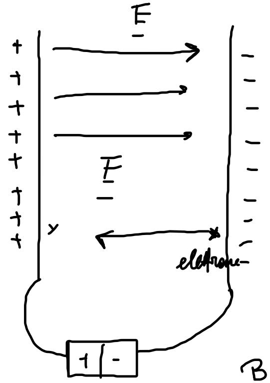
Definizione di elettronvolt



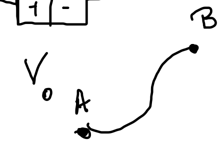
$q<0$ vanno verso pot. crescenti

$q>0$ = = pot. decrescenti

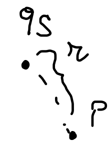
Le linee di campo vanno verso pot. decrescenti

$$\Delta K = e\Delta V$$

1 eV è l'energia cinetica che un elettrone acquisisce quando si muove (spontaneamente) tra due punti alla differenza di potenziale di un volt



$$1\,eV = 1\frac{J}{\cancel{C}}\cdot 1.6\cdot 10^{-19}\,\cancel{C} = 1.6\cdot 10^{-19}\,J$$



$$V_B - V_A = \Delta V = -\int_A^B \underline{E}\cdot d\underline{s}$$

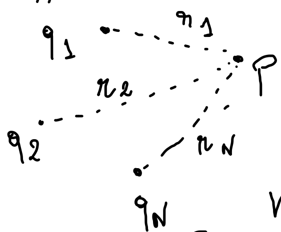
Nel caso della carica puntiforme $V(r) = \frac{k_e q_s}{r}$ $\left(E \propto \frac{1}{r^2}\right)$

Potenziale prodotto da N cariche puntiformi?

Pr. sovrapposizione

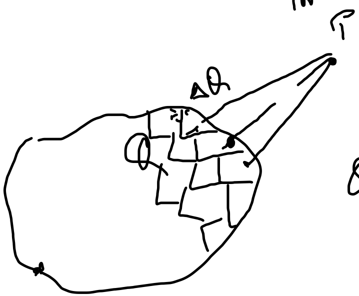
$$\underline{E}(P) = \sum_{i=1}^{N} \underline{E}_i(P)$$

$$= \sum_{i=1}^{N} \frac{1}{4\pi\varepsilon_0} \frac{q_i}{r_i^2} \hat{\underline{r}}_i$$



$$V(P) = -\int \underline{E} \cdot d\underline{s} = -\int \sum_{i=1}^{N} \underline{E}_i \cdot d\underline{s} = \sum_{i=1}^{N} \underbrace{-\int \underline{E}_i \cdot d\underline{s}}_{V_i(P)} = \sum_{i=1}^{N} V_i(P)$$

pr. sovrapposizione



$$Q = \sum_{i=1}^{N} \Delta Q_i$$

$$\Delta Q_i = \frac{Q}{N}$$

$$V(P) = \sum_{i=1}^{N} k_e \frac{\Delta Q_i}{r_i}$$

$$\lim_{N \to +\infty} \sum_{i=1}^{N} k_e \frac{dQ}{r_i} = \int \frac{k_e \, dQ}{r}$$

$$\underline{E} = -\underline{\nabla} V$$

$$\Delta Q = \frac{Q}{N} \xrightarrow[N \to +\infty]{} dQ$$

Proprietà dei conduttori all'equilibrio elettrostatico

Tempi di equilibrio: più rapidi del ns ; equilibrio elettrostatico è istantaneo

→ gli elettroni liberi del materiale sono "fermi"

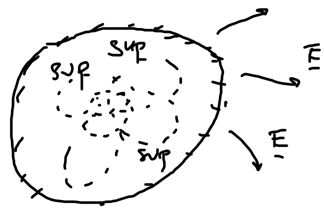
Equilibrio e.s. ⇒ $\underline{E} = \underline{0}$ nel conduttore

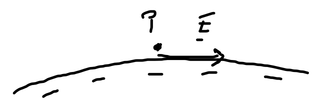
$$V_B - V_A = \Delta V = -\int_A^B \underline{E} \cdot d\underline{s} = 0 \Rightarrow V_B = V_A$$

$V = \text{const}$ nel conduttore

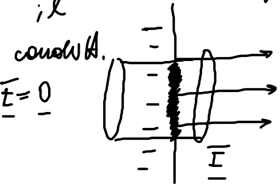
$$\oint_{\text{area}} \underline{E} \cdot d\underline{a} = \frac{q^{int}}{\varepsilon_0}$$

$$\oint_{\text{area}} \underline{E} \cdot d\underline{a} = 0$$





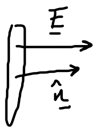
Vicino alla sup. del conduttore, all'ext, $\underline{E}$ è $\perp$ sup.



Uso th. Gauss

Scelgo come sup. di Gauss un cilindro "a cavallo" della sup. conduttore

$$\int_{S \equiv \text{cilindro}} \underline{E}\cdot d\underline{A} = \int_{\substack{\text{base}\\ \text{esterna}}} \underline{E}\cdot d\underline{A} + \underbrace{\cancel{\int_{\substack{\text{base}\\ \text{interna}}} \underline{E}\cdot d\underline{A}}}_{=0} + \underbrace{\cancel{\int_{\substack{\text{sup.}\\ \text{laterale}}} \underline{E}\cdot d\underline{A}}}_{=0}$$

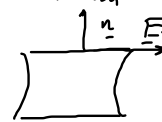


Base esterna: $\underline{E}\cdot d\underline{A} = E\,dA$

$$= \int_{\substack{\text{base}\\ \text{esterna}}} E\,dA = E \int_{\substack{\text{base est.}\\ \text{cilindro}}} dA =$$

molto piccolo

$E \approx \text{cost}$

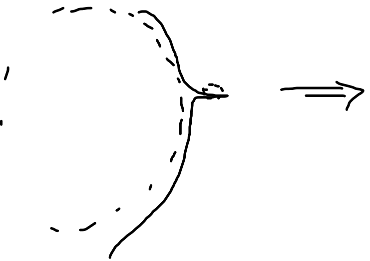


$$\longrightarrow E\cdot A = \frac{Q^{int}}{\varepsilon_0} = \frac{\sigma\cdot A}{\varepsilon_0}$$

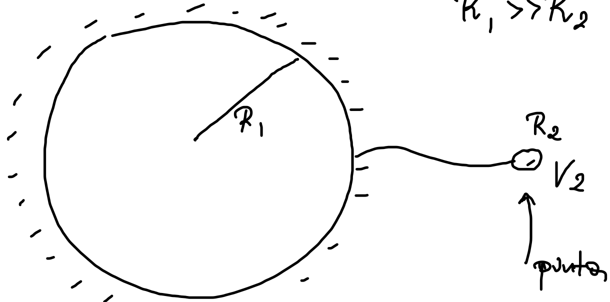
densità superficiale di carica locale

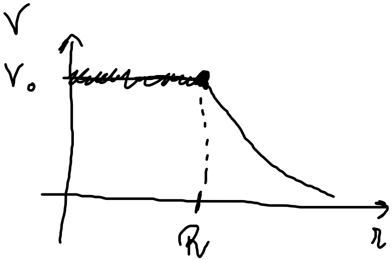
$$\underline{E} = \frac{\sigma_{locale}}{\varepsilon_0}$$

Effetto punta



$R_1 \gg R_2$





Per una sfera (unif. carica) all'esterno della sfera

$$\underline{E} = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}\,\hat{\underline{r}}$$

$$V_{\text{sfera fuori}} = \underbrace{\frac{1}{4\pi\varepsilon_0}\frac{q}{r}}_{V \text{ carica puntiforme}}$$

$$V_{\text{dentro la sfera}} = \frac{1}{4\pi\varepsilon_0}\frac{q}{R}$$

$$\underbrace{\frac{1}{\cancel{4\pi\varepsilon_0}}\frac{q_1}{R_1}}_{V_1} = \underbrace{\frac{1}{\cancel{4\pi\varepsilon_0}}\frac{q_2}{R_2}}_{V_2} \quad ; \quad \frac{q_1}{q_2} = \frac{R_1}{R_2}$$

$$E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{R^2} \implies \frac{E_1}{E_2} = \frac{Q_1}{R_1^2}\cdot\frac{R_2^2}{Q_2} = \frac{\cancel{R_1}}{\cancel{R_2}}\cdot\frac{R_2^{\cancel{2}}}{R_1^{\cancel{2}}} = \frac{R_2}{R_1}$$

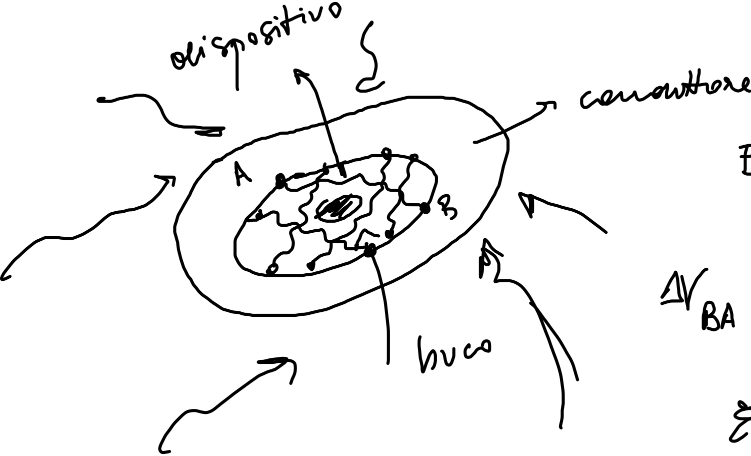
fuori in ap.

$$\Rightarrow E_2 = \frac{R_1}{R_2}E_1 \qquad R_1 >> R_2$$

$$E_2\Big|_{\text{punta}} >> E_1\Big|_{\text{\underline{\underline{non}} punta}}$$

$$E = \frac{\sigma_{locale}}{\varepsilon_0} \Rightarrow \sigma_{locale} \propto E$$

$$\sigma_{\text{punta}} >> \sigma_{\text{\underline{\underline{non}} punta}}$$



$E_A = E_B = 0$

$\Delta V_{BA} = 0 \Rightarrow V = \text{cost nel buco}$

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

Effetto schermo