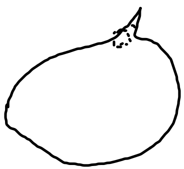
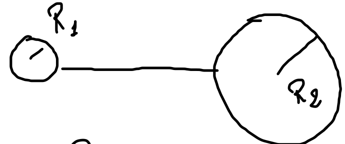
$$\Delta V_{AB} = -\int_A^B \underline{E}\cdot d\underline{l} = 0 \Rightarrow V = \text{const nel conduttore}$$

$\underline{E} = \underline{0}$

Effetto punta



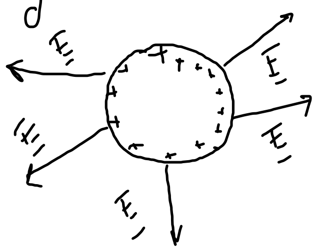


$R_1 << R_2$

Q in totale

V del sistema è noto ?

V di una sfera conduttrice di raggio R con carica Q ?

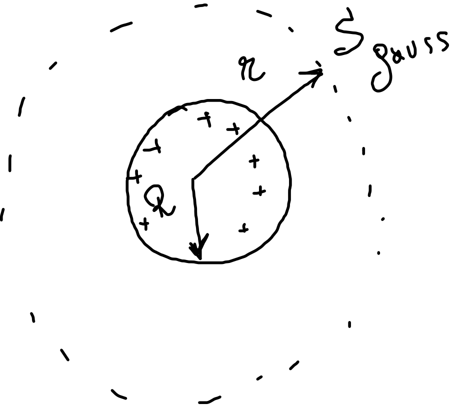


$\underline{E}$ radiale

Pti esterni alla sfera

S: sup. sferica di raggio $r > R$

$$\int \underline{E}\cdot d\underline{S} = \frac{q_{int}}{\varepsilon_0}$$



$$\oint_S \underline{E} \cdot d\underline{S} = \frac{q_{int}}{\varepsilon_0} = Q/\varepsilon_0$$

$$\Rightarrow \quad \underline{E} = k_e \frac{Q}{r^2} \hat{\underline{r}}$$

V associato è

$$V(r) = k_e \frac{Q}{r} \qquad r > R$$

Per continuità, sulla sup.,

$$V(r=R) = k_e \frac{Q}{R} \Rightarrow V = k_e \frac{Q}{R}$$ nel conduttore

V sfera 1 = V sfera 2

$$\Rightarrow \frac{k_e Q_1}{R_1} = \frac{k_e Q_2}{R_2} \quad e \quad Q = Q_1 + Q_2$$

$$Q_1 = \frac{R_1}{R_2} Q_2$$

$$Q = Q_1 + Q_2 = \frac{R_1}{R_2} Q_2 + Q_2 = \frac{R_1 + R_2}{R_2} Q_2 ;$$

$$Q_2 = \frac{R_2}{R_1 + R_2} Q \qquad Q_1 = \frac{R_1}{R_1 + R_2} Q \Rightarrow \frac{Q_1}{Q_2} = \frac{R_1}{R_2}$$

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

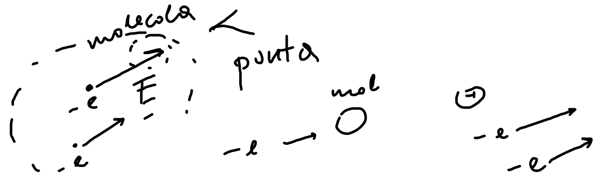
vicino sup. conduttore

$$E_1 = \frac{Q_1}{4\pi R_1^2} \cdot \frac{1}{\varepsilon_0} \qquad E_2 = \frac{Q_2}{4\pi R_2^2} \cdot \frac{1}{\varepsilon_0}$$

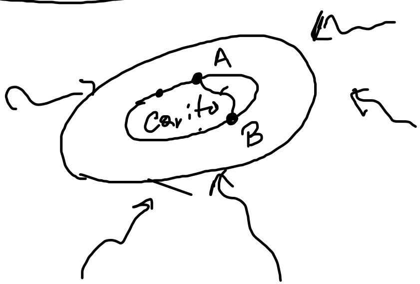
($\frac{Q_1}{4\pi R_1^2} \to \sigma_1$, $\frac{Q_2}{4\pi R_2^2} \to \sigma_2$)

$$\frac{E_1}{E_2} = \frac{Q_1}{Q_2} \cdot \frac{R_2^2}{R_1^2} = \frac{R_1}{R_2} \cdot \frac{R_2^2}{R_1^2} = \frac{R_2}{R_1}$$

$$R_1 << R_2 \Rightarrow R_2/R_1 >> 1$$



Schermo elettrostatico



Conduttore cavo

A, B due pti del conduttore ai "bordi" della cavità

$V = \text{const}$ condutt

$$\Delta V = 0 = -\int_A^B \underline{E} \cdot d\underline{l} \Rightarrow \underline{E} = \underline{0}$$

Capacità elettrica

Di conduttore: $C = \frac{Q}{V}$ costante per un certo dispositivo

$$[C] = \frac{C}{V} = \text{Farad} \qquad \mu F \quad nF \quad pF$$

Sfera conduttrice R

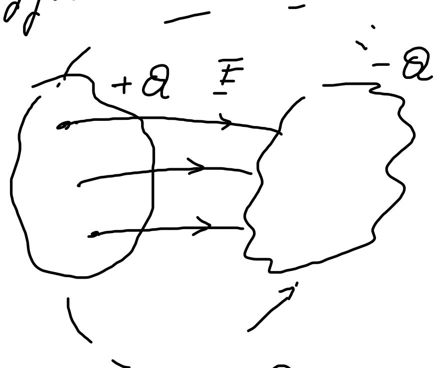
$$V = k_e \frac{Q}{R} \Rightarrow C = \frac{Q}{V} = \frac{R}{k_e} = 4\pi\varepsilon_0 R$$

Terra come sfera conduttrice $R = 6.4 \cdot 10^{6}\ m$

$\varepsilon_0 = 8.85 \cdot 10^{-12}\ \frac{m^2}{NC^2}$

$$V \simeq 12 \cdot 8.85 \cdot 10^{-12} \cdot 6.4 \cdot 10^{6} \simeq 0.7\ mF$$

Condensatore: due conduttori di forma generica affacciati con carica di segno opposto



Ciascuno dei due conduttori è detto <u>armatura</u>

$$C = \frac{Q}{\Delta V} \qquad C \approx \mu F,\ nF,\ pF$$

Come calcolare la capacità?

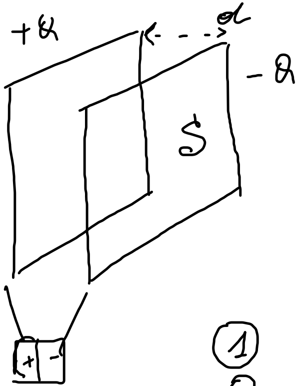
1) Mettere Q sulle armature

2) Calcolare $\underline{E}$ prodotto dal dispositivo caricato

3) Calcolare $\Delta V = -\int_{\text{Armatura 1}}^{\text{Armatura 2}} \underline{E} \cdot d\underline{l}$

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

Condensatore piano

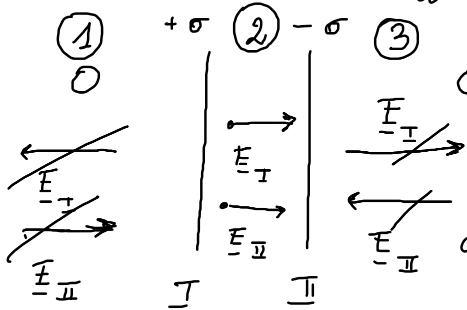


Due piani carichi
Superficie S
Affacciati
Distanza d

$\sqrt{S} \simeq$ dimensione armatura

$d \ll \sqrt{S}$

$\sigma = \frac{Q}{S}$



Per un piano indefinito carico uniform.

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

$\underline{E} \perp$ piano

In ②

$\underline{E} = \underline{E}_I + \underline{E}_{II} \Rightarrow E = 2 \cdot \frac{\sigma}{2\varepsilon_0} = \frac{\sigma}{\varepsilon_0} = \frac{Q}{S\varepsilon_0}$

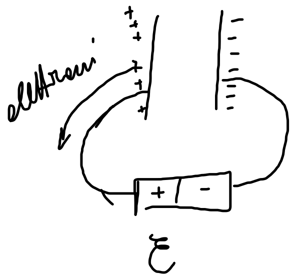
E uniforme $\Rightarrow$

$$\Delta V = E \cdot d = \frac{Q}{\varepsilon_0 S} \cdot d$$

$$C = \frac{Q}{\Delta V} = \frac{\cancel{Q}}{\cancel{Q}} \frac{\varepsilon_0 S}{d} = \varepsilon_0 S / d$$

dip. geometrica

(no Q, no ΔV)



$dq \longrightarrow$ armatura

$dq \longrightarrow$ armatura

$$C = \frac{Q}{\mathcal{E}}$$

$$C = \frac{q}{\Delta V} \; ; \; \Delta V = \frac{q}{C}$$

$$dW = \Delta V \cdot dq$$

$$W = \sum dW = \int_{\text{processo}} \Delta V \cdot dq = \int_{\text{processo}} \frac{1}{C} q \, dq = \frac{1}{C} \int_0^Q q \, dq = \frac{1}{C} \frac{q^2}{2} \Big|_0^Q = \frac{Q^2}{2C} = \frac{1}{2} C \mathcal{E}^2$$