$

Sentido de $B_1 \Rightarrow$ Aplicamos la mano derecha.

Tramo 2

$$B_2 = \frac{1}{4}\,\frac{\mu_0 I}{2\cdot R} = \frac{\mu_0 I}{4\cdot 2\cdot 3a} = \frac{\mu_0 I}{24a}$$

El sentido del B_2 es hacia dentro ya que el sentido de I es contrario.

Tramo 3

$\cancel{[d\vec{l}\times d\vec{r} =]}$ $\quad d\vec{l}\times\vec{u}_r = dl\cdot u_r\cdot \cancelto{0}{\text{sen}\,0} = 0$

Tramo 4

$$dl\times\vec{u}_r = dl\cdot u_r\cdot \cancelto{0}{\text{sen}\,180^\circ} = 0$$

Campo en el punto p (B_p)

$B_p = B_1 + B_2 \Rightarrow$ En teoría sería una suma pero el B_2 va en sentido contrario a B_1, así pues $\Rightarrow B_p = B_1 - B_2 =$

$$= \frac{\mu_0 I}{8a} - \frac{\mu_0 I}{24a} = \mu_0 I\left(\underbrace{\frac{1}{8a} - \frac{1}{24a}}_{\text{m.c.m}}\right) = \mu_0 I\left(\frac{3-1}{24a}\right) =$$

$$= \mu_0 I\left(\frac{2}{24a}\right) = \mu_0 I\,\frac{1}{12a} = \frac{\mu_0 I}{12a}$$

El sentido de B_P es hacia fuera ya que B_1 es mayor que B_2.

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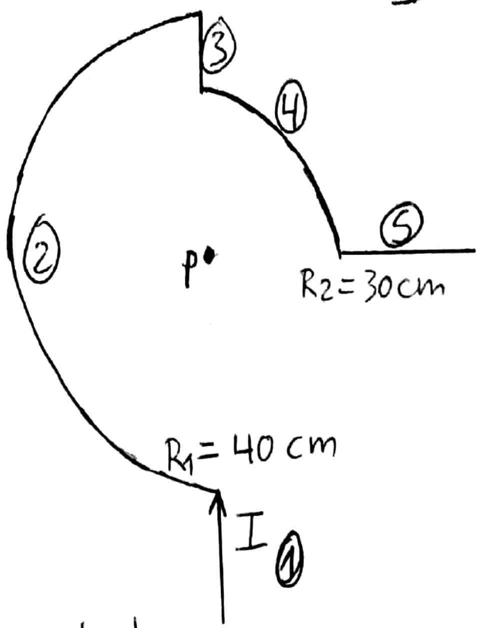
2

$I = 1A$

$R_1 = 40cm = 0{,}4\ m$

$R_2 = 30cm = 0{,}3\ m$



a) $dB = \frac{\mu_0}{4\pi} \cdot \frac{I\, d\vec{l} \times \vec{u_r}}{R^2}$

$B_2 = \frac{1}{2} \frac{\mu_0 I}{2 \cdot 0{,}4} = \frac{\mu_0 I}{1{,}6}$

$B_4 = \frac{1}{4} \cdot \frac{\mu_0 I}{2 \cdot 0{,}3} = \frac{\mu_0 I}{2{,}4}$

En el tramo 1, 3 y 5 $\Rightarrow$

$\Rightarrow B = 0.$

$B_p = B_2 + B_4 = \frac{\mu_0 I}{1{,}6} + \frac{\mu_0 I}{2{,}4} =$

$= \mu_0 I \left(\frac{1}{1{,}6} + \frac{1}{2{,}4} \right) =$

$= \mu_0 I \left(\frac{3+2}{4{,}8} \right) = \frac{5}{4{,}8} \cdot \mu_0 I =$

$= \frac{5}{4{,}8} \mu_0 I = 1{,}30 \cdot 10^{-6} T$

b) Fm en un cable de 10cm $\perp$ al plano del circuito.

El campo generado en el apartado a) va hacia dentro (x)

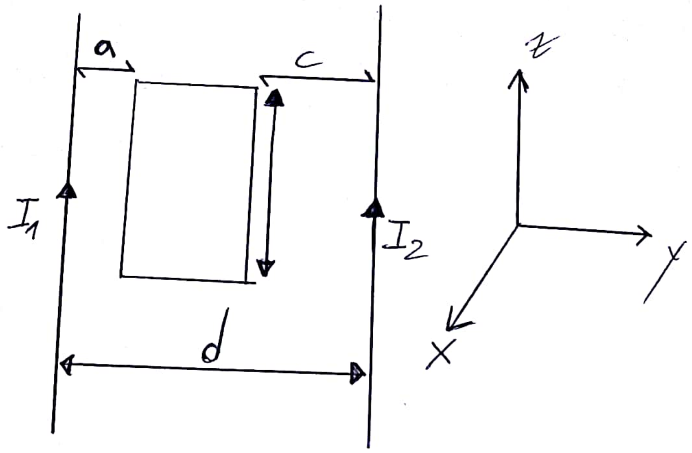
por lo cual $\Rightarrow$

Ley Lorent $\Rightarrow$ Fuerza sobre un hilo

$F = I \vec{l} \times \vec{B} \Rightarrow F = 1 \cdot 0{,}1 \cdot 1{,}30 \cdot 10^{-6} \cdot \overset{0}{\cancel{\operatorname{sen} 180}} =$

$= 0N$

13)



Datos

$I_1 = 20 A$

$I_2 = 10 A$

$a = 5 cm$

$b = 20 cm$

$c = 10 cm$

$d = 25 cm$

$$\frac{V_0 = \sqrt{V_c}}{\sqrt{2}}$$

$$V_0 = \sqrt{V_c} \sqrt{2}$$

$$V_0 = E_0$$

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