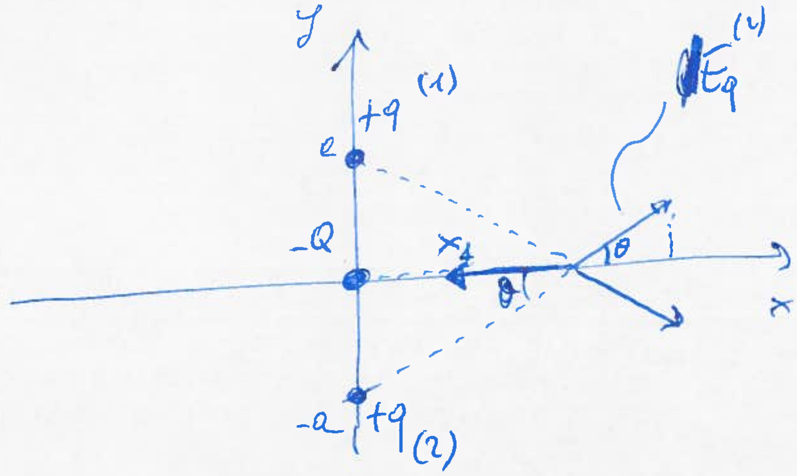
11/9/2018

1)



$$E_q^{(1,2)} = \frac{q}{4\pi\varepsilon_0} \frac{1}{(a^2+x_1^2)^{\cancel{2/2}}}$$

$$E_{q_x}^{(1,2)} = \frac{q}{4\pi\varepsilon_0} \frac{1}{(a^2+x_1^2)} \cos\theta$$

$$E_{q_x} = E_{q_x}^{(1)} + E_{q_x}^{(2)} = 2 E_{q_x}^{(1,2)} = \frac{2q}{4\pi\varepsilon_0} \frac{1}{(a^2+x_1^2)} \cos\theta =$$

$$= \frac{2q}{4\pi\varepsilon_0} \frac{1}{(a^2+x_1^2)} \frac{x_1}{\sqrt{a^2+x_1^2}} =$$

$$= \frac{2q}{4\pi\varepsilon_0} \frac{x_1}{(a^2+x_1^2)^{3/2}}$$

E_q $\vec{E}$ sull'asse x e per simmetria diretto solo lungo $\pm\hat{x}$

$$E_{TOT} = E_{q_x} + E_{Q_x}$$

con $E_{Q_x} = \dfrac{-Q}{4\pi\varepsilon}\dfrac{1}{x_1^2}$

$$E_{TOT} = \frac{2q}{4\pi\varepsilon}\frac{x_1}{(\ell^2+x_1^2)^{\frac{3}{2}}} - \frac{Q}{4\pi\varepsilon}\frac{1}{x_1^2} =$$

$$= \frac{1}{4\pi\varepsilon_0}\left[\frac{2q\,x_1}{(\ell^2+x_1^2)^{\frac{3}{2}}} - \frac{Q}{x_1^2}\right] = 0$$

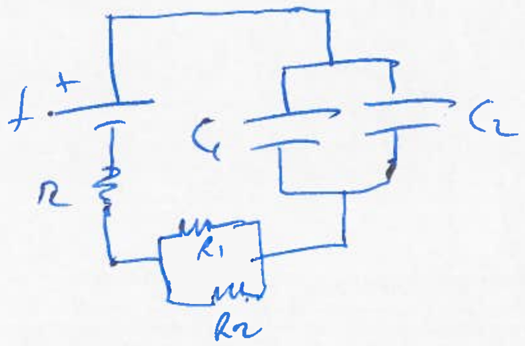
cioè $\dfrac{2qx_1}{(\ell^2+x_1^2)^{3/2}} = \dfrac{Q}{x_1^2}$; $\dfrac{2q}{Q}x_1^3 = (\ell^2+x_1^2)^{\frac{3}{2}}$;

; $\left(\dfrac{2q}{Q}\right)^{\frac{1}{3}} x_1 = (\ell^2+x_1^2)^{\frac{1}{2}}$; $\left(\dfrac{2q}{Q}\right)^{\frac{2}{3}} x_1^2 = \ell^2+x_1^2$;

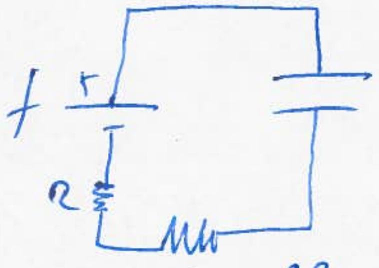
; $\ell^2 = \left(\dfrac{2q}{Q}\right)^{\frac{2}{3}} x_1^2 - x_1^2 = \left[\left(\dfrac{2q}{Q}\right)^{\frac{2}{3}} - 1\right]x_1^2$

$$\ell = x_1\sqrt{\left(\frac{2q}{Q}\right)^{\frac{2}{3}} - 1}$$

2)



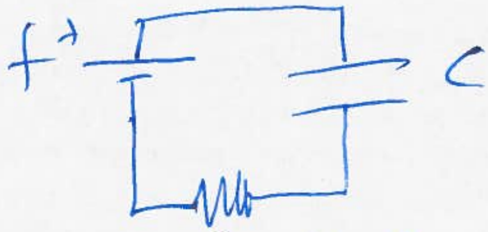
$=$



$C = C_1 + C_2$

$$R_{//} = \frac{R_1 R_2}{R_1 + R_2}$$

$=$



$$R = R + R_{//}$$

$$\tau = R C \Rightarrow$$

$$C = \frac{\tau}{R} = \frac{\tau}{R + R_{//}}$$

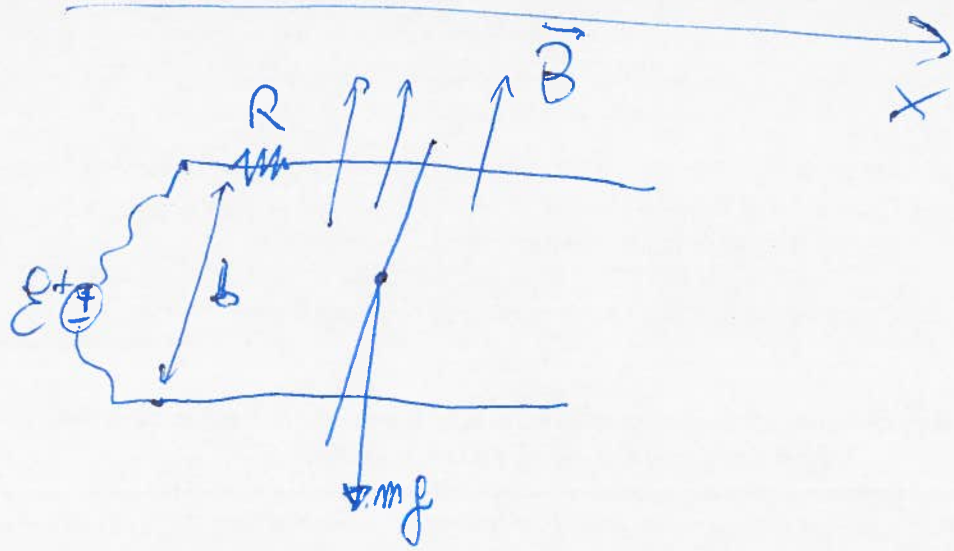
A regime non scorre corrente

quindi $V_C = f = V_{C_1} = V_{C_2}$

quindi $C_1 = \dfrac{Q_1}{V_{C_1}} = \dfrac{Q_1}{f}$

e allora $C_2 = C - C_1 = \dfrac{\tau}{R} - C_1$

3)



$v_0 = v(t=0) = 0$

$t=0 \rightarrow \quad \mathcal{E} = R i_0 \rightarrow i_0 = \dfrac{\mathcal{E}}{R}$

$v_\infty = v(t=+\infty) = \text{cost} \rightarrow a_\infty = 0 \rightarrow F_x = 0$

$F_x = i_\infty b B = 0 \rightarrow i_\infty = 0$

$\cancel{i_\infty} \quad i_\infty = \dfrac{f_{em}}{R} = \dfrac{\mathcal{E} + \mathcal{E}_i}{R} = 0 \rightarrow$

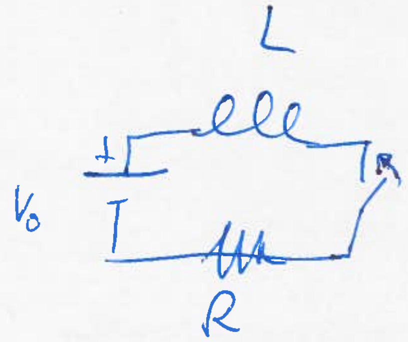
$\mathcal{E}_i = -\mathcal{E}$

$\mathcal{E}_i = -\dfrac{d}{dt}\phi(B) = -\dfrac{d}{dt}(x \cdot bB) = -bBv_\infty$

$\mathcal{E}_i = -bBv_\infty = -\mathcal{E} \rightarrow v_\infty = \dfrac{\mathcal{E}}{bB}$

$E_k = \dfrac{1}{2} m v_\infty^2$

4)



eq. maglia

$$V_0 + \mathcal{E}_i = Ri$$

$$V_0 - L\frac{di}{dt} = Ri$$

$$V_0 - Ri = L\frac{di}{dt} \rightarrow \frac{V_0}{R} - i = \frac{L}{R}\frac{di}{dt} \rightarrow$$

$$\rightarrow \frac{R}{L}dt = \frac{di}{\frac{V_0}{R} - i} \rightarrow \frac{di}{i - \frac{V_0}{R}} = -\frac{R}{L}dt$$

$$\int_0^{i_1} \frac{di}{i - \frac{V_0}{R}} = -\frac{R}{L}\int_0^{t_1} dt \rightarrow \ln\frac{i_1 - \frac{V_0}{R}}{-\frac{V_0}{R}} = -\frac{R}{L}t_1$$

$$\rightarrow \frac{i_1 - \frac{V_0}{R}}{-\frac{V_0}{R}} = e^{-\frac{R}{L}t_1} \rightarrow i_1 - \frac{V_0}{R} = -\frac{V_0}{R}e^{-\frac{R}{L}t_1} \rightarrow$$

$$\rightarrow i_1 = \frac{V_0}{R}\left[1 - e^{-\frac{R t_1}{L}}\right] \qquad \left(i(t) = \frac{V_0}{R}\left[1 - e^{-\frac{R}{L}t}\right]\right)$$

$$\mathcal{E}_g = \int_0^{t_1} \mathcal{P}_g \cdot dt =$$

$$= \int_0^{t_1} V_0 \cdot i(t)\, dt = V_0 \int_0^{t_1} i(t)\, dt =$$

$$= V_0 \int_0^{t_1} \frac{V_0}{R}\left[1 - e^{-\frac{R}{L}t}\right] dt = \frac{V_0^2}{R}\left[t_1 + \frac{L}{R}\left(e^{-\frac{R}{L}t_1} - 1\right)\right]$$