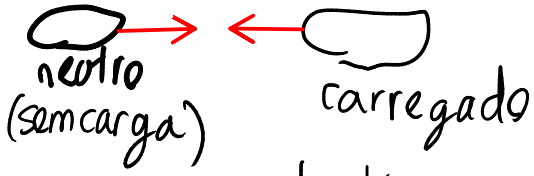
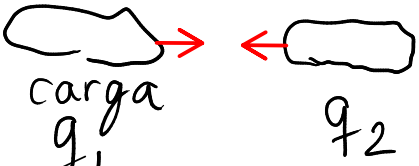
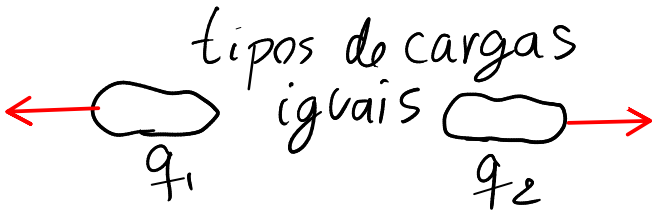
Força elétrica (Macroscópico)



força atrativa



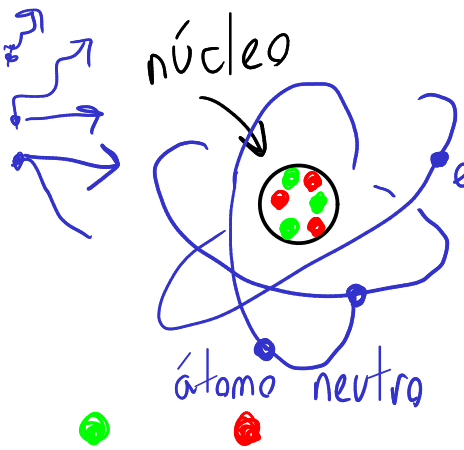


q_1 e q_2 tipos diferentes de cargas

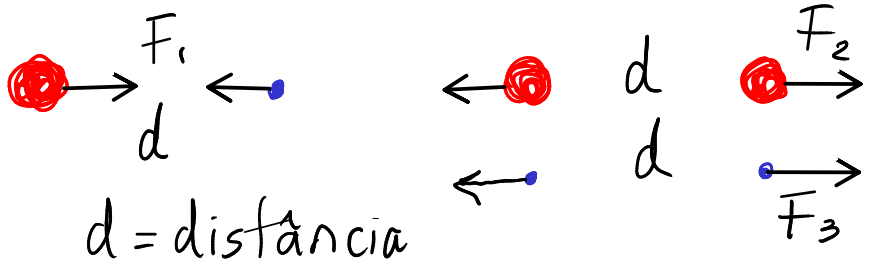
cargas { + positivas
− negativas

Modelo atómico (Microscópico)

- neutrão $q_n = 0$
- protão $q_p > 0$



$F = 0$

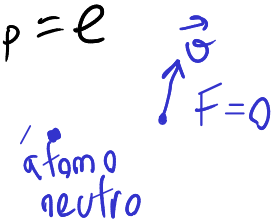


d = distância

d igual nos 3 casos → $F_1 = F_2 = F_3$

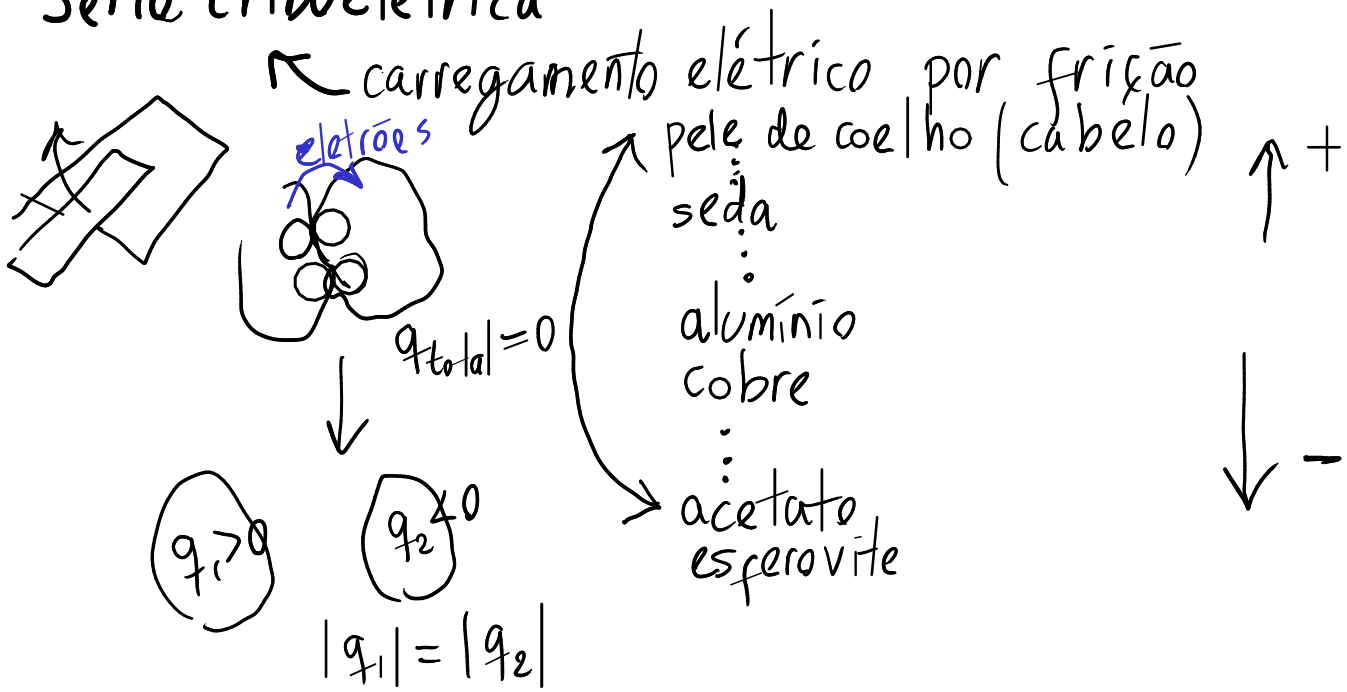
$\Rightarrow |q_e| = |q_p| =$ carga elementar $= e$

qualquer protão $q_p = e$



qualquer eletrão $q_e = -e$

Série triboelétrica



Propriedades da carga elétrica.

① **Quantização.** Qualquer objeto com carga q

$$\boxed{q = ne}$$

n = inteiro positivo ou negativo

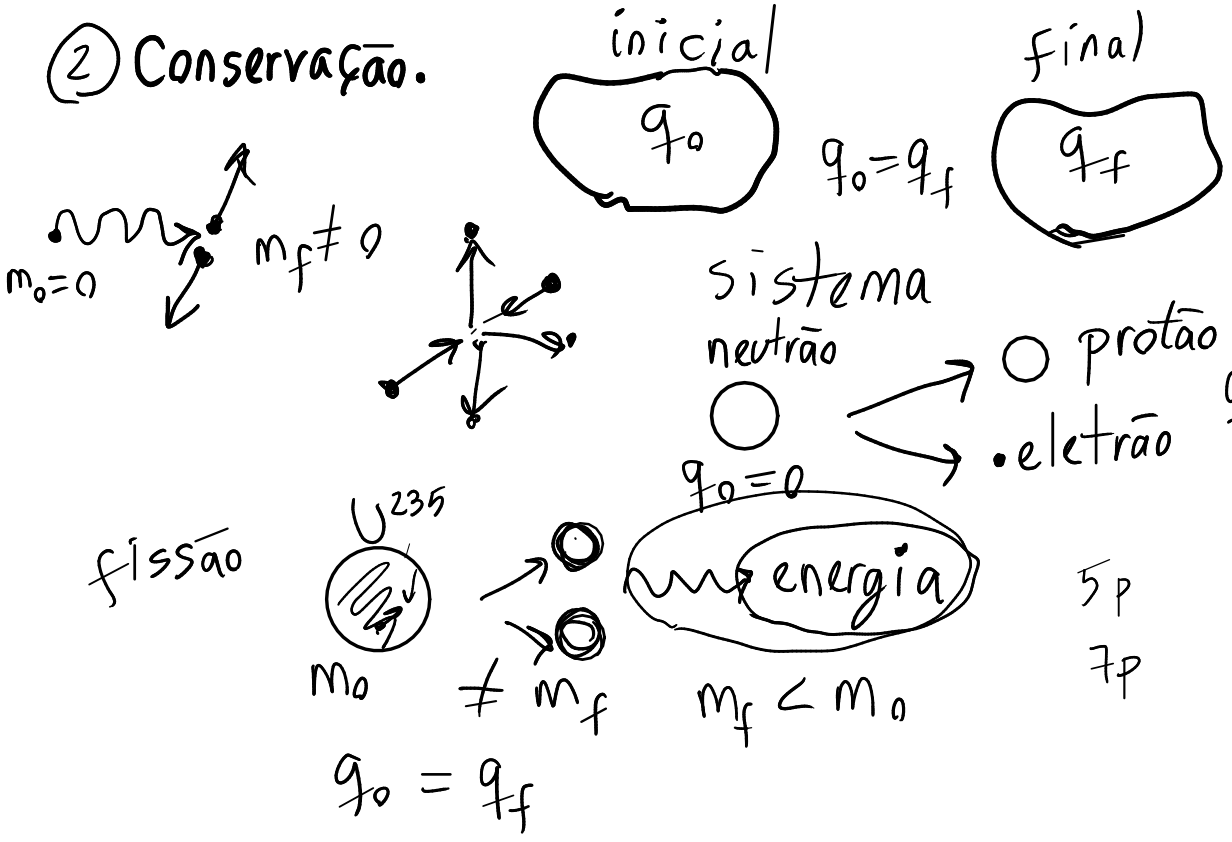
$\Longrightarrow$ muitas outras partículas elementares todas com carga $q=ne$

Unidade S.I. de carga: 1 C (coulomb) ($nC = 10^{-9}$ C)

$1\ C \approx 6.242 \times 10^{18}\ e$

$$\boxed{1e = 1.602 \times 10^{-19}\ C}$$

② Conservação.

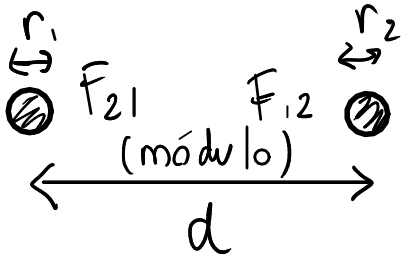


$q_0 = q_f$

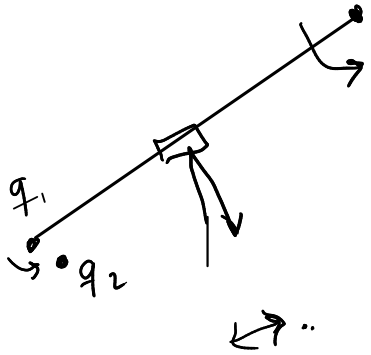
Lei de Coulomb. duas cargas pontuais q_1 e q_2

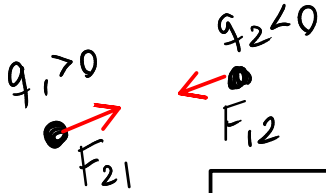
$r_1 \ll d$

$r_2 \ll d$



$$F_{12} = F_{21} = k\frac{|q_1||q_2|}{d^2}$$





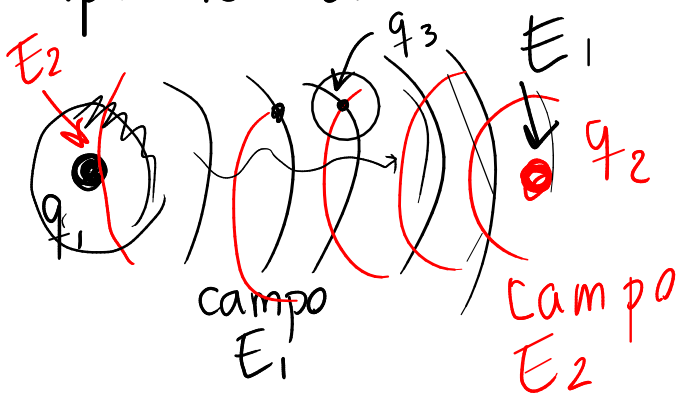
k = constante de Coulomb

$$k \simeq 8.998 \times 10^9 \ \frac{N \cdot m^2}{C^2}$$

usaremos 3 algarismos significativos: $e = 1.6 \times 10^{-19}$ C

$k = 9 \times 10^9 \ \frac{N \cdot m^2}{C^2}$

Campo elétrico.



F_{12} (de 1 sobre 2) ↓ força de E_1 em q_2

F_{21} (de 2 sobre 1) ↓ do campo E_2 em q_1

campo vetorial $\vec{E}$:

$q \neq 0$ no ponto P ⇓ se existir força elétrica $\vec{F}_q$ sobre q então em P existe campo

$$\vec{E} = \frac{\vec{F}_q}{q}$$

S.I. $E \rightarrow \frac{N}{C}$

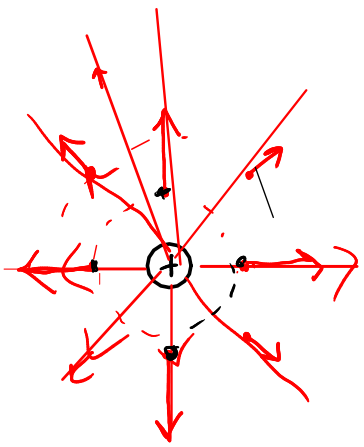
q sem valor absoluto →

P → $\vec{E}_P$

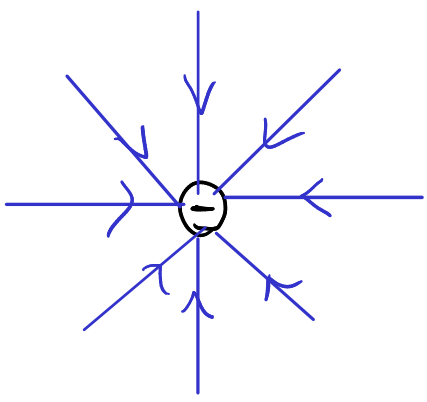
↓ E_P

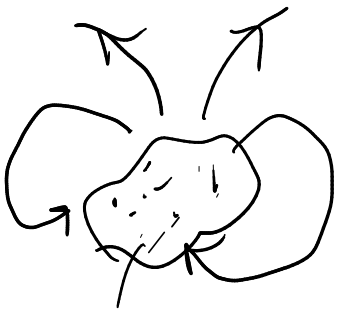
$\vec{F}_e = q_e \vec{E}_P$ ↖ $q_e < 0$

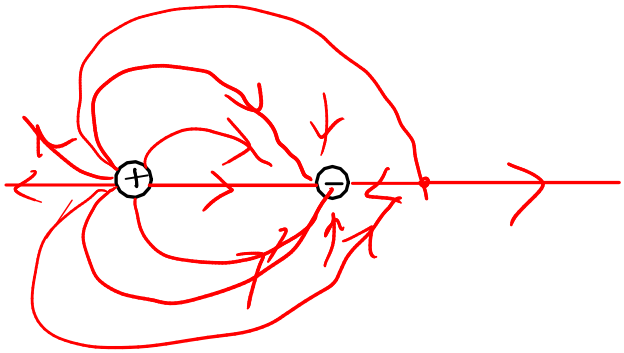
$q > 0$ → $\vec{F}_q = q\vec{E}_P$ ↖ $q > 0$



linhas de campo elétrico





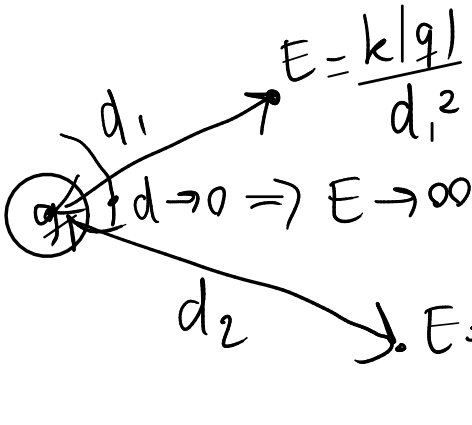


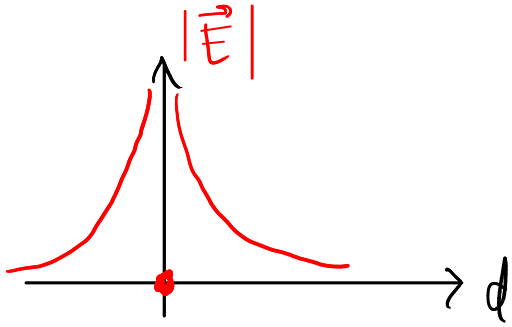
Campo de uma <u>carga pontual</u> q

$$|\vec{E}| = \frac{k|q|}{d^2}$$

$\begin{cases} \text{repulsivo, se } q>0 \\ \text{atrativo, se } q<0 \end{cases}$

d = distância desde q até o ponto onde se calcula $\vec{E}$

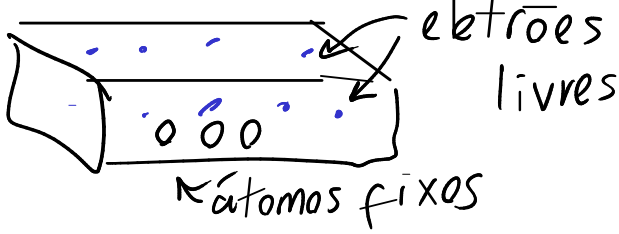


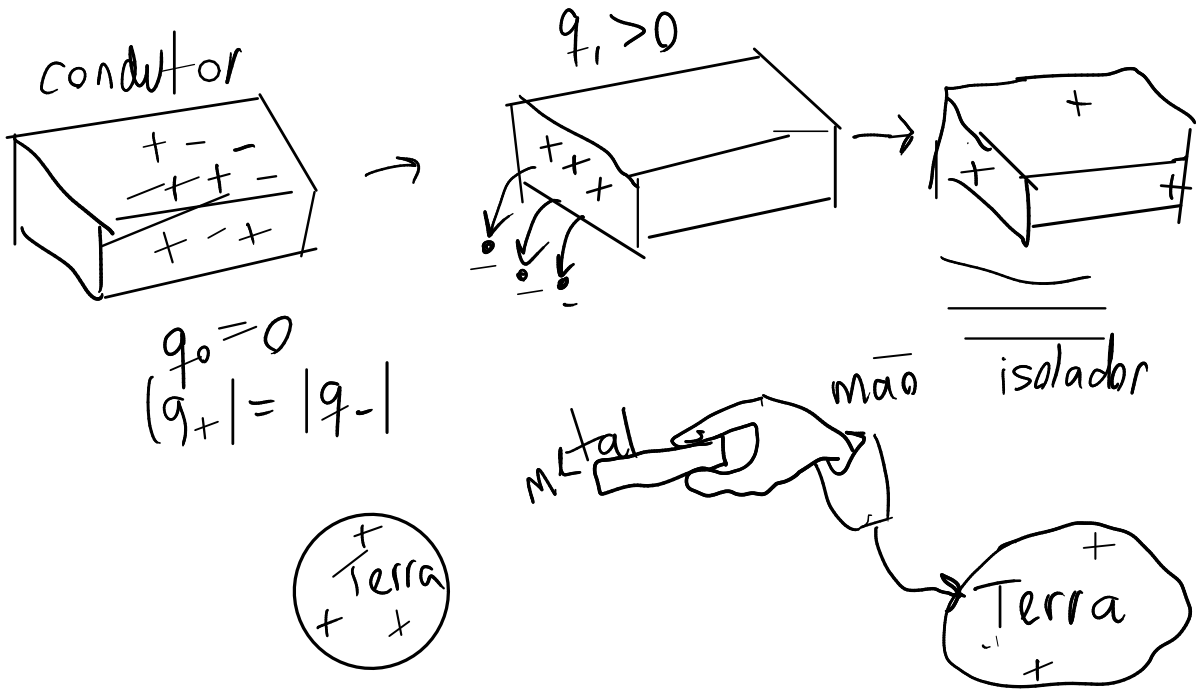


Materiais macroscópicos $\begin{cases} \text{Condutores} \\ \text{Isoladores} \end{cases}$

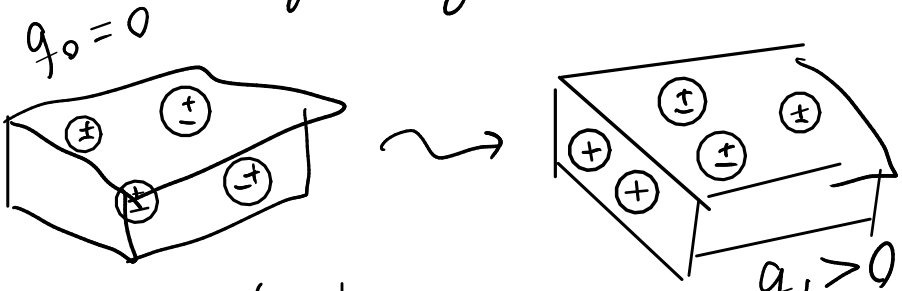
Condutor. Possui muitas cargas pontuais livres

Exemplo → metais

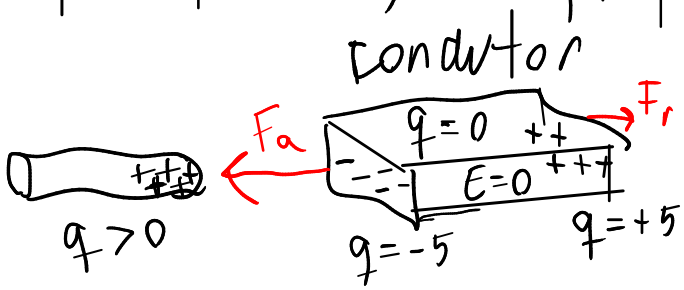




Isolador. Cargas ligadas aos átomos/moléculas

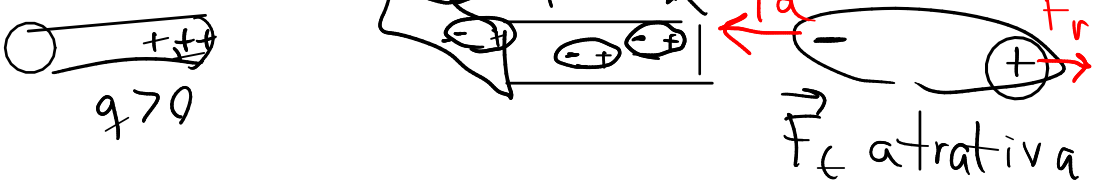


exemplo: plástico, vidro, papel.



$F_r < F_a$

$\vec{F}_t$ atrativa



$\vec{F}_t$ atrativa

Carregamento por indução