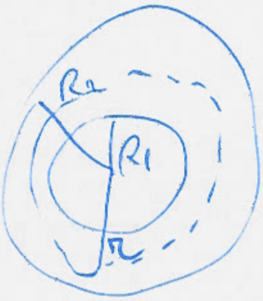
4-7-19

1)



GAUSS per $R_1 < r < R_2$

$$E(r)\,4\pi r^2 = \frac{Q_1}{\varepsilon_0}$$

$$E(r) = \frac{Q_1}{4\pi\varepsilon_0 r^2} \qquad \underbrace{\vec{E}(r) = E(r)\,\hat{r}}_{Q_1 \text{ è } <0 \text{ per cui } \vec{E} \text{ è diretto verso il centro}}$$

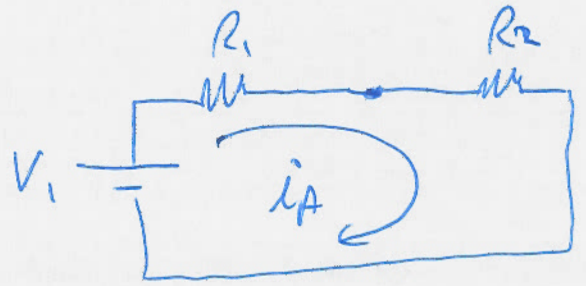
$$\Delta V = V(R_2) - V(R_1) = -\int_{R_1}^{R_2} \vec{E}(r)\cdot d\vec{r} =$$

$$= -\int_{R_1}^{R_2} \frac{Q_1}{4\pi\varepsilon_0}\frac{dr}{r^2} = +\underbrace{\frac{\overset{<0}{Q_1}}{4\pi\varepsilon_0}\overbrace{\left(\frac{1}{R_2} - \frac{1}{R_1}\right)}^{<0}}_{>0}$$

$$L = -\Delta U = -(-e)\Delta V = +e\Delta V = \frac{1}{2} m v_F^2$$

$$v_F^2 = \frac{2e\Delta V}{m} \qquad v_F = \sqrt{\frac{2e\Delta V}{m}}$$

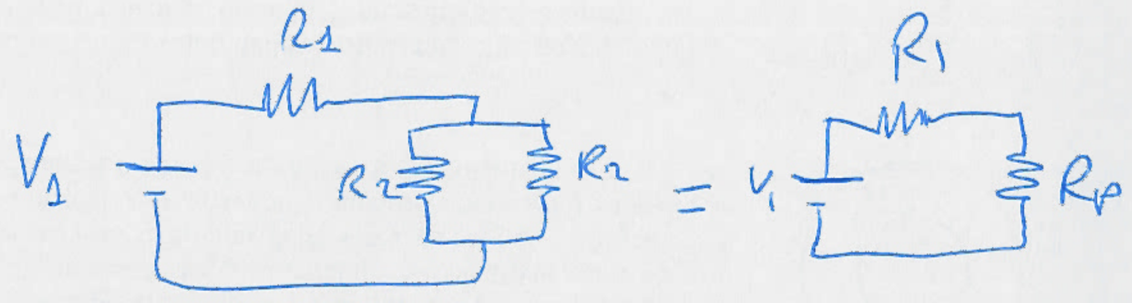
2) CASO A) T APERTO



$$i_A = \frac{V_1}{R_1+R_2}$$

$$P_{R_1} = i_A^2 R_1 = \frac{V_1^2 R_1}{(R_1+R_2)^2} \rightarrow V_1 = \sqrt{\frac{(R_1+R_2)^2 P_{R_1}}{R_1}}$$

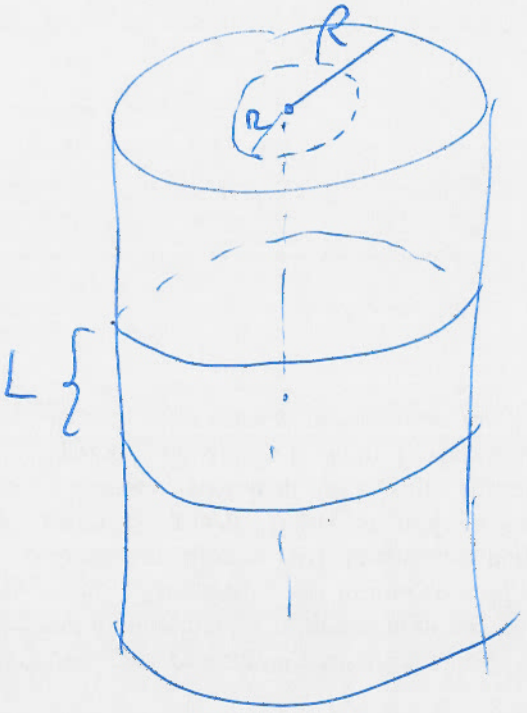
CASO B) T CHIUSO



$$R_p = \frac{1}{\frac{1}{R_2}+\frac{1}{R_2}} = \frac{R_2}{2} \qquad i_B = \frac{V_1}{R_1+R_p}$$

$$P_{GEN} = V_1 i_B = \frac{V_1^2}{R_1+R_p}$$

3)



$$j = \frac{i}{\pi R^2}$$ UNIFORME

densità energia magnetica

$$u_m = \frac{1}{2}\frac{B^2}{\mu} \quad \text{con } B(r)$$

AMPERE $\quad 0 < r < R$

$$\oint \vec{B}\cdot d\vec{l} = \mu\, i_{conc} \Rightarrow B(r)\,2\pi\cancel{r} = \mu\, j\, \cancel{\pi}\, r^{\cancel{2}}$$

$$B(r) = \frac{\mu j}{2}\, r = \frac{\mu i}{2\pi R^2}\, r$$

per cui $$u_m = \frac{1}{2\cancel{\mu}}\,\frac{\mu^{\cancel{2}} i^2}{4\pi^2 R^4}\, r^2 = \frac{\mu i^2}{8\pi^2 R^4}\cdot r^2$$

U_m in un volume di base πR^2 e alto L:

$$U_m = \int u_m\, d\tau = L\int_0^R u_m\, 2\pi r\, dr =$$

$$= \frac{L\mu i^2\, \cancel{2\pi}}{\underset{4}{\cancel{8}}\pi^{\cancel{2}} R^4}\int_0^R r^2 r\, dr = \frac{L\mu i^2}{4\pi R^4}\,\frac{R^4}{4} = \frac{L\mu i^2}{16\pi}$$

$$U_{m_L} = \frac{U_m}{L} = \frac{\mu i^2}{16\pi}$$

Energia x unità di lunghezza

$$\vec{j} = \sigma \vec{E} \rightarrow \boxed{\vec{E} = \rho \vec{j}} \qquad \rho = \frac{1}{\sigma}$$

Se c'è j c'è un campo $\vec{E}$

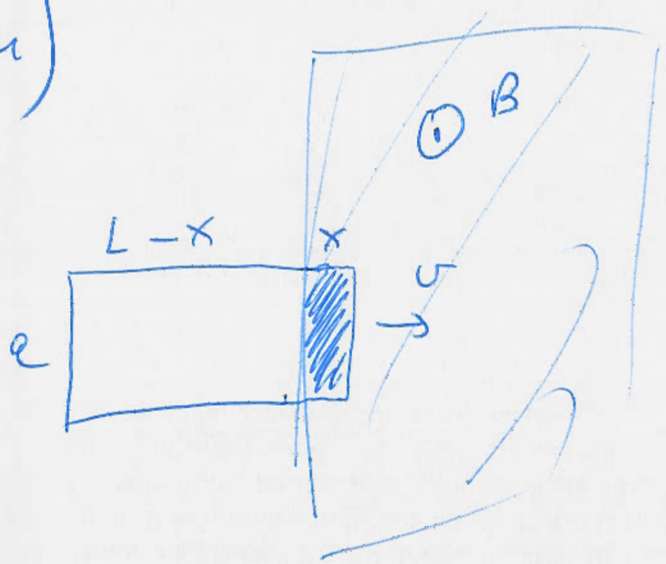
$$E = \rho j = \rho \frac{i}{\pi R^2}$$

$$u_e = \frac{1}{2} \varepsilon E^2 = \frac{1}{2} \varepsilon \rho^2 \frac{i^2}{\pi^2 R^4}$$ UNIFOR.

$$U_e = \int u_e \, d\tau = L \cancel{\pi} \cancel{R^2} \frac{1}{2} \varepsilon \rho^2 \frac{i^2}{\pi^{\cancel{2}} R^{\cancel{4}\,2}}$$

$$U_{e_L} = \frac{U_e}{L} = \frac{1}{\cancel{L}} \frac{\cancel{L} \varepsilon \rho^2 i^2}{2\pi R^2} = \frac{\varepsilon \rho^2 i^2}{2\pi R^2}$$

4)



per $t<0$ la spira è fuori la zona con B per cui $\boxed{i=0}$

la spira sta entrando per $0<x<L$
cioè dal tempo 0 al tempo $\boxed{t^* = \frac{L}{v}}$

per $0<t<\frac{L}{v}$ $\quad (x=vt)$

$$\phi(B) = B(t)\cdot x\cdot a = kt^2\cdot x\cdot a =$$
$$= kt^2\cdot vt\cdot a = k\cdot v\cdot a\cdot t^3$$

$$-\frac{d\phi}{dt} = -3kvat^2 = fem$$

$$i(t) = \frac{fem}{R} = \frac{-3kvat^2}{R}$$

per $t>\frac{L}{v}$ la spira è dentro e

$$\phi(t) = B(t)\cdot L\cdot a = kt^2 L\cdot a \qquad -\frac{d\phi}{dt} \text{ " } -2kLat$$

$$i = \frac{-2kLat}{R}$$