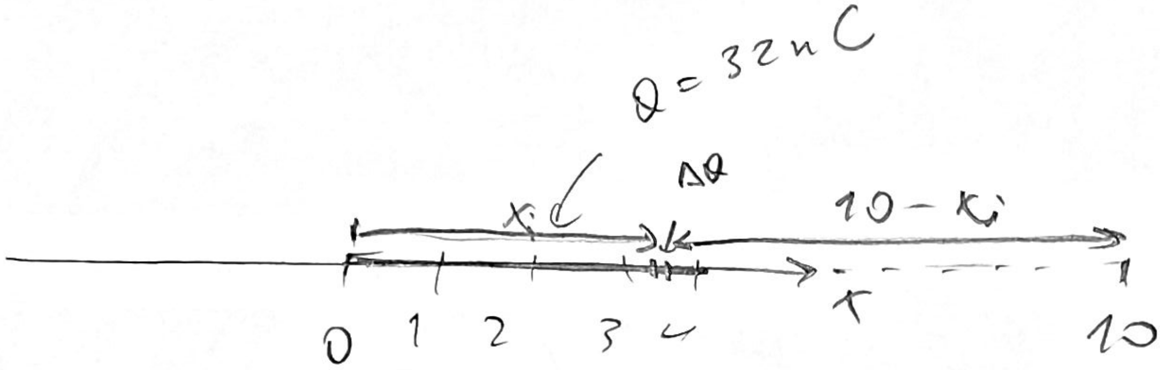
1



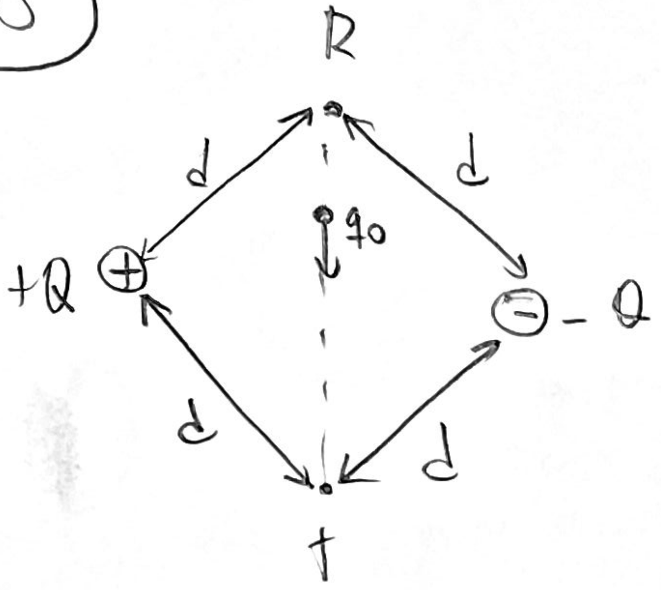
$$\lambda = \frac{Q}{L} = \frac{32\ nC}{4\ m} = 8\ nC/m = 8\cdot 10^{-9}\ C/m$$

$$(E_x)_i = \frac{1}{4\pi\varepsilon_0}\frac{\Delta Q}{r_i^2} = \frac{1}{4\pi\varepsilon_0}\frac{\lambda \Delta x_i}{(10-x_i)^2}$$

$$E_x = \sum_i (E_x)_i = \frac{1}{4\pi\varepsilon_0}\lambda \sum_i \frac{\Delta x_i}{(10-x_i)^2} \longrightarrow \frac{1}{4\pi\varepsilon_0}\lambda \int_0^4 \frac{dx}{(10-x)^2}$$

$$= \cancel{9\cdot 10^{9}}\cdot \cancel{8\cdot 10^{-9}} \int_0^4 \frac{dx}{(10-x)^2} \Rightarrow \boxed{E_x = \int_0^4 \frac{72dx}{(10-x)^2}}$$

(5)



U_+: energia potencial do par $+Q/q_0$

U_-: energia potencial do par $-Q/q_0$

Em R: $U_R = U_+ + U_- = \dfrac{K(+Q)(q_0)}{d} + \dfrac{K.(-Q)(q_0)}{d}$

$\therefore U_R = 0$

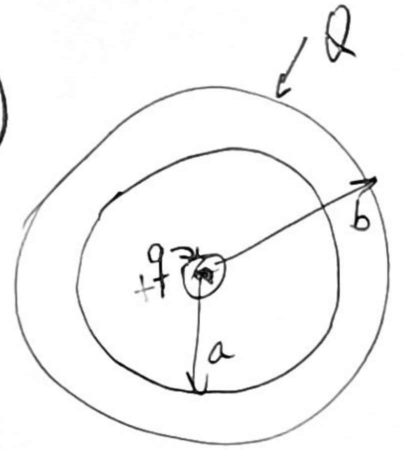
Em T: $U_R = U_+ + U_- = \dfrac{K(+Q)(q_0)}{d} + \dfrac{K(-Q)(q_0)}{d} = 0$

Daí: $\Delta U_{elet} = U_T - U_R = 0$

Mas: $W_{elet}(R \to T) = -\Delta U_{elet}$

$$\boxed{W_{elet}(R \to T) = 0}$$

6



$Q = -500\,nC = -5{,}0 \cdot 10^{-7}\,C$

$q = +300\,nC = +3{,}0 \cdot 10^{-7}\,C$

$a = 0{,}80\,m$
$= 8{,}0 \cdot 10^{-1}\,m$

$b = 1{,}2\,m$

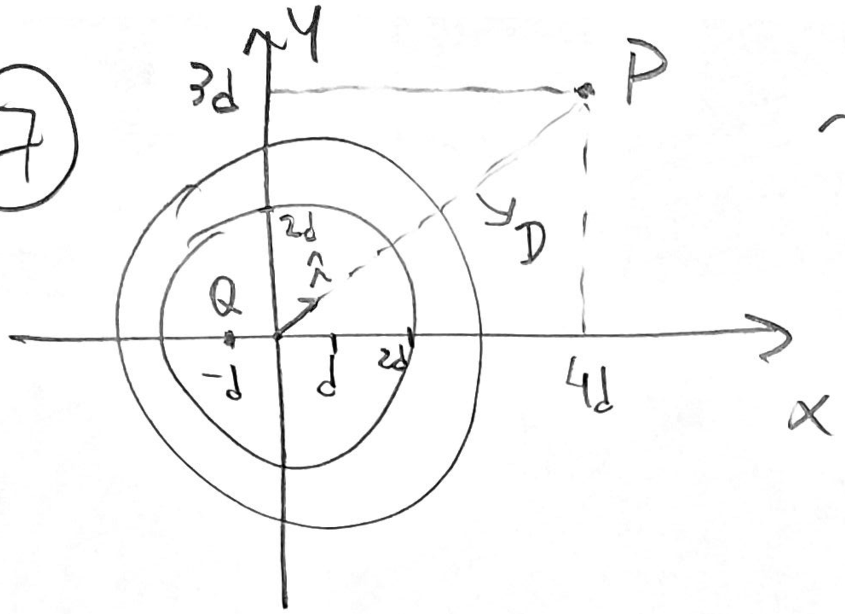
→ carga q polariza o condutor, atrai uma carga $\underline{-q}$ p/ a superfície da esfera de raio a, e uma carga $\underline{+q}$ se desloca p/ a superfície da esfera de raio b (essa passa a ter carga $Q + q = -500 + 300 =$
$= -200\,nC = -2{,}0 \cdot 10^{-7}\,C$)

Superfície esférica interna (raio a):

$$\eta_a = \frac{\text{carga}}{\text{área}} = \frac{-q}{4\pi a^2} = \frac{-(3{,}0 \cdot 10^{-7})}{4\pi \cdot (8{,}0 \cdot 10^{-1})^2} =$$

$$= \frac{-3{,}0 \cdot 10^{-7}}{4\pi \cdot 64 \cdot 10^{-2}} \Rightarrow \boxed{\eta_a = 3{,}7 \cdot 10^{-8}\,C/m^2}$$

7



$$\rightarrow D^2 = (3d)^2 + (4d)^2$$
$$= 9d^2 + 16d^2$$
$$= 25d^2$$
$$\therefore \underline{\underline{D = 5d}}$$

carga Q interna (em $x=-d$) polariza a superfície condutora interna, atraindo uma carga $-Q$, e desloca uma carga $+Q$ para a superfície de raio 2d. A casca metálica era neutra e passa a ter carga $+Q$.

Campo gerado pela casca externa (via Lei de Gauss): $\vec{E} = K\frac{Q}{r^2}\hat{r}$, a uma distância r do centro. Daí, no ponto P:

$$\vec{E} = K\frac{Q}{D^2}\hat{r} = K\frac{Q}{(5d)^2}\hat{r} \Rightarrow \boxed{\vec{E} = \frac{KQ}{25d^2}\hat{r}}$$

Q8) O potencial elétrico criado por uma esfera carregada é o potencial na superfície desta esfera. Assim,

$$V = k\frac{Q}{R} \quad , \text{ onde } \quad k = \frac{1}{4\pi\varepsilon_0} = 8{,}99\times10^{9}\,\frac{Nm^2}{C^2}$$

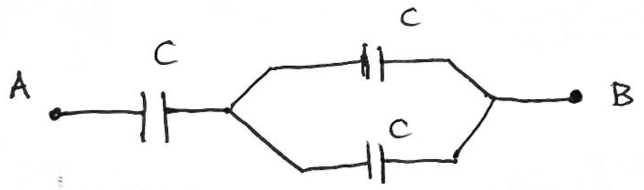
$$R = 3{,}0\times10^{-7}\,m.$$

Assim,

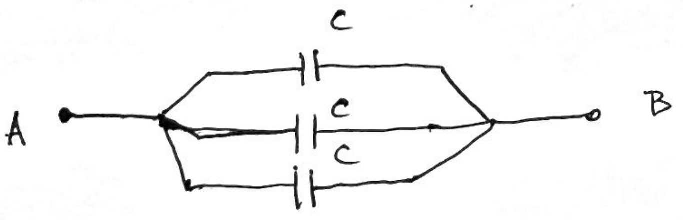
$$Q = \frac{VR}{k} = \frac{-(0{,}15\,V)\times(3{,}0\times10^{-7}\,m)}{8{,}99\times10^{9}\,\frac{Nm^2}{C^2}} \Longrightarrow$$

$$Q = -\,0{,}50\times10^{-16}\,C \Longrightarrow Q = -\,5{,}0\times10^{-18}\,C \;//.$$

Q9)

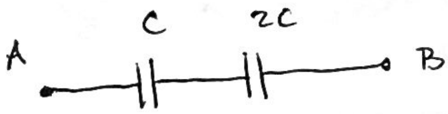


(1)



(2)

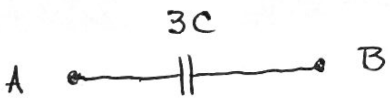
O capacitor ①:



$$(1) \Rightarrow \frac{1}{C_1} = \frac{1}{C} + \frac{1}{2C} = \frac{3}{2C}$$

$$\Rightarrow C_1 = \frac{2}{3}C \;//$$

O capacitor ②:



$$\Rightarrow C_2 = 3C$$

Então, $\frac{C_1}{C_2} = \frac{2}{3}C\cdot\frac{1}{3C} = \frac{2}{9}\;//$

Q15) O campo é nulo dentro de um condutor.