PROBLEMAS ELECTROMAGNETISMO. TEMA 4.

1.-

e^- $\Delta V = 1000$ Voltios (V)

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

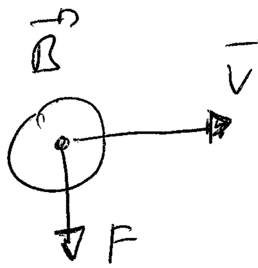
$m_e = 9'1 \cdot 10^{-31} Kg$

$\vec{B} \perp \vec{V}$

↳ símbolo de perpendicular.

$T = 2 \cdot 10^{-11} s$

a) v ? b) B ? c) $\vec{E}$?



$\vec{F} = q\,(\vec{v} \wedge \vec{B})$ $\vec{v} \perp \vec{B}$

$F = q\,v \cdot B$

traxectoria circular $q\,v \cdot B = m\,\frac{v^2}{r}$

$E_c = \frac{1}{2} m v^2$; $eV = \frac{1}{2} m v^2$

↓

sen signo.

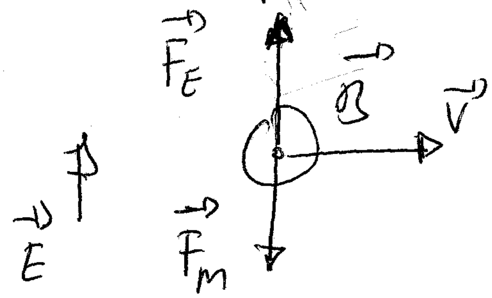
$$v = \left(\frac{2eV}{m}\right)^{1/2} \Rightarrow v = \left(\frac{2 \cdot 1'6 \cdot 10^{-19} C \cdot 1000 V}{9'1 \cdot 10^{-31} Kg}\right)^{1/2}$$

$v = 1'87 \cdot 10^{7} m/s$

$$q \cdot B = m\frac{v}{r}; \quad qB = \frac{m\,\omega \cdot r}{r} \Rightarrow qB = m\frac{2\pi}{T}$$

$$B = \frac{m\,2\pi}{q\,T} \Rightarrow B = \frac{2 \times \pi \cdot 9'1 \cdot 10^{-31} Kg}{1'6 \cdot 10^{-19} C \cdot 2 \cdot 10^{-11} s} = 1'79\,T$$

c) Si supoñemos as direccións postas o principio



Resultante das forzas ($\vec{F}_E$ e $\vec{F}_m$) nula traxectoria rectilínea

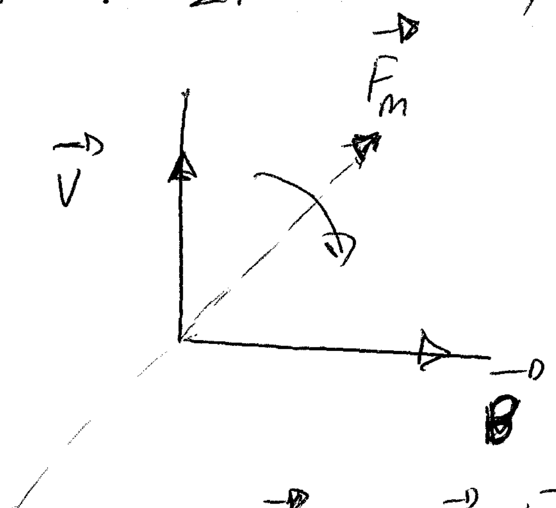
2.-

$q = 0'5\,10^{-9}\,C$

$\vec{v} = 4 \cdot 10^{6}\,\vec{j}\ m/s$

$\vec{B} = 0'5\,\vec{i}\ T$

a) $\vec{E}$? $\Sigma F = 0$ b) $\vec{E} = 0$ m? $r = 10^{-7}\,m.$



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

$\vec{F}_m = -q\,|\vec{v}| \cdot |\vec{B}|\ \vec{K}$

$\vec{F}_m = -0'5\,10^{-9}\,C \cdot 4\,10^{6}\,\frac{m}{s} \cdot 0'5\,T\,\vec{K} = -1\,10^{-3}\,\vec{K}\ N.$

$\vec{F}_E = 1\,10^{-3}\,\vec{K}\ N$

$\vec{F}_E = q\,\vec{E} \Rightarrow \vec{E} = \frac{\vec{F}_E}{q} = \frac{1 \cdot 10^{-3}\,\vec{K}\,N}{0'5 \cdot 10^{-9}\,C} = 2 \cdot 10^{6}\ N/C\ \vec{K}$

$$\vec{v} \wedge \vec{B} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 0 & 4\cdot10^6 & 0 \\ 0'5 & 0 & 0 \end{vmatrix} = \begin{vmatrix} 4\cdot10^6 & 0 \\ 0 & 0 \end{vmatrix} \vec{i} - \begin{vmatrix} 0 & 0 \\ 0'5 & 0 \end{vmatrix} \vec{k}$$

$$+ \begin{vmatrix} 0 & 4\,10^6 \\ 0'5 & 0 \end{vmatrix} \vec{k} = -0'5 . 4\,10^6 \vec{k} \; (T.m/s)$$

$$\vec{F} = -0'5 . 10^{-9} C . 0'5 . 4\,10^6 \vec{k} \; \frac{T.m}{s} \; (N)$$

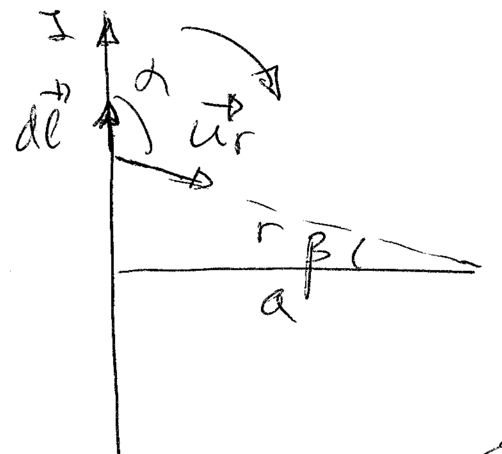
b)

$$q v B = m \frac{v^2}{r} \Rightarrow m = \frac{q B r}{v}$$

$$m = \frac{0'5\,10^{-9} C \; 0'5 T \; 10^{-7} m.}{4.10^6 m/s} = 6'25\,10^{-24} Kg$$

c) O campo electrico é un campo conservativo o traballo non depende do camiño percorrido senón do punto inicial e final. Se describe unha traxectoria circular $W=0$

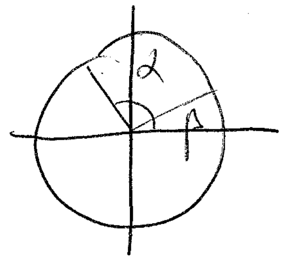
3.- Campo magnético creado por un conductor retilíneo e uniforme.



$$d\vec{B} = \frac{\mu \cdot I}{4\pi} \frac{d\vec{l} \wedge \vec{u}_r}{r^2}$$

$$d\vec{l} \wedge \vec{u}_r = |dl| \cdot |1| \cdot \operatorname{sen}\alpha$$

$$\alpha - \beta = 90^\circ ; \alpha - \beta = \pi$$



$$\operatorname{sen}\alpha = -\cos\beta$$
$$\cos\alpha = \operatorname{sen}\beta$$

$$dB = \frac{\mu \cdot I}{4\pi} \frac{dl \operatorname{sen}\alpha}{r^2} ; dB = \frac{\mu \cdot I}{4\pi} \frac{dl \cdot (-\cos\beta)}{r^2}$$

$$dB = -\frac{\mu I}{4\pi} \frac{\cos\beta \, dl}{r^2}$$

$$\operatorname{tg}\beta = \frac{l}{a} ; \operatorname{sen}\beta = \frac{l}{r} ; \cos\beta = \frac{a}{r}$$

$$l = \operatorname{tg}\beta \, a ; dl = \frac{a \, d\beta}{\cos^2\beta} ; r^2 = \frac{a^2}{\cos^2\beta}$$

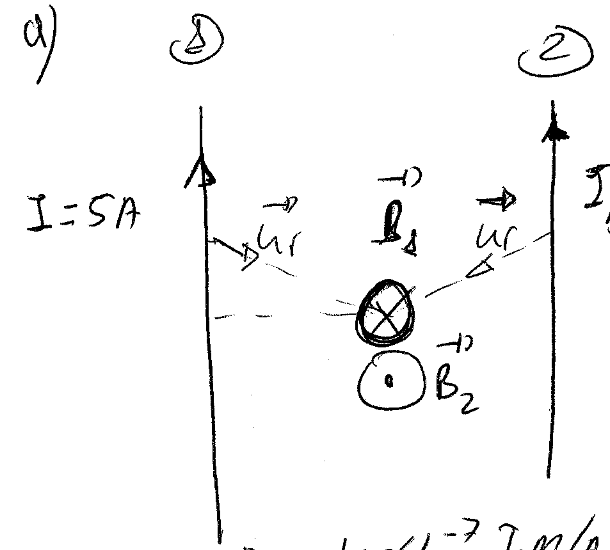
$$dB = -\frac{\mu I}{4\pi} \frac{\cos\beta \frac{a \, d\beta}{\cancel{\cos^2\beta}}}{\frac{a^2}{\cancel{\cos^2\beta}}} ; dB = -\frac{\mu I}{4\pi a} \cos\beta \, d\beta$$

$$B = -\frac{\mu \cdot I}{4\pi a} \int \cos\beta \, d\beta ; B = -\frac{\mu \cdot I}{4\pi a} \left[-\operatorname{sen}\beta\right]_{-\pi/2}^{\pi/2}$$

$$B = \frac{\mu I}{4\pi a} \left[\operatorname{sen}\pi/2 - \operatorname{sen}(-\pi/2)\right]$$

$$B = \frac{\mu \cdot I}{2\pi a}$$

a)



$$|\vec{B_1}| = \frac{\mu \cdot I_1}{2\pi\, 0'1 m} =$$

$$|\vec{B_2}| = \frac{\mu \cdot I_2}{2\pi\, 0'2 m} =$$

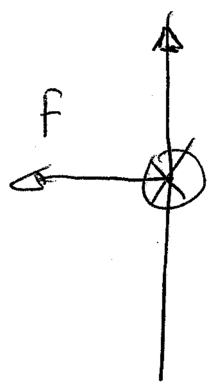
$$|\vec{B_1}| = \frac{4\pi\cdot 10^{-7}\, T\cdot m/A \cdot 5A}{2\pi \cdot 0'1 m} = 1\cdot 10^{-5}\ T$$

$$|\vec{B_2}| = \frac{4\pi\cdot 10^{-7}\, Tm/A \cdot 3A}{2\pi\, 0'1 m} = 6\cdot 10^{-6}\ T$$

$$|\vec{B}|_{TOTAL} = 1\cdot 10^{-5} - 6\cdot 10^{-4}\, T = 4\cdot 10^{-6}\, T$$

b) $\vec{F} = I(\vec{l} \wedge \vec{B})$

$$|\vec{F}| = 2A\ 0'5m \cdot 4\cdot 10^{-6}\, T = 4\cdot 10^{-6}\, N$$



4.-

$p^+ \to \Delta V = 5000 V$

$B = 0'32 T$

$q_{p+} = 1'6\cdot 10^{-19} C$

$m_{p+} = 1'67\cdot 10^{-27} Kg$

a) v? b) r? c) f?

$$E_c = \frac{1}{2} m v^2 \Rightarrow q_{p+}\cdot V = \frac{1}{2} m v^2$$

$$v = \left(\frac{2 q_{p+} V}{m}\right)^{1/2} = \left(\frac{2\cdot 1'6\cdot 10^{-19} C\cdot 5000 V}{1'67\cdot 10^{-27} Kg}\right)^{1/2}$$

$$v = 9'79\cdot 10^{5} m/s$$

b)

$$q \cancel{v}\cdot B = m \frac{v^{\cancel{2}}}{r} \Rightarrow q B = m \frac{v}{r}$$

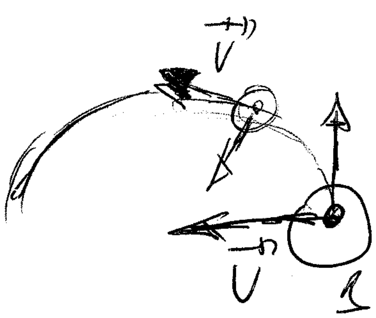
$$r = \frac{m v}{q\cdot B} \Rightarrow r = \frac{1'67\cdot 10^{-27} Kg\cdot 9'79\cdot 10^{5} m/s}{1'6\cdot 10^{-19} C\cdot 0'32 T}$$

$$r = 3'19\cdot 10^{-2} m.$$

c)

$$v = w\cdot r \Rightarrow v = 2\pi\cdot f\, r \Rightarrow f = \frac{v}{2\pi r}$$

$$f = \frac{9'79\cdot 10^{5} m/s}{2\pi\cdot 3'19\cdot 10^{-2} m} = 4'88\cdot 10^{6} s^{-1}$$



$$\vec{F} = q\vec{v} \wedge \vec{B}$$

5.- p^+ $E_c = 10^{-15}\ J$ | $m_p = 1'67 \cdot 10^{-27}\ Kg$

$B = 2T$ | $q_p = 1'6\ 10^{-19} C$

a) r? b) f? por minuto.

$$qvB = m\frac{v^2}{r} ; \quad qB = m\frac{v}{r} ; \quad v = \frac{qBr}{m}$$

$$E_c = \frac{1}{2}mv^2 ; \quad E_c = \frac{1}{2}\cancel{m}\frac{q^2B^2r^2}{m^{\cancel{2}}}$$

$$E_c = \frac{1}{2}\frac{q^2 B^2 r^2}{m} ; \quad r^2 = \frac{2mE_c}{q^2 \cdot B^2}$$

$$r = \left(\frac{2 \cdot 1'67 \cdot 10^{-27} Kg \cdot 10^{-15} J}{(1'6 \cdot 10^{-19} C)^2 \cdot (2T)^2}\right)^{1/2} = 5'71\ 10^{-3} m.$$

Outra forma de facelo

$$E_c = \frac{1}{2}mv^2 \Rightarrow v = \left(\frac{2E_c}{m}\right)^{1/2}$$

$$v = \left(\frac{2 \cdot 10^{-15} J}{1'67 \cdot 10^{-27} Kg}\right)^{1/2} = 1'09 \cdot 10^6 m/s$$

$$q\cancel{v}B = m\frac{v^{\cancel{2}}}{r} \Rightarrow r = \frac{mv}{q \cdot B}$$

$$r = \frac{1'67 \cdot 10^{-27} Kg \cdot 1'09\ 10^6 m/s}{1'6 \cdot 10^{-19} C \cdot 2T} = 5'69 \cdot 10^{-3} m.$$

b)

$$v = \omega \cdot r \Rightarrow v = 2\pi \cdot f \cdot r \Rightarrow f = \frac{v}{2\pi r}$$

$$f = \frac{1'09\ 10^6 m/s}{2\pi\ 5'69 \cdot 10^{-3} m} = 3'05\ 10^7 s^{-1}$$

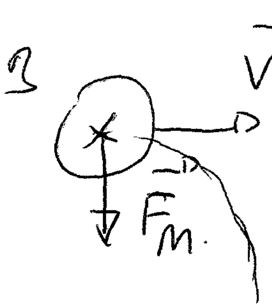
$$3'05\ 10^7 \frac{1}{s} \frac{60 s}{1 min} = 1'83\ 10^4 min^{-1}$$

6.- p^+ $\quad B = 5T \quad v = 1000 m/s$ $\quad$ | $m_p = 1'67 \cdot 10^{-27} Kg$

| $q_p = 1'6 \, 10^{-19} C$

$v \perp B$

a) r? $\quad$ b) $\vec{E}$? $\quad \underline{\underline{\Sigma F = 0}}$



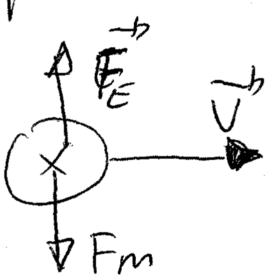
$$q \cancel{v} B = m \frac{v^{\cancel{2}}}{r}$$

$$q B = m \frac{v}{r}$$

$$r = \frac{m v}{q . B}$$

$$r = \frac{1'67 \cdot 10^{-27} Kg \cdot 10^3 m/s}{1'6 \, 10^{-19} C \cdot 5T} = 2'1 \, 10^{-6} m.$$

b) Segundo o debuxo anterior



$$F_E + F_M = 0$$

$$F_M = m \frac{v^2}{r} = q v B = F_E = q \vec{E}$$

$$\vec{E} = V . B = 10^3 m/s \cdot 5T = 5 \, 10^3 N/C$$

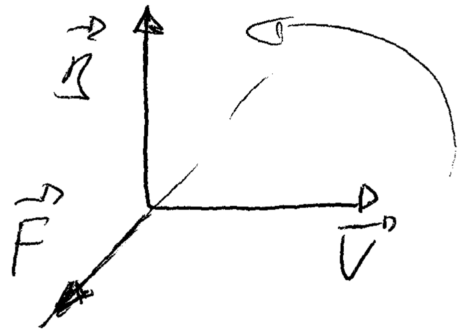
7.-

p^+, $2\,10^6\,V$

V_x $\quad B = 0'2\,T$

$\vec{V_x} = +\,\vec{i}$

$\vec{B} \equiv +\,0'2\,T\,\vec{j}$



$$\vec{F} = q\,(\vec{v} \wedge \vec{B})$$ Forza de Lorentz.

$$\vec{F} = + \quad \vec{K}$$

$$|\vec{F}| = q\,|\vec{v}|\,|\vec{B}|.$$

$$E_c = q_p V \Rightarrow \frac{1}{2} m v^2 = q_p V \Rightarrow v = \left(\frac{2\,q_p V}{m}\right)^{1/2}$$

$$v = \left(\frac{2 \cdot 1'6\,10^{-19}\,C \cdot 2\,10^6\,V}{1'67 \cdot 10^{-27}\,Kg}\right)^{1/2} \Rightarrow v = 1'96\,10^7\,m/s$$

$$|\vec{F}| = 1'6 \cdot 10^{-19}\,C \cdot 1'96 \cdot 10^7\,\frac{m}{s} \cdot 0'2\,T = 6'26\,10^{-13}\,N.$$

$$m\frac{v^2}{r} = q\,\cancel{v}\,B \Rightarrow r = \frac{m \cdot v}{q \cdot B}$$

a) $$r = \frac{1'67\,10^{-27}\,Kg \cdot 1'96\,10^7\,m/s}{1'6\,10^{-19}\,C \cdot 0'2\,T} = 1'02\,m.$$

b) $$v = \omega \cdot r \Rightarrow v = 2\pi f \cdot r \Rightarrow f = \frac{v}{2\pi r}$$

$$f = \frac{1'96 \cdot 10^7\,m/s}{2\pi\,1'02\,m} = 3'06\,10^6\,s^{-1}$$

8.-
$q = 1'6 \cdot 10^{-19} C$ $\quad v \perp B$
$1'67 \cdot 10^{-27} Kg$ $\quad B = 5T$ $\quad r = 15 \cdot 10^{-6} m.$

a) v? $\quad$ b) f minuto.

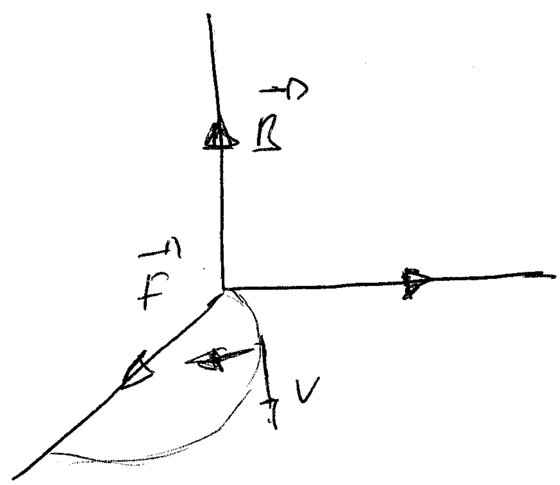
$$q \cancel{v} B = m \frac{v^{\cancel{2}}}{r} \Rightarrow v = \frac{q \cdot B \cdot r}{m}$$

$$v = \frac{1'6 \cdot 10^{-19} C \cdot 5T \cdot 15 \cdot 10^{-6} m}{1'67 \cdot 10^{-27} Kg} = 7'19 \cdot 10^{3} m/s$$

b)
$$v = \omega \cdot r \Rightarrow v = 2\pi \cdot f \cdot r$$

$$f = \frac{v}{2\pi \cdot r} = \frac{7'19 \cdot 10^{3} m/s}{2 \cdot \pi \cdot 15 \cdot 10^{-6} m} = 7'63 \cdot 10^{7} s^{-1}$$

$$7'63 \cdot 10^{7} \frac{1}{s} \cdot \frac{60 s}{1 min} = 4'58 \cdot 10^{9} min^{-1}$$



9.-

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

$q_e = -1'6.10^{-19}\,C.$

$\vec{v} \perp B$

$B = 2'7\,T$; $v = 2000\,\frac{Km}{s}$

a) r? b) nº voltas es 0'05 s

$$q\,v.B = m\frac{v^2}{r} \Rightarrow r = \frac{m\,v}{q\,B}$$

$$r = \frac{9'1\,10^{-31}\,Kg.\ 2.10^6\,m/s}{1'6.10^{-19}\,C.\ 2'7\,T} = 4'21\,10^{-6}\,m.$$

$\uparrow$

sen signo

b)

$$v = \omega . r \Rightarrow v = \frac{2\pi}{T}.r \Rightarrow v = 2\pi.f.r$$

$$f = \frac{v}{2\pi.r} = \frac{2\,10^6\,m/s}{2.\,\pi.\,4'21\,10^{-6}\,m} = 7'56\,10^4\,\frac{voltas}{s}$$

$$7'56.10^4\,\frac{voltas}{s} \times 0'05\,s = 3'78.10^3\,voltas$$

10.-

$m_p = 1'7.10^{-27}\,Kg$

$q_p = 1'6.10^{-19}\,C$

$eV = 1'6.10^{-19}\,J$

p^+ $E_c = 4'5\,10^6\,eV$

$B = 8\,T$

a) F? b) r?

$|F| = q\,|\vec{v}|\cdot|\vec{B}|$

$E_c = \frac{1}{2} m v^2 \; ; \; v = \left(\frac{2E_c}{m}\right)^{1/2}$

$E_c = 4'5\,10^6 eV \; \frac{1'6.10^{-19} J}{eV} = 7'2.10^{-13} J$

$v = \left(\frac{2.7'2.10^{-13} J}{1'7.10^{-27} Kg}\right)^{1/2} = 2'91.10^7 m/s$

$F = 1'6.10^{-19} C.\, 2'91\,10^7 \frac{m}{s}.\, 8T = 3'73.10^{-11} N$

b)

$q.\cancel{v}.B = m\frac{v^{\cancel{2}}}{r} \Rightarrow r = \frac{mv}{q.B}$

$r = \frac{1'7.10^{-27} Kg.\, 2'91.10^7 m/s}{1'6.10^{-19} C.\, 8T} = 3'86\,10^{-2} m.$

11.-

$v = 1.10^7 m/s$ | $q_{e^-} = -1'60\,10^{-9} C$

$B = 2.10^4 T$ | $m_{e^-} = 9'11.10^{-31} Kg$

$v \perp B$

a) F? b) r?

$|\vec{F}| = q\,|\vec{v}|\cdot|\vec{B}| = 1'6\,10^{-19} C.\, 1\,10^7 \frac{m}{s}.\, 2\,10^4 T =$

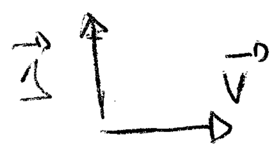
$|\vec{F}| = 3'2.10^{-8} N$

b) $m\frac{v^2}{r} = q\,v\cdot B \Rightarrow r = \frac{mv}{q\cdot B}$

$$r = \frac{9'11\,10^{-31}\,Kg.\ 1\,10^{7}\,m/s}{1'6.10^{-19}\,C.\ 2.10^{4}\,T} = 2'85\,10^{-9}\,m.$$

PROBLEMAS ~~T~~EMA 4

1.-



por exemplo desta maneira

$$\left.\begin{array}{l} F_c = m\frac{v^2}{r} \\ F_m = qvB \end{array}\right\} \quad m\frac{v^2}{r} = qvB$$

a) $E_c = q\cdot V \Rightarrow \frac{1}{2} m v^2 = q V$

$\downarrow$

velocidade

$$v = \left(\frac{2qV}{m}\right)^{1/2} = \left(\frac{2\cdot 1'6\cdot 10^{-19}C\cdot 1000V}{9'1\cdot 10^{-31}kg}\right)^{1/2}$$

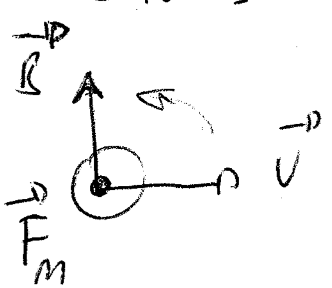
$$v = 1'87\cdot 10^{7} m/s$$

b) $m\frac{v^{\cancel{2}}}{r} = q\cancel{v}\cdot B \; ; \; m\frac{v}{r} = q\cdot B$

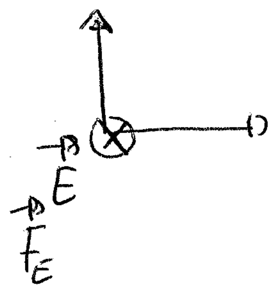
$$m\frac{\omega\cdot \cancel{r}}{\cancel{r}} = qB \Rightarrow B = \frac{m\omega}{q} \; ; \; B = \frac{m2\pi}{T\cdot q}$$

$$B = \frac{9'1\cdot 10^{-31}kg\cdot 2\pi}{2\cdot 10^{-11}s\cdot 1'6\cdot 10^{-19}C} = 1'79\,T$$

c)



$\vec{E}$ perpendicular o folio e cara o interior



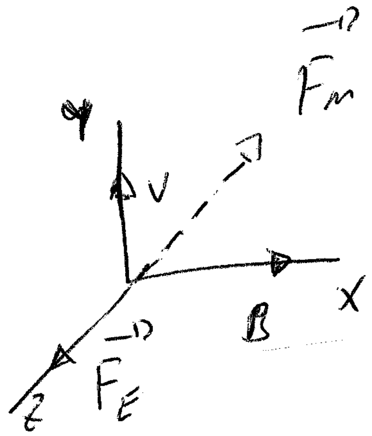
2.-

$q = 0'5\,10^{-9}\,C$

$\vec{v} = 4\,10^{6}\,\vec{j}\ m/s$

$\vec{B} = 0'5\,\vec{i}\ T$

$|\vec{F}_e| = |\vec{F}_M|$



$$\vec{F}_M = q\,(\vec{v} \wedge \vec{B})$$

$$\vec{F}_M = -\,(?)\,\vec{K}$$

$$\vec{F}_e = +\,(?)\,K$$

$$|\vec{F}_M| = q\,|\vec{v}|\,|\vec{B}| = 0'5\,10^{-9}\,C \;\; 4\,10^{6}\,m/s \cdot 0'5\,T$$

$$|\vec{F}_M| = 1 \cdot 10^{-3}\,N$$

$$|\vec{F}_M| = q \cdot |\vec{E}| \Rightarrow |\vec{E}| = \frac{|\vec{F}_M|}{q} = \frac{1\,10^{-3}\,N}{0'5\,10^{-9}\,C} = 2\,10^{6}\,N/C$$

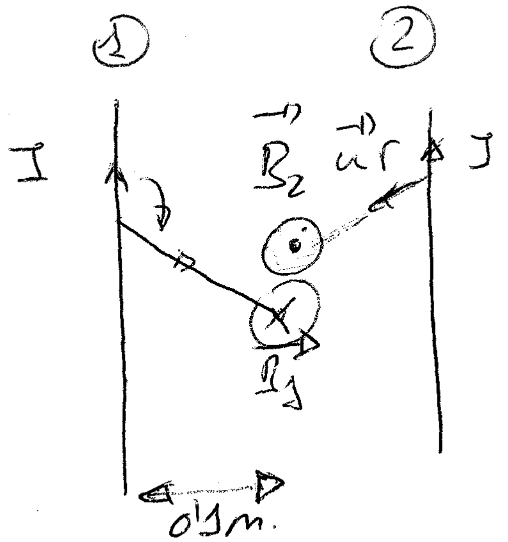
$$\vec{E} = 2\,10^{6}\,N/C \cdot \vec{K}$$

b) $F = \frac{mv^2}{r}$

$$r = \frac{F \cdot r}{v^2} = \frac{1\cdot 10^{-3} N \cdot 1\cdot 10^{-7} m}{(4\cdot 10^{6} m/s)^2} = 6'25 \cdot 10^{-24} kg$$

c) O campo eléctrico é unha forza conservativa só depende do valor final e inicial. Si describe unha circunferencia volve o mesmo punto o $W=0$

3.-



$$d\vec{B} = \frac{\mu_0 I}{4\pi} \frac{d\vec{l} \wedge \vec{u_r}}{r^2}$$

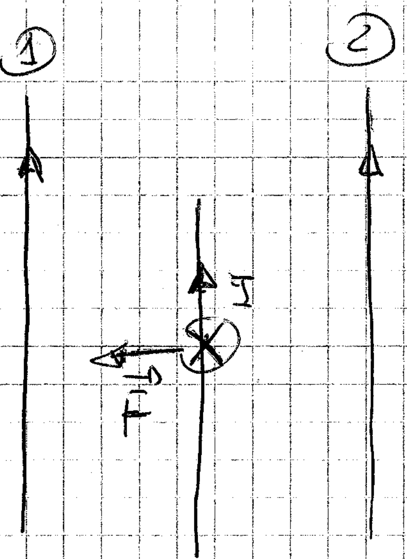
$$B = \frac{\mu_0 I}{2\pi a}$$

$$|\vec{B}_1| = \frac{4\pi 10^{-7}\ 5A}{2\pi\ 0'1m} = 10\cdot 10^{-6} T$$

$$|\vec{B}_2| = \frac{4\pi 10^{-7} N/cm/g \cdot 3A}{2\pi\ 0'1m} = 6\cdot 10^{-6} T$$

$$|B_T| = 4\cdot 10^{-6} T$$

b)



$$\vec{F} = I(\vec{l} \wedge \vec{B})$$

$$|\vec{F}| = 2A \cdot 0'5m \cdot 4 \cdot 10^{-6} T = 4 \cdot 10^{-6} N$$

4.-

$q_p = 1'6 \cdot 10^{-19} C$ $\quad M_p = 1'67 \cdot 10^{-27} kg$

$V = 5000V$

$B = 0'32T$

a) v? b) r? f?

$$E_c = q_p \cdot V \Rightarrow \frac{1}{2} m v^2 = q_p V \; ; \; v = \left(\frac{2 q_p V}{m_p}\right)^{1/2}$$

$$v = \left(\frac{2 \cdot 1'6 \cdot 10^{-19} C \cdot 5000V}{1'67 \cdot 10^{-27} kg}\right)^{1/2} = 9'79 \cdot 10^5 m/s$$

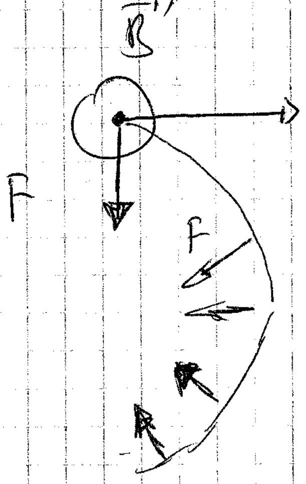
b) $m \frac{v^2}{r} = q v B \Rightarrow m \frac{v}{r} = q B \Rightarrow m \frac{2\pi}{T} = q \cdot B$

$$m 2\pi \cdot f = q B \Rightarrow f = \frac{q \cdot B}{2\pi m}$$

$$f = \frac{1'6 \cdot 10^{-19} C \cdot 0'32T}{2 \cdot \pi \, 1'67 \cdot 10^{-27} kg} = 4'88 \cdot 10^6 s^{-1}$$

$v = \omega \cdot r \Rightarrow v = 2\pi f \cdot r$

$$r = \frac{v}{2\pi f} = \frac{9'79\,10^{5}\,m/s}{2\cdot\pi\cdot 4'88\,10^{6}\,s^{-1}} = 3'19\,10^{-2}\,m.$$



5.-

$M_p = 1'67\,10^{-27}\,Kg \quad q_p = 1'6\,10^{-19}\,C$

$E_c = 10^{-15}\,J \quad B = 2T$

a) r? b) nº de voltas por minuto.

$$q v B = m \frac{v^2}{r} \quad ; \quad E_c = \frac{1}{2} m v^2$$

$$q B = \frac{m v}{r} \Rightarrow q B = m \frac{2\pi}{T} \; ; \; q B = m\, 2\frac{\pi}{T}$$

$$f = \frac{q \cdot B}{2\pi m} = \frac{1'6\,10^{-19}\,C \cdot 2T}{2\cdot\pi\, 1'67\,10^{-27}\,Kg} = 3'049\,10^{6}\,\frac{voltas}{s}$$

$$3'049\,10^{6}\,\frac{voltas}{s}\;\frac{60\,s}{1\,min} = 1'83\,10^{9}\,\frac{voltas}{min}$$

b) $E_c = \frac{1}{2} m v^2 \Rightarrow E_c = \frac{1}{2} m\, 4\pi^2 f^2 r^2 \Rightarrow r = \left(\frac{2 E_c}{m 4\pi^2 f^2}\right)^{1/2}$

$r = 5'71\,10^{-3}\,m.$

CUESTIÓNS

1.-

$$\vec{F} = I(\vec{l} \wedge \vec{B})$$

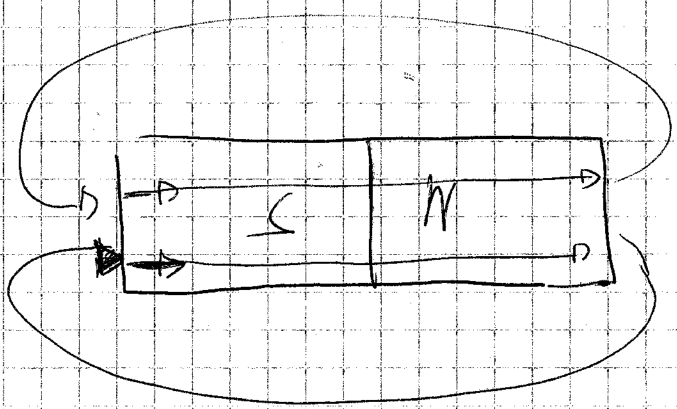
$$|\vec{F}| = I\,|\vec{l}|\,|\vec{B}|\,\text{sen}\,\alpha$$

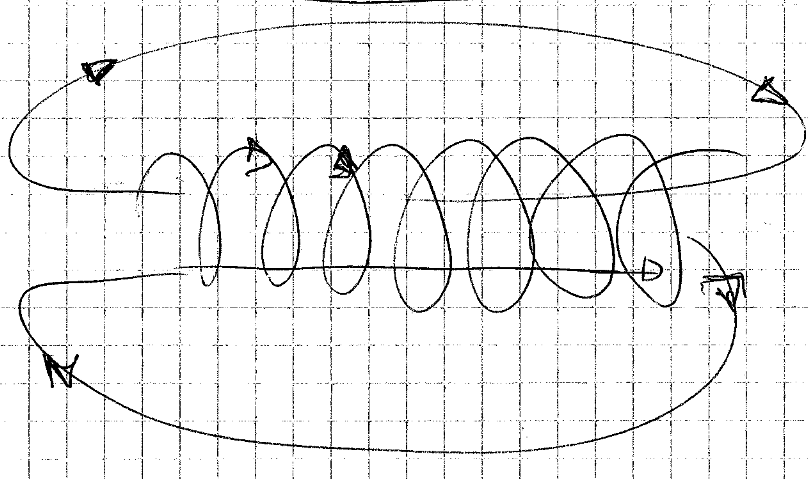
α ángulo que forman $\vec{l}$ e $\vec{B}$

$\text{sen}\,\alpha = 1 \Rightarrow \alpha\ 90°$

c) son perpendiculares

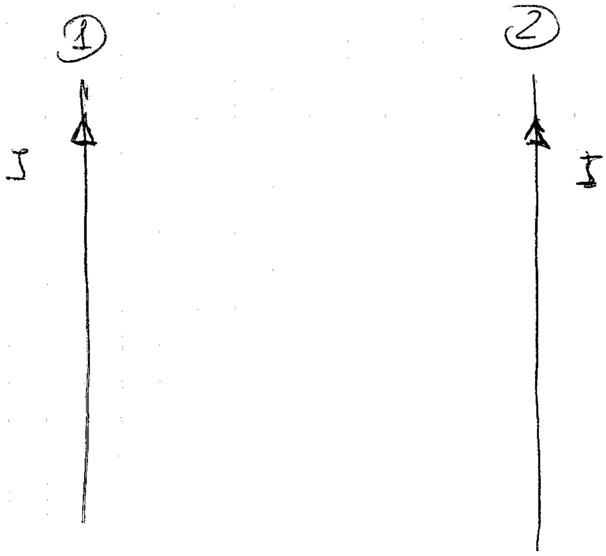
2.-





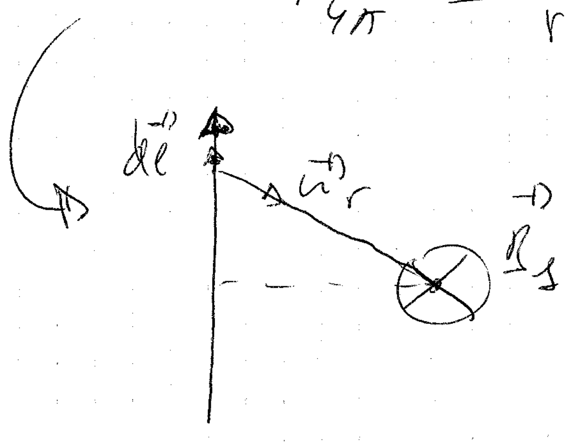
c) resposta correcta

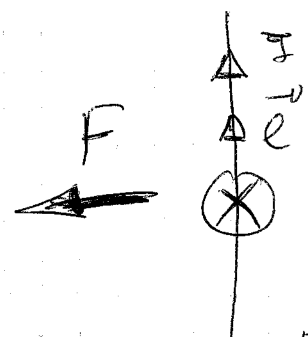
3.-



Campo creado polo conductor 1 no punto no que se coloca o conductor 2

$$d\vec{B} = \frac{\mu \cdot I}{4\pi}\,\frac{d\vec{l}\wedge\vec{u}_r}{r^2}$$





$$\vec{F} = I(\vec{l}\wedge\vec{B})$$

Atráense

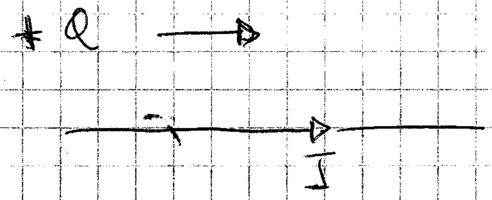
4.-

$$F = I(\vec{l}\wedge\vec{B})$$

$$|\vec{F}| = I|\vec{l}|\,|\vec{B}|\,\text{sen}\,\theta$$

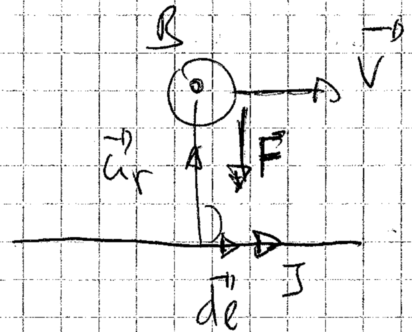
b)

5.-



$\vec{F} = q(\vec{v} \wedge \vec{B})$ $\quad \vec{F} = I(\vec{l} \wedge \vec{B})$

$$dB = \frac{\mu_0 I}{4\pi} \frac{d\vec{l} \wedge \vec{u}_r}{r^2}$$



é atraída

6.-

a) $E_c = \frac{1}{2} m v^2$

$$v = \left(\frac{2E_c}{m}\right)^{1/2}$$

$$\left.\begin{aligned} v_p &= \left(\frac{2E_c}{m_p}\right)^{1/2} \\ v_e &= \left(\frac{2E_c}{m_e}\right)^{1/2} \end{aligned}\right\} \quad m_p \gg m_e \Rightarrow v_e \gg v_p$$

FALSA

$$q v B = m \frac{v^2}{r} \quad ; \quad q B = \frac{v m}{r} \Rightarrow r = \frac{v \cdot m}{q B}$$

ponemos v en función de E_c.

$$E_c = \frac{1}{2} m v^2 \Rightarrow v = \left(\frac{2E_c}{m}\right)^{1/2}$$

$$r = \frac{\left(\frac{2E_c}{m}\right)^{1/2} \cdot m}{q \cdot B} \Rightarrow r = \frac{\left(\frac{2E_c m^2}{m}\right)^{1/2}}{q \cdot B}$$

$$r = \frac{(2E_c \cdot m)^{1/2}}{q \cdot B} \quad ;$$

$$\left.\begin{aligned} r_p &= \frac{(2E_c m_p)^{1/2}}{q \cdot B} \\ r_e &= \frac{(2E_c m_e)^{1/2}}{q \cdot B} \end{aligned}\right\} \quad m_p \gg m_e \Rightarrow r_p > r_e.$$

Correcta.

c)

$$q v B = m \frac{v^{\cancel{2}}}{r} \Rightarrow q B = \frac{m v}{r} \; ; \; q B = \frac{m \omega \cdot \cancel{r}}{\cancel{r}}$$

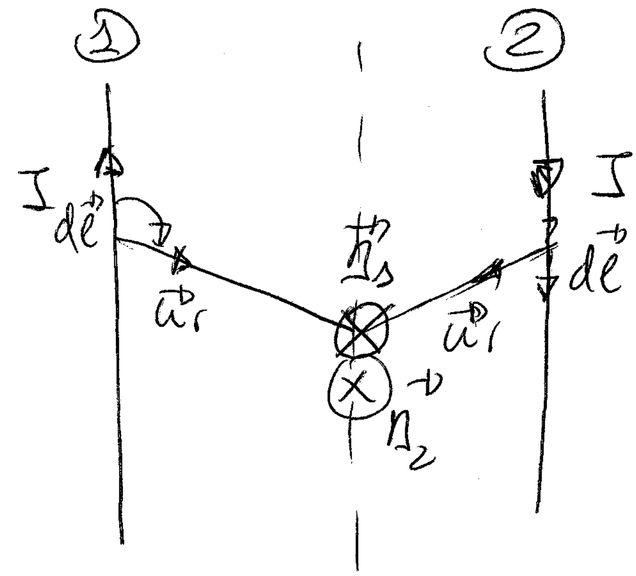
$$q \cdot B = \frac{m 2\pi}{T} \Rightarrow T = \frac{2\pi m}{q \cdot B}$$

$$T_p = \frac{2\pi m_p}{q \cdot B}$$

$$T_e = \frac{2\pi m_e}{q \cdot B}$$

FALSA

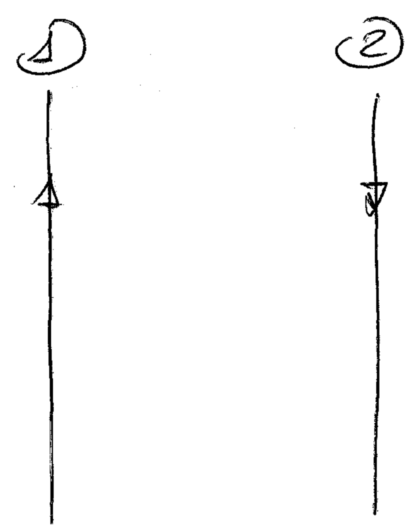
7.-



$$dB = \frac{\mu_0 I}{4\pi} \frac{d\vec{l} \wedge \vec{u}_r}{r^2}$$

a) é maior

8.-

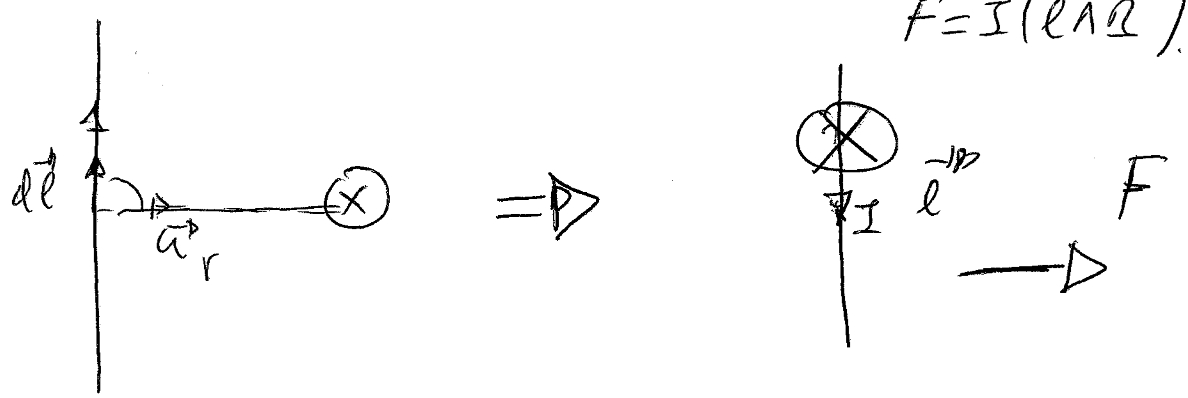


Biot-Savart

$$dB = \frac{\mu_0 I}{4\pi} \frac{d\vec{l} \wedge \vec{u}_r}{r^2}$$

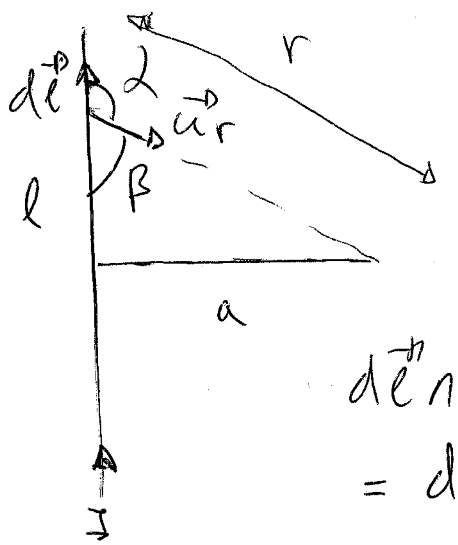
Determinamos o campo creado polo conductor ① na posición do conductor ②

$$\vec{F} = I(\vec{l} \wedge \vec{B})$$



repelense

9.-



$$d\vec{B} = \frac{\mu \cdot I}{4\pi} \frac{d\vec{l} \wedge \vec{u}_r}{r^2}$$

$$B = \frac{\mu \cdot I}{4\pi} \int \frac{d\vec{l} \wedge \vec{u}_r}{r^2}$$

$$d\vec{l} \wedge \vec{u}_r = |d\vec{l}|\,|\vec{u}_r|\, \text{sen}\,\alpha =$$
$$= dl\, \text{sen}\,\beta$$

$$\text{sen}\,\beta = \frac{a}{r} \rightarrow r^2 = \frac{a^2}{\text{sen}^2\beta}$$

$$\cos\beta = \frac{l}{r}$$

$$\text{tg}\,\beta = \frac{a}{l} \Rightarrow dl = \frac{a}{\text{tg}\,\beta} \Rightarrow dl = \frac{0 - \frac{1}{\cos^2\beta} \cdot a\, d\beta}{\frac{\text{sen}^2\beta}{\cos^2\beta}} =$$

$$dl = -\frac{a\, d\beta}{\text{sen}^2\beta}$$

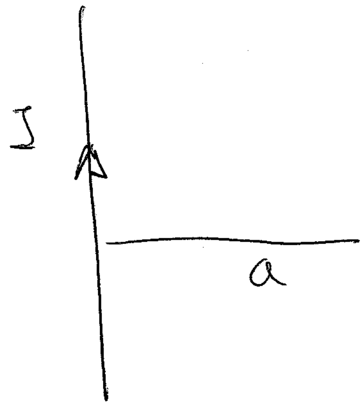
$$\int \frac{d\vec{l} \wedge \vec{u}_r}{r^2} = \frac{\frac{-\cancel{a}\, d\beta}{\cancel{\text{sen}^2\beta}} \cdot \text{sen}\,\beta}{\frac{a^{\cancel{2}}}{\cancel{\text{sen}^2\beta}}} = \int -\frac{\text{sen}\,\beta\, d\beta}{a}$$

$$\int -\frac{\text{sen}\,\beta\, d\beta}{a} = \frac{1}{a}\left[\cos\beta\right]_{180}^{0}$$

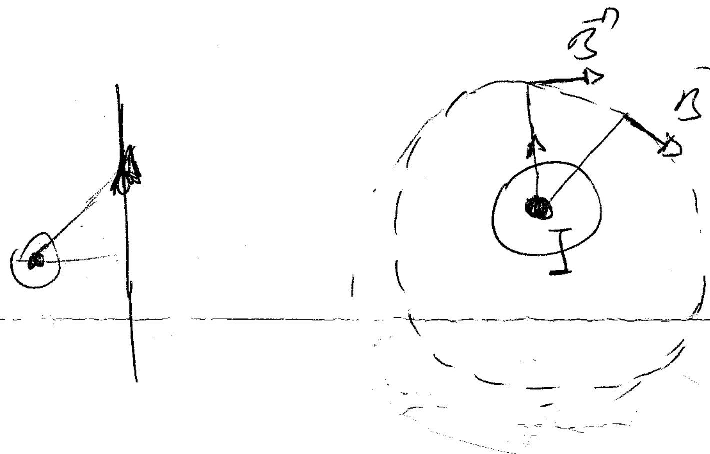
$$B = \frac{\mu \cdot I}{4\pi a}\left[\cos 0^\circ - \cos 180^\circ\right] \Rightarrow B = \frac{\mu \cdot I}{2\pi a}.$$

8.- Xa feito

9.-



$B = \mu \frac{\cdot I}{2\pi a}$



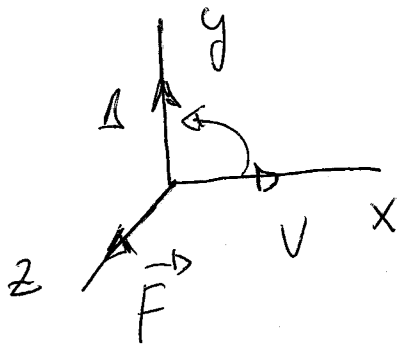
b) correcta

10.- Son sempre cerrados

11.-

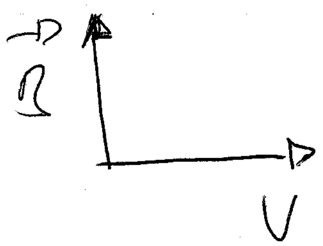
$q = +1'6 . 10^{-19} C$
$\vec{B} = 0'1 \vec{j}$
$\vec{V} = 10^5 \vec{i} \ m/s$

$\vec{F} = q (\vec{V} \wedge \vec{B})$

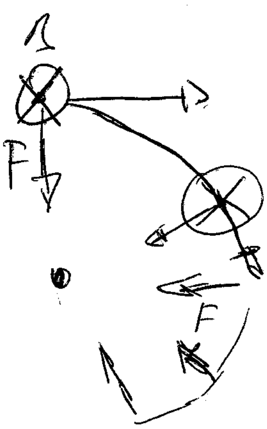


$\vec{F} = 1'6 \cdot 10^{15} \vec{K}$

12.-



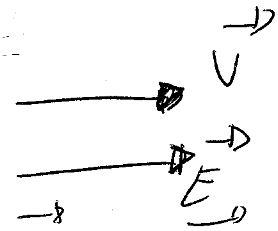
para debuxar no plano



b) circular

13.-

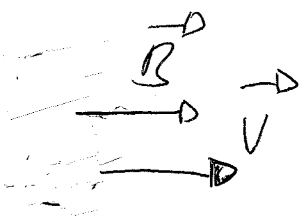
a) Si existen pode suceder:



$\vec{F} = q \cdot \vec{E}$; $\vec{a} = \frac{q\vec{E}}{m}$

a aceleración e na mesma dirección da velocidade e polo tanto non sofre desviación

b)



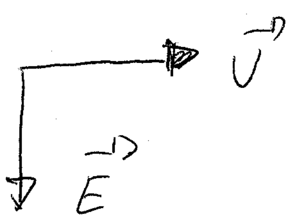
$\vec{F} = q(\vec{v} \wedge \vec{B})$

$|\vec{F}| = q|\vec{v}||\vec{B}| \cdot sen\alpha$

$\alpha = 0 \Rightarrow sen\, 0^{\circ} = 0$

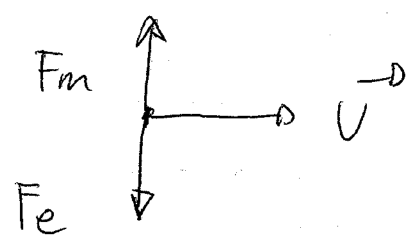
Non hai forza a partícula segue a súa traxectoria

c)

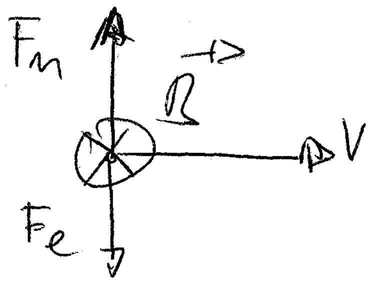


$\vec{F} = q.\vec{E}$

Debuxo un campo B cunha dirección que anule a forza electrica

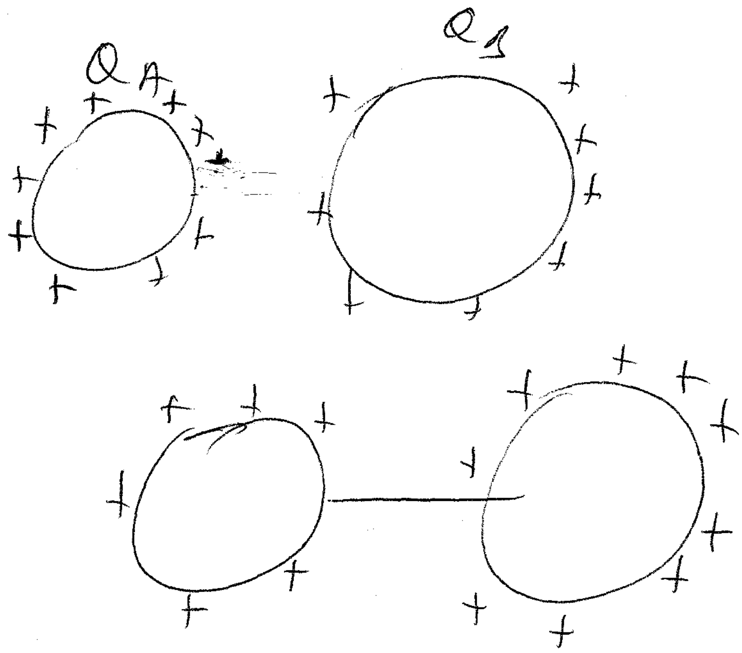


$\vec{F} = q(\vec{v} \wedge \vec{B})$



c) correcta.

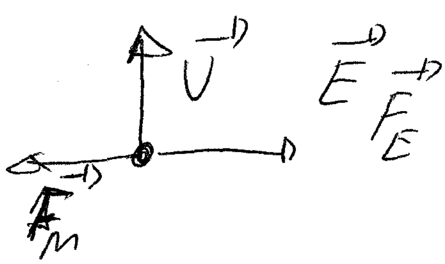
14.-



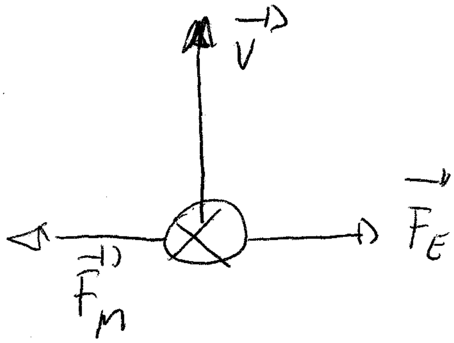
redistribúese a carga das dúas esferas

b) correcta.

15.- igual que a cuestión nº 13



1?



16.-

Si a forza e 0, a partícula non cambia a traxectoria

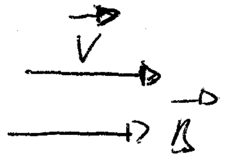
$$\vec{F}_A = q_A(\vec{v} \wedge \vec{B}) \qquad \Big| \qquad \vec{F}_A = \vec{F}_B = 0$$
$$\vec{F}_B = q_B(\vec{v} \wedge \vec{B})$$

$$\vec{v} \wedge \vec{B} = 0$$

$$\text{Sen } 0° \Rightarrow 0$$

17.-

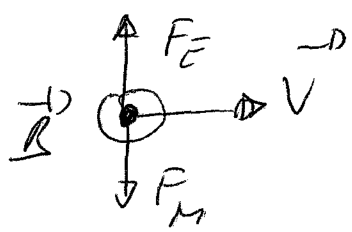
a)



$$\text{Sen } 0° \Rightarrow 0$$

$$F = q(\vec{v} \wedge \vec{B}) = 0 \qquad \text{FALSA.}$$

b) Si CORRECTA



c) O campo eléctrico e un campo conservativo o traballo non depende da traxectoria

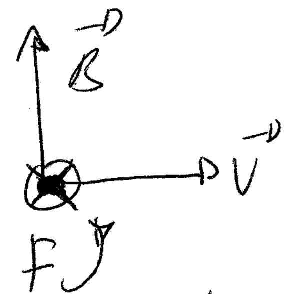
18.-

a) $\vec{F}_m = q(\vec{v} \wedge \vec{B})$

si $|\vec{v}|=0 \Rightarrow |\vec{F}|=0$

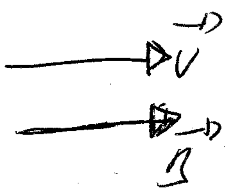
FALSA

b)



VERDADEIRA

c)

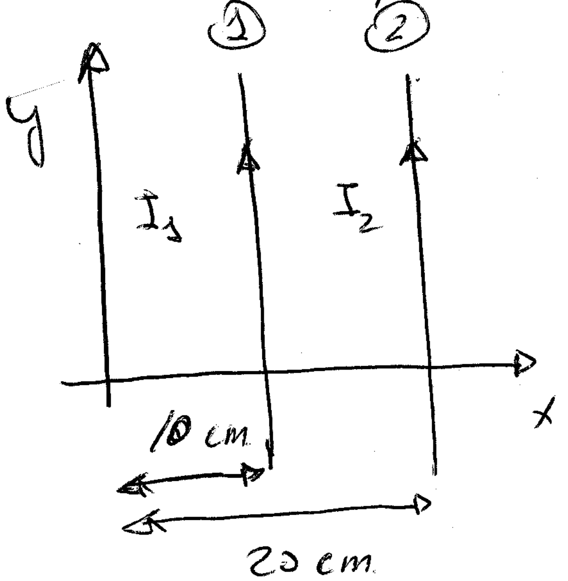


$\operatorname{sen} 0^\circ = 0$

$\vec{F} = 0$

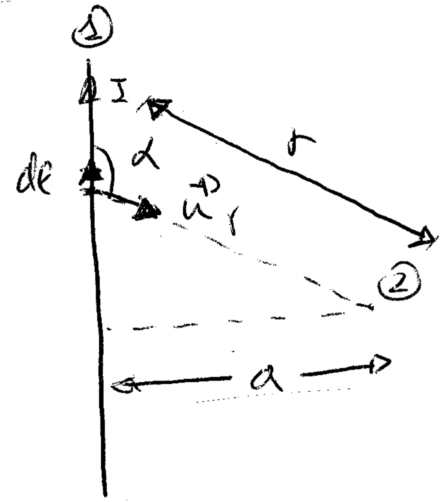
FALSA.

Dous conductores rectos, ... (XUÑO 2009)



$I_1 = I_2 = 5\,A$

Imos calcular o campo creado polo conductor 1 a unha distancia a



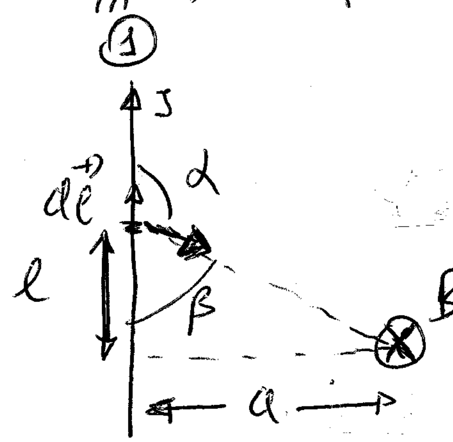
$$B = \frac{\mu_0 I}{4\pi} \int \frac{d\vec{l} \wedge \vec{u}_r}{r^2}$$

$$d\vec{l} \wedge \vec{u}_r = |d\vec{l}|\,|\vec{u}_r| \operatorname{sen}\alpha$$

$\vec{u}_r$ é un vector unitario

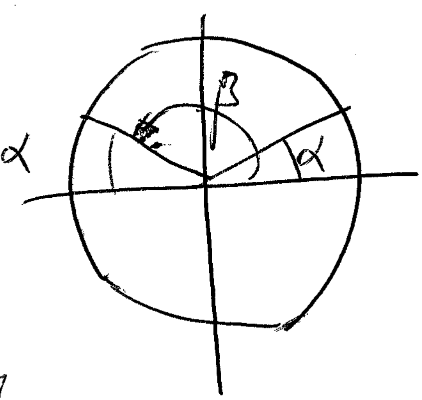
$|\vec{u}_r| = 1$

$$B = \frac{\mu_0 I}{4\pi} \int \frac{dl \operatorname{sen}\alpha}{r^2}$$



$\alpha + \beta = 180^\circ = \pi$

$\operatorname{sen}\alpha = \operatorname{sen}\beta$



$$B = \frac{\mu . I}{4\pi} \int \frac{dl . \operatorname{sen}\beta}{r^2}.$$

$$\operatorname{sen}\beta = \frac{a}{r} \; ; \; \cos\beta = \frac{l}{r} \; ; \; \operatorname{tg}\beta = \frac{a}{l} \; ; \; l = \frac{a}{\operatorname{tg}\beta}$$

$$dl = \frac{0.\operatorname{tg}\beta - \frac{a}{\cos^2\beta} d\beta}{\operatorname{tg}^2\beta} = -\frac{a}{\operatorname{sen}^2\beta} d\beta$$

$$B = \frac{\mu . I}{4\pi} \int \frac{(-\cancel{a}\, d\beta \operatorname{sen}\beta)}{\cancel{\operatorname{sen}^2\beta} \cdot \frac{a^{\cancel{2}}}{\cancel{\operatorname{sen}^2\beta}}} \Rightarrow$$

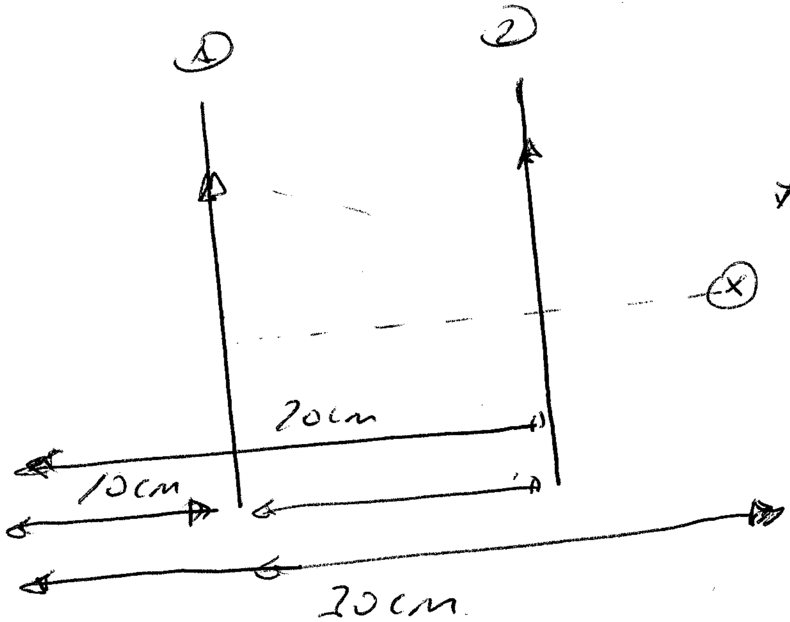
$$B = -\frac{\mu . I}{4\pi a} \int \operatorname{sen}\beta . d\beta$$

$$B = -\frac{\mu I}{4\pi a} \left[-\cos\beta\right]_{\pi}^{0} \Rightarrow B = \frac{\mu . I}{2\pi a}$$

a) $B = \frac{\mu_0 I}{2\pi a}$

↳ distancia do conductor o punto onde queremos calcular o campo magnético.

b)

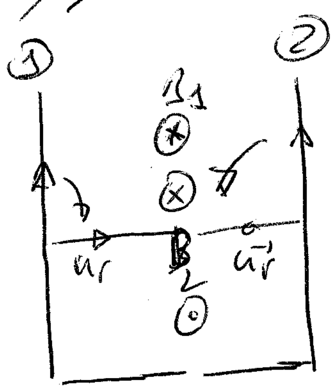


$$\left.\begin{aligned} |B_1| &= \frac{\mu_0 I_1}{2\pi\, 0'2m} \\ |B_2| &= \frac{\mu_0 I_2}{2\pi\, 0'1m} \end{aligned}\right\} |B_T| = \frac{\mu_0 I}{2\pi}\left(\frac{1}{0'2m}+\frac{1}{0'1m}\right)$$

$$|B_T| = \frac{\mu_0 I}{2\pi}\left(\frac{0'1m+0'2m}{0'02m^2}\right) ; \quad |B_T| = \frac{\mu_0 I}{2\pi}\,\frac{0'3m}{0'02m^2}$$

$$|B_T| = \frac{\overset{2}{\cancel{4}}\cancel{\pi}10^{-7}\,T\cdot \cancel{m}/\cancel{A}\cdot 5\cancel{A}/15m^{-1}}{\cancel{2}\cancel{\pi}} = 150\,10^{-7}\,T$$

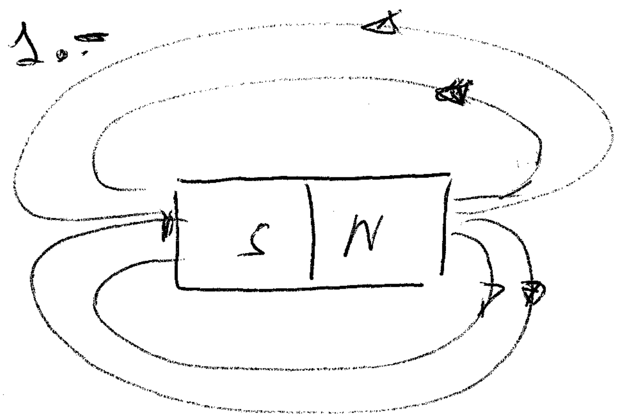
c)



$B_T = 0$

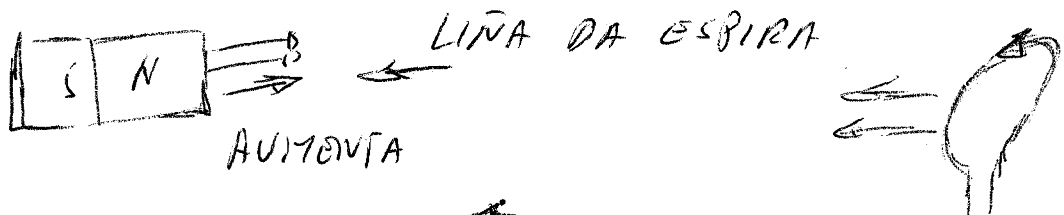
CUESTIÓNS INDUCCIÓN ELECTROMAGNÉTICA

1.-



$$\mathcal{E} = -\frac{d\phi}{dt} \qquad \phi = \vec{B} \cdot \vec{S}$$

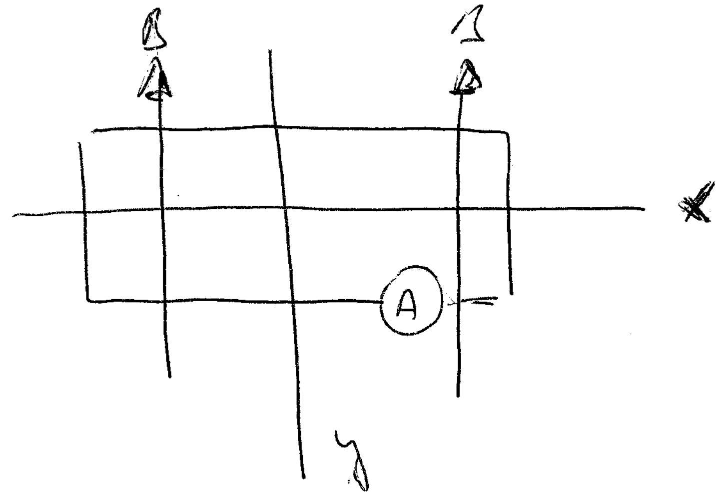
O campo creado pola espira debe opoñerse a variación creada polo imán.



ANTIHORARIO

DENDE A POSICIÓN DO IMÁN

2.-



A Lei de Faraday-Lenz $\mathcal{E} = -\frac{d\phi}{dt}$

Para a produción dunha forza electromotriz ten que haber unha variación do fluxo magnetico co tempo.

$$\Delta\phi = \vec{B}\cdot\vec{S}$$

$$\Delta\phi = |\vec{B}|\,|\vec{S}|\cdot\cos\theta$$

Debe haber un cambio en $\vec{B}$ ou en $\vec{S}$ o longo de t

So se produce un cambio en $\vec{S}$ si xira en torno o eixe x.

3.- igual que a primeira

4.-

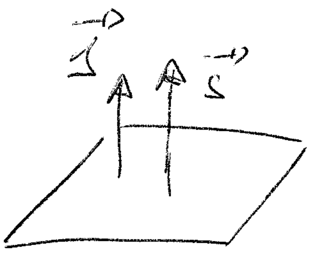
$\mathcal{E} = -\left(\frac{d\phi}{dt}\right)$ variación do fluxo co tempo

$V = \frac{de}{dt}$ ← velocidade

b)

5.-

a)

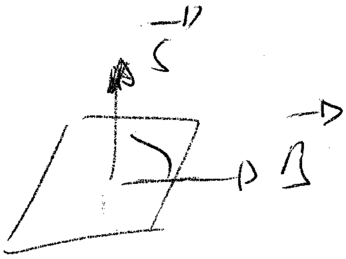


$\phi = cte \Rightarrow \Delta\phi = 0$

$\mathcal{E} = 0$

$$\mathcal{E} = -\frac{d\phi}{dt}$$

b)



$\phi = \vec{B} \cdot \vec{S}$

$\phi = |\vec{B}|\,|\vec{S}| \cdot \cos\alpha$

$\cos\alpha = 0$

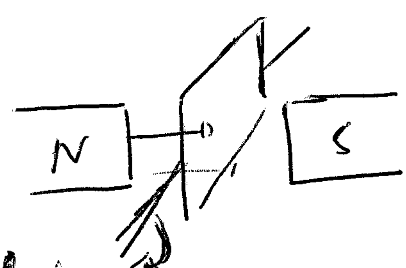
c)

B varia co tempo

$$\frac{d\phi}{dt} = 0$$

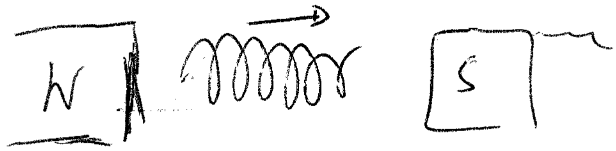
6.-

a)

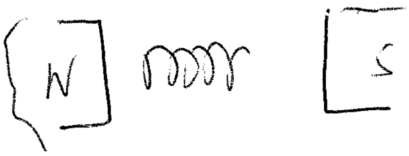


$\frac{d\phi}{dt}$ = varia $\Rightarrow \mathcal{E}$

b)



c)



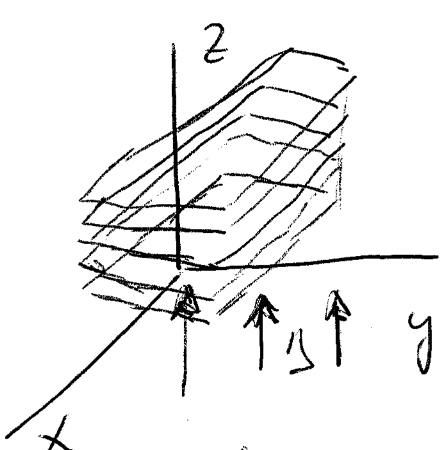
EXERCICIOS INDUCCIÓN ELECTROMAGNÉTICA

1.-

a) $\mathcal{E} = -\frac{d\phi}{dt}$

Prodúcese unha forza electromotriz cando hai variación do fluxo magnético. O sentido da forza electromotriz producida é tal que se opón a causa que o produciu.

b)



$S = 5.25\,cm^2 = 125\cdot 10^{-4}\,m^2$

$\mathcal{E} = -\frac{\Delta\phi}{\Delta t}$

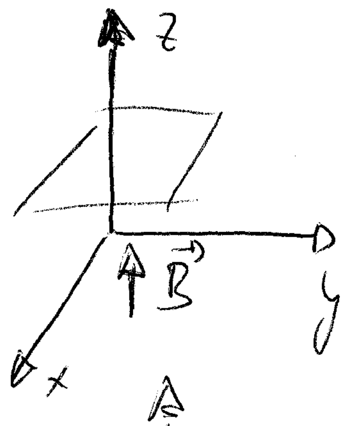
$\Delta t = 0'1\,s$

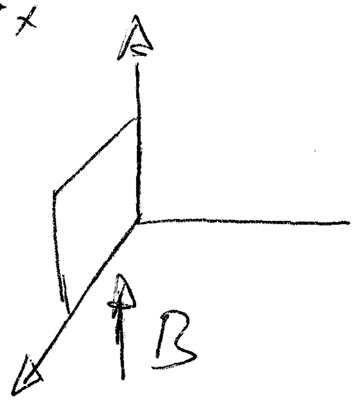
$\Delta\phi = S(B_f - B_i)$

$\Delta\phi = 125\cdot 10^{-4}\,m^2(0'2T - 0'5T) = -3'75\cdot 10^{-3}\,Wb$

$\mathcal{E} = -\frac{(-3'75\cdot 10^{-3}\,Wb)}{0'1} = 3'75\cdot 10^{-2}\,V$

c)





$\phi = 0$

$$\Delta\phi = S(\phi_f - \phi_i) = 125 \cdot 10^{-4} m^2 (0 - 0'5T) = -6'25 \cdot 10^{-3} Wb$$

$$\varepsilon = -\frac{125 \cdot 10^{-4} m^2 (-0'5T)}{0'1 s} = 6'25 \cdot 10^{-2} V.$$