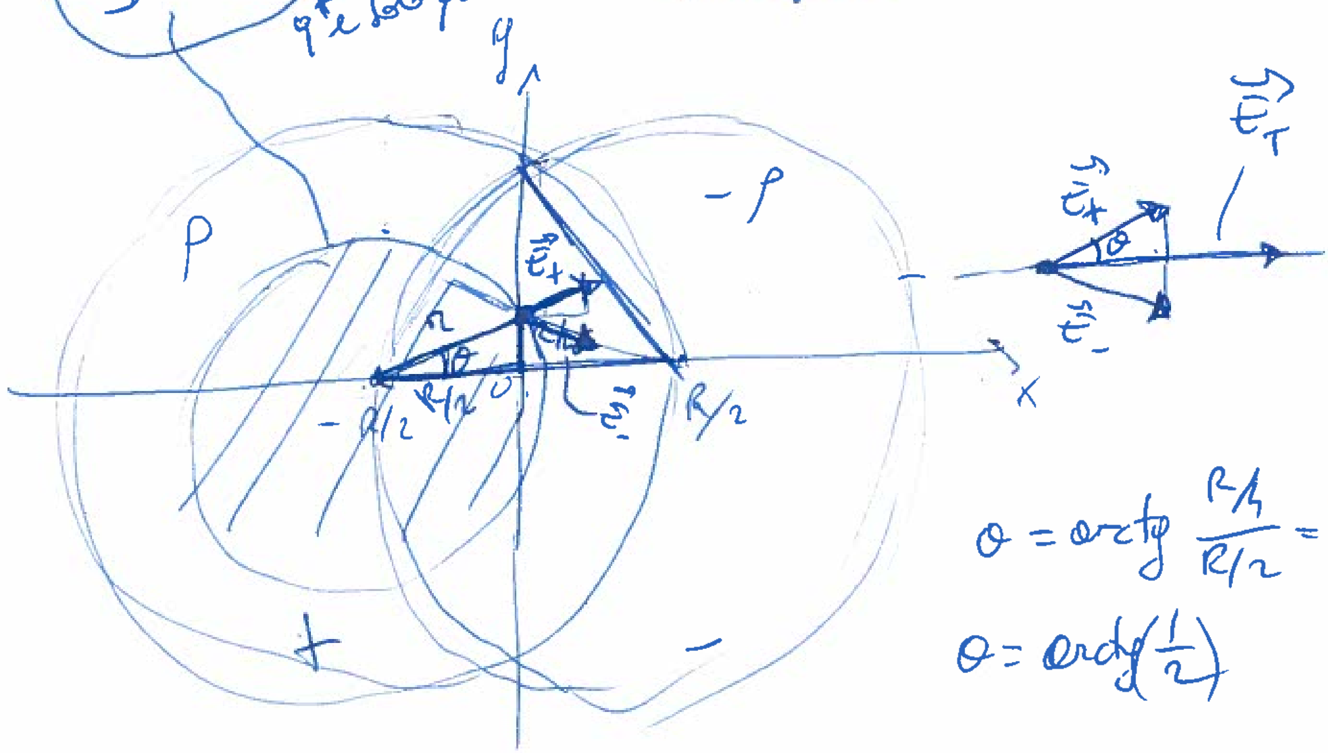
21/10/2020

1) $\boxed{\oint(\vec{E}) = \frac{q^+}{\varepsilon_0}}$

q^+ è solo quella dentro una sfera di raggio r



$\theta = \operatorname{arctg} \frac{R/4}{R/2} = \operatorname{arctg} \frac{1}{2}$

$\theta = \operatorname{arctg}\left(\frac{1}{2}\right)$

$$r = \sqrt{\left(\frac{R}{4}\right)^2 + \left(\frac{R}{2}\right)^2} = \sqrt{\frac{R^2}{16} + \frac{R^2}{4}} = \sqrt{\frac{4R^2 + R^2}{16}} = \frac{R}{4}\sqrt{5}$$

$E_+ = \frac{q^+}{4\pi\varepsilon}\frac{1}{r^2}$ $\qquad q^+ = \rho \cdot \frac{4}{3}\pi r^3$ $\qquad E_+ = \frac{\rho 4\pi r^{\cancel{3}}}{3 \cdot 4\pi\varepsilon \cancel{r^2}} = \frac{\rho r}{3\varepsilon_0}$

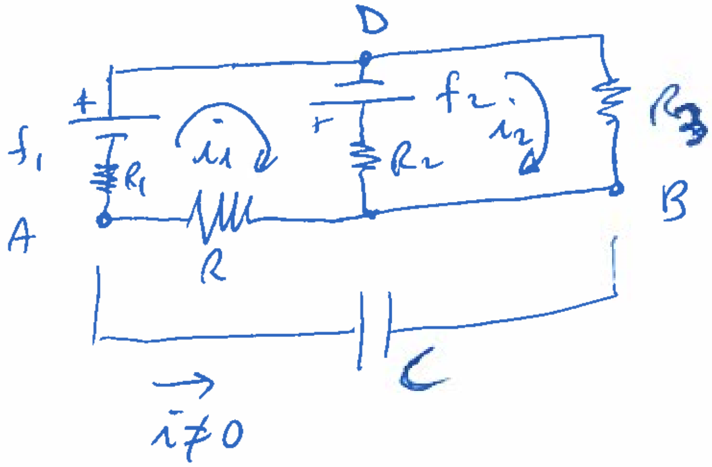
$E_- = \frac{q^-}{4\pi\varepsilon}\frac{1}{r^2}$ $\qquad q^- = \left|-\rho\frac{4}{3}\pi r^3\right|$ $\qquad E_- = \left|\frac{-\rho r}{3\varepsilon}\right|$

$$E_T = 2E_+\cos\theta = 2E_+\frac{R/2}{r} = \cancel{2}E_+\frac{\cancel{R}/\cancel{2}\,4}{\cancel{R}/\cancel{4}\sqrt{5}} = \frac{4E_+}{\sqrt{5}}$$

$$\vec{E}_T = \hat{x}E_T = \hat{x}\frac{4E_+}{\sqrt{5}} = \hat{x}\frac{\rho\cancel{4}\cancel{\pi}r^{\cancel{3}}\cdot 4}{3\,\cancel{4}\cancel{\pi}\varepsilon_0\cancel{r^2}\sqrt{5}} = \hat{x}\frac{\rho r \cdot 4}{3\varepsilon\sqrt{5}} =$$

$$= \hat{x}\frac{\rho\cdot\cancel{4}R\cancel{\sqrt{5}}}{3\varepsilon\cancel{\sqrt{5}}\cancel{4}} = \hat{x}\frac{\rho R}{3\varepsilon_0}$$

2) IN C NON SCORRE CORRENTE



$$V_C = V_{AB} = V_A - V_B$$

$$\boxed{U_e = \frac{1}{2} C V_{AB}^2}$$

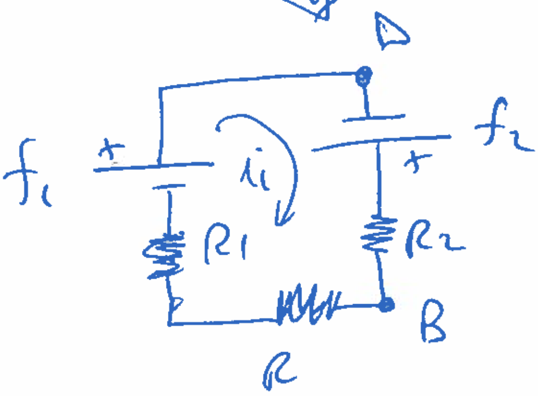
DEVO TROVARE V_{AB}.

PER FAR SI CHE IN R_3 NON SCORRA CORRENTE

$\boxed{i_2 = 0}$ → DEVE ESSERE $V_D - V_B = 0$

Se $i_2 = 0$

⇓



$$i_1 = \frac{f_1 + f_2}{R_1 + R_2 + R}$$

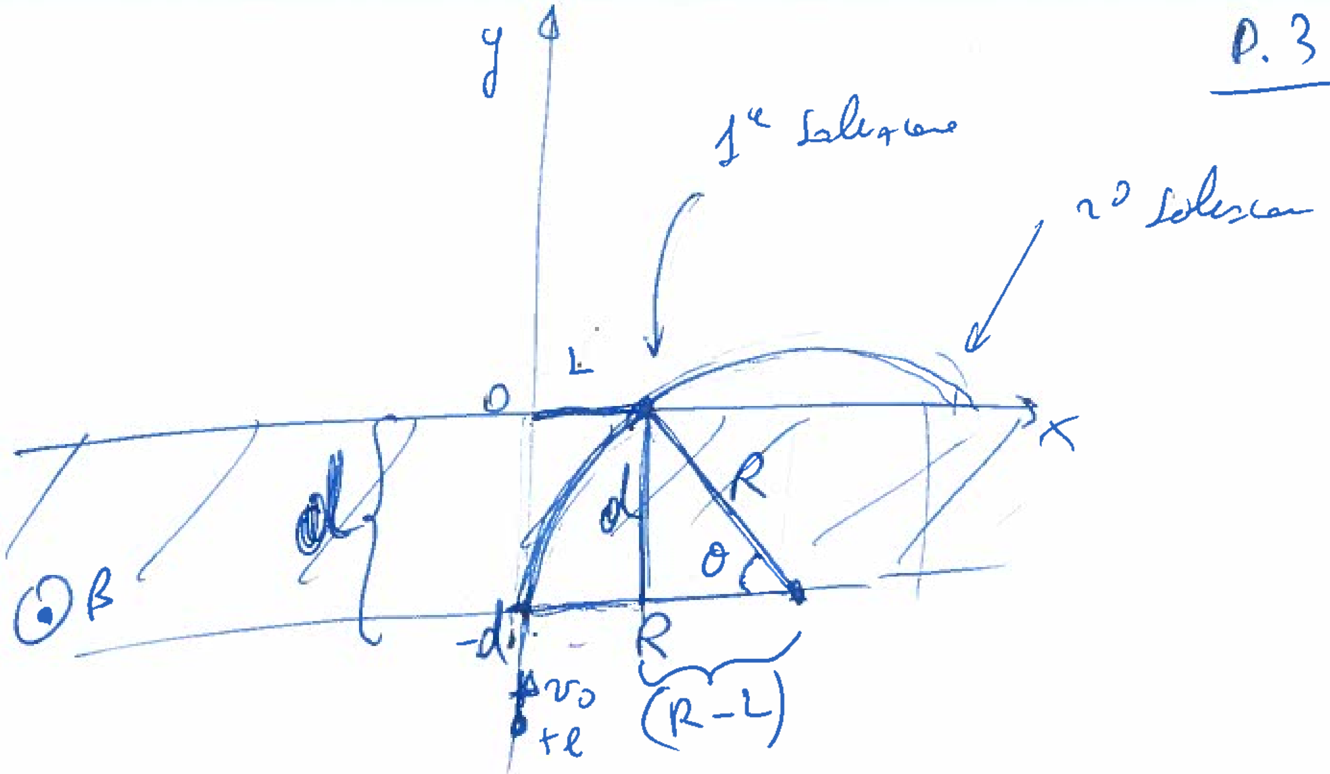
$$V_D - V_B = -f_2 + R_2 i_1 = 0$$

$$f_2 = R_2 i_1 \qquad i_1 = \frac{f_2}{R_2} = \frac{f_1 + f_2}{R_1 + R_2 + R}$$

$$(R + R_1 + R_2) f_2 = R_2 (f_1 + f_2) \qquad R f_2 = -f_2 (R_1 + R_2) + R_2 (f_1 + f_2)$$

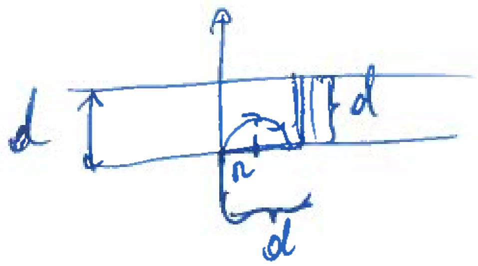
$$R = \frac{R_2 (f_1 + f_2)}{f_2} - (R_1 + R_2) = \frac{f_1 R_2 + \cancel{f_2 R_2} - \cancel{f_2 R_2} - f_2 R_1}{f_2}$$

3)



$$F = e v_0 B = m_p a_c = m_p \frac{v_0^2}{R} \qquad R = \frac{m_p v_0^{\cancel{2}}}{e \cancel{v_0} B} = \frac{m_p v_0}{e B}$$

Se $R < d$ NON TOCCO MAI LO SCHERMO



$$\hookrightarrow R = \frac{m_p v_0}{eB} < d \rightarrow \boxed{B > \frac{m_p v_0}{e d}}$$

$\boxed{\text{Se } R \geq d}$

$$R^2 = (R-L)^2 + d^2 = R^2 + L^2 - 2RL + d^2$$

$$\cancel{R^2} = \cancel{R^2} + L^2 - 2RL + d^2 \rightarrow L^2 - 2RL + d^2 = 0$$

$$L = \frac{+2R \pm \sqrt{4R^2 - 4d^2}}{2} = R \pm \sqrt{R^2 - d^2}$$

PRENDO SOLO SEGNO (−) (1ª soluzione)

$$L(B) = R - \sqrt{R^2 - d^2} = \frac{m_p v_0}{eB} - \sqrt{\frac{m_p^2 v_0^2}{e^2 B^2} - d^2}$$

4) $i(\omega) = f_0 \Big/ \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$

$$i_{max} = i(\omega_0) = f_0/R \quad \text{per} \quad \left(\omega_0 L - \frac{1}{\omega_0 C}\right) = 0 \Rightarrow \omega_0 = \frac{1}{\sqrt{LC}}$$

$$i' = i(\omega') = \frac{i_{max}}{\sqrt{2}} = \frac{f_0}{R\sqrt{2}} = \frac{f_0}{\sqrt{R^2 + \left(\omega' L - \frac{1}{\omega' C}\right)^2}}$$

$$2R^2 = R^2 + \left(\omega' L - \frac{1}{\omega' C}\right)^2$$

$$\left(\omega' L - \frac{1}{\omega' C}\right)^2 = R^2$$

$$\omega' L - \frac{1}{\omega' C} = \pm R \Rightarrow \omega'^2 LC - 1 \mp RC\omega' = 0$$

$\omega' \geq 0$
per cui ~~il~~ termine con $\sqrt{}$ solo (+)

$$\omega' = \frac{\pm R\cancel{C} \pm \sqrt{\frac{R^2C^2 + 4LC}{4L^2C^2}}}{2L\cancel{C}}$$

$$\omega' = \pm \frac{R}{2L} + \sqrt{\left(\frac{R}{2L}\right)^2 + \frac{1}{LC}}$$

$$\omega_1' = +\frac{R}{2L} + \sqrt{\left(\frac{R}{2L}\right)^2 + \frac{1}{LC}} \qquad \omega_2' = -\frac{R}{2L} + \sqrt{\left(\frac{R}{2L}\right)^2 + \frac{1}{LC}}$$

$$\Delta\omega = \omega_1' - \omega_2' = \frac{R}{2L} + \frac{R}{2L} = \frac{R}{L}$$