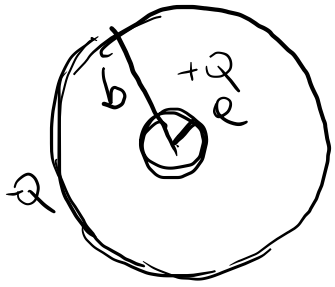
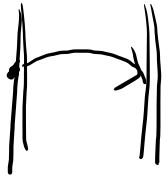
- condensatore sferico



$$C = \frac{e \cdot b}{k_e \cdot (b - e)}$$

- condensatore cilindrico

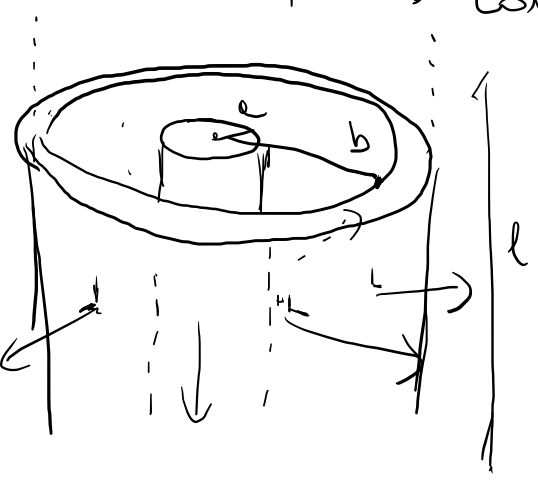
Energia immagazzinata in un condensatore



$$dW = \Delta V \, dq = \frac{q}{C} dq \qquad C = \frac{Q}{\Delta V} \qquad Q = C \cdot \Delta V$$

$$W = \int_0^Q \frac{q}{C} dq = \boxed{\frac{Q^2}{2C} \Rightarrow \frac{1}{2} C \cdot \Delta V^2 = \frac{1}{2} Q \cdot \Delta V}$$

ES 26.1 → CONDENSATORE CILINDRICO



$l \gg a, b$

• per simmetria — — —

$\vec{E} \perp$ one del cilindro

$V_b - V_a = -\int_a^b \vec{E}\, d\vec{S}$

$= -\int_a^b E(r)\, dr$

$E(r)$ = campo elettrico generato da filo ∞ uniformemente carico.

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

(per il filo carico)

$E_r = 2k_e \frac{\lambda}{r}$

$$\Delta V = V_b - V_a = -2k_e\lambda \int_a^b \frac{dr}{r} = -2k_e\lambda \ln\left(\frac{b}{a}\right)$$

$$C = \frac{Q}{\Delta V} = \frac{\lambda \ell}{(2k_e\lambda)\ln(b/a)} = \frac{\ell}{(2k_e)\ln(b/a)}$$

$$\lambda = Q/\ell$$

$$Q = \lambda \ell$$

$$C_{cilindrico} = \frac{\ell}{(2k_e)\cdot \ln(b/a)}$$

se: $\ell \gg a, b$

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- condensatore sferico
  $r_1 = 7\ cm$
  $r_2 = 14\ cm$ → $C = ?$
  $\Delta V = ?$ e $Q = 4\pi C$

- capacità condensatore sferico:

b = raggio esterno
e = raggio interno

$$C = \frac{eb}{k_e(b-e)} = \frac{0{,}07 \cdot 0{,}14}{9 \cdot 10^9 (\underbrace{0{,}14-0{,}07}_{0{,}07})} = \frac{0{,}0098}{0{,}63 \cdot 10^9} \rightarrow 9{,}8 \cdot 10^{-3}$$

$$= \frac{9{,}8}{0{,}63} \cdot 10^{-12}$$

$$= 15{,}55 \cdot 10^{-12}\ F$$

$$= 15{,}55\ pF$$

$$C = \frac{Q}{\Delta V} \rightarrow \Delta V = \frac{Q}{C}$$

$$\Delta V = \frac{4 \cdot 10^{-6}}{15{,}55 \cdot 10^{-12}}$$

$$\frac{4}{15{,}55} \cdot 10^6 = 0{,}257 \cdot 10^6 V$$

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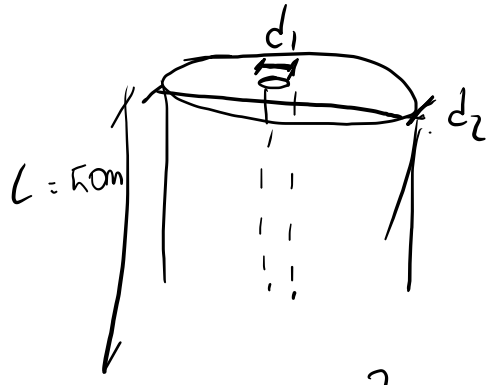
- cavo coassiale



$L = 50\ m$

$d_1 = 2{,}58\ mm$

$d_2 = 7{,}27\ mm$

$\sigma_1 = 8{,}1\ \mu C$

$\sigma_2 = -8{,}1\ \mu C$

$C = ?$ $\quad \Delta V = ?$

$\ell \gg 0{,}b$

$$C = \frac{\ell}{2k\varepsilon \ln(b/a)}$$

$r_1 = 1{,}29 \cdot 10^{-3}$

$r_2 = 3{,}63 \cdot 10^{-3}$

$\ln\left(\frac{7{,}27}{7{,}58}\right)$

$$= \frac{50}{2 \cdot 9 \cdot 10^{9} \ln\left(\frac{3{,}63 \cdot 10^{-3}}{1{,}29 \cdot 10^{-3}}\right)} \quad 7{,}8178$$

$$C = \frac{5\,\Omega}{2 \cdot (3 \cdot 10^3)\, \ln(2{,}8178)}$$

$\ln(2{,}8178) \rightarrow 1{,}0359$

$$C = \frac{5\,\Omega}{2 \cdot 3 \cdot 10^3 \cdot 1{,}0359} = 2{,}68 \cdot 10^{-3}\ F$$

$$= 2{,}68\ mF$$

$C = Q/\Delta V$

$$\Delta V = \frac{Q}{C} = \frac{8 \cdot 1 \cdot 10^{-6}}{2{,}68 \cdot 10^{-3}} = 3{,}02 \cdot 10^{3}\ V$$

$$= 3{,}02\ kV$$

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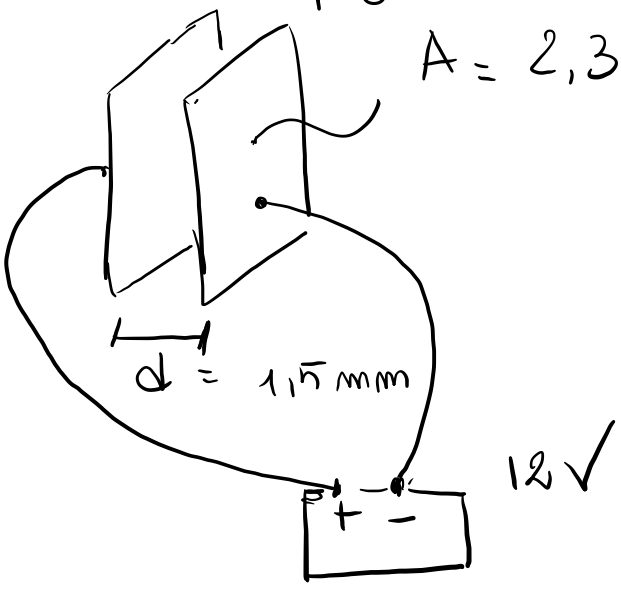


$A = 2{,}3\ cm^2$

• no dielettrico

$C = ?$

$Q = ?$

$E = ?$ Tra le armature

12 V

$$C = \frac{k\varepsilon_0 A}{d} = \frac{8{,}85 \cdot 10^{-12} \cdot 2{,}3 \cdot 10^{-4}}{1{,}5 \cdot 10^{-3}} = \frac{8.85 \cdot 2{,}3}{1{,}5} : 10^{-13}$$

$13{,}57$

$= 1{,}357 \cdot 10^{-12}\ F$

$= 1{,}357\ pF$

$Q = C \cdot \Delta V$ ← (ove $C = Q/\Delta V$)

↳ 12 V

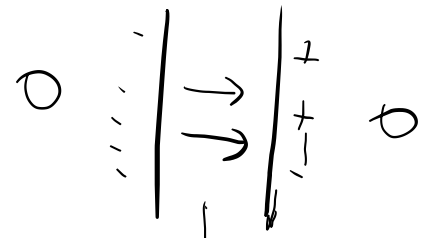
$Q = 1{,}36 \cdot 10^{-17} \cdot 12 = 16{,}3 \cdot 10^{-12}\ C$

$\doteq 16{,}3\ pC$

$$\Delta V = -\int_A^B \vec{E} \cdot d\vec{s}$$

$$\Delta V = -E \int_A^B ds = -Ed$$

$$|E| = \frac{\Delta V}{d} = \frac{12}{1{,}5 \cdot 10^{-3}} = 8 \cdot 10^3\ V/m$$



$$E = \frac{\sigma}{2\varepsilon_0}$$

si somma

$$E = \frac{\sigma}{\varepsilon_0}$$

$$\sigma = Q/A$$

$$E = \frac{Q}{\varepsilon_0 A}$$

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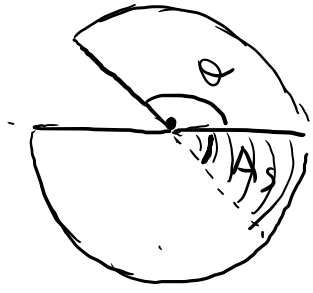


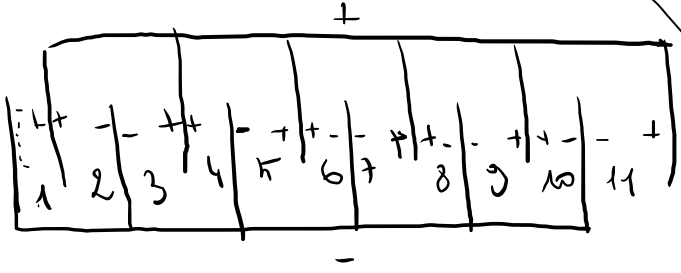
$C(\theta)$

$$C = \frac{A_s}{D} \qquad A_s = (\pi-\theta)\frac{R^2}{2}$$

$$D = d/2$$

$$C(\theta) = \frac{(\pi-\theta)R^2}{d}$$

$(2N-1)$



$= (2N-1)$

$2 \cdot 6 - 1 = 11$

$$C_{TOT} = (2N-1) \cdot (\pi-\theta) \cdot \frac{R^2}{d}$$

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$Q = 54\ \mu C$

$\Delta V = 12\ V$

Energia = ?

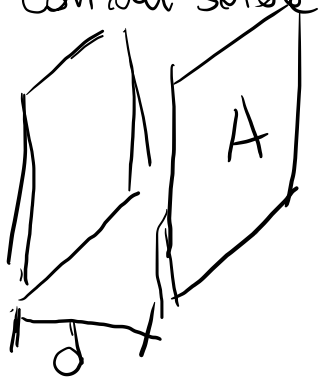
$C = \frac{Q}{\Delta V}$

$E_e = \frac{Q^2}{2C} = \frac{1}{2} Q \cdot \Delta V = \frac{1}{2} C (\Delta V)^2$

$E = \frac{1}{2} \cdot 54 \cdot 10^{-6} \cdot 12 = 3{,}24 \cdot 10^{-4}\ J$

$$C \equiv \frac{Q}{\Delta V} \rightarrow$$ dipende esclusivamente dalla geometria

- condensatore piano



$d \ll \sqrt{A}$ ← assumiamo il vuoto tra le armature

$$\Rightarrow C = \frac{\varepsilon_0 \cdot A}{d}$$

$$= \frac{(\kappa)\varepsilon_0 \cdot A}{d}$$