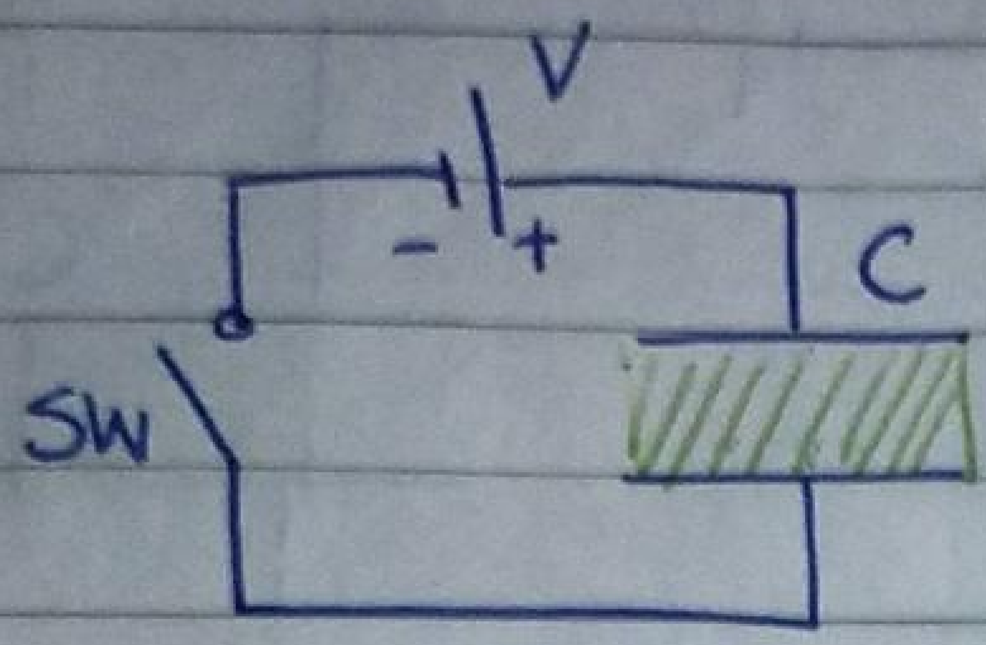
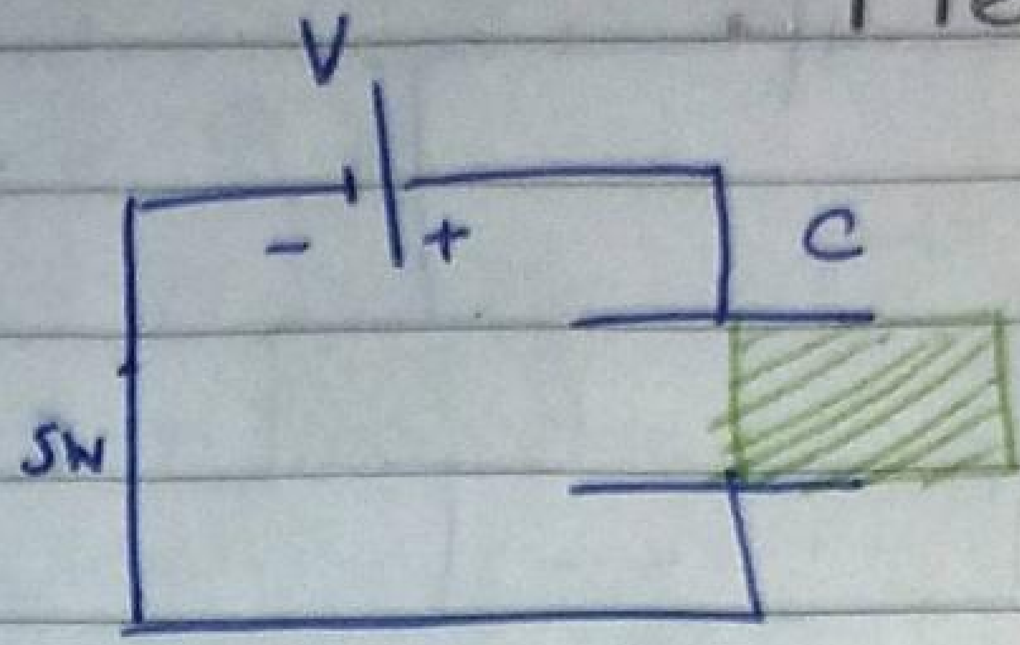
TP6 - 2do intento.

Melina Sol Fleitas

1)



①



②

DATOS
$$\begin{cases} A = A \\ \varepsilon_r = 5{,}3 \\ C = 0{,}000000089\ F \\ \varepsilon_0 = 8{,}85 \times 10^{-12}\ \frac{F}{m} \\ V = 165{,}1\ V \end{cases}$$

Calculo las Cargas $\xrightarrow{\text{sin dieléctrico}}$ $Q = C.V$

$Q = 0{,}000000089\ F \cdot 165{,}1\ V$

$\boxed{Q = 1{,}46939 \times 10^{-5}\ C}$

↓ con dieléctrico

$Q_0 = C_0 V$

$C = C_0 K$

$\downarrow K = \varepsilon_r$

$C = C_0 \varepsilon_r$

$\frac{C}{\varepsilon_r} = C_0$

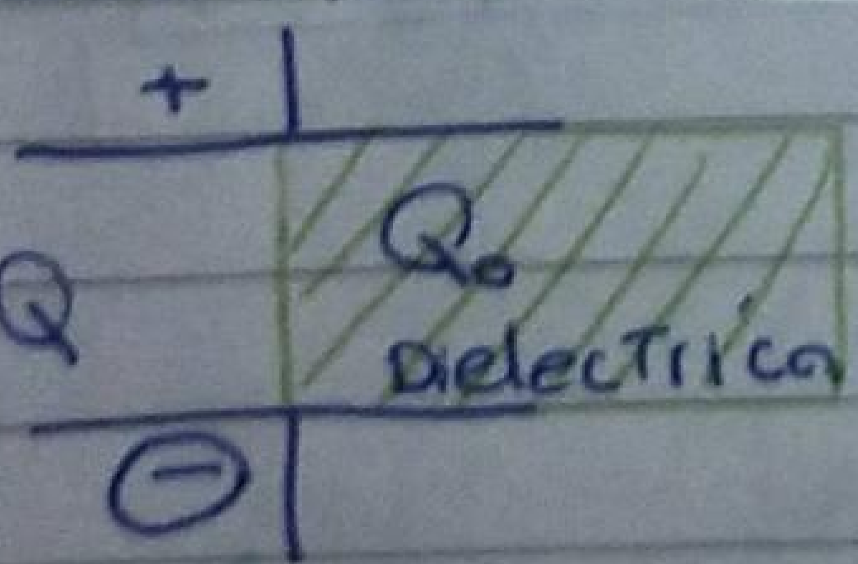
$Q_0 = \frac{C}{\varepsilon_r} V$

$\boxed{Q_0 = \frac{0{,}000000089}{5{,}3} \cdot 165{,}1 = 2{,}77243 \times 10^{-6}\ C}$

(ambas caras) → $Q_T = Q + Q_0$

$Q_T = 1{,}46939 \times 10^{-5} + 2{,}77243 \times 10^{-6}$

cara inferior



$\boxed{Q_T = 1{,}7466 \times 10^{-5}\ C}$

en c/cara

$\frac{Q_T}{2} = \frac{1{,}7466 \times 10^{-5}}{2} = 8{,}733 \times 10^{-6}$

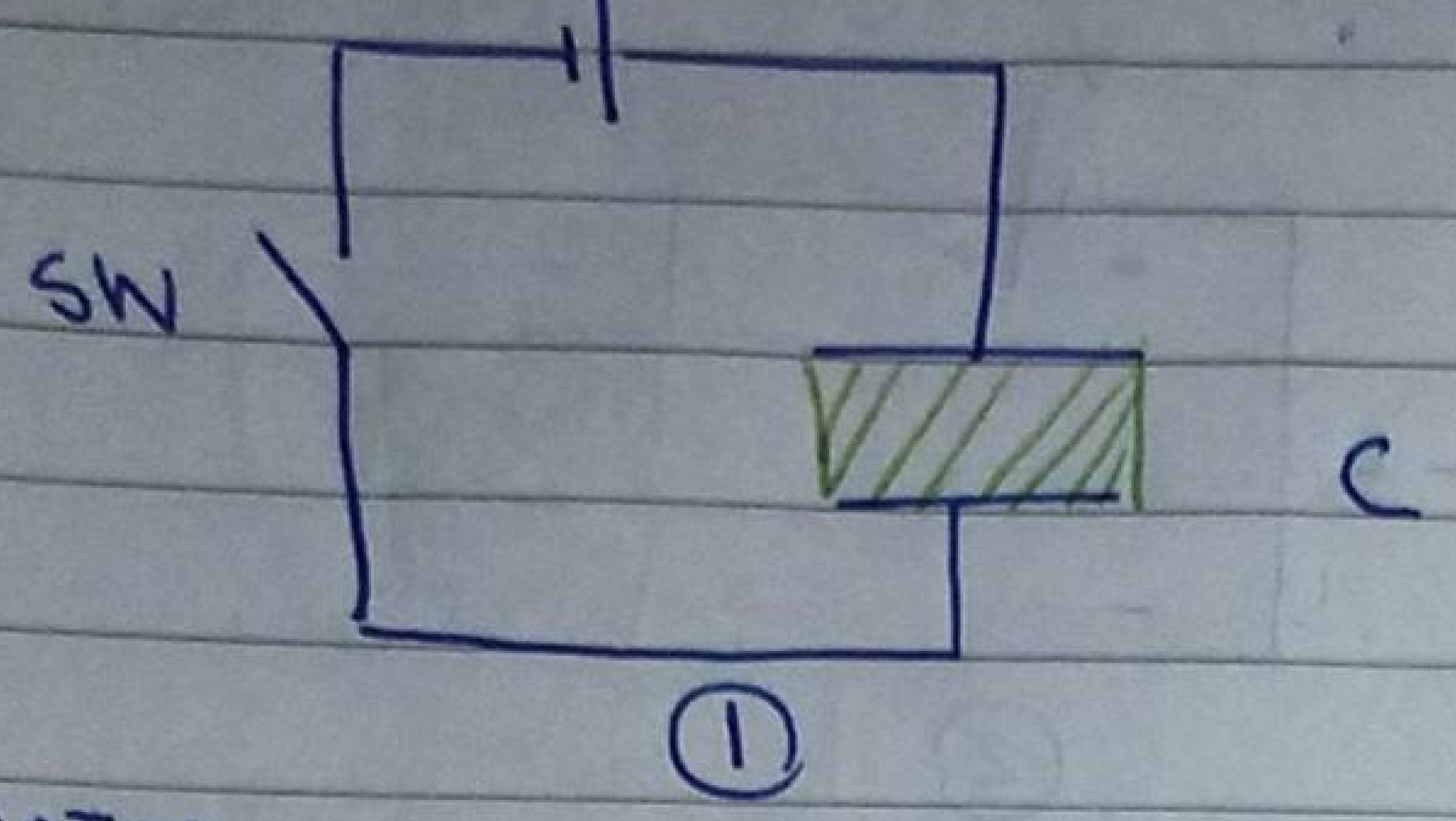
$\Rightarrow RTA = -\frac{Q_T}{2} = -8{,}733 \times 10^{-6}$

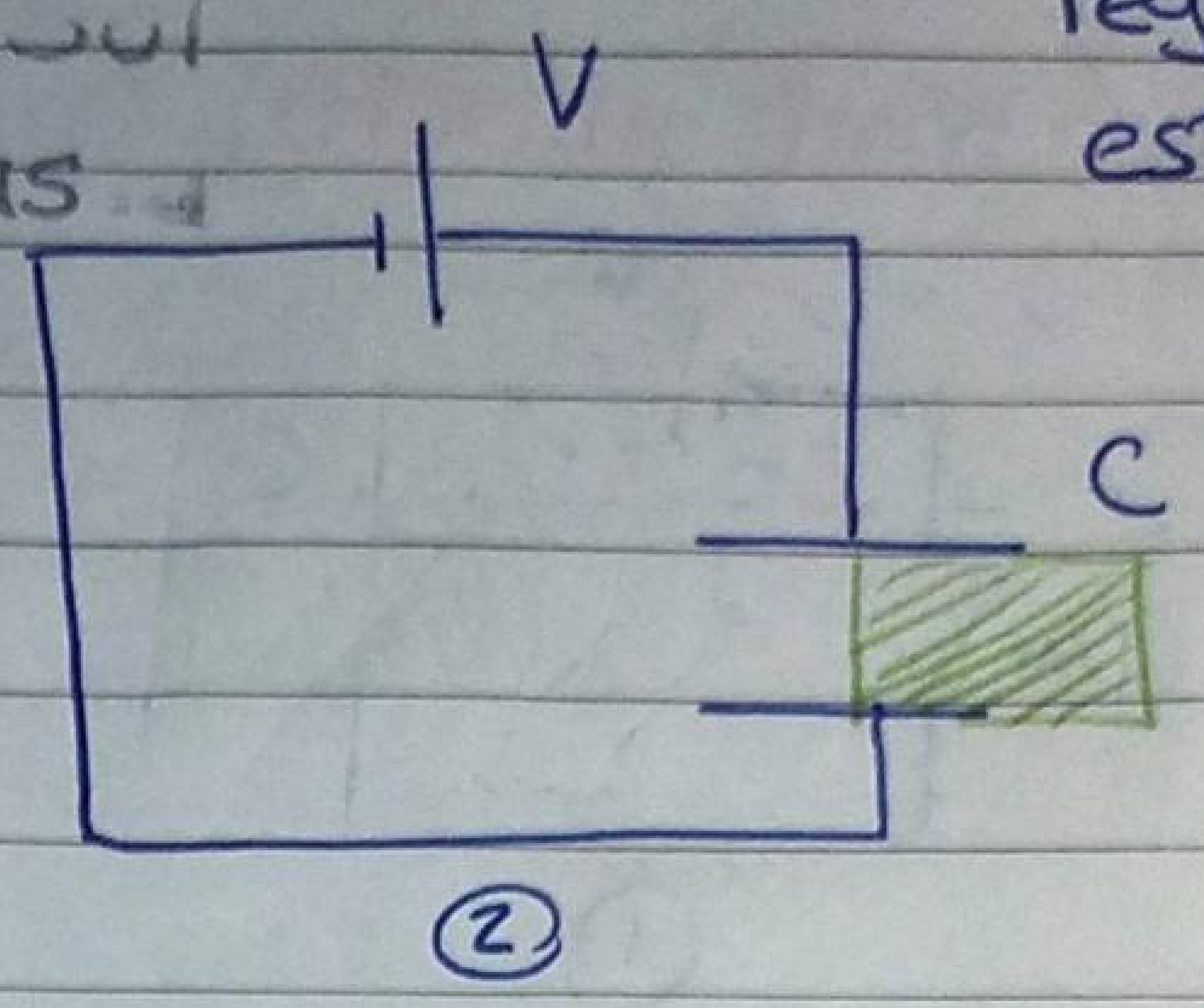
$\boxed{RTA = -0{,}000008733\ C}$

carga de la cara inferior

2) Fleitas

régimen estacionario





DATOS

$A = 0{,}16\ m^2 = Sup$
$\varepsilon_r = 5$
$C = 0{,}0000000090\ F$
$\varepsilon_0 = 8{,}85 \times 10^{-12}\ F/m$
$V = 163{,}1 V$

$C = C_0 K$
$\downarrow K = \varepsilon_r$
$C = C_0 \varepsilon_r$
$\boxed{\frac{C}{\varepsilon_r} = C_0}$

- $Q_0 = C_0 V$

$Q_0 = \left(\frac{C}{\varepsilon_r}\right) V$

$Q_0 = \left(\frac{0{,}0000000090}{5}\right) 163{,}1 V$

$\boxed{Q_0 = 2{,}9358 \times 10^{-6} C}$

Por ley de gauss

$\oint_{SG} \bar{E} \cdot ds = \frac{Q}{\varepsilon}$

$E \cdot S = \frac{Q}{\varepsilon}$

$E = \frac{Q}{\varepsilon S}$

$\Rightarrow \boxed{E = \frac{Q_0}{A (\varepsilon_r \cdot \varepsilon_0)}}$

- $\bar{D} = \varepsilon_0 \varepsilon_r \bar{E}$

$\bar{D} = \cancel{\varepsilon_0} \cancel{\varepsilon_r} \cdot \left(\frac{Q_0}{A \cancel{\varepsilon_r} \cancel{\varepsilon_0}}\right)$

$\bar{D} = \frac{Q_0}{A}$

$\bar{D} = \frac{2{,}9358 \times 10^{-6}\ C}{0{,}16\ m^2}$

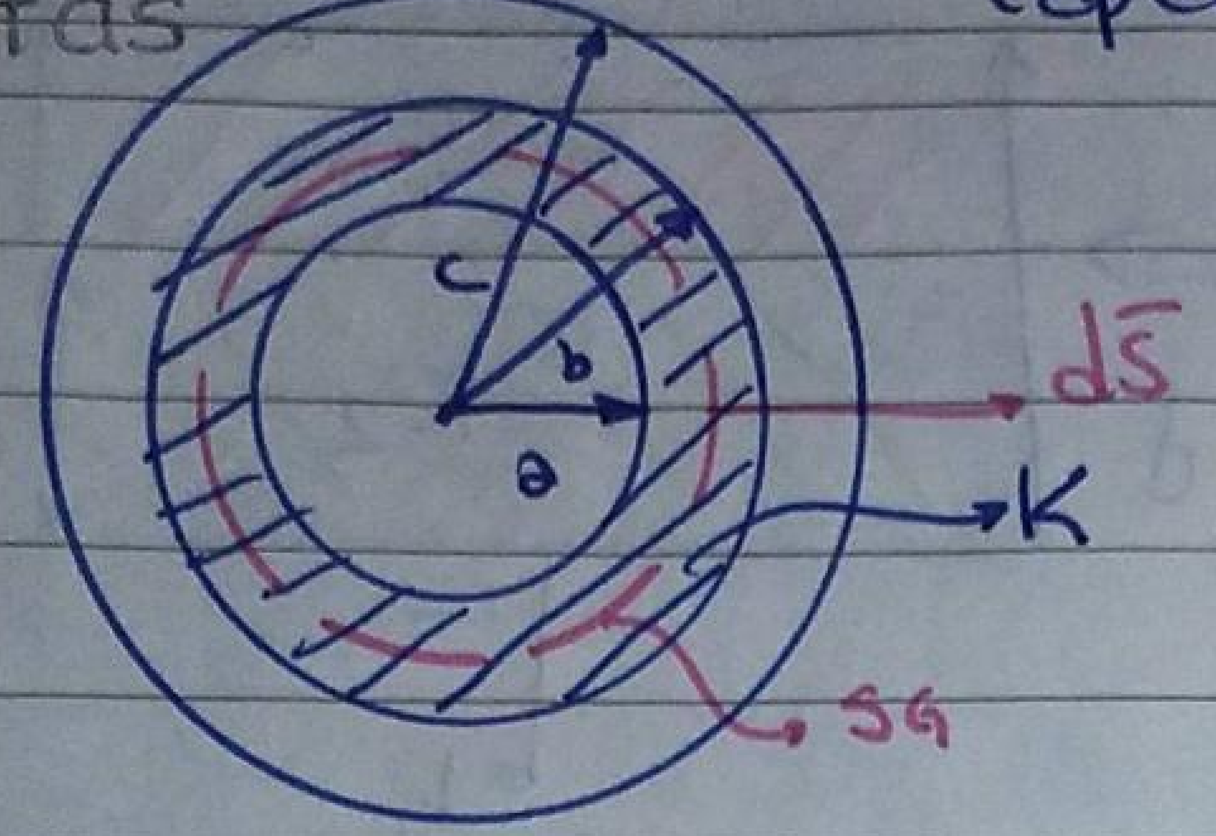
$|\bar{D}| = 1{,}8348875 \times 10^{-5}\ \frac{C}{m^2} \simeq 0{,}0000183\ C/m^2$

Melina Sol
Fleitas

capacitor esferico

¿$V_a - V_c$?

3)



$\varepsilon_r = 8,6$

$Q = 0,000000014\ C$

$a = 0,008\ m$

$b = 0,026\ m$

$c = 0,0522\ m$

$$\oint_{SG} \bar{D} \cdot d\bar{s} = Q$$

$$D \cdot S = Q$$

$$\boxed{D = \frac{Q}{4\pi r^2}} \longrightarrow E = \frac{D}{\varepsilon} \longrightarrow E = \frac{1}{\varepsilon}\left(\frac{Q}{4\pi r^2}\right)$$

con Dielectrico $(a \to b)$

$\varepsilon = \varepsilon_0 \cdot \varepsilon_r$

sin dielectrico $(b \to c)$ $\quad E = \frac{1}{\varepsilon_0}\left(\frac{Q}{4\pi r^2}\right)$

$$\Rightarrow V_{ca} = V_a - V_c$$

$$V_{ca} = (V_a - V_b) + (V_b - V_c)$$

$$V_{ca} = -\int_b^a \frac{Q\ dr}{4\pi r^2 \varepsilon_0 \varepsilon_r} - \int_c^b \frac{Q\ dr}{4\pi r^2 \varepsilon_0}$$

integral indefinida

$$\int \frac{dr}{r^2} = -\frac{1}{r} + C$$

$$V_{ca} = -\frac{Q}{4\pi\varepsilon_0}\left[\left(\frac{-1}{\varepsilon_r r}\right)\Bigg|_b^a + \left(\frac{-1}{r}\right)\Bigg|_c^b\right]$$

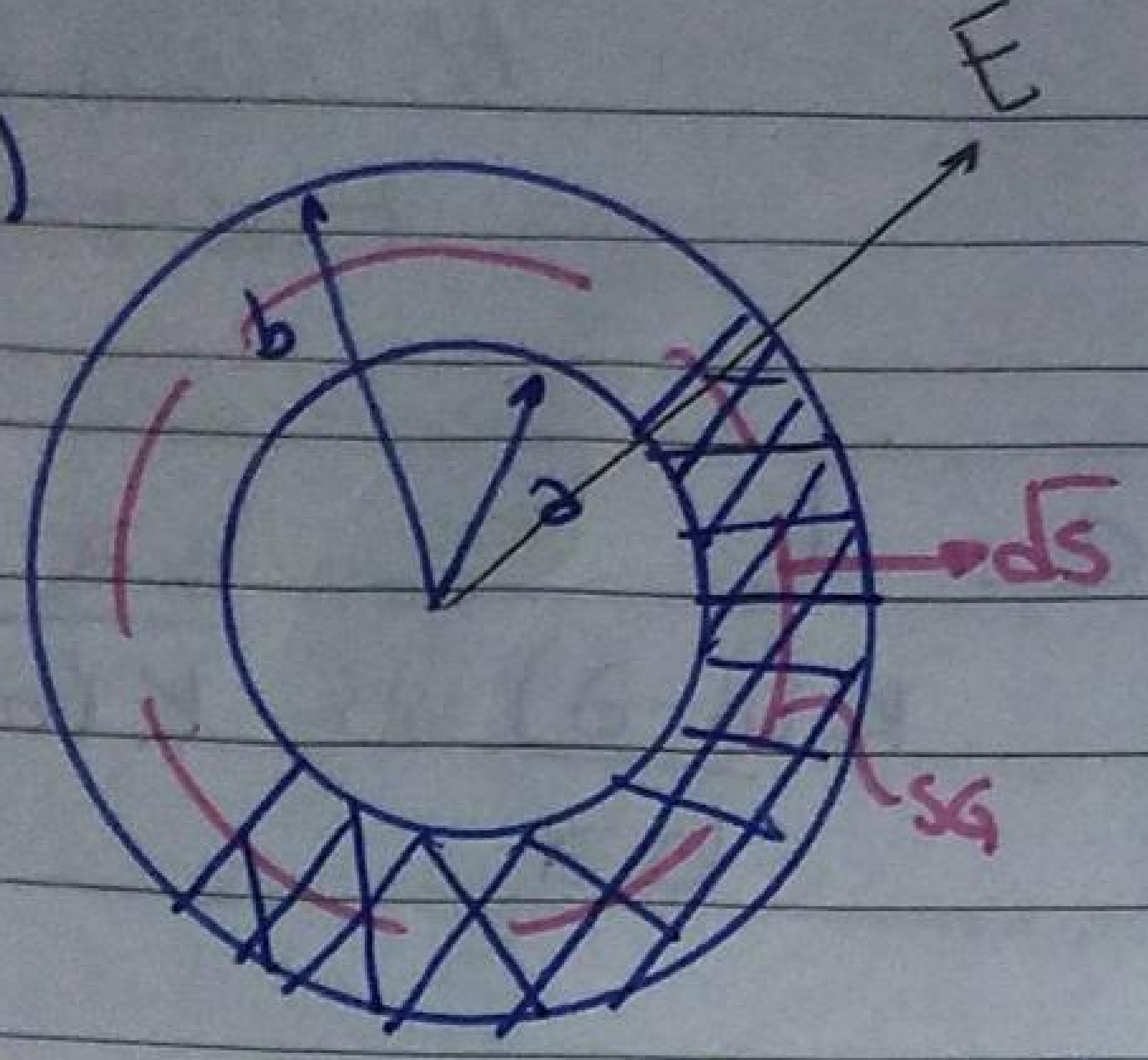
$$V_{ca} = \cancel{-}\frac{Q}{4\pi\varepsilon_0}\,\cancel{(-1)}\left(\frac{1}{\varepsilon_r r}\Bigg|_b^a + \frac{1}{r}\Bigg|_c^b\right)$$

$$V_{ca} = \frac{Q}{4\pi\varepsilon_0}\left[\left(\frac{1}{\varepsilon_r a} - \frac{1}{\varepsilon_r b}\right) + \left(\frac{1}{b} - \frac{1}{c}\right)\right]$$

$$V_{ca} = \frac{0,000000014}{4\pi\ 8,85 \times 10^{-12}}\left[\left(\frac{1}{8,6 \cdot 0,008} - \frac{1}{8,6 \cdot 0,026}\right) + \left(\frac{1}{0,026} - \frac{1}{0,0522}\right)\right]$$

$$\boxed{V_{ca} = 3696,88\ V \cong 3697\ V}$$

4)



$\varepsilon_r = 5{,}8$

$a = 0{,}04\ m$

$b = 0{,}06\ m$

$\varepsilon_0 = 8{,}85 \times 10^{-12}\ \frac{F}{m}$

Supongo que el capacitor es esferico

Melina Sol Fleitas

① calcular $\bar{E}$ por ley de gauss $\Phi = \oint_{SG} \bar{E}\, d\bar{S} = \frac{Q_{neta}}{\varepsilon_0}$

$$\Rightarrow E \cdot \int dS \cdot 1 = \frac{Q}{\varepsilon_0}$$

$$E = \frac{Q}{\varepsilon_0 S}$$

$$E = \frac{Q}{4\pi R^2 \varepsilon_0}$$

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

$$\boxed{E = \frac{QK}{R^2}}$$

② Calcular $V_a - V_b = -\int_b^a \bar{E}\, d\bar{l}$

$$V_{ba} = -\int_b^a \frac{QK}{R^2} \cdot dR$$

$$V_{ba} = -QK \int_b^a \frac{dR}{R^2}$$

$$V_{ba} = \cancel{-}QK \left(\cancel{-}\frac{1}{R}\right)\Bigg|_b^a$$

$$V_{ba} = QK \left(\frac{1}{a} - \frac{1}{b}\right)$$

$$\boxed{V_{ba} = QK \left(\frac{b-a}{b \cdot a}\right)}$$

Scanned by TapScanner

Melina Sol
Fleitas

③ Buscar la capacidad

$$C = \frac{Q}{V} = \frac{\cancel{Q}}{K \cancel{Q} \cdot \left(\frac{b-a}{b.a}\right)} \Rightarrow \boxed{C = \frac{1}{\frac{K(b-a)}{b.a}} \frac{ba}{ba} = \frac{b.a}{K(b-a)}}$$

. Capacidad en el vacío

$$C_1 = \frac{b.a}{K(b-a)} = 4\pi \varepsilon_0 \frac{b \cdot a}{(b-a)}$$

. Capacidad con dieléctrico

$$C_2 = \frac{b.a}{K(b-a)} = 4\pi \varepsilon \frac{b.a}{(b-a)} \xrightarrow{\varepsilon = \varepsilon_r . \varepsilon_0} C_2 = 4\pi \varepsilon_0 \varepsilon_r \frac{ba}{(b-a)}$$

$$\Rightarrow C_{sist} = \frac{C_1}{2} + \frac{C_2}{2}$$

$$C_{sist} = \frac{\cancel{4}\pi \varepsilon_0 \frac{b.a}{(b-a)}}{\cancel{2}} + \frac{\cancel{4}\pi \varepsilon_0 \varepsilon_r \frac{ba}{(b-a)}}{\cancel{2}}$$

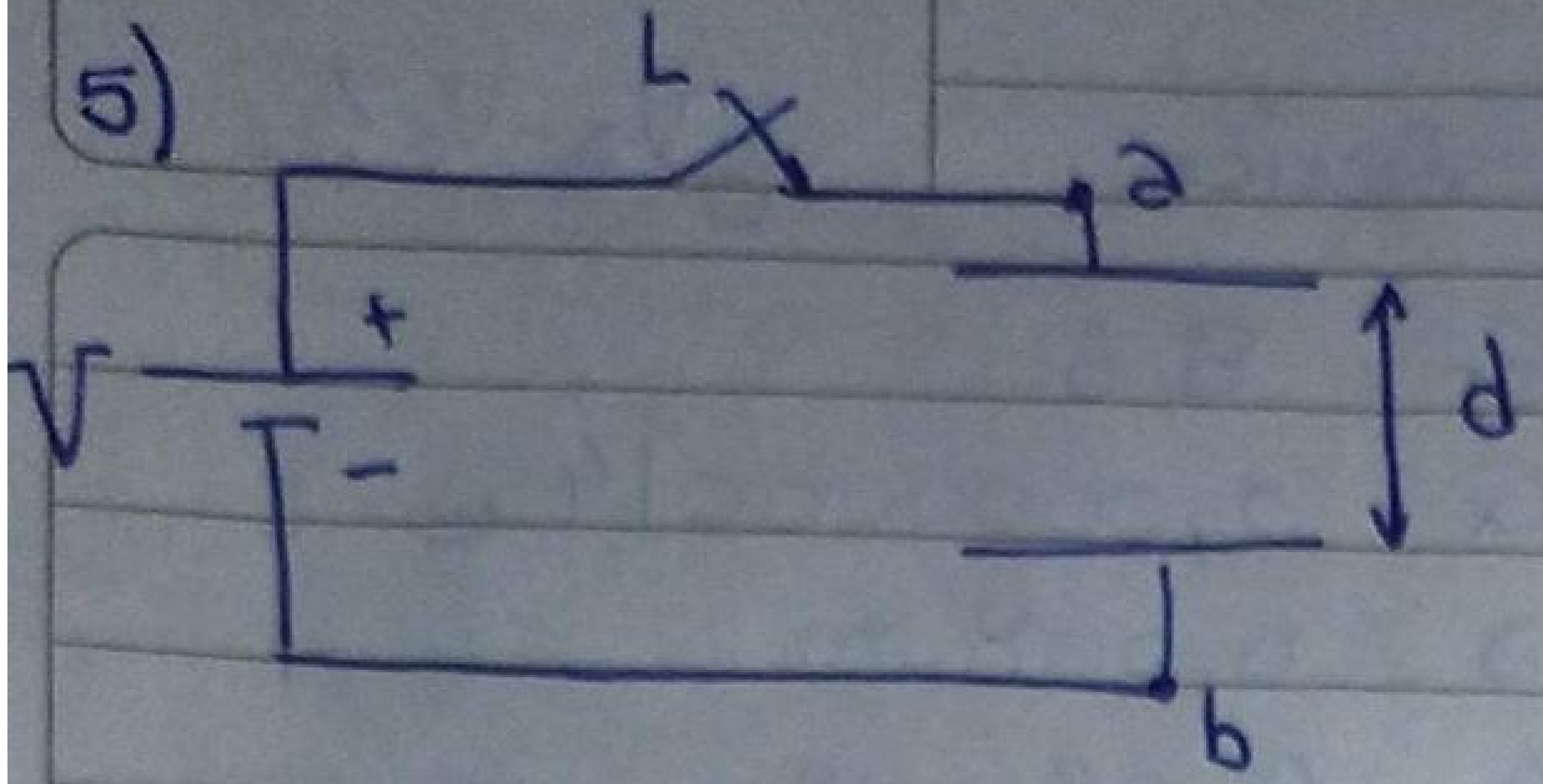
$$C_{sist} = 2\pi \varepsilon_0 \frac{ba}{(b-a)} + 2\pi \varepsilon_0 \varepsilon_r \frac{ba}{(b-a)}$$

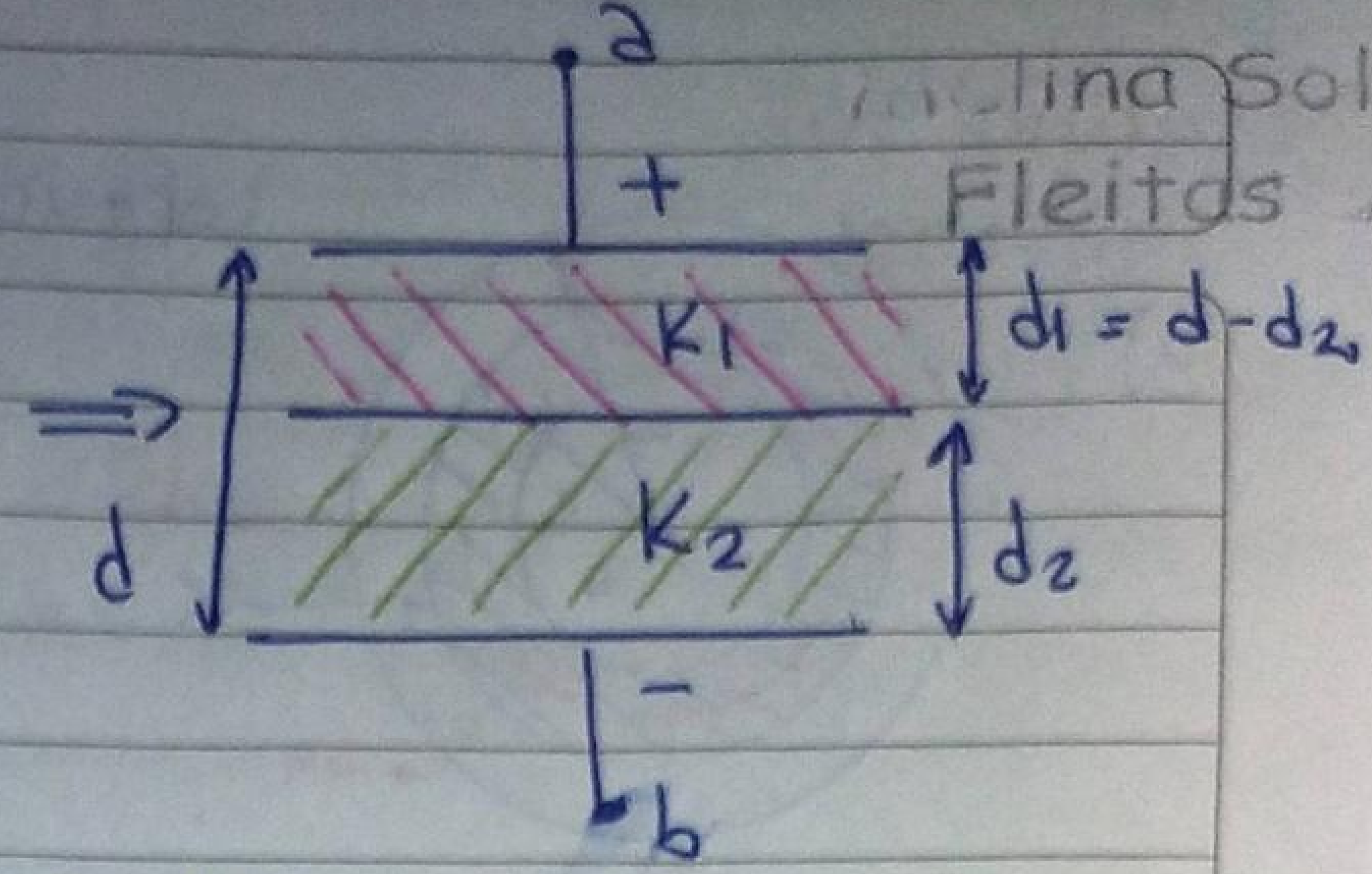
$$C_{sist} = 2\pi \varepsilon_0 \frac{ba}{(b-a)} (1 + \varepsilon_r)$$

$$C_{sist} = 2\pi \, 8{,}85 \times 10^{-12} \cdot \frac{0{,}04 . 0{,}06}{0{,}06 - 0{,}04} (1 + 5{,}8)$$

$$\boxed{C_{sist} = 4{,}537 \times 10^{-11}}$$

5)





DATOS

$A = 0{,}001389\ m^2$

$d = 0{,}0297\ m$

$V = 126\ V$

$K_1 = 5{,}6$

$K_2 = 5{,}9$

$d_2 = 0{,}0040\ m$

→ Dieléctricos en serie

$V' = V_1 + V_2$

$\boxed{E = \frac{D}{\varepsilon}} \rightarrow V' = E_1 d_1 + E_2 d_2$

$V' = \frac{D_1}{\varepsilon_1} d_1 + \frac{D_2}{\varepsilon_2} d_2$

$\boxed{\varepsilon = \varepsilon_0 K} \rightarrow V' = \frac{D_1}{\varepsilon_0 K_1} d_1 + \frac{D_2}{\varepsilon_0 K_2} d_2$

$\boxed{D_1 = D_2 = D} \rightarrow V' = \frac{D\, d_1}{\varepsilon_0 K_1} + \frac{D\, d_2}{\varepsilon_0 K_2}$

C.A

$\oint D \cdot dA = Q$

$D \cdot A = Q \leftarrow Q = CV$

$DA = (C \cdot V)$

$D \cdot A = \left(\frac{A \varepsilon_0}{d}\right) V \leftarrow C = \frac{A \cdot \varepsilon_0}{d}$

$D = \frac{\cancel{A} \varepsilon_0}{d} V \cdot \frac{1}{\cancel{A}}$

$\boxed{D = \frac{V \cdot \varepsilon_0}{d}}$

$V' = D\left(\frac{d_1}{\varepsilon_0 K_1} + \frac{d_2}{\varepsilon_0 K_2}\right)$

$V' = \left(\frac{V \cancel{\varepsilon_0}}{d}\right) \cdot \frac{1}{\cancel{\varepsilon_0}} \left(\frac{d_1}{K_1} + \frac{d_2}{K_2}\right)$

$V' = \frac{V}{d}\left(\frac{d_1}{K_1} + \frac{d_2}{K_2}\right)$

$V' = \frac{126}{0{,}0297} \cdot \left(\frac{d - d_2}{5{,}6} + \frac{d_2}{5{,}9}\right)$

$V' = \frac{126}{0{,}0297}\left(\frac{0{,}0297 - 0{,}0040}{5{,}6} + \frac{0{,}0040}{5{,}9}\right)$

$\boxed{V' = 22{,}3459\ V \cong 22{,}35\ V}$