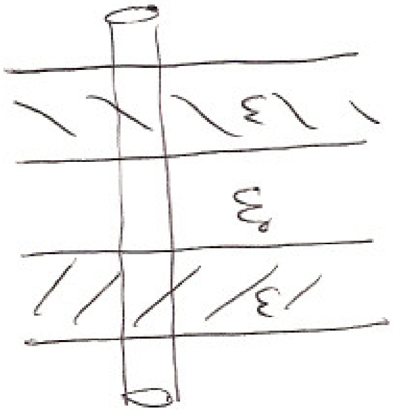
1º teste TEO – VERSÃO C (3/11/2006)

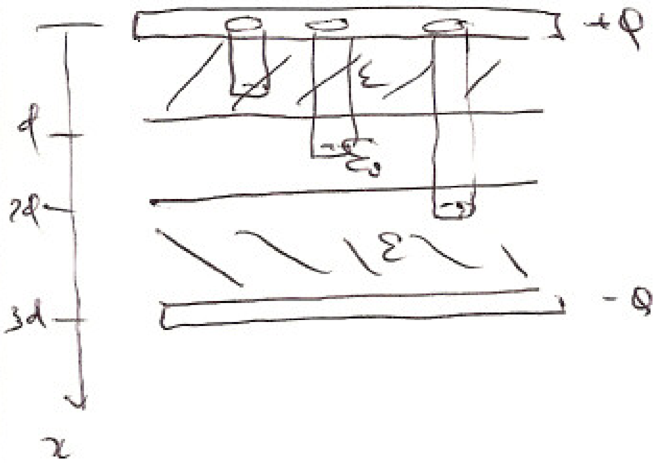
a) Por razões de simetria os campos são perpendiculares aos condutores. Usando a lei de Gauss em S



$$\int_S (\vec{D}\cdot\vec{n})\,dS = 0$$

$\Rightarrow$ Campo no exterior nulo

então usando as superfícies de Gauss indicadas podemos ver que sempre



$$\int_S (\vec{D}\cdot\vec{n})\,dS = \sigma S$$

$\Rightarrow |\vec{D}| = \sigma$ dentro do condensador.

logo $0 < x < d$

$$\vec{D} = \sigma \vec{e}_x \; ; \quad \vec{E} = \frac{\sigma}{\varepsilon}\vec{e}_x \; ; \quad \vec{P} = \frac{\varepsilon - \varepsilon_0}{\varepsilon}\sigma \vec{e}_x$$

$d < x < 2d$

$$\vec{D} = \sigma \vec{e}_x \; ; \quad \vec{E} = \frac{\sigma}{\varepsilon_0}\vec{e}_x \; ; \quad \vec{P} = 0$$

$2d < x < 3d$

$$\vec{D} = \sigma \vec{e}_x \; ; \quad \vec{E} = \frac{\sigma}{\varepsilon}\vec{e}_x \; ; \quad \vec{P} = \frac{\varepsilon - \varepsilon_0}{\varepsilon}\sigma \vec{e}_x$$

b) $$V = \int_0 \vec{E}\cdot\vec{dx} = \frac{\sigma}{\varepsilon_0} d + \frac{\sigma}{\varepsilon} d + \frac{\sigma}{\varepsilon} d$$

$$= \sigma d \left(\frac{1}{\varepsilon_0} + \frac{2}{\varepsilon} \right) = \sigma d \, \frac{2\varepsilon_0 + \varepsilon}{\varepsilon_0 \varepsilon}$$

c)

$$C = \frac{Q}{V} = \frac{\sigma A}{V} = \frac{\cancel{\sigma} A}{\cancel{\sigma} d \, \frac{2\varepsilon_0+\varepsilon}{\varepsilon_0 \varepsilon}} = \frac{\varepsilon_0 \varepsilon}{\varepsilon + 2\varepsilon_0} \frac{A}{d}$$

d) Em $x=0$: $\vec{n} = -\vec{e}_x \Rightarrow \sigma' = \vec{P}\cdot\vec{n} = -\frac{\varepsilon-\varepsilon_0}{\varepsilon}\sigma < 0$

em $x=d$ $\vec{n} = \vec{e}_x \Rightarrow \sigma' = \vec{P}\cdot\vec{n} = +\frac{\varepsilon-\varepsilon_0}{\varepsilon}\sigma > 0$

1º Teste EaO – Versão G (3/11/2006) ①

"Igual" ao C. Soluções:

a) $0 < x < d$: $\boxed{\vec{E} = \frac{\sigma}{\varepsilon_0}\,\vec{a}_x \;;\; \vec{D} = \sigma\,\vec{e}_x \;;\; \vec{P} = 0}$

e

$2d < x < 3d$; $\boxed{\vec{E} = \frac{\sigma}{\varepsilon_0}\,\vec{a}_x \;;\; \vec{D} = \sigma\,\vec{e}_x \;;\; \vec{P} = 0}$

$d < x < 2d$; $\boxed{\vec{E} = \frac{\sigma}{\varepsilon}\,\vec{a}_x \;;\; \vec{D} = \sigma\,\vec{e}_x \;;\; \vec{P} = \frac{\varepsilon - \varepsilon_0}{\varepsilon}\,\sigma\,\vec{e}_x}$

b) $\boxed{V = \sigma d \,\frac{\varepsilon_0 + 2\varepsilon}{\varepsilon_0 \varepsilon}}$

c) $\boxed{C = \frac{\varepsilon_0 \varepsilon}{2\varepsilon + \varepsilon_0}\,\frac{A}{d}}$

d) em $x = d$; $\boxed{\sigma' = -\,\frac{\varepsilon - \varepsilon_0}{\varepsilon}\,\sigma < 0}$

em $x = 2d$: $\boxed{\sigma' = \frac{\varepsilon - \varepsilon_0}{\varepsilon}\,\sigma > 0}$