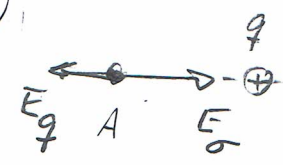
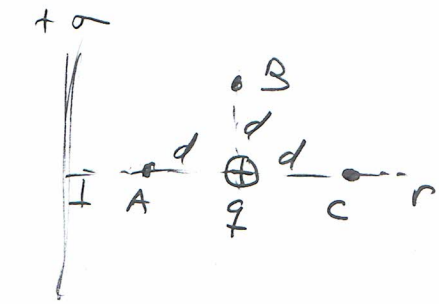
Física II - Tecnólogos. Examen 13/12/2019

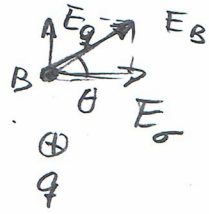
Ejercicio 1

a)



$$E_A = E_\sigma - E_q = \frac{\sigma}{2\varepsilon_0} - \frac{q}{4\pi\varepsilon_0 d^2}$$



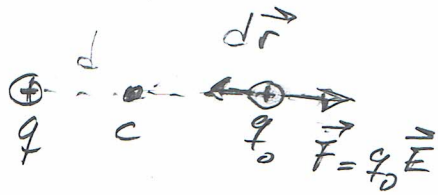


$$E_B = \sqrt{E_\sigma^2 + E_q^2} = \sqrt{\left(\frac{\sigma}{2\varepsilon_0}\right)^2 + \left(\frac{q}{4\pi\varepsilon_0 d^2}\right)^2}$$

$$\tan\varphi = \frac{E_q}{E_\sigma} = \frac{q/4\pi\varepsilon_0 d^2}{\sigma/2\varepsilon_0} = \frac{q}{2\pi\sigma d^2}$$

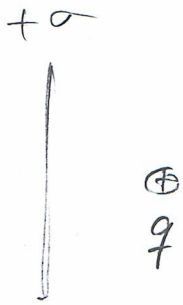
$$E_B = E_\sigma + E_q = \frac{\sigma}{2\varepsilon_0} + \frac{q}{4\pi\varepsilon_0 d^2}$$

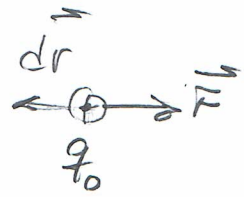
b)



$$W_{\infty q} = -\int_\infty^C \vec{F}\cdot d\vec{r} = -q_0\int_\infty^C \vec{E}\cdot d\vec{r} = \frac{qq_0}{4\pi\varepsilon_0 d}$$

c)





$$\vec{F} = \hat{r}\underbrace{\frac{q_0 q}{4\pi r^2}}_{\vec{F}_q} + \hat{r}\underbrace{\frac{\sigma}{2\varepsilon_0} q_0}_{\vec{F}_\sigma}$$

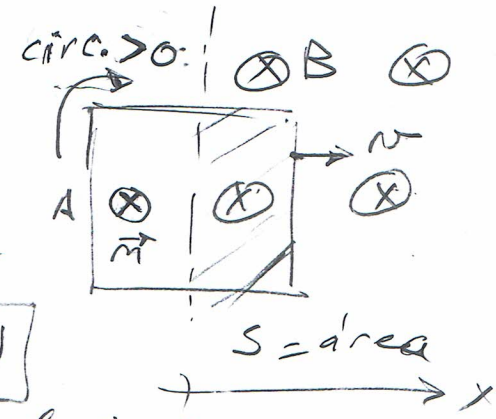
$$W_{\infty q} = -\int_\infty^0 \vec{F}_q\cdot d\vec{r} - \underbrace{\int_{-\infty}^{\infty} \vec{F}_\sigma\cdot d\vec{r}}$$

es ∞ porque

$$F_\sigma = \frac{\sigma q_0}{2\varepsilon_0} = \text{constante}.$$

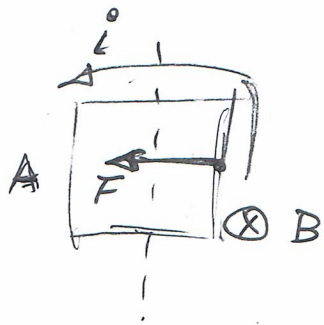
Ejercicio 2

a) $\mathcal{E} = -\frac{d\Phi_B}{dt} = -B\frac{dS}{dt} = -BA\frac{dx}{dt}$



$\mathcal{E} = -BAv \Rightarrow \boxed{\mathcal{E}(t) = -BAv(t)}$

$\Rightarrow$ corriente contra la circulación (sentido antihorario)

b) 

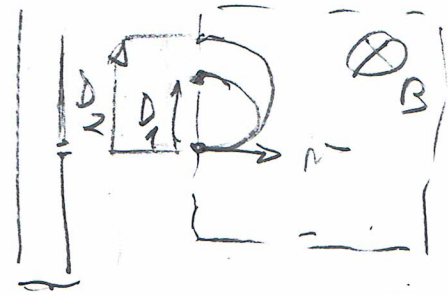
$F = BiA = B\frac{\mathcal{E}}{R}A$ hacia la izquierda

c) $F = m\frac{dv}{dt} = \frac{B\mathcal{E}(t)A}{R} = \frac{BA}{R}\underbrace{(-BAv)}_{\mathcal{E}} = -\frac{B^2A^2}{R}v(t) \Rightarrow$

$\frac{dv}{dt} + \frac{B^2A^2}{mR}v(t) = 0 \Rightarrow \boxed{v(t) = v_0 e^{-\frac{B^2A^2}{mR}t}}$

Ejercicio 3

$$\frac{m v^2}{2} = \Delta V \cdot q \Rightarrow v = \sqrt{\frac{2 \Delta V \cdot q}{m}}$$



$B = 50 \mu T$

$\Delta V = 2000 V$ $\quad q = 1,6 \times 10^{-14} C$

$m_1 = 4,0 \times 10^{-26} kg$ $\quad m_2 = 3,3 \times 10^{-25} kg$

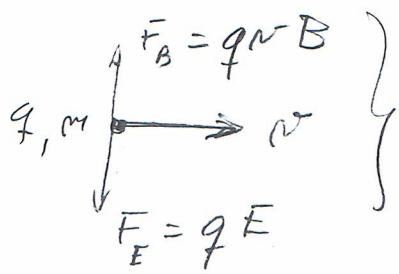
a) $v_1 = 1.26 \times 10^5 \frac{m}{s}$

$v_2 = 4.40 \times 10^4 \frac{m}{s}$

b) $F_B = F_{cpta.} \Rightarrow q v B = \frac{m v^2}{R} \Rightarrow R = \frac{m v}{qB} \Rightarrow$

$R_1 = 63 cm$ $\quad R_2 = 182 cm$

c)



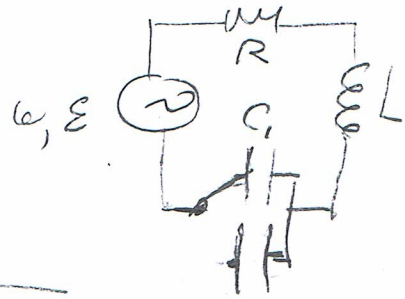
$\Rightarrow E = vB = 6300 \frac{N}{C}$ hacia abajo

Ejercicio 4

a) Resonancia $\Rightarrow \omega^2 = \frac{1}{LC_1} \Rightarrow$

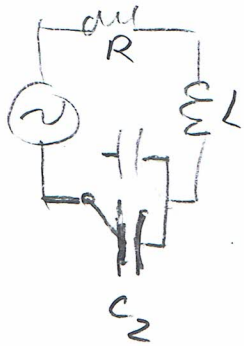
$$\Rightarrow \boxed{L = \frac{1}{\omega^2 C_1} = 2\,H}$$

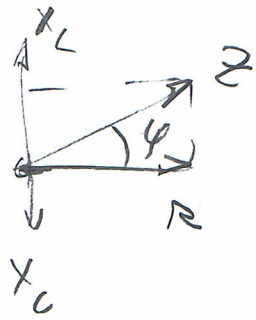
$$\Rightarrow \boxed{I = \frac{\mathcal{E}}{R} = \frac{220}{100} = 2{,}2\,A}$$



$\omega = 500\ 1/s$
$\mathcal{E} = 220\ V$
$R = 100\ \Omega$
$C_1 = 2{,}0\ \mu F$
$C_2 = 10\ \mu F$

b)





$$X_L = \omega L = 1000\,\Omega$$

$$X_C = \frac{1}{\omega C_2} = 200\,\Omega$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2} = 806\,\Omega \Rightarrow \boxed{I = \frac{\mathcal{E}}{Z} = 0{,}27\,A}$$

$$\tan\varphi = \frac{X_L - X_C}{R} = 0.8 \Rightarrow \boxed{\varphi \simeq 83^\circ}$$