

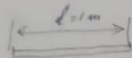
Correzione Prova parziale 4/11/2020.

#1.

$$i = \frac{4.1}{14\Omega} = 0.29 A$$

$$\Delta V = 4.1 V$$

$$R = 14\Omega$$



$$E \text{ uniforme nel filo: } E = \frac{\Delta V}{d} = \frac{4.1}{1} = 4.1 V/m.$$

#2



$$C_1 = 4 \mu F$$

$$C_2 = 6 \mu F$$

$$C_3 = 5 \mu F$$

$$V_{ab} = 65 V$$

$$C_{tot} = C_3 + \frac{C_1 C_2}{C_1 + C_2} = 5 \mu F + \frac{4 \times 6}{10} \mu F = 7.4 \mu F$$

$$\Delta V(C_3) = 65 V, \Rightarrow Q_3 = 65 \times 5 \mu F = 325 \mu C$$

$$C_1, C_2 \text{ in serie} \Rightarrow C_{eq} = 2.4 \mu F$$

$$\text{su } C_1, C_2 \quad Q_{1,2} = 2.4 \mu F \times 65 = 156 \mu C$$

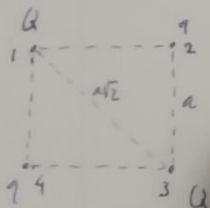
$$\text{ma } Q_1 = Q_2 = Q_{1,2} \text{ perche'}$$

$$\Delta V(C_1) = \frac{Q_1}{C_1} = \frac{156 \mu C}{4 \mu F} = 39 V$$

$$\Delta V(C_2) = \frac{Q_2}{C_2} = \frac{156}{6} V = 26 V$$

$$E_{TOT} = \frac{1}{2} C_{TOT} V^2 = \frac{1}{2} 7.4 \times 10^{-6} (65)^2 = \frac{7.4 \times 4.22}{2} \times 10^{-3} = 15.614 mJ.$$

#3



osservo che se le cariche avessero stesso segno la risultante su una carica non può essere nulla.

consideriamo carica "1"

$$\text{- forza da carica 3: } \vec{F}_{13} = \frac{1}{4\pi\epsilon_0} \frac{Q^2}{(a\sqrt{2})^2} \hat{r}_{13} = \frac{1}{4\pi\epsilon_0} \frac{Q^2}{2a^2} \hat{r}_{13}$$

$$\text{- forze da carica 2 e 4: } \vec{F}_{12} = \frac{1}{4\pi\epsilon_0} \frac{qQ}{a^2}, \vec{F}_{14} = \frac{1}{4\pi\epsilon_0} \frac{qQ}{a^2}$$

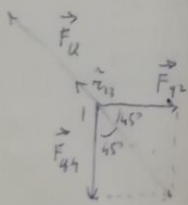
$$|\vec{F}_{12}| = |\vec{F}_{14}| \Rightarrow \vec{F}_{12} + \vec{F}_{14} = \sqrt{2} |\vec{F}_{13}|$$

per avere risultante nulla

$$\frac{1}{4\pi\epsilon_0} \frac{qQ}{a^2} \sqrt{2} = \frac{1}{4\pi\epsilon_0} \frac{Q^2}{2a^2}$$

$$|q| = \frac{1}{2\sqrt{2}} |Q| \Rightarrow$$

$$q = -\frac{Q}{2\sqrt{2}}$$



#4



$$r < a: E = 0$$

$$r > b: E = 0$$

$$\lambda = \frac{Q}{l}$$

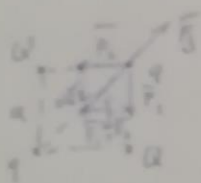
$$a < r < b: E 2\pi r l = \frac{\lambda l}{\epsilon_0} \Rightarrow E = \frac{\lambda}{2\pi\epsilon_0 r}$$

$$V(b) - V(a) = \int_a^b E dr = \frac{\lambda}{2\pi\epsilon_0} \int_a^b \frac{1}{r} dr = \frac{\lambda}{2\pi\epsilon_0} \ln \frac{b}{a}$$

$$C = \frac{Q}{\Delta V} = \frac{\lambda l}{\frac{\lambda}{2\pi\epsilon_0} \ln \frac{b}{a}} = 2\pi\epsilon_0 l \ln^{-1} \frac{a}{b} = -2\pi\epsilon_0 l \ln \frac{a}{b} = 2\pi\epsilon_0 l (\ln b - \ln a)$$

#3 - seconda domanda:

perché $q = -\frac{Q}{\sqrt{2}}$ e $|\vec{F}_1| = |\vec{F}_2| = \frac{1}{4\pi\epsilon_0} \frac{qQ}{a^2}$



$$|\vec{F}_3| = \frac{1}{4\pi\epsilon_0} \frac{q^2}{2a^2}$$

Il modulo della risultante

$$|\vec{F}_1 + \vec{F}_2| \quad \text{vale} \quad \frac{q^2}{\pi\epsilon_0 a^2}$$

però la risultante nulla

allora q vale:

$$\frac{1}{4\pi\epsilon_0} \frac{q^2}{a^2} - \frac{q^2}{\pi\epsilon_0 a^2} = \frac{q^2 - 4q^2}{4\pi\epsilon_0 a^2} = -\frac{3q^2}{4\pi\epsilon_0 a^2}$$

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