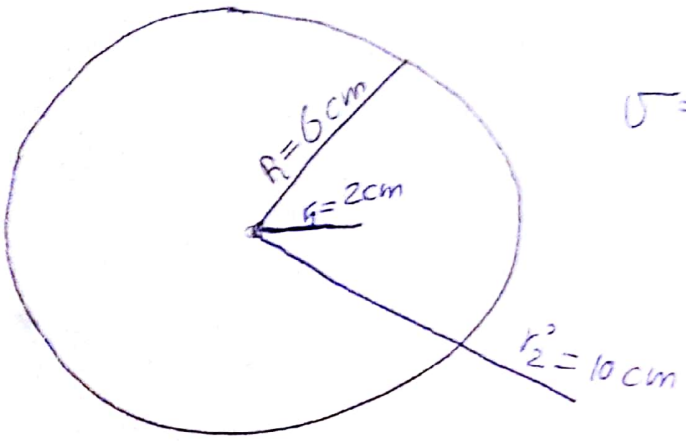
4)



a)

$\sigma = \frac{dq}{dS}$

$\sigma = \frac{Q}{S}$ $\quad Q = \sigma S = 9\cdot10^{-9} \times 4\pi (0,06)^2$

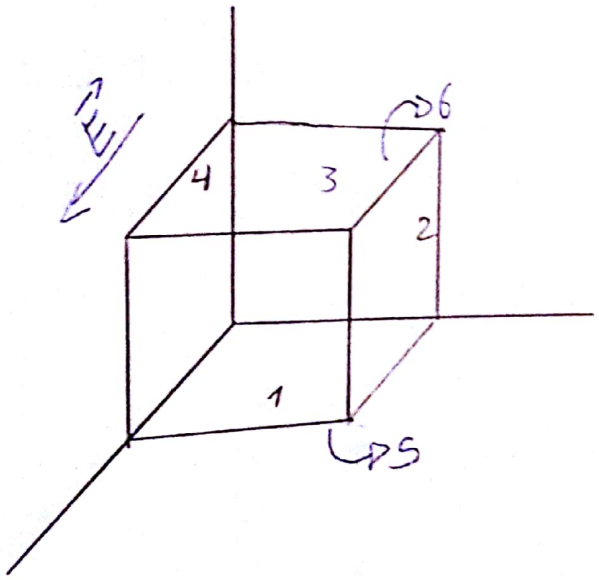
$Q = 4,07\cdot10^{-10} C$

b) $r_1 = 2\,cm \Rightarrow \vec{E} = 0$ $\quad V = k\frac{Q}{R}$

$r_2 = 10\,cm \Rightarrow \vec{E} = k\frac{Q}{r_2^2} = 9\cdot10^9 \cdot \frac{4,07\cdot10^{-10}}{(0,1)^2} = 3,66\,V \rightarrow N/C$

$V = k\frac{Q}{r^2}$

1)



$\Phi = \vec{E}\cdot\vec{S} = ES\cdot\cos\alpha$

$\Phi_1 = ES = E_0 \cdot a^2$

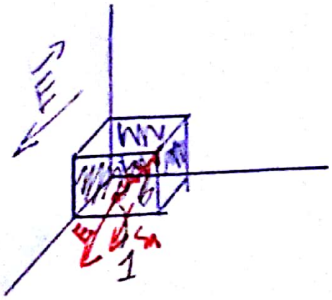
$\Phi_2 = 0$

$\Phi_3 = -E_0 \cdot a^2$

$\Phi_4 = 0$

$\Phi_5 = 0$

$\Phi_6 = 0$

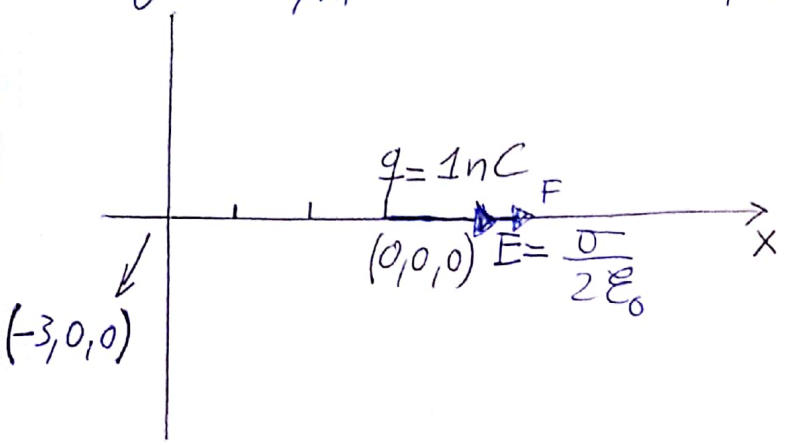


10-10-2017

3)

a)

$\sigma = 3\ C/m^2$



$\vec{F} = q \cdot \vec{E}$

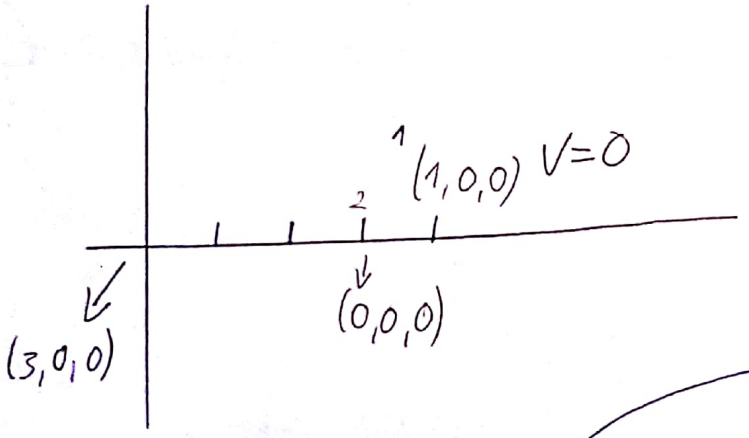
$\Downarrow$

$F = 1 \cdot 10^{-9} \cdot \frac{\sigma}{2\varepsilon_0} = 54\pi\ N$

$k = \frac{1}{4\pi\varepsilon_0}$ $\quad \vec{F} = 54\pi\ \vec{i}$

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

b) $U = ?$ $\quad U = q \cdot V$



$\int_1^2 dV = \int_1^2 -\vec{E} \cdot d\vec{r}$

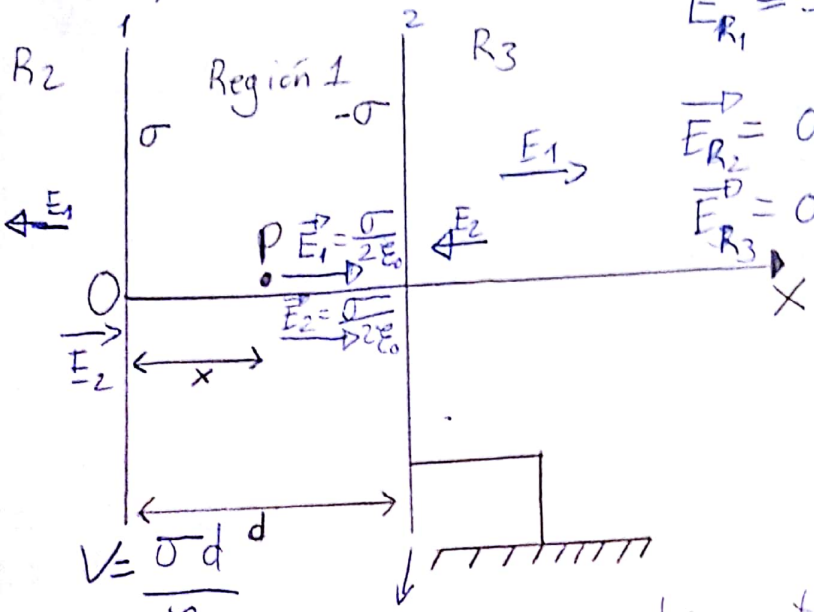
$V(0,0,0) - V(1,0,0) = -\frac{\sigma}{2\varepsilon_0} \int_{(1,0,0)}^{(0,0,0)} dx =$

$= -\frac{\sigma}{2\varepsilon_0}(0-1) = \frac{\sigma}{2\varepsilon_0}$

$U = 1 \cdot 10^{-9} \cdot \frac{\sigma}{2\varepsilon_0} =$

5

a)



$\vec{E}_{R_1} = \frac{\sigma}{\varepsilon_0} i$

$\vec{E}_{R_2} = 0$

$\vec{E}_{R_3} = 0$

$V = 0$ porque está conectada a la tierra.

b) V en todos los puntos.

$$\int dV = -\int \vec{E} \cdot d\vec{r}$$

$$V = -\int \frac{\sigma}{\varepsilon_0} dx = -\frac{\sigma}{\varepsilon_0} x + C$$

Si no ponen límites de integración ponemos la constante de integración.

$$V_{R_1} = -\frac{\sigma}{\varepsilon_0} x + C_1 = \frac{-\sigma}{\varepsilon_0} x + \frac{\sigma}{\varepsilon_0} d$$

$$V_{R_1} = 0 = \frac{-\sigma}{\varepsilon_0} d + C_1$$

$$\left[C_1 = \frac{\sigma}{\varepsilon_0} d \right]$$

$$V_{R_1} = \frac{\sigma}{\varepsilon_0} (d - x)$$

Si no hay campo el potencial es constante.

$V_{R_3} = C_2 = 0$

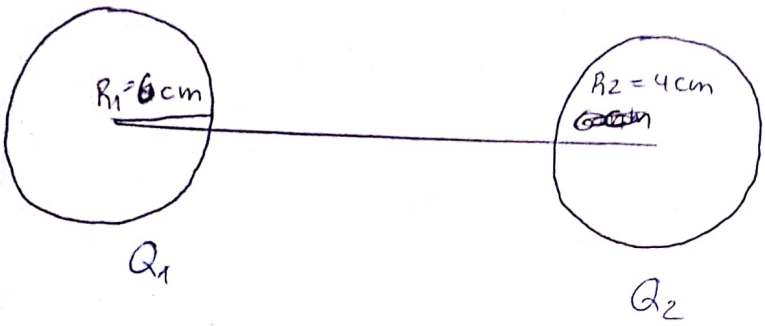
$d_{R_2} V = -\vec{E} \cdot d\vec{r}$

$dV = 0$

$V_{R_2} = cte = C_2 = \frac{\sigma}{\varepsilon_0} \cdot d.$

6)

$Q = 20\mu C$



$Q_T = Q_1 + Q_2$

$E_1 = K \cdot \frac{Q_1}{R_1^2} = 10$ $\qquad E_2 = K \frac{Q_2}{R_2^2}$

$V_1 = K \frac{Q_1}{R_1}$ $\qquad V_2 = K \frac{Q_2}{R_2}$

$V_1 = V_2$

$K \cdot \frac{Q_1}{R_1} = K \cdot \frac{Q_2}{R_2}$

$Q_1 = \frac{Q_2 R_1}{R_2}$

$Q_1 + Q_2 = 20 \cdot 10^{-6}$

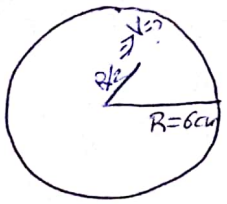
$Q_1 = Q_2 \frac{R_1}{R_2}$

$Q_2 \frac{R_2}{R_1} + Q_2 = 20 \cdot 10^{-6}$

$Q_2 = 8 \cdot 10^{-6} C$

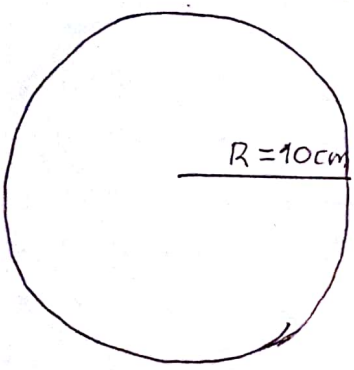
$Q_1 = 12 \cdot 10^{-6} C$

6) b



El potencial es el mismo que en la superficie de ambas esferas, ya que como no hay cargas dentro de la esfera el V es constante.

8) a) $V = 500\,V \quad R = 10\,cm \Rightarrow 0{,}01\,m$



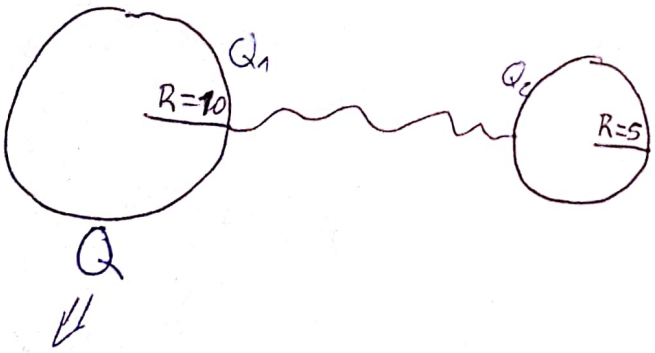
$$V = k\frac{Q}{R}$$

$$500 = 10 \cdot 10^9 \cdot \frac{Q}{0{,}01^2}$$

$$\frac{500 \cdot (0{,}01)^2}{10\,10^9} = Q$$

$$Q = 5{,}6 \cdot 10^{-9}\,C$$

b)



$$Q = Q_1 + Q_2$$

$$V_1 = k\frac{Q_1}{R_1} \qquad V_2 = k\frac{Q_2}{R_2}$$

$$V_1 = V_2$$

$$\cancel{k}\frac{Q_1}{R_1} = \cancel{k}\cdot\frac{Q_2}{R_2}$$

$$Q_1 = Q_2 \cdot \frac{R_1}{R_2}$$

$$\left.\begin{aligned} Q &= Q_1 + Q_2 \\ Q_1 &= Q_2 \cdot \frac{R_1}{R_2} \end{aligned}\right\}$$

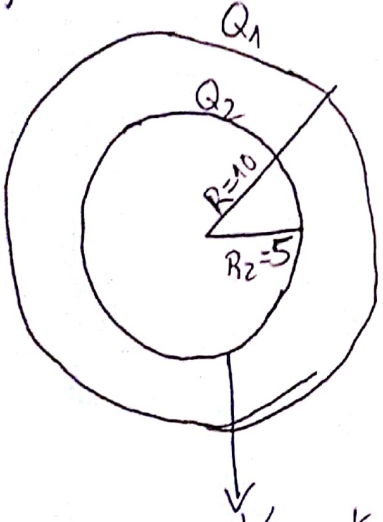
$$Q = Q_2 \cdot \frac{R_1}{R_2} + Q_2$$

$$Q_2 = 1'86 \cdot 10^{-9}\ C$$

$$Q_1 = 3{,}7 \cdot 10^{-9}\ C$$

$$V_1 = k \cdot \frac{3{,}7 \cdot 10^{-9}}{0{,}01} = 333\ V$$

c)



Cuando una esfera está dentro de otra y queremos calcular el potencial de la mayor lo que hacemos es: Calcular el V en la esfera mayor y sumarle el V que crea la Q de la esfera pequeña.

$$V_1 = k \cdot \frac{Q_1}{R_1} + k \frac{Q_2}{R_1}$$

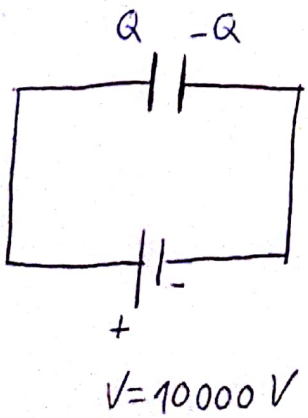
$$V_2 = k \cdot \frac{Q_2}{R_2} + k \frac{Q_1}{R_1}$$

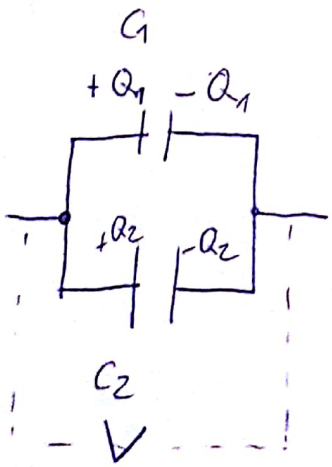
11/10/2017

14) $C_1 = 0{,}1\ \mu F$

$V = 10000\ V$

$C_2 = 9\ \mu F$





la diferencia de V será la misma para ambos.

$$Q_1 + Q_2 = Q$$

$$Q_1 + Q_2 = 10^{-3}$$

$$V = \frac{Q_1}{C_1}$$

$$V = \frac{Q_2}{C_2}$$

$$\left.\begin{array}{l} Q_1 + Q_2 = 10^{-3} \\ \frac{Q_1}{C_1} = \frac{Q_2}{C_2} \end{array}\right\}$$

$$C = \frac{Q}{V} \Rightarrow Q = CV = 0{,}1\ 10^{-6} \cdot 10^4 = 10^{-3}\ C$$

$$\left.\begin{array}{l} Q_1 + Q_2 = 10^{-3} \\ Q_1 = Q_2 \cdot \frac{C_1}{C_2} \end{array}\right\} \quad \begin{array}{l} Q_1 = 25 \cdot 10^{-5}\ C \\ Q_2 = 75 \cdot 10^{-5}\ C \end{array}$$

$$V = \frac{Q_1}{C_1} = 2500\ V$$

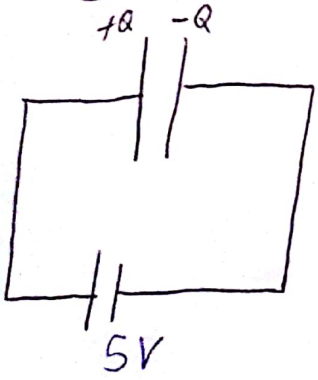
b) $U = \frac{1}{2} C V^2 \;//\; \frac{Q^2}{2C}$

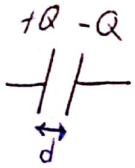
$U_1 = \frac{1}{2} C_1 V^2 =$

$U_2 = \frac{1}{2} C_2 V^2 =$

12 17/10/2017

$C = 20\ nF = 20 \cdot 10^{-9} F$

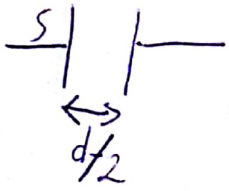




$C = \frac{Q}{V}$

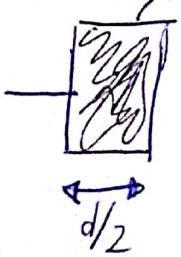
$Q = CV = 20 \cdot 10^{-9} \cdot 5 = 100 \cdot 10^{-9} C = 10^{-7} C$

$C = \varepsilon_0 \frac{S}{d}$



$\Rightarrow C_1 = \varepsilon_0 \frac{S}{d/2} = 2\varepsilon_0 \frac{S}{d} = 2C$

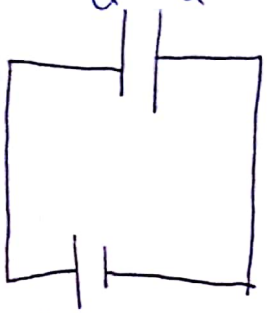
$\varepsilon_r = 2$ $\quad \varepsilon_r = \frac{\varepsilon}{\varepsilon_0}$



$C_2 = \varepsilon_r C_1 = 2 \cdot 2C = 4C = 4 \cdot 20 \cdot 10^{-9} =$

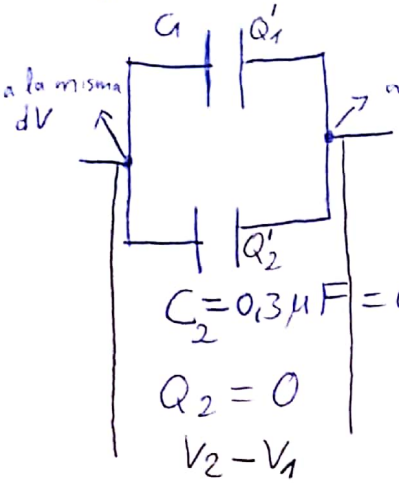
$=$

14



$V = 10000\,V$

$C_1 = 0{,}1\,\mu F = 0{,}1 \cdot 10^{-6}\,F$



$C_2 = 0{,}3\,\mu F = 0{,}3\,10^{-6}$

$Q_2 = 0$

$V_2 - V_1$

$Q_1 = C_1 \cdot V =$

$= 0{,}1 \cdot 10^{-6} \cdot 10000 =$

$= 10^{-3} C$

$V_1 = \frac{Q_1}{C_1}$

$Q'_1 + Q'_2 = Q_1$

$V_1 = \frac{Q'_1}{0{,}1 \cdot 10^{-6}} \quad V_2 = \frac{Q'_2}{0{,}3 \cdot 10^{-6}}$

$= Q_1 = 25 \cdot 10^{-5}$

$= Q_2 = 75 \cdot 10^{-5}$

$V_1 = V_2 = \frac{25 \cdot 10^{-5}}{0{,}1 \cdot 10^{-6}} = 2500\,V$

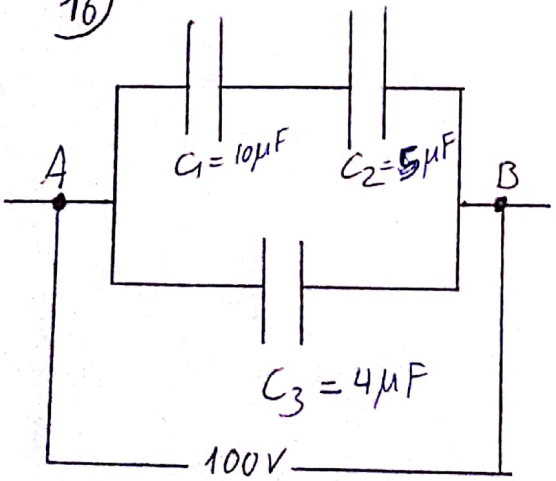
$U = \frac{1}{2}\frac{Q^2}{C} = \frac{1}{2} C V^2 = \frac{1}{2} QV$

$C = \frac{Q}{V}$

$U_1 = \frac{1}{2} C_1 V^2 = \frac{1}{2} \cdot 0{,}1 \cdot 10^{-6} \cdot (2500)^2 = 0{,}31\,J$

$U_2 = \frac{1}{2} C_2 V^2 = \frac{1}{2}\, 0{,}3 \cdot 10^{-6}\, (2500)^2 = 0{,}9375\,J$

16)



$C = \frac{Q}{V}$

$Q_1 = C_1 V = 10 \cdot 10^{-6} \cdot 100$

Resistencias en serie se suman

Conductores " " no se suman

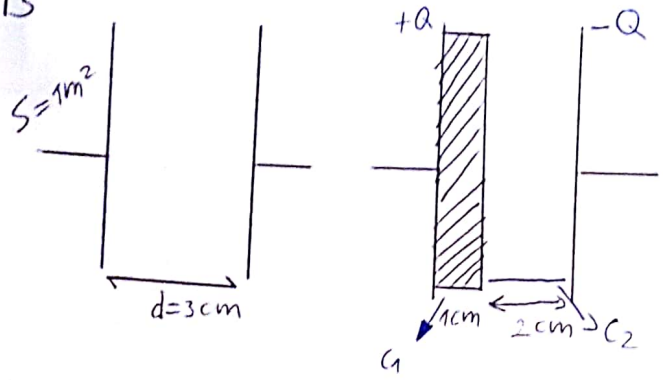
$\frac{1}{C_e} = \frac{1}{C_1} + \frac{1}{C_2} =$

$\frac{C_1 + C_2}{C_1 C_2}$

$C_e = \frac{C_1 C_2}{C_1 + C_2}$

Conductores en paralelo se suman

13



$C' = \varepsilon_r C_0$

$E = \frac{E}{\varepsilon_r}$

$V = \frac{V_0}{\varepsilon_r}$

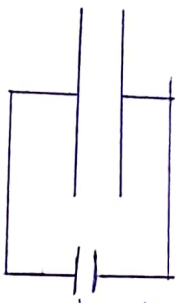
$\varepsilon_r = \frac{\varepsilon}{\varepsilon_0}$

$C_0 = \varepsilon_0 \frac{S}{d} = \frac{1}{4\pi 9\cdot 10^9} \frac{1}{0{,}03} =$

$=$

$C_0 = \frac{Q}{V_0}$

$Q = C_0 V_0 = 3\,10^{-8}\,C$



$dV = -\vec{E}\cdot d\vec{l}$

$V_0 = E_0 l \Rightarrow E_0 = \frac{V_0}{d}$

Al poner el dialectrico es como si hubieran 2 condensadores

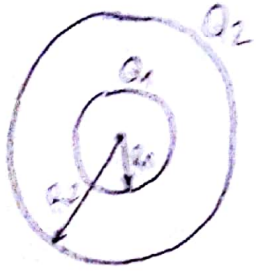
$C_1 = \varepsilon \frac{1}{1}$

$C_2 = \varepsilon_0 \frac{1}{2}$

$\frac{1}{Ce} = \frac{1}{C_1} + \frac{1}{C_2}$ $\quad Ce = \frac{1}{C_1} + \frac{1}{C_2}$ $\quad Ce = \frac{C_1 C_2}{C_1 + C_2}$

Fundamentos físicos de la informática. Kenny Berrones 5 16/10/17

a)



$R_1 = 10\,cm = 0{,}1\,m$ $\quad Q_2 = 10^{-10}\,C$

$R_2 = 20\,cm = 0{,}2\,m$ $\quad V_1 - V_2 = 10000\,V$

$Q_1 = ?$

$V = \frac{Q_2}{4\pi R^2}$

a) La carga Q_1 de la superficie interior.

$V = K \cdot \frac{Q}{R}$ $\qquad V_1 - V_2 = 10000\,V$

$$K \cdot \frac{Q_1}{R_1} - K \cdot \frac{Q_2}{R_2} = 10000$$

$$K\left(\frac{Q_1}{R_1} - \frac{Q_2}{R_2}\right) = 10000$$

$$\frac{Q_1}{R_1} - \frac{Q_2}{R_2} = \frac{10000}{K}$$

$$Q_1 = \frac{10000\, R_1 R_2}{K} + Q_2$$

$$Q_1 = \frac{10000 \cdot 0{,}1 \cdot 0{,}2}{9 \cdot 10^9} + 10^{-10} = 2{,}23 \cdot 10^{-8}\,C$$

$$V_1 = K\frac{Q_1}{R_1} + K\frac{Q_2}{R_2}$$

$$V_2 = K\frac{Q_2}{R_2} + K\frac{Q_1}{R_2}$$

$$V_1 - V_2 = 10000$$

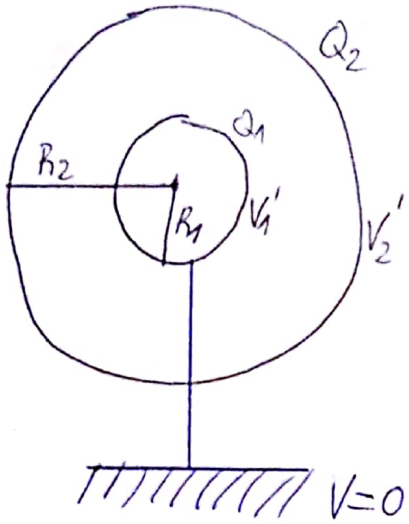
$$K\frac{Q_1}{R_1} + K\frac{Q_2}{R_2} - K\frac{Q_2}{R_2} + K\frac{Q_1}{R_2} = 10000$$

$$K\left(\frac{Q_1}{R_1} + \frac{Q_1}{R_2}\right) = 10000$$

$$Q_1\left(\frac{1}{R_1} - \frac{1}{R_2}\right) = \frac{10000}{K} \Rightarrow$$

b)

Si la superficie interna se conecta a la tierra a que potencial queda la superficie externa.



$R_1 = 0,1\ m$

$R_2 = 0,2\ m$

Valores iniciales de las cargas: $Q_1 = 2,22 \cdot 10^{-7} C$

$Q_2 = 10^{-10} C$

b) $V_1' = K \cdot \frac{Q_1'}{R_1} + K \frac{Q_2'}{R_2} = 0$

$V_2' = K \frac{Q_1'}{R_2} + K \frac{Q_2'}{R_2}$

$Q_2' = Q_2 \Rightarrow$ Porque la esfera exterior no se ha conectado a ~~nada~~ la tierra.

$\cancel{K} \cdot \frac{Q_1'}{R_1} = -\frac{\cancel{K} Q_2'}{R_2}$

$Q_1' = -Q_2 \frac{R_1}{R_2} = -10^{-10} \cdot \frac{0,1}{0,2} =$

$= -0,5 \cdot 10^{-10} C \Rightarrow -5 \cdot 10^{-11} C$

↳ la carga es negativa pq la carga Q_2 atrae cargas positivas

$V_2' = K \cdot \frac{Q_1' + Q_2'}{R_2} = \cancel{9 \cdot 10^9}$

$= 9 \cdot 10^9 \frac{(-0,5 \cdot 10^{-10} + 10^{-10})}{0,2} =$

$= [2,25\ V]$

Si conectamos una carga a tierra los e^- de la tierra pasan a la carga o al contrario, esto lo hace para conseguir 0

$\Rightarrow \frac{10000}{K} = Q_1 \cdot 5$

$Q_1 = 2,22 \cdot 10^{-7} C$