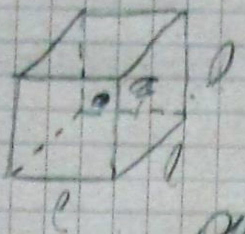
Lista 02 (solução)

a) carga no centro do cubo:



* Superfície fechada (6 lados de l^2) carga no centro de simetria:

* Lei de Gauss:

$$\boxed{\Phi_{E_{cubo}} = \frac{q}{\epsilon_0} \; ; \; \Phi_{E_{lado}} = \frac{q}{6\epsilon_0}}$$

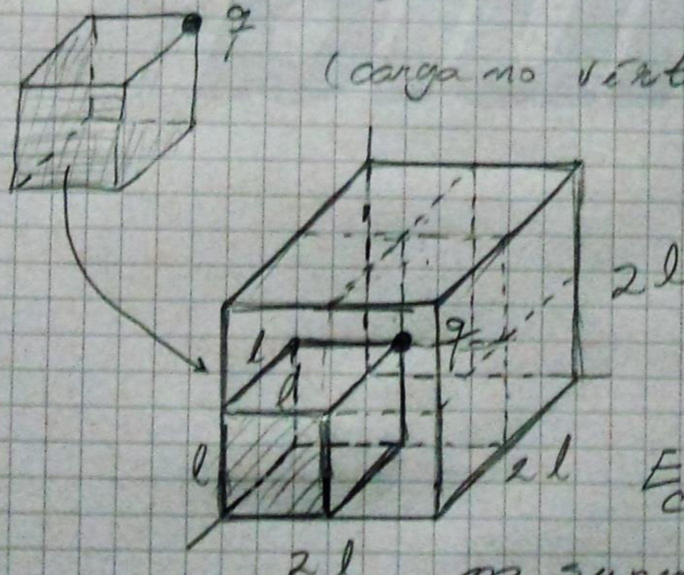
ou:

$$\left.\begin{aligned} \Phi_{E_{cubo}} &= |E||S| = \frac{q}{\epsilon_0} \\ S &= 6 \cdot l^2 \end{aligned}\right\} \quad E_{cubo} \cdot 6 l^2 = \frac{q}{\epsilon_0}$$

$$E_{cubo} = \frac{q}{6 l^2 \epsilon_0} \; ; \; \Phi_{E_{lado}} = E_{cubo} \cdot l^2$$

$$\Phi_{E_{lado}} = \frac{q}{6 l^2 \epsilon_0} \cdot l^2 = \boxed{\frac{q}{6\epsilon_0}}$$

b) (carga no vértice)



$$\Phi_{CUBO} = \frac{q}{\epsilon_0}$$

$$S_{CUBO} = 6 \cdot 4 l^2$$

$$S_{CUBO} = 24 l^2$$

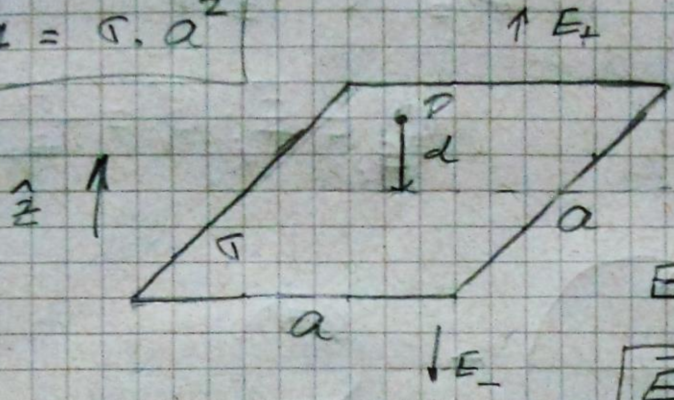
$$E_{CUBO} = \frac{q}{24 l^2 \epsilon_0}$$

na superfície l^2:

$$\Phi_{E_{LADO}} = E_{CUBO} \cdot l^2$$

$$\Phi_{E_{Lado}} = \frac{q}{24 l^2 \epsilon_0} \cdot l^2 = \boxed{\frac{q}{24\epsilon_0}}$$

$\boxed{q = \sigma \cdot a^2}$



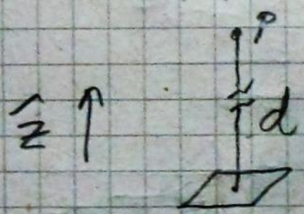
$d << a$: superficie infinita

$$\Phi_E = E(P) \cdot 2a^2 = \frac{q}{\epsilon_0}$$

$$E(P) = \frac{\sigma a^2}{\epsilon_0} \cdot \frac{1}{2a^2}$$

$$\boxed{\vec{E}(P) = \frac{\sigma}{2\epsilon_0} \hat{z}}$$

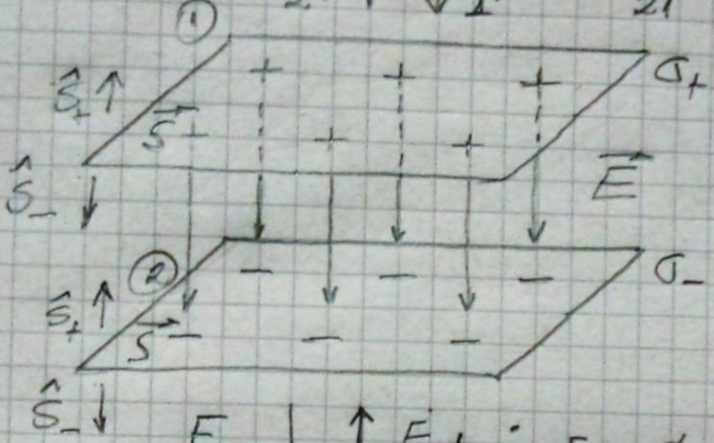
$d >> a$: superficie puntual:



$$\boxed{\vec{E}(P) = \frac{q}{4\pi\epsilon_0} \cdot \frac{1}{d^2} \hat{z}}$$

(3)

$E_{2+} \uparrow \; \downarrow E_{1-} \;\therefore\; E_{21} = \emptyset$



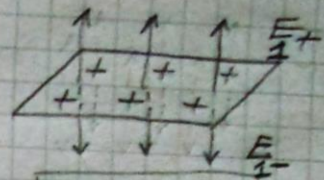
$E_{1-} \downarrow \; \uparrow E_{2+} \;\therefore\; E_{12} = \emptyset$

$$\Phi_E = |\vec{E}_\pm| \cdot |2\vec{S}| = \frac{\sigma_\pm S}{\epsilon_0} \; *$$

$$E_\pm = \frac{\sigma_\pm}{2\epsilon_0}$$ ($\vec{E}$ acima e abaixo de cada placa)

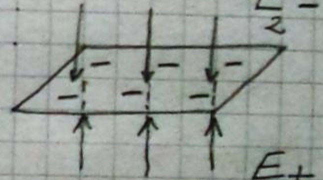
Potencial entre as placas:

$$\boxed{E = \frac{\sigma}{\epsilon_0}}$$



$$\boxed{E_- = -E_+}$$

$$\boxed{q_\pm = \sigma_\pm \cdot S} \; *$$

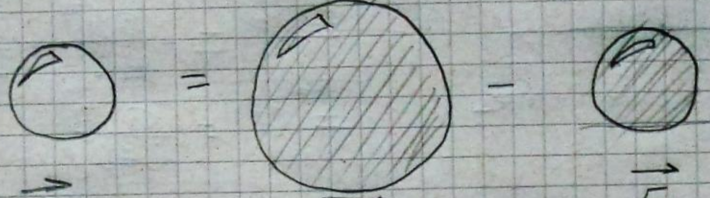


$$\boxed{E_- = -E_+}$$

④

$$\boxed{q_i = \rho \cdot \frac{4}{3}\pi r^3}$$

$$\Phi_{E_i} = \vec{E}_i \cdot \vec{S}_i = \frac{q_i}{\epsilon_0}$$



$$\vec{E}_{buraco} = \vec{E}_{esfera} - \vec{E}$$

$$\Phi_{E_{esfera}} = \vec{E}_{esfera} \cdot \vec{S}_{esfera} = \frac{\rho \cdot \frac{4}{3}\pi r^3}{\epsilon_0}$$

$$E_{esfera} = \frac{\rho \, 4/3 \pi r^3}{\epsilon_0} \cdot \frac{1}{4\pi r^2}$$

$$\boxed{\vec{E}_{esfera} = \frac{\rho \vec{r}}{3\epsilon_0}}$$

$$E = \frac{\rho \, 4/3 \pi a^3}{\epsilon_0} \cdot \frac{1}{4\pi a^2} = \frac{\rho a}{3\epsilon_0} \; ; \; c/ \; \vec{a} = \vec{r} - \vec{b}$$

$$\boxed{\vec{E} = \frac{\rho(\vec{r} - \vec{b})}{3\epsilon_0}}$$

$$\vec{E}_{buraco} = \frac{\rho \vec{r}}{3\epsilon_0} - \frac{\rho(\vec{r} - \vec{b})}{3\epsilon_0}$$

$$\boxed{\vec{E}_{buraco} = \frac{\rho \vec{b}}{3\epsilon_0}}$$

campo uniforme!