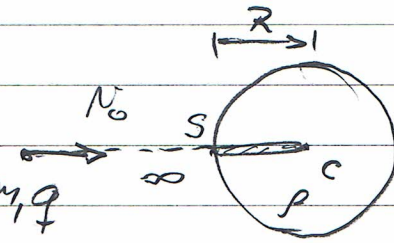
EXAMEN DE FÍSICA II TECNÓLOGOS 18/12/2020

Problema 1

Conservación de la energía

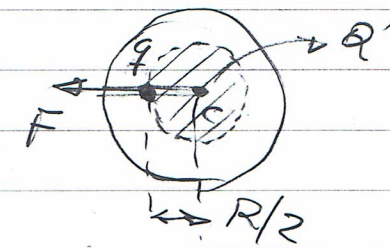



$$K_\infty + U_\infty = K_S + U_S \qquad U(r) = \frac{Qq}{4\pi\varepsilon r} \qquad U_\infty = 0$$

$$U_S = \frac{Qq}{4\pi\varepsilon R} \Rightarrow \frac{m v_0^2}{2} = \frac{m v_S^2}{2} + \frac{Qq}{4\pi\varepsilon R}$$

$$Q = \rho \cdot \text{Volumen} = \rho \frac{4}{3}\pi R^3 \Rightarrow \frac{m v_0^2}{2} = \frac{m v_S^2}{2} + \frac{\rho q R^2}{3\varepsilon_0}$$

$$\Rightarrow a) \quad v_S = \sqrt{v_0^2 - \frac{2}{3}\frac{\rho q R^2}{m\varepsilon_0}}$$




$$F = \frac{Q'q}{4\pi\varepsilon_0 r^2} \qquad Q' = \rho \cdot \text{Vol}'$$

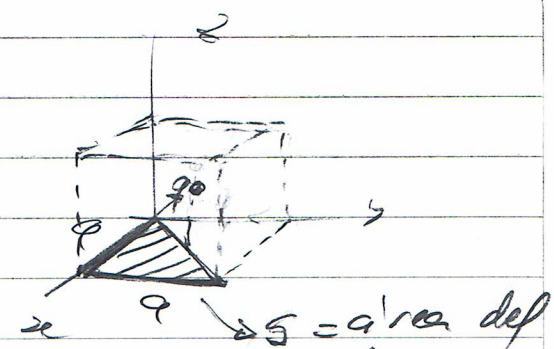
$$Q' = \rho \frac{4}{3}\pi r^3 \Rightarrow F = \frac{\rho q r}{3\varepsilon_0}$$

$$r = \frac{R}{2} \Rightarrow b) \quad F = \frac{\rho q R}{6\varepsilon_0}$$

Problema 2

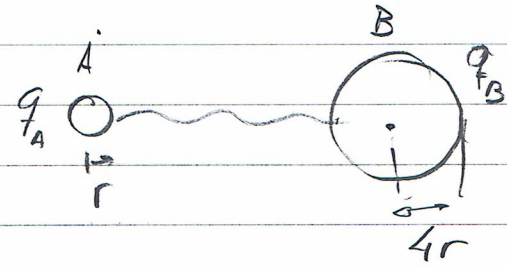
Carga en el medio del cubo

$$\phi_{cubo} = \frac{q}{\varepsilon_0}$$




$\phi_{ca}$ = $\phi$ sobre cada cara = $\frac{q}{6\varepsilon_0}$

$\phi_s$ = $\phi$ sobre media cara $\Rightarrow$ a) $\phi_s = \frac{q}{12\varepsilon_0}$



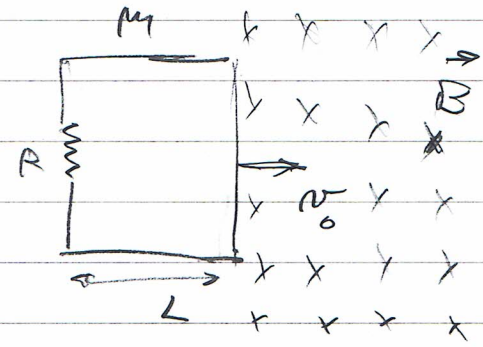

Se igualan potenciales

$$V_A = V_B \Rightarrow \frac{q_A}{4\pi\varepsilon_0 r} = \frac{q_B}{4\pi\varepsilon_0 4r}$$

$$\Rightarrow q_A = \frac{q_B}{4} \quad \text{(i)} \qquad \text{Además } q_A + q_B = q_0 \quad \text{(ii)}$$

De (i) y (ii) $\begin{cases} q_A = \frac{1}{5} q_0 \\ q_B = \frac{4}{5} q_0 \end{cases}$ b)

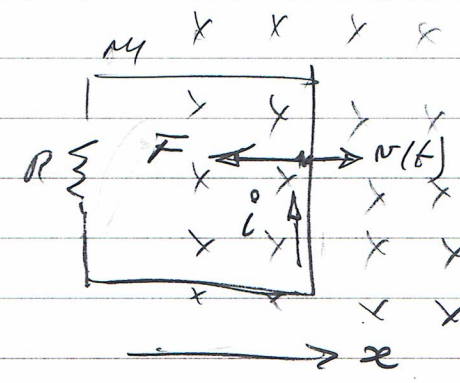
problema 3




$$F(t) = -B\,i(t)\cdot L$$

$$i(t) = \frac{\mathcal{E}(t)}{R} = \frac{BL\,v(t)}{R}$$

$$\Rightarrow F(t) = -\frac{B^2L^2\,v(t)}{R}$$




$$F(t) = M\frac{dv}{dt} \Rightarrow \frac{dv}{dt} = -\frac{B^2L^2}{MR}v(t)$$

$$\Rightarrow a)\ v(t) = v_0\, e^{-\frac{B^2L^2}{MR}t}$$

$$\Delta E_{perdida} = -\Delta E_{cinética} = \frac{M v_0^2}{2} - \frac{M(v_0/2)^2}{2}$$

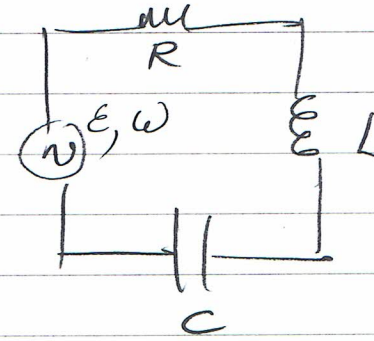
$$b)\ \Delta E_R = \frac{3}{8} M v_0^2$$

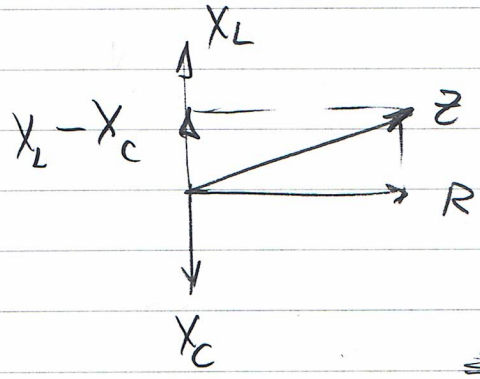
Problema 4

$\mathcal{E}_{rms} = 250\ V$ $\quad \omega = 10^3\ s^{-1}$

$R = 400\ \Omega$ $\quad C = 2\ \mu F$

$L = 0.2\ H$




$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$X_L = \omega L = 200\ \Omega \qquad X_C = \frac{1}{\omega C} = 500\ \Omega$$

$$\Rightarrow Z = \sqrt{400^2 + (200-500)^2} = 500\ \Omega$$

$$i = \frac{\mathcal{E}}{Z} = \frac{250}{500} = 0.5\ A \qquad V_L = i X_L = 0.5 \times 200$$

a) $V_L = 100\ V$

Resonancia $\Rightarrow X_L = X_C \Rightarrow \omega L = \frac{1}{\omega C_{TOT}} \Rightarrow C_{TOT} = \frac{1}{\omega^2 L}$

$$C_{TOT} = \frac{1}{10^3 \times 200} = 5 \times 10^{-6}\ F = 5\ \mu F > C \rightarrow 2\ \mu F$$

$$\Rightarrow C_{TOT} = C + C' \Rightarrow 5 = 2 + C' \Rightarrow C' = 3\ \mu F$$

b) Conexión en paralelo

$C' = 3\ \mu F$