FORZE DI CONTATTO

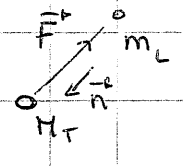
forze di pressione

forza di attrito

forze elastiche

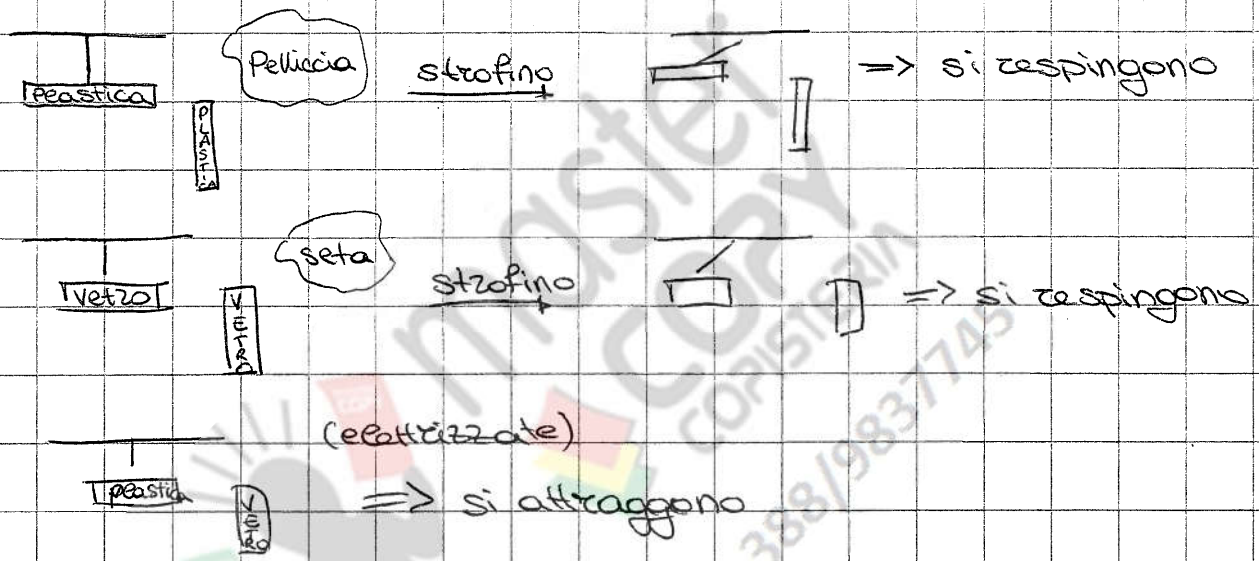
FORZE CHE AGISCONO A DISTANZA

forza di gravità $\vec{F}_G = -\frac{G M_T m_L}{r^2}\vec{n}$



forze elettriche

PROCESSI DI ELETTRIZZAZIONE



La forza di gravità è solo attrattiva, le forze elettriche possono essere sia attrattive che repulsive.

Le cariche dello stesso segno si respingono, quelle di segno opposto si attraggono

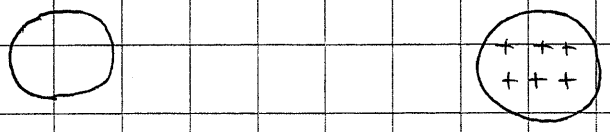
ELETTRIZZAZIONE PER STROFINIO

→ isolanti (plastica, vetro, ambra

→ conduttori (impugnati per mezzo di isolanti)

ELETTRIZZAZIONE PER CONTATTO

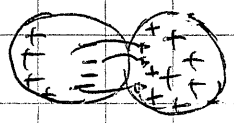
Metallo neutro Isolante carico

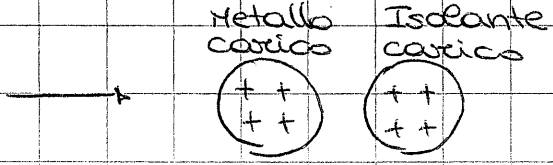


Se li avviciano, quello neutro si polarizza e le cariche si redistribuiscono.

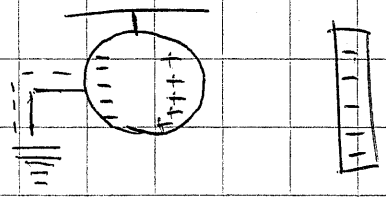
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Quando si toccano

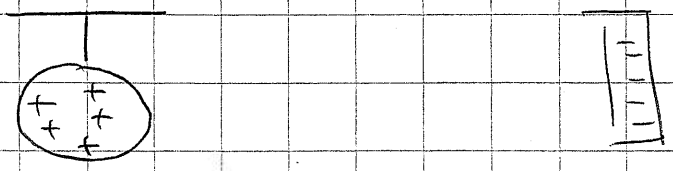




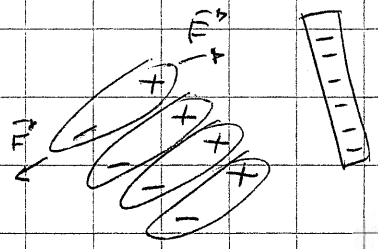
ELETTRIZZAZIONE PER INDUZIONE



↳ messa a terra
↳ via di fuga cariche mobili

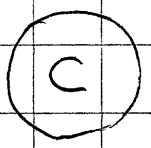


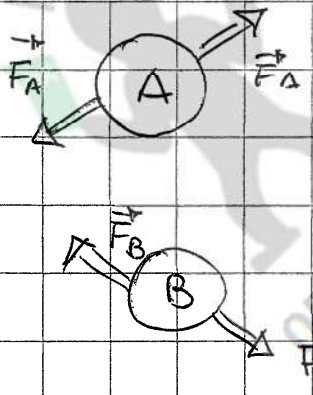
Stacco la messa a terra e allontano la bacchetta carica

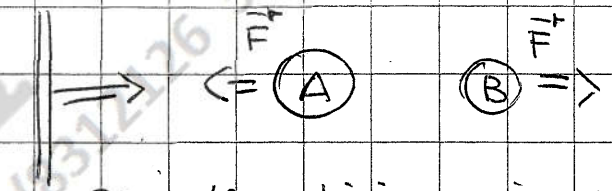


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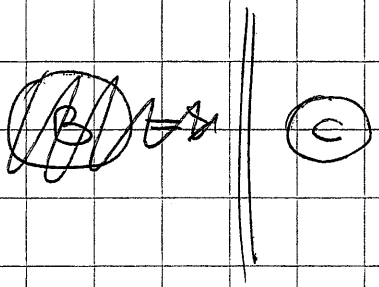
26/09/17

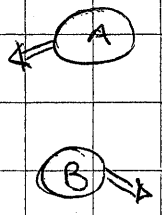


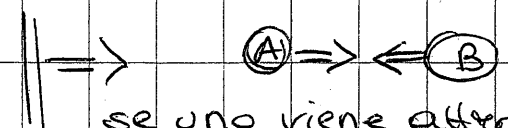




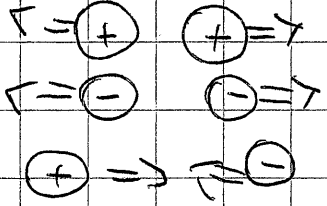
se entrambi i corpi carichi vengono o respinti o attratti da un terzo corpo si respingono SEMPRE!







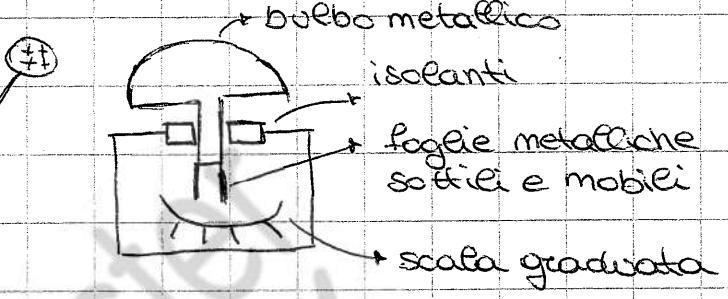
se uno viene attratto e uno respinto i due corpi si attraggono



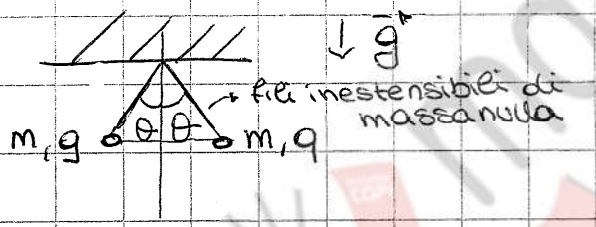
	MASSA	CARICA
PROTONE	$m_p = 1{,}6725 \cdot 10^{-27}$ Kg	$+ (1{,}6 \cdot 10^{-19}$ C)
NEUTRONE	$m_N = 1{,}6748 \cdot 10^{-27}$ Kg	0
ELETTRONE	$m_E = \frac{1}{1840} m_p \approx 9{,}109 \cdot 10^{-31}$ Kg	$- (1{,}6 \cdot 10^{-19}$ C)

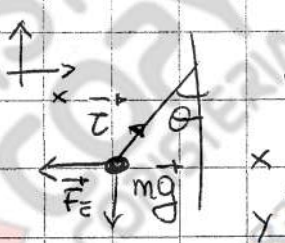
la carica di cui parliamo è sempre un multiplo intero di queste qui.

ELETTROSCOPIO



se lo carico le foglie metalliche si caricano a loro volta e si respingono

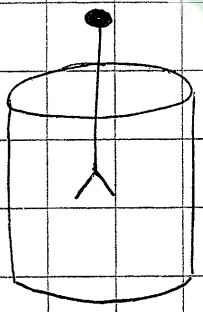


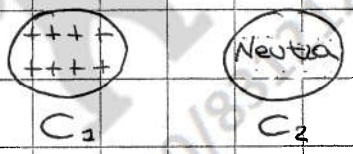


$$m\vec{g} + \vec{T} + \vec{F}_E = 0$$

$$\begin{cases} x) \; T\sin\theta - F_E = 0 \\ y) \; T\cos\theta - mg = 0 \end{cases}$$

$$\Rightarrow \tan\theta = \frac{F_E}{mg} \Rightarrow F_E = mg\tan\theta$$



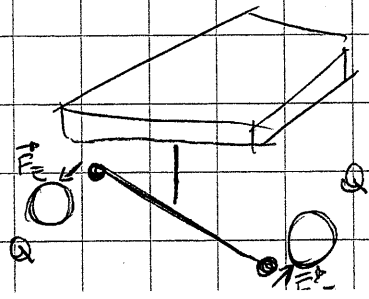


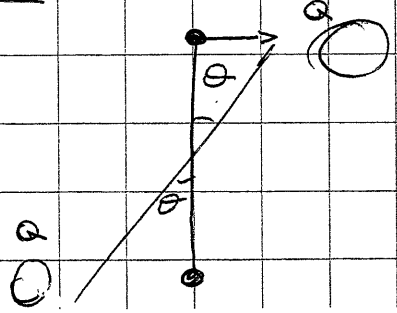
→ 2 corpi identici

- due corpi identici caricati se producono deflessioni diverse saranno caricati diversamente
- se metto a contatto C_1 e C_2 elettrizzo anche C_2. Se lo poggio sull'elettroscopio producono la stessa deflessione

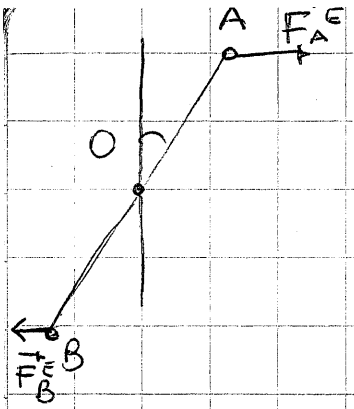
BILANCIA DI TORSIONE

Coulomb (1785) / Cavendish (1798)





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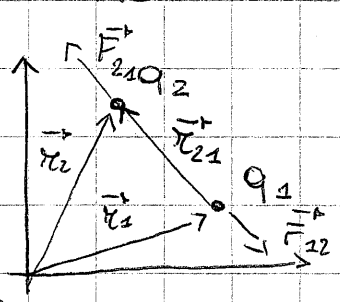
momento di torsione del filo

$$\vec{OA} \times \vec{F}_A^E + \vec{OB} \times \vec{F}_B^E + K\theta\hat{K} = 0$$

$$\vec{F}_A^E = -\vec{F}_B^E$$

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FORZA DI COULOMB



$$\vec{r}_{21}$$

$$\vec{r}_2 = \vec{r}_1 + \vec{r}_{21}$$

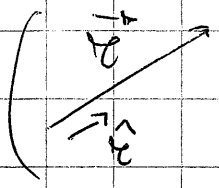
$$\vec{r}_{21} = \vec{r}_2 - \vec{r}_1$$

$$\vec{F}_{21} = K \frac{q_1 q_2}{\|\vec{r}_2 - \vec{r}_1\|^3} (\vec{r}_2 - \vec{r}_1)$$

$$\vec{F}_{21} = K \frac{q_1 q_2}{\|\vec{r}_{21}\|^3} \vec{r}_{21} = K \frac{q_1 q_2}{\|\vec{r}_{21}\|^2} \hat{r}_{21}$$

$$\hat{r}_{21} = \frac{\vec{r}_{21}}{\|\vec{r}_{21}\|} \quad \text{(versore)}$$

($\vec{F}_{21}$ forza esercitata da 1 su 2)



$$\hat{r} = \frac{\vec{r}}{\|\vec{r}\|}$$

COULOMB

$$\vec{F}_{21} = K \frac{q_1 q_2}{r^2} \hat{r}_{21}$$

sia attrattiva che repulsiva

$$K = 8{,}99 \cdot 10^9 \frac{N \cdot m^2}{C^2}$$

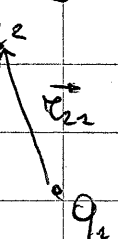
$$K = \frac{1}{4\pi\varepsilon_0}$$

ε_0 = cost. dielettrica del vuoto o permeabilità dielettrica del vuoto

$$\varepsilon_0 = 8{,}854 \cdot 10^{-12} \frac{C^2}{N \cdot m^2}$$

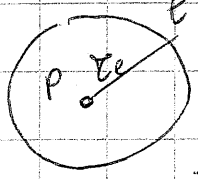
FORZA GRAVITAZIONALE

$$\vec{F}_{21} = -G \frac{m_1 m_2}{r^2} \hat{r}_{21}$$



$$G = 6{,}67478 \cdot 10^{-11} \frac{N \cdot m^2}{kg^2}$$

forza solo attrattiva



$q_e = -1{,}6 \cdot 10^{-19}\,C \qquad m_e = 9{,}1 \cdot 10^{-31}\,kg$

$q_p = 1{,}6 \cdot 10^{-19}\,C \qquad m_p = 1{,}67 \cdot 10^{-27}\,kg$

$r_e = 0{,}5 \cdot 10^{-10}\,m$

$$F_G = 6{,}7 \cdot 10^{-11}\,\frac{N \cdot m^2}{kg^2} \cdot \frac{(1{,}67 \cdot 10^{-27}\,kg)(9{,}1 \cdot 10^{-31}\,kg)}{0{,}5 \cdot 10^{-10}\,m}$$

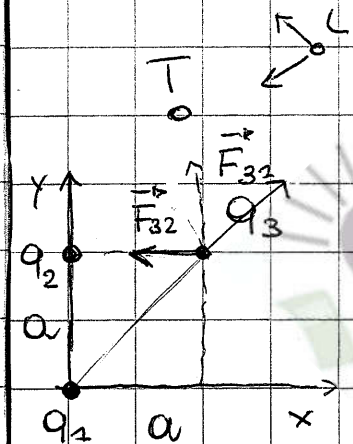
$$\simeq 4 \cdot 10^{-47}\,N$$

$$F_E = 8{,}99 \cdot 10^{9}\,\frac{N \cdot m^2}{r^2}\,\frac{(1{,}6 \cdot 10^{-19}\,C)^2}{(0{,}5 \cdot 10^{-10}\,m)^2} \simeq 9 \cdot 10^{-8}\,N$$

$$\frac{F_E}{F_G} = 2{,}2 \cdot 10^{39}$$

PRINCIPIO DI SOVRAPPOSIZIONE LINEARE

S — le forze si sommano come vettori



$q_1 = 5 \cdot 10^{-6}\,C$

$q_2 = -2 \cdot 10^{-6}\,C$

$q_3 = 5 \cdot 10^{-6}\,C$

$a = 0{,}10\,m$

$$|\vec{F}_{32}| = K\frac{|q_2||q_3|}{a^2} \rightarrow \vec{F}_{32} = (-9\,N,\ 0)$$

$$|\vec{F}_{31}| = K\frac{|q_1||q_3|}{(\sqrt{2}a)^2} \rightarrow \vec{F}_{31} = \left(11{,}0\,N\cos\frac{\pi}{4},\ 11{,}0\,N\sin\frac{\pi}{4}\right)$$

$$\vec{F}_T = (-1{,}1\,N,\ 7{,}9\,N)$$

GENERALIZZO →

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