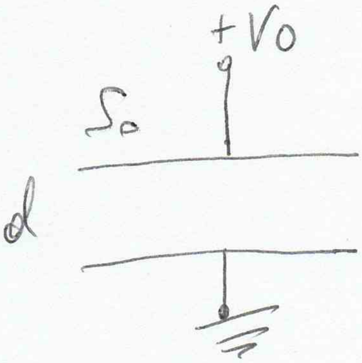
1)

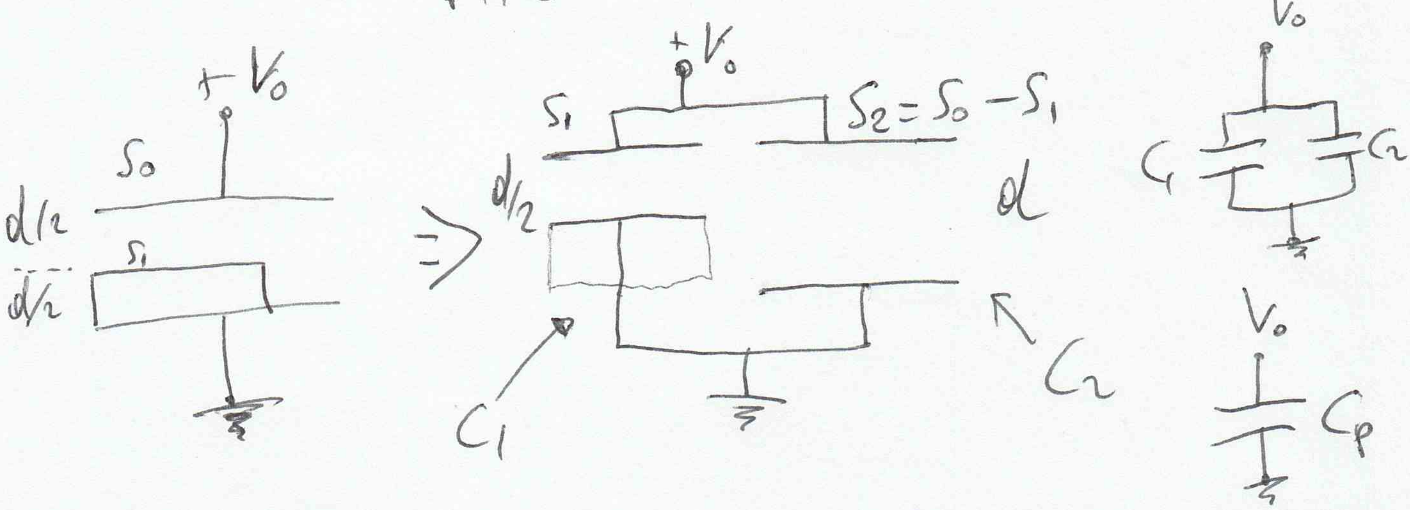


INIZIO

$$C_0 = \varepsilon_0 \frac{S_0}{d}$$

$$U_0 = \frac{1}{2} C_0 V_0^2 = \frac{1}{2} \varepsilon_0 \frac{S_0}{d} V_0^2$$

FINE



$$C_p = C_1 + C_2 \qquad C_1 = \varepsilon_0 \frac{S_1}{d/2} = \varepsilon_0 \frac{2 S_1}{d} \qquad C_2 = \frac{\varepsilon_0 (S_0 - S_1)}{d}$$

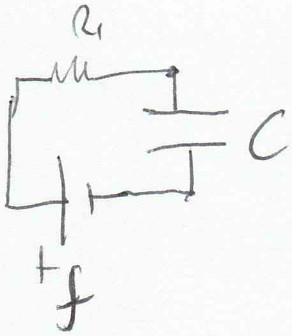
$$C_p = \frac{\varepsilon_0}{d}\left[2 S_1 + (S_0 - S_1)\right] = \frac{\varepsilon_0}{d}\left[\cancel{2} S_1 + S_0 - \cancel{S_1}\right] = \frac{\varepsilon_0}{d}\left[S_0 + S_1\right]$$

$$U_N = \frac{1}{2} C_p V_0^2 = \frac{1}{2} \frac{\varepsilon_0}{d} V_0^2 (S_0 + S_1) = 1{,}5\ U_0 = \frac{3}{2} \frac{1}{2} \frac{\varepsilon_0}{d} V_0^2 S_0$$

$$\cancel{\frac{1}{2}} \cancel{\frac{\varepsilon_0}{d}} \cancel{V_0^2} (S_0 + S_1) = \frac{3}{2} \cdot \cancel{\frac{1}{2}} \cancel{\frac{\varepsilon_0}{d}} \cancel{V_0^2} S_0 \rightarrow S_0 + S_1 = \frac{3}{2} S_0 \rightarrow 2S_0 + 2S_1 = 3S_0$$

$$S_0 = 2 S_1 \qquad \boxed{S_1 = \frac{S_0}{2}}$$

2) INIZIO



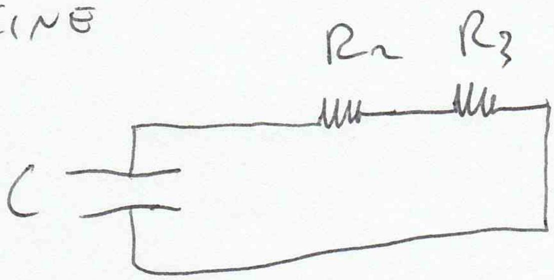
$\boxed{Q_0 = Cf}$ $\qquad U_0 = \frac{1}{2}Cf^2$

$E_{R1} = U_0 = \frac{1}{2}Cf^2$

$$E_{R_1} = \int_0^{+\infty} R_1 i^2 \, dt \quad \text{con} \quad i(t) = \frac{f}{R_1} e^{-\frac{t}{R_1 C}}$$

$$= \cancel{R_1} \int_0^{+\infty} \frac{f^2}{R_1^{\cancel{2}}} e^{-\frac{2t}{R_1 C}} \, dt = \frac{f^2}{\cancel{R_1}}\left(\frac{R_1 C}{2}\right) = \frac{1}{2}Cf^2$$

FINE



$R_S = R_2 + R_3$

$E_{R_S} = \frac{1}{2}Cf^2$

$$E_{R_2} = \int_0^{+\infty} R_2 i^2 \, dt = R_2 \int_0^{+\infty} \left(\frac{f}{R_S} e^{-\frac{t}{R_S C}}\right)^2 dt =$$

$$= \underbrace{\frac{R_2 f^2}{(R_3+R_2)^{\cancel{2}}} \frac{\cancel{(R_3+R_2)}C}{2} = \frac{1}{3}\,\frac{1}{2}Cf^2}$$

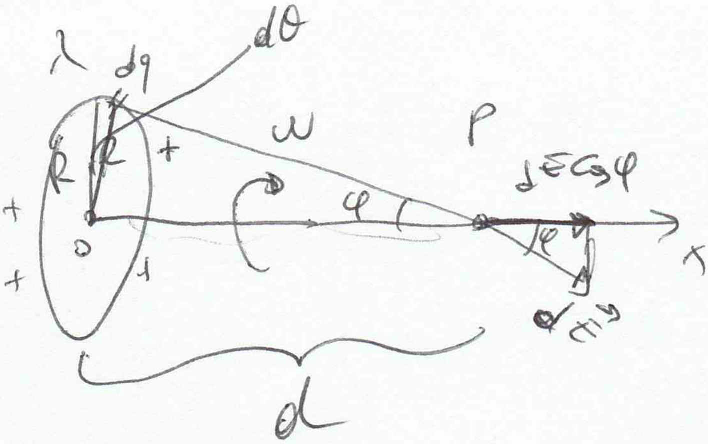
$$\frac{R_2}{(R_3+R_2)} \cancel{\frac{1}{2}} \cancel{C} \cancel{f^2} = \frac{1}{3} \cancel{\frac{1}{2}} \cancel{C} \cancel{f^2}$$

$3R_2 = R_3 + R_2$

$2R_2 = R_3$

$\boxed{R_2 = \frac{R_3}{2}}$

3)



$$dl = R\,d\theta$$

$$dq = \lambda\,dl$$

$$dq = \lambda R\,d\theta$$

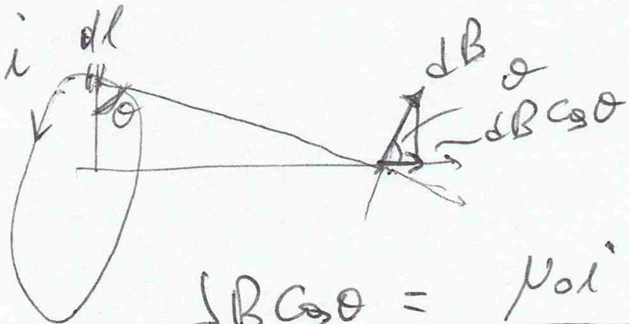
$$d\vec{E} = \frac{dq}{4\pi\varepsilon_0(R^2+d^2)}$$

$$dE\cos\varphi = \frac{dq}{4\pi\varepsilon_0(R^2+d^2)^{3/2}}\,d$$

$$\vec{E}_{tot} = \hat{x}\,\frac{\lambda R\cancel{2\pi}\,d}{{}_2\cancel{4\pi}\,\varepsilon_0(R^2+d^2)^{3/2}} = \hat{x}\,\frac{\lambda R d}{2\varepsilon_0(R^2+d^2)^{3/2}}$$

$$\boxed{T = \frac{2\pi}{\omega}} \qquad \boxed{q = \lambda R 2\pi}$$

$$i = \frac{dq}{dt} = \frac{q}{T} = \frac{\lambda R\cancel{2\pi}\,\omega}{\cancel{2\pi}} = \omega R\lambda$$

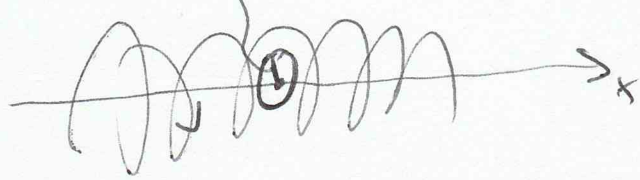


$$dB = \frac{\mu_0 i\,dl}{4\pi(R^2+d^2)}$$

$$dB\cos\theta = \frac{\mu_0 i\,dl}{4\pi(R^2+d^2)}\,\frac{R}{(R^2+d^2)^{1/2}} = \frac{\mu_0 i R\,dl}{4\pi(R^2+d^2)^{3/2}}$$

$$\vec{B}_{TOT} = \hat{x}\,\frac{\mu_0 i R\,\cancel{2\pi}R}{{}_2\cancel{4\pi}(R^2+d^2)^{3/2}} = \hat{x}\,\frac{\mu_0 i R^2}{2(R^2+d^2)^{3/2}} = \hat{x}\,\frac{\mu_0 R^3\omega\lambda}{2(R^2+d^2)^{3/2}}$$

3 4) L $\quad n \quad i(t) = a t^3$



$$\vec{B}^{(t)}_{solen} = \hat{x}\, \mu_0 n\, i(t) = \hat{x}\, \mu_0 n a t^3$$

$$i_{SPIRA}(t) = \frac{fem}{R} = -\frac{1}{R}\frac{d\Phi(B)}{dt} = -\frac{1}{R}(\pi L^2)\frac{d}{dt}B(t)$$

$$= -\frac{\pi L^2}{R}\, \mu_0 n a\, 3t^2$$

$$\vec{B}_{SPIRA} = +\hat{x}\, \frac{\mu_0\, i_{SPIRA}\, \cancel{2\pi L}}{2\cancel{4\pi}\, L^{\cancel{2}}} = +\hat{x}\, \frac{\mu_0\, i_{SPIRA}}{2L}$$

$$\vec{B}_{SPIRA}(t) = -\hat{x}\, \frac{\mu_0}{2R}\, \frac{\pi L^{\cancel{2}}}{\cancel{L}}\, \mu_0 n a\, 3t^2$$

$$\vec{B}_{TOT}(t) = \vec{B}_{solen}(t) + \vec{B}_{SPIRA}(t) = \hat{x}\left[\mu_0 n a t^3 - \frac{\mu_0}{2R}\pi L\, \mu_0 n a\, 3t^2\right]$$