FORZE DI CONTATTO

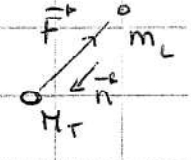
forze di pressione

forza di attrito

forze elastiche

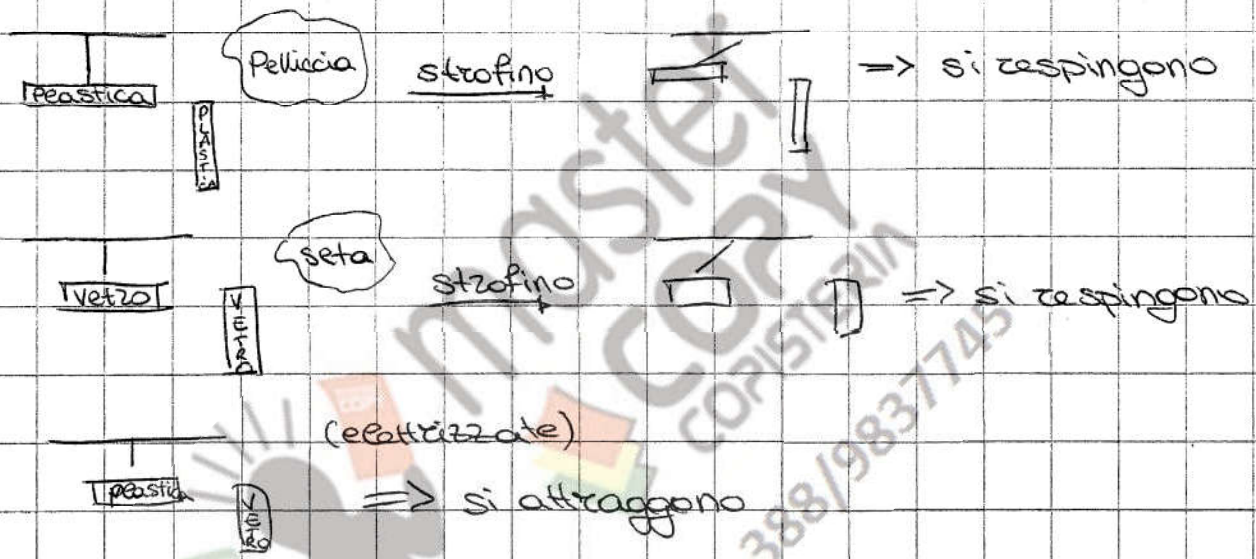
FORZE CHE AGISCONO A DISTANZA

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

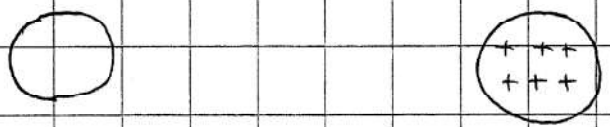
ELETTRIZZAZIONE PER STROFINIO

→ isolanti (plastica, vetro, ambra

→ conduttori (impugnati per mezzo di isolanti)

ELETTRIZZAZIONE PER CONTATTO

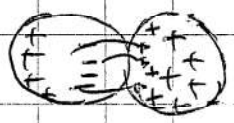
Metallo neutro  Isolante carico

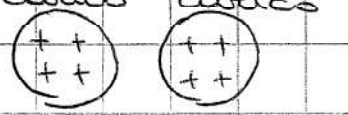


Se li avviciano, quello neutro si polarizza e le cariche si redistribuiscono.

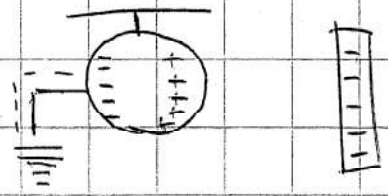
MASTER COPY
Tel. 050 9512126
Cell. 388 9837745

Quando si toccano

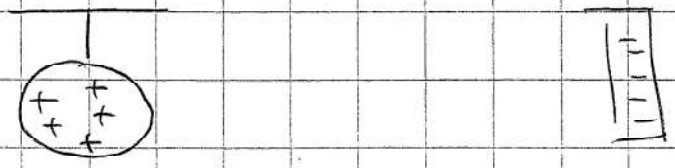




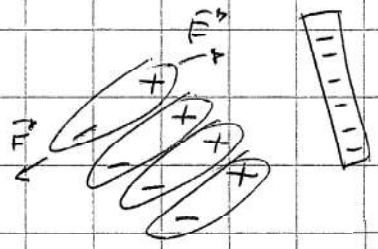

ELETTRIZZAZIONE PER INDUZIONE



↳ messa a terra
↳ via di fuga cariche mobili

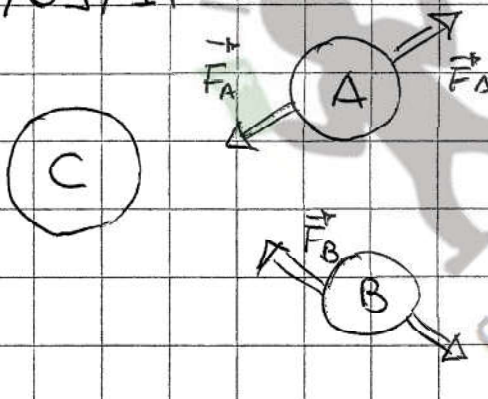


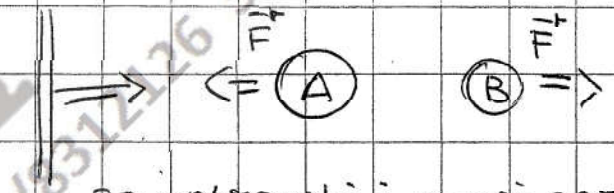
stacco la messa a terra e allontano la bacchetta carica



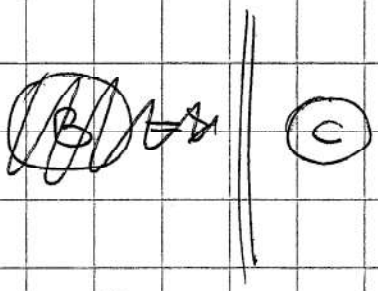
MASTER COPY
Tel. 050 831 21 26
Cell. 388 9837745

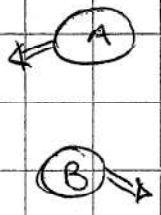
26/09/17

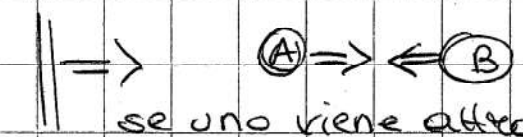


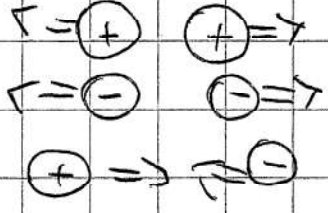

se entrambi i corpi carichi vengono o respinti o attratti da un terzo corpo si respingono SEMPRE!




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



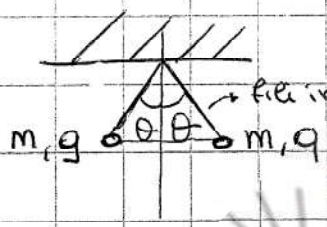
| | MASSA | CARICA |
|---|---|---|
| PROTONE | $m_p = 1{,}6725 \cdot 10^{-27}$ Kg | $+ (1{,}6 \cdot 10^{-19}$ C) |
| NEUTRONE | $m_N = 1{,}6748 \cdot 10^{-27}$ Kg | 0 |
| ELETTRONE | $m_E = \frac{1}{1840} m_p \approx 9{,}109 \cdot 10^{-31}$ Kg | $- (1{,}6 \cdot 10^{-19}$ C) |

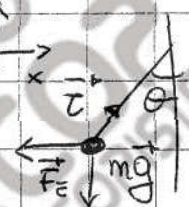
la carica di cui parliamo è sempre un multiplo intero di queste qui.

## ELETTROSCOPIO




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

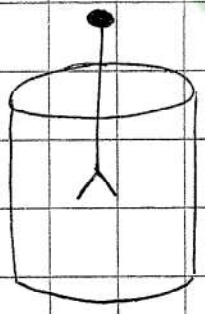


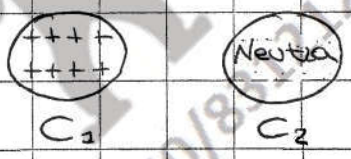



$$m\vec{g} + \vec{T} + \vec{F}_E = 0$$

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

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



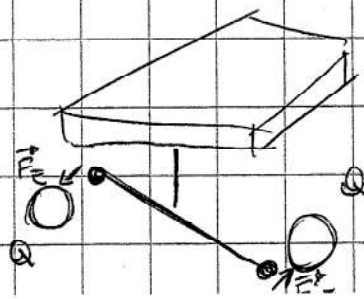


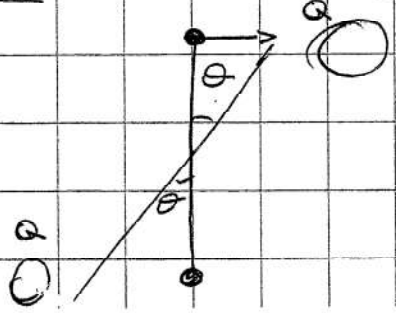

→ 2 corpi identici

- 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 le poggio sull'elettroscopio producono la stessa deflessione

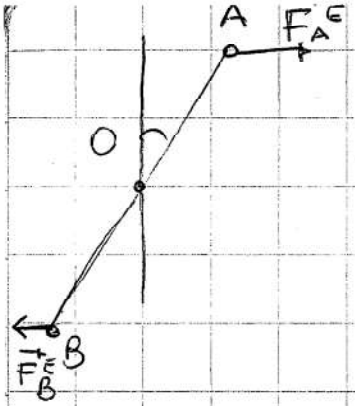
## BILANCIA DI TORSIONE

Coulomb (1785)/Cavendish (1798)




MASTER COPY
Tel. 050 0321425
Cell. 393 9837715



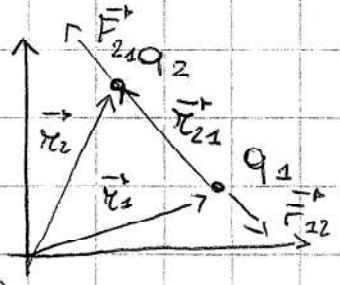

momento di torsione del filo

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

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

MASTER COPY
Tel. 050 8312126
Cell. 388 9837745

# FORZA DI COULOMB




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

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

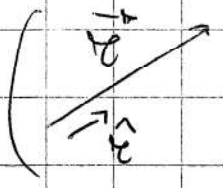
$$\vec{r}_{21} = \vec{r}_2 - \vec{r}_1$$

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

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

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

($\vec{F}_{21}$ 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

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

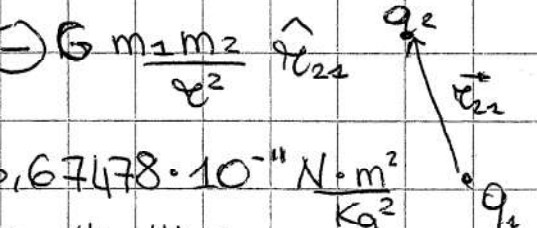
$$K = \frac{1}{4\pi\varepsilon_0}$$

$\varepsilon_0$ = cost. dielettrica del vuoto o permeabilità dielettrica del vuoto

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

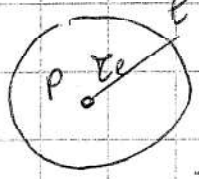
## FORZA GRAVITAZIONALE

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




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

forza solo attrattiva




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

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

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

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

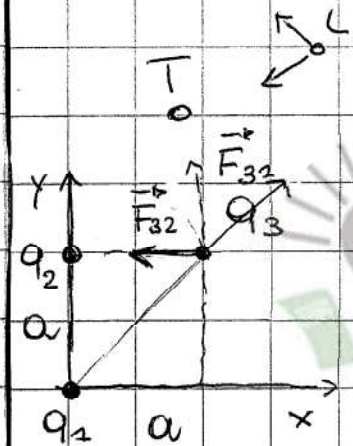
$$\simeq 4 \cdot 10^{-47} N$$

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

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

## PRINCIPIO DI SOVRAPPOSIZIONE LINEARE

S  le forze si sommano come vettori




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

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

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

$a = 0,10 m$

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

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

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

GENERALIZZO →

MASTER COPY COPISTERIA 050/8311126 388/9837745