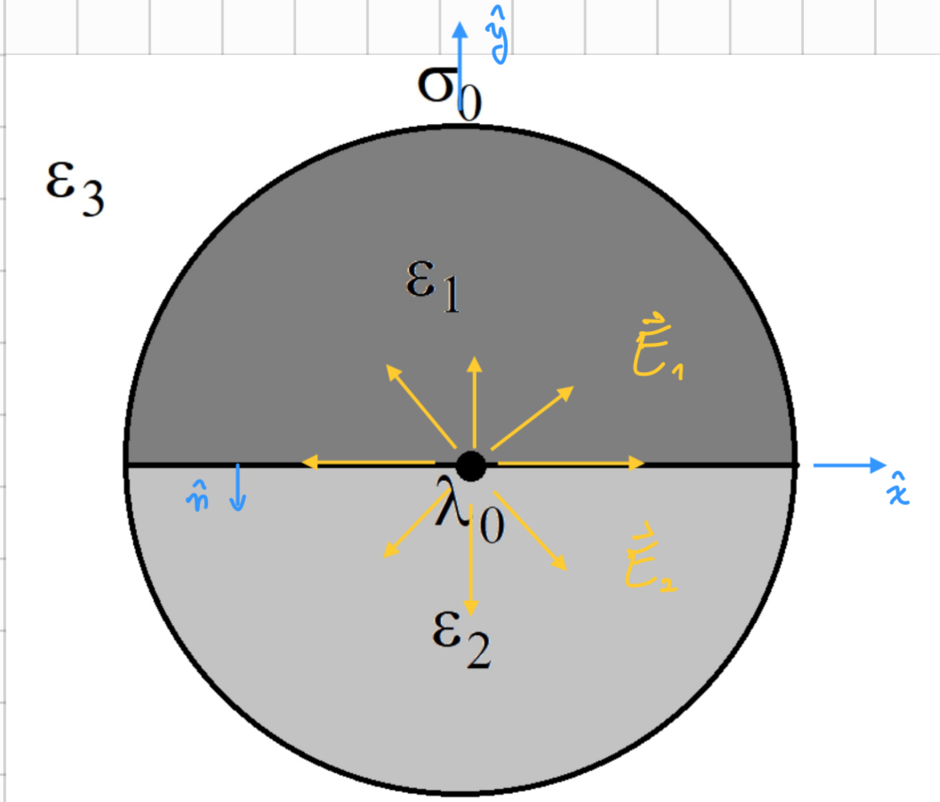
a)



+0.5

$\boxed{\text{Por simetría el campo es radial.}}$

A priori E1 y E2 son diferentes, lo mismo para D1 y D2

CB

$D_2^{\perp} - D_1^{\perp} = \sigma_l$ $\qquad\qquad$ $E_2^{\parallel} = E_1^{\parallel}$

Notar que en la interfaz el campo es tangencial a esta, por lo que

$D_2^{\perp} = D_1^{\perp} = 0$

$\therefore \quad E_{1,2}^{\parallel} = \vec{E}_{1,2}$ en la interfaz

Además

$E_2^{\parallel} = E_1^{\parallel} \Rightarrow \boxed{\vec{E}_2 = \vec{E}_1 = \vec{E}}$ +0.5

E es igual dentro de todo el cilindro hueco.
Como se cumple $\vec{D} = \varepsilon \vec{E}$
D es diferente en cada dieléctrico, por lo tanto

$$\vec{D} = \begin{cases} D_1(r)\,\hat{r} & \varphi \in [0, \pi) \\ D_2(r)\,\hat{r} & \varphi \in (\pi, 2\pi) \end{cases} \qquad r < R$$

Gauss

$$\oint_S \vec{D}\cdot d\vec{S} = Q_{enc}^{(l)}$$

$$\int_{-\frac{L}{2}}^{\frac{L}{2}}\int_0^{\pi} D_1\,\hat{r}\cdot\hat{r}\,r\,d\varphi\,dz + \int_{-\frac{L}{2}}^{\frac{L}{2}}\int_{\pi}^{2\pi} D_2\,\hat{r}\cdot\hat{r}\,r\,d\varphi\,dz = L\lambda_0$$; El flujo sobre las tapas es 0.

$$D_1\pi\cancel{L}r + D_2\pi\cancel{L}r = \cancel{L}\lambda_0 \quad +0.5$$

$$\vec{D} = \varepsilon\vec{E} \Rightarrow \varepsilon_1 E\pi r + \varepsilon_2 E\pi r = \lambda_0$$

$$(\varepsilon_1+\varepsilon_2)E\pi r = \lambda_0$$

$$\boxed{\vec{E}(r) = \frac{\lambda_0\,\hat{r}}{(\varepsilon_1+\varepsilon_2)\pi r}} \quad r<R \quad +0.25$$

$\therefore$

$$\boxed{\vec{D} = \begin{cases} \dfrac{\varepsilon_1\lambda_0\,\hat{r}}{(\varepsilon_1+\varepsilon_2)\pi r} & \varphi\in[0,\pi) \\ \dfrac{\varepsilon_2\lambda_0\,\hat{r}}{(\varepsilon_1+\varepsilon_2)\pi r} & \varphi\in(\pi,2\pi) \end{cases}} \quad r<R \quad +0.65$$

$r > R$

Gauss

$$\oint_S \vec{D} \cdot d\vec{S} = Q_{enc}^{(l)}$$

$$2\pi r \cancel{L} D(r) = \cancel{L}\lambda_0 + 2\pi R \cancel{L} \sigma_0$$

$$\vec{D}(r) = \left(\frac{\lambda_0 + 2\pi R \sigma_0}{2\pi r} \right) \hat{r}$$

$$\boxed{\vec{D}(r) = \left(\frac{\lambda_0}{2\pi} + R\sigma_0 \right) \frac{\hat{r}}{r}} \quad r > R \quad +0.35$$

$$\Rightarrow \boxed{\vec{E}(r) = \left(\frac{\lambda_0}{2\pi} + R\sigma_0 \right) \frac{\hat{r}}{\varepsilon_3 r}} \quad r > R \quad +0.25$$

b)

$$\vec{P} = \vec{D} - \varepsilon_0 \vec{E}$$

$r < R$

$$\vec{P} = \begin{cases} \dfrac{\varepsilon_1 \lambda_0 \hat{r}}{(\varepsilon_1 + \varepsilon_2)\pi r} - \dfrac{\varepsilon_0 \lambda_0 \hat{r}}{(\varepsilon_1 + \varepsilon_2)\pi r} & \varphi \in [0, \pi) \\ \dfrac{\varepsilon_2 \lambda_0 \hat{r}}{(\varepsilon_1 + \varepsilon_2)\pi r} - \dfrac{\varepsilon_0 \lambda \hat{r}}{(\varepsilon_1 + \varepsilon_2)\pi r} & \varphi \in (\pi, 2\pi) \end{cases}$$

$$\boxed{\vec{P} = \begin{cases} \dfrac{(\varepsilon_1-\varepsilon_0)\lambda_0\,\hat{r}}{(\varepsilon_1+\varepsilon_2)\pi r} & \varphi \in [0,\pi) \\[2ex] \dfrac{(\varepsilon_2-\varepsilon_0)\lambda_0\,\hat{r}}{(\varepsilon_1+\varepsilon_2)\pi r} & \varphi \in (\pi, 2\pi) \end{cases} \qquad r < R}$$

$+0.65$

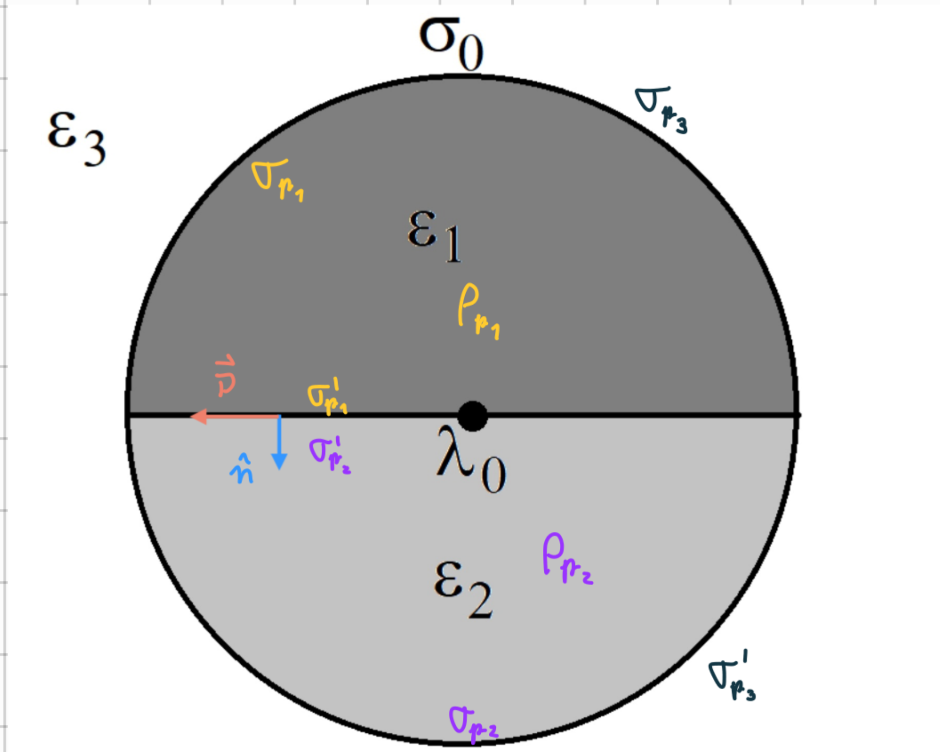
$r > R$

$$\vec{P} = \left(\frac{\lambda_0}{2\pi} + R\sigma_0\right)\frac{\hat{r}}{r} - \varepsilon_0\left(\frac{\lambda_0}{2\pi} + R\sigma_0\right)\frac{\hat{r}}{\varepsilon_3 r}$$

$$\boxed{\vec{P} = \left(1-\frac{\varepsilon_0}{\varepsilon_3}\right)\left(\frac{\lambda_0}{2\pi} + R\sigma_0\right)\frac{\hat{r}}{r}} \qquad r > R$$

$+0.35$

c)



Notar que

$\vec{P} \perp \hat{n}$

$\therefore$

$$\boxed{\sigma'_{p_1} = \sigma'_{p_2} = 0}$$

$+0.5$

$$\sigma_{p_1} = \vec{P}\Big|_{\substack{r=R \\ \varphi\in[0,\pi)}} \cdot \hat{r} = \frac{(\varepsilon_1-\varepsilon_0)\lambda_0 \hat{r}}{(\varepsilon_1+\varepsilon_2)\pi R} \cdot \hat{r}$$

$$\sigma_{p_2} = \vec{P}\Big|_{\substack{r=R \\ \varphi\in(\pi,2\pi)}} \cdot \hat{r} = \frac{(\varepsilon_2-\varepsilon_0)\lambda_0 \hat{r}}{(\varepsilon_1+\varepsilon_2)\pi r} \cdot \hat{r}$$

$$\boxed{\sigma_{p_1} = \frac{(\varepsilon_1-\varepsilon_0)\lambda_0}{(\varepsilon_1+\varepsilon_2)\pi R}}$$

$$\boxed{\sigma_{p_2} = \frac{(\varepsilon_2-\varepsilon_0)\lambda_0}{(\varepsilon_1+\varepsilon_2)\pi R}}$$

$$\sigma_{p_3} = \vec{P}\Big|_{r=R} \cdot (-\hat{r})$$

+1.0

$$\boxed{\sigma_{p_3} = \left(\frac{\varepsilon_0}{\varepsilon_3}-1\right)\left(\frac{\lambda_0}{2\pi} + R\sigma_0\right)\frac{1}{R}}$$

Las derivadas respecto a φ y z son 0.

$$\rho_{p_i} = -\nabla\cdot\vec{P} = -\frac{1}{r}\frac{\partial}{\partial r}(r P_r) + 0$$

$$= -\frac{1}{r}\frac{\partial}{\partial r}\left(\cancel{r}\,\frac{(\%)}{\cancel{r}}\right)$$

$$\rho_{p_i} = 0 \Rightarrow \boxed{\rho_{p_1} = \rho_{p_2} = \rho_{p_3} = 0}$$ +0.5