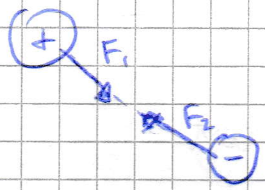
ELETTROMAGNETISMO

- (+) (−)
- LE CARICHE SI CONSERVANO
- $e = 1,6 \cdot 10^{-19}\ C$
- LEGGE DI COULOMB : Due cariche, interagendo tra loro, risentono di una forza che è proporzionale al valore delle cariche stesse

$$\propto \frac{q_1 q_2}{d^2}$$

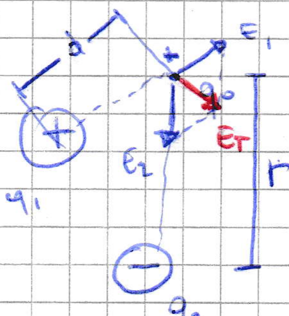
FORZE di COULOMB



$$\boxed{F_1 = F_2 = \frac{1}{4\pi\varepsilon_0} \frac{q_1 q_2}{d^2}}$$

$$\varepsilon_0 = 8,85 \cdot 10^{-12} \frac{C^2}{N \cdot m^2}$$

CAMPO ELETTRICO : Forza per unità di carica che una carica sonda sente per la presenza delle cariche sorgenti



$$F_{0,1} = \frac{1}{4\pi\varepsilon_0} \frac{q_0 q_1}{d^2}$$

$$E_1 = \frac{F_{0,1}}{q_0} = \frac{1}{4\pi\varepsilon_0} \cdot \frac{q_1}{d^2}$$

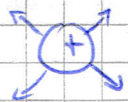
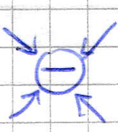
$$F_{0,2} = \frac{1}{4\pi\varepsilon_0} \frac{q_0 q_2}{r^2}$$

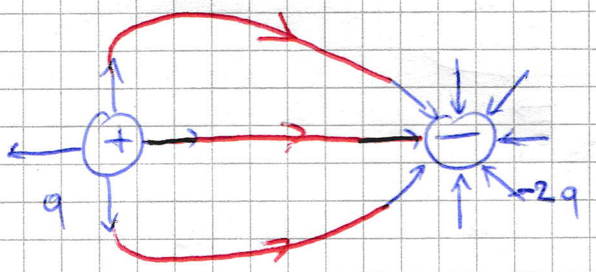
$$E_2 = \frac{F_{0,2}}{q_0} = \frac{1}{4\pi\varepsilon_0} \cdot \frac{q_2}{r^2}$$

$$\vec{E_T} = \vec{E_1} + \vec{E_2}$$

$$\boxed{\vec{E_1} = \frac{1}{4\pi\varepsilon_0} \cdot \frac{q_1}{d^2}\hat{u}}$$

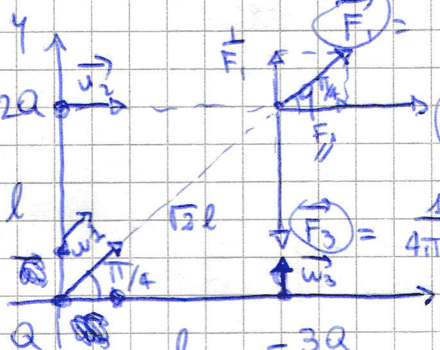
Linee di Forza

1) $\vec{E}$ tg. Linee di Forza
2) L.F. ~~INTERS~~
3) L.F. nascono sempre da cariche positive 
4) L.F. 
5) $E \propto$ DENSITA' L.F.



ANDAMENTO CAMPO ELETTRICO

es.



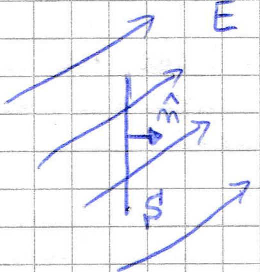
$$\vec{F_1} = \frac{1}{4\pi\varepsilon_0}\frac{qQ}{(\sqrt{2}l)^2} = \frac{1}{4\pi\varepsilon_0}\frac{qQ}{2l^2}\vec{u_1} = \vec{F_1}_x + \vec{F_1}_y =$$

$$\vec{F_2} = \frac{1}{4\pi\varepsilon_0}\frac{q2Q}{l^2}\vec{u_2}$$

$$\vec{F_3} = \frac{1}{4\pi\varepsilon_0}\frac{q(-3Q)}{l^2}\cdot\vec{u_3}$$

$$\vec{F} = \vec{F_1} + \vec{F_2} + \vec{F_3} = \frac{1}{4\pi\varepsilon_0}\frac{qQ}{l^2}\left[\underbrace{\left(\frac{1}{2}\cdot\frac{\sqrt{2}}{2} + 2\right)}_{>0}\vec{u_x} + \underbrace{\left(\frac{1}{2}\frac{\sqrt{2}}{2} - 3\right)}_{<0}\vec{u_y}\right]$$

Flusso campo elettrico

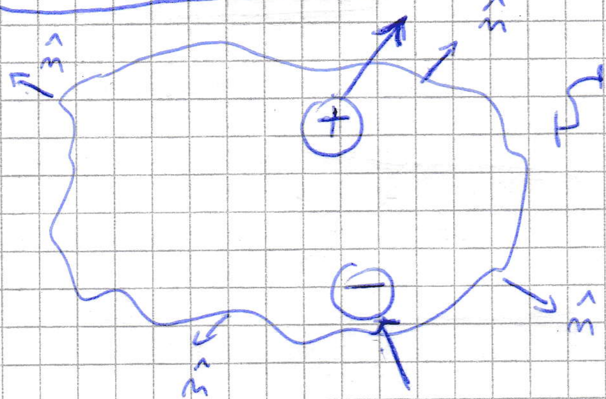


$\phi_{S}(\vec{E}) \rightarrow$ n° linee di forza che attraversano S

DIPENDE DA

1. ORIENTAMENTO NELLO SPAZIO DI S
2. GRANDEZZA DI S
3. INTENSITA' $\vec{E}$

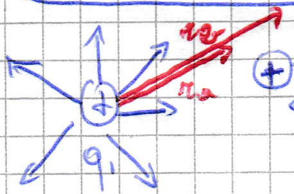
TEOREMA DI GAUSS



$\oint$ (superficie chiusa) $\Longrightarrow$

$$\boxed{\Phi_S(\vec{E}) = \frac{\Sigma Q_{INT}}{\varepsilon_0}}$$

ENERGIA POTENZIALE ELETTRICA



$\vec{F} = q_2 \vec{E}_1$

$$W = \oint_{r_a}^{r_b} F_{tang}\, dr = \int_{r_a}^{r_b} q_2 E_1\, dr = \int_{r_b}^{r_a} q_2 \frac{1}{4\pi\varepsilon_0} \frac{q_1}{r^2} \hat{u}_r\, dr$$

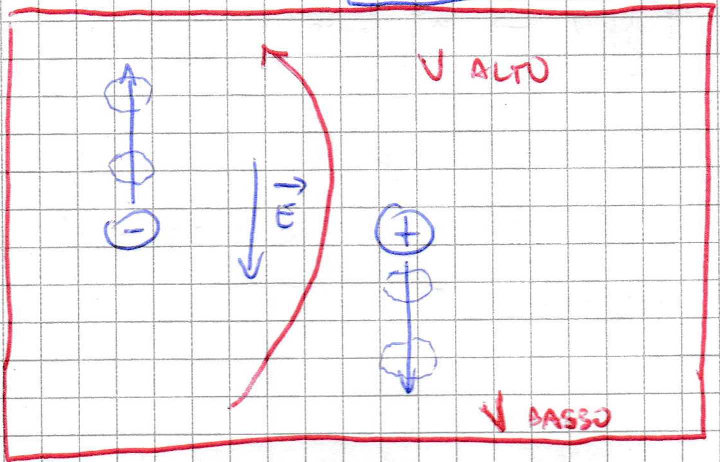
$F_{tang} \downarrow \vec{F}\,\hat{u}$

$$= \frac{q_1 q_2}{4\pi\varepsilon_0} \int_{r_a}^{r_b} \frac{1}{r^2}\, dr = \frac{q_1 q_2}{4\pi\varepsilon_0} \cdot \left[-\frac{1}{r}\right]_{r_a}^{r_b} =$$

$$= \frac{q_1 q_2}{4\pi\varepsilon_0} \left[\frac{1}{r_a} - \frac{1}{r_b}\right]$$

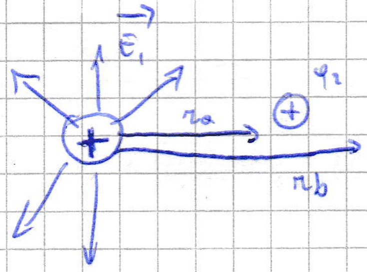
$$W_{cons} = -\Delta U_E = U_{INIZ} - U_{FIN}$$

$$\boxed{U_E = \frac{q_1 q_2}{4\pi\varepsilon_0} \cdot \frac{1}{r}}$$



LE CARICHE **POSITIVE** VANNO DA POTENZIALE ALTO A POTENZIALE BASSO

LE CARICHE **NEGATIVE** VANNO DA POTENZIALE BASSO A POTENZIALE ALTO



$$W = -\Delta U_E = \frac{q_1 q_2}{4\pi\varepsilon_0}\left[\frac{1}{r_a} - \frac{1}{r_b}\right]$$

$$\Delta V_{AB} = V(r_a) - V(r_b) = \frac{W}{q_2}$$

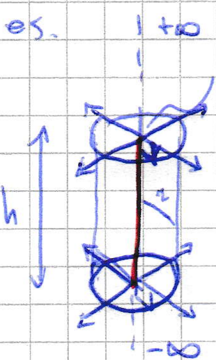
$$= \frac{q_1}{4\pi\varepsilon_0}\left[\frac{1}{r_a} - \frac{1}{r_b}\right]$$

$$\boxed{V = \frac{q_1}{4\pi\varepsilon_0} \cdot \frac{1}{r}}$$

POTENZIALE IN UN PUNTO NEL CAMPO ELETTRICO

$$[V] = V = \left[\frac{J}{C}\right]$$

es.

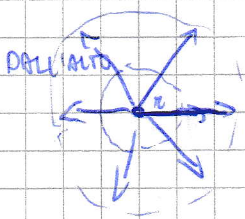


$\lambda > 0 \quad [\lambda] = \frac{C}{m}$

$$\phi_S(\vec{E}) = \frac{Q_{INT}}{\varepsilon_0}$$

$$\phi_S(\vec{E}) = \underset{S_{sup}}{0} + \underset{S_{inf}}{0} + \underset{S\ cilindro}{E(r) \cdot 2\pi r \cdot h}$$

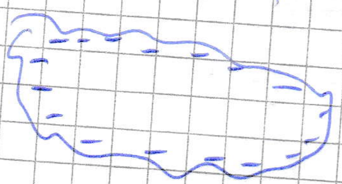
$$Q_{INT} = \lambda \cdot h$$



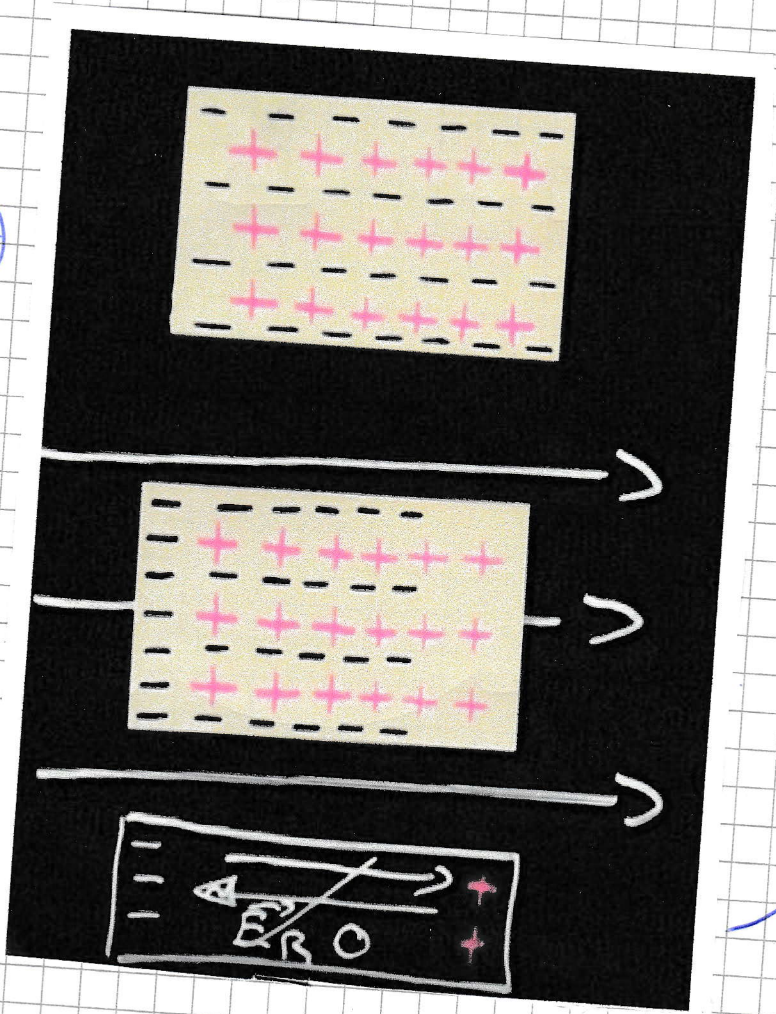
$$E(r) \cdot 2\pi r \cdot \cancel{h} = \frac{\lambda \cdot \cancel{h}}{\varepsilon_0}$$

$$\boxed{E(r) = \frac{\lambda}{2\pi r \cdot \varepsilon_0}}$$

MATERIALI CONDUTTORI

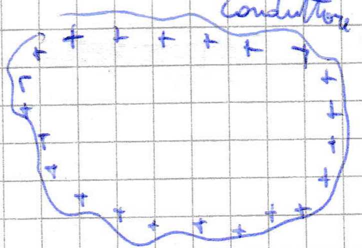
1) $\forall$ ATOMO $1\,e^-$ È LIBERO
2) $E_{INT} = 0$
3) 

4) OGNI PUNTO È ALLO STESSO POTENZIALE V
5) INDUZIONE ELETTROSTATICA



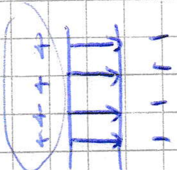
$\oplus$ FERMI
$\ominus$ LIBERI (ALMENO 1 PER ATOMO)

CONDENSATORI



le cariche si posizionano all'esterno

$$C = \frac{Q}{V} \qquad [C] = \frac{C}{V} = [F]$$



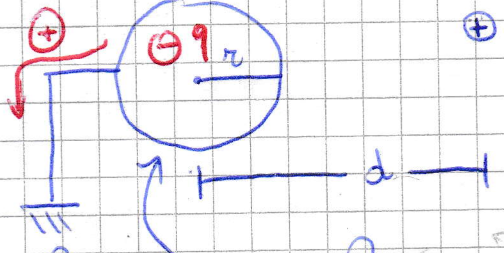
$$C = \frac{Q}{\Delta V} \quad [F]$$

$$U = \frac{1}{2} Q V^+ - \frac{1}{2} Q V^-$$

$$= \frac{1}{2} Q (V^+ - V^-) = \frac{1}{2} Q \Delta V$$

$$\boxed{U = \frac{1}{2} C \Delta V^2 = \frac{1}{2} \frac{Q^2}{C}}$$

es.



$V_M = 0$

$\oplus\ Q > 0$

$d \gg r$

$$V_S = \underbrace{\frac{Q}{4\pi\varepsilon_0 \cdot d}}_{>0} + \underbrace{\frac{q}{4\pi\varepsilon_0 \cdot r}}_{<0}$$

INIZIO (prima di collegare la massa)

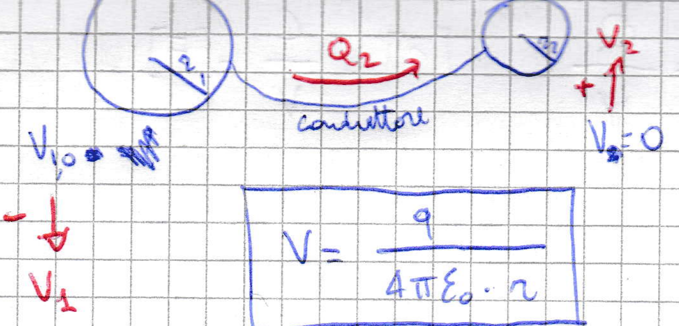
(1) $q = 0$ $\qquad V_S = \frac{Q}{4\pi\varepsilon_0 \cdot d} > 0$

EQUILIBRIO

(2) $V_S = V_M \longrightarrow \frac{Q}{4\pi\varepsilon_0 \cdot d} + \frac{q}{4\pi\varepsilon_0 \cdot r} = 0$

$$\boxed{q = -Q \frac{r}{d}}$$

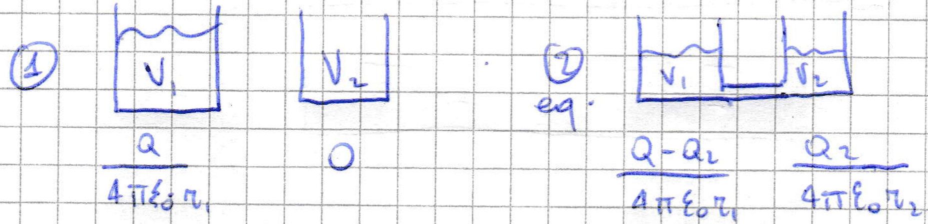
carica nella sfera dopo aver collegato la massa



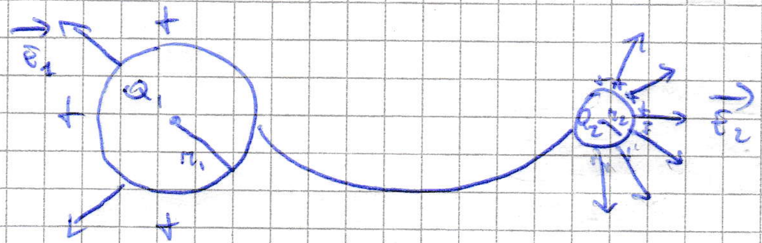
$$\boxed{V = \frac{q}{4\pi\varepsilon_0 \cdot r}}$$

$$V_1 = \frac{Q - Q_2}{4\pi\varepsilon_0 \cdot r_1} \qquad V_2 = \frac{Q_2}{4\pi\varepsilon_0 \cdot r_2}$$

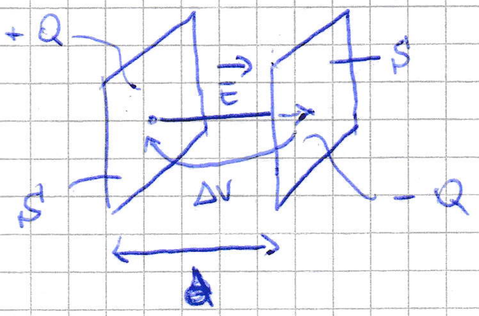
EQUILIBRIO $\quad V_1 = V_2 \longrightarrow Q_2 = Q \cdot \dfrac{r_2}{r_1 + r_2}$



EFFETTO PUNTA ~~[illegible]~~



CONDENSATORE PIANO



$$\boxed{Q \longrightarrow \vec{E} \longrightarrow \Delta V}$$

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

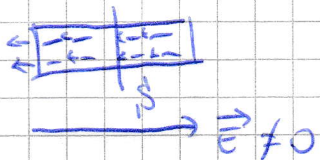
$$\vec{E} = \frac{\sigma}{\varepsilon_0}$$

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

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

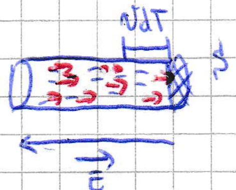
CORRENTE

$$\boxed{I = \frac{\Delta Q}{\Delta t}}$$



$v_d \cong 10^{-4}$ m/s

$$[I] = \left[\frac{C}{s}\right] = [A]$$



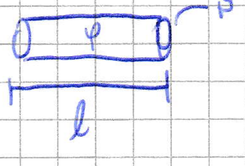
$$I = \boxed{\frac{\Delta Q}{T}} = \frac{n q S v_d \cancel{T}}{\cancel{T}}$$ corr. [A]

$$\vec{j} = n q \vec{v_d}$$ corr. su superficie $\left[\frac{A}{m^2}\right]$

LEGGI DI OHM

1) $\Delta V = R \cdot I$ $\qquad [R] = \Omega \qquad \frac{1V}{1A}$

2)



$$R = \rho \frac{l}{S}$$