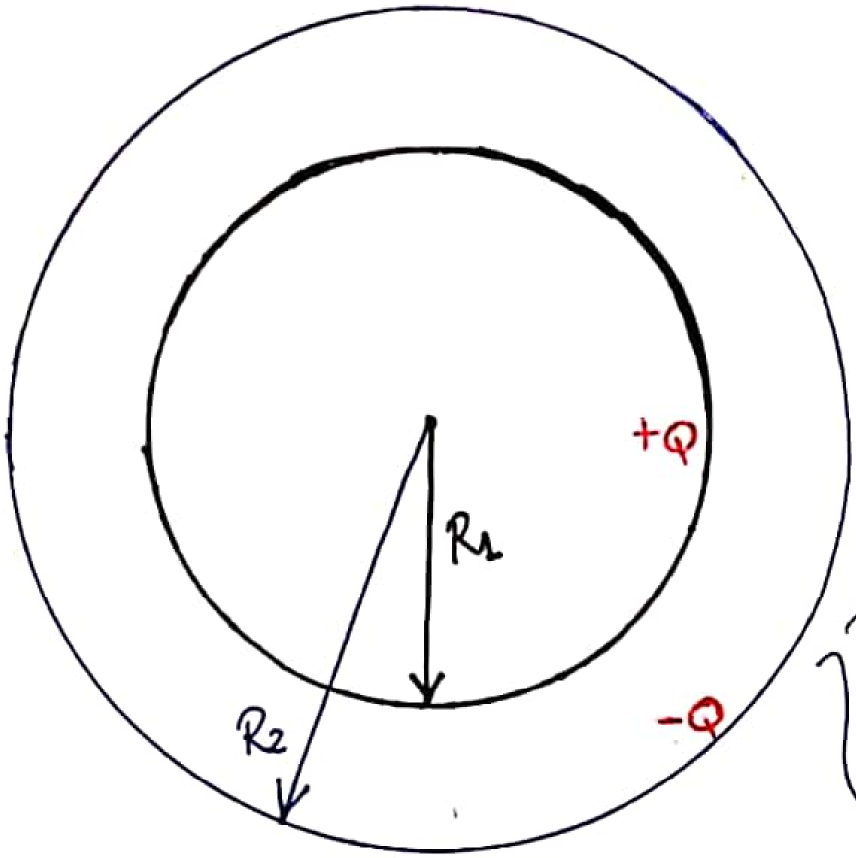
Pauta P2



$$\sigma_{R_1} = \frac{Q}{2\pi R_1 L}$$

$$\sigma_{R_2} = \frac{-Q}{2\pi R_2 L}$$

A] Calcular campo eléctrico

$r < R_1 \Rightarrow \vec{E}(r) = E(r)\,\hat{r} \Longrightarrow \oiint \vec{E}\cdot d\vec{S} = E(r)\cdot 2\pi r l$

$Q_{enc} = 0$

Por ser conductor Q se almacena en la superficie

Luego, $E(r)\cdot 2\pi r l = \frac{0}{\epsilon_0} \Rightarrow \boxed{\vec{E}(r) = 0\,\hat{r}}$

Para $R_1 < r < R_2$

$$\Phi = \oiint \vec{E} \cdot \vec{ds} = 2\pi r \ell\, E(r) = \frac{Q}{\epsilon_0}\left(\frac{\ell}{L}\right)$$

$$\Rightarrow \boxed{\vec{E} = \frac{Q}{2\pi\epsilon_0 L r}\,\hat{r}} \quad R_1 < r < R_2$$

En $r > R_2$

$$\Phi = 2\pi r \ell\, E(r) = \frac{Q - Q}{\epsilon_0} = 0 \Rightarrow \boxed{\vec{E} = 0\,\hat{r}} \quad r > R_2$$

B] Capacitancia y Energía

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

$$\Delta V = V(R_2) - V(R_1) = -\int_{R_1}^{R_2} \vec{E} \cdot \vec{d\ell} = -\int_{R_1}^{R_2} \frac{Q}{2\pi\epsilon_0 L r}\, dr$$

$$\Delta V = \frac{-Q}{2\pi\epsilon_0 L} \ln\left(\frac{R_2}{R_1}\right)$$

$$\Rightarrow C = \frac{Q}{|\Delta V|} = \frac{\cancel{Q} \cdot 2\pi\epsilon_0 L}{\cancel{Q} \ln(R_2/R_1)} \Rightarrow \boxed{C = \frac{2\pi\epsilon_0 L}{\ln(R_2/R_1)}}$$

Energía

↳ Directo, usando los resultados anteriores

$$U = \frac{1}{2}\frac{Q^2}{C} = \boxed{\frac{Q^2}{4\pi\epsilon_0 L}\ln\left(\frac{R_2}{R_1}\right) = U}$$

$$= \frac{1}{2}\frac{Q^2}{2\pi\epsilon_0 L}\ln\left(\frac{R_2}{R_1}\right)$$