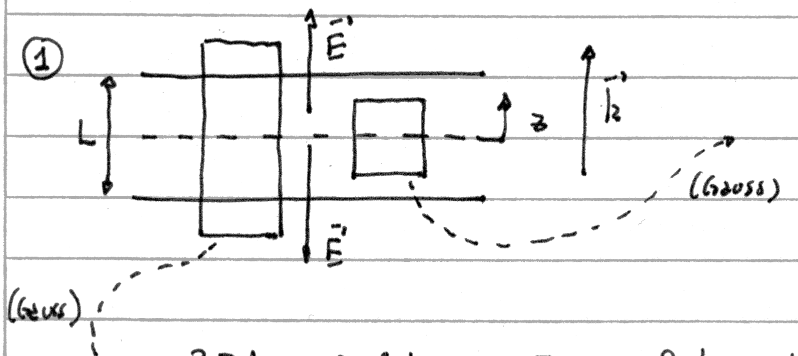
FÍSICA 3 – Primer parcial (02/10/2014)

(1)



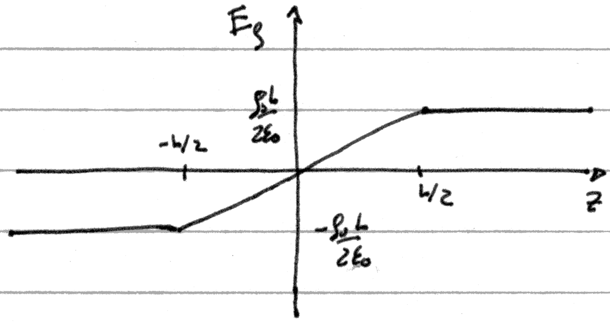
$$2EA = \rho_0 \frac{A2z}{\varepsilon_0}$$

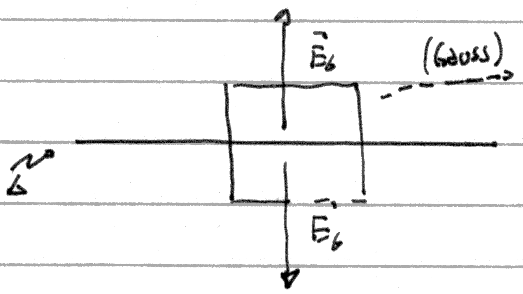
$$E(z) = \frac{\rho_0 z}{\varepsilon_0} \qquad |z| \leq L/2$$

$$2EA = \rho_0 \frac{AL}{\varepsilon_0} \qquad E(z) = \frac{\rho_0 L}{2\varepsilon_0} \qquad |z| \geq L/2$$

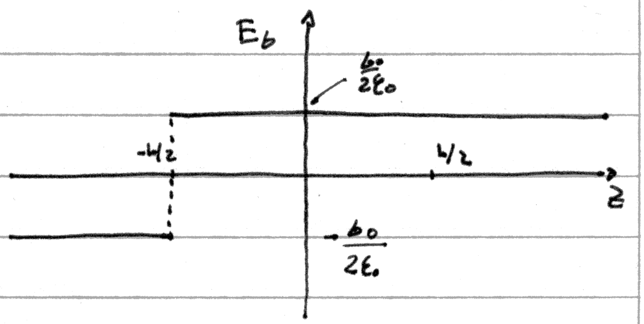
$$\boxed{\vec{E}_\rho(z) = \frac{\rho_0 z}{\varepsilon_0}\hat{z}} \qquad |z| \leq L/2$$

$$\boxed{\vec{E}_\rho(z) = \frac{\rho_0 L}{2\varepsilon_0}\,\mathrm{sgn}(z)\,\hat{z}} \qquad |z| \geq L/2$$

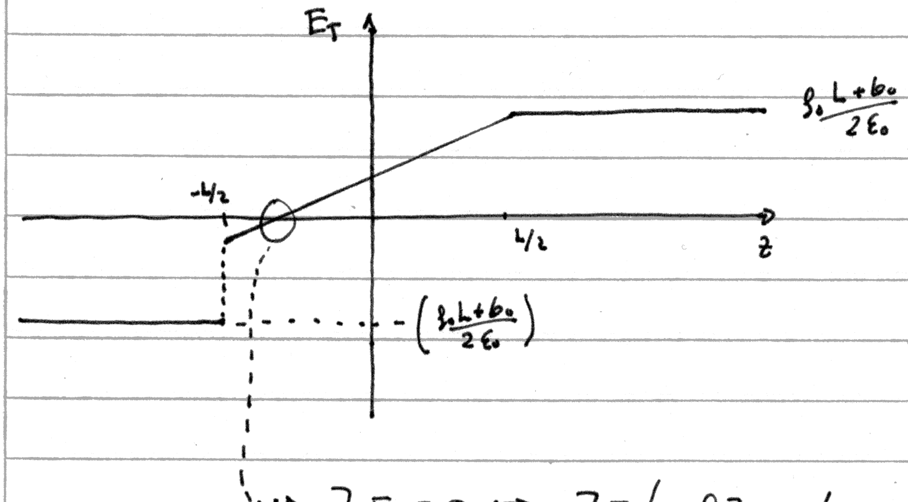




$$2E_\sigma A = \frac{\sigma_0 A}{\varepsilon_0} \qquad |\vec{E}_\sigma| = \frac{\sigma_0}{2\varepsilon_0}$$

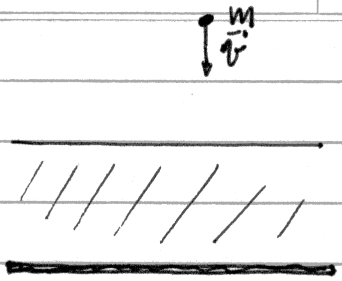


$$\vec{E}_T = \vec{E}_\rho + \vec{E}_\sigma$$



$$\exists\, E_T = 0 \iff \exists\, z \,/\, \frac{\rho_0 z}{\varepsilon_0} + \frac{\sigma_0}{2\varepsilon_0} = 0 \Rightarrow z = -\frac{\sigma_0}{2\rho_0}$$

$$\exists\, z \iff +\frac{\sigma_0}{2\rho_0} < L/2 \Rightarrow \boxed{\frac{\sigma_0}{\rho_0} < L}$$



$$\Delta E = 0$$

$$\Delta K = -\frac{1}{2} m v^2$$

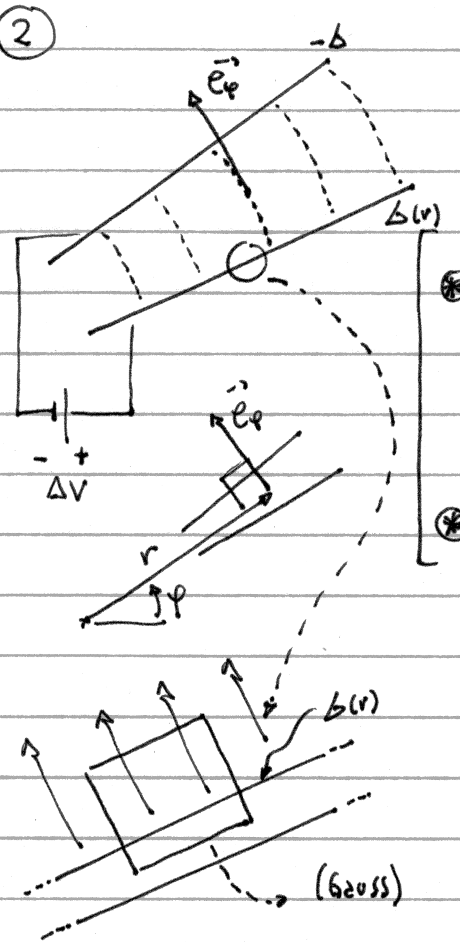
$$\Delta U_e = q\,\Delta V = -q \int_{z_0}^{z_f} \vec{E}\cdot(dz\,\vec{k}) = -q\left(\frac{\rho_0 L + \sigma_0}{2\varepsilon_0}\right)\Delta z =$$

$$= q\left(\frac{\rho_0 L + \sigma_0}{2\varepsilon_0}\right) L \qquad \left(z_0 = 3L/2,\ z_f = L/2\right)$$

$$\Delta K + \Delta U_e = 0 \Rightarrow -\frac{1}{2} m v^2 + q\left(\frac{\rho_0 L + \sigma_0}{2\varepsilon_0}\right) L = 0$$

$$\boxed{v = \sqrt{\frac{q L}{m \varepsilon_0}\left(\rho_0 L + \sigma_0\right)}}$$

2



$$\Delta V = -\int_0^{\ell_f} \vec{E}\cdot\vec{d\ell} = +\int_{\varphi_0}^{\varphi_f} E(r)\, r\, d\varphi = +E(r)\, r\, \alpha$$

⊛ Simetría de revolución
$E \neq E(\varphi)$
Como $\vec{E} \perp$ conductor $\Rightarrow \vec{E} = E(r)\,\vec{e}_\varphi$

⊛ $\vec{d\ell} = r\, d\varphi\, \vec{e}_\varphi$

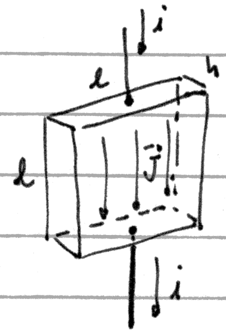
$$\Delta V = +E(r)\, r\, \alpha \Rightarrow \boxed{\vec{E}(r) = \frac{\Delta V}{r\alpha}\,\vec{e}_\varphi}$$

$$E(r)\, A = \frac{\sigma(r)\, A}{\varepsilon_0} \Rightarrow \boxed{\sigma(r) = \frac{\varepsilon_0\, \Delta V}{r\alpha}}$$

$$Q = \left[\int_a^{a+b} \sigma(r)\, dr \right] \cdot L = \frac{\varepsilon_0 \Delta V}{\alpha} \, Ln\left(\frac{a+b}{a}\right) \cdot L$$

$\underbrace{\qquad\qquad}$ carga por unidad de ancho de placa

$$C = \frac{Q}{\Delta V} \Rightarrow \boxed{C = \frac{\varepsilon_0 L}{\alpha} Ln\left(\frac{a+b}{a}\right)}$$



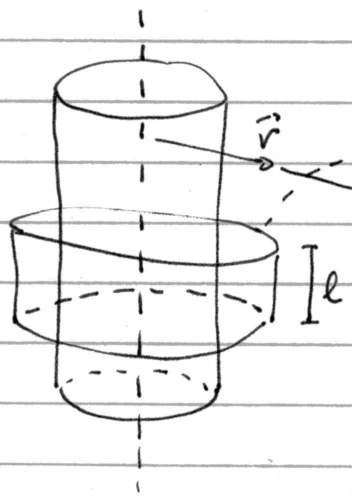
$$R = \rho \frac{l}{(l \cdot h)} = \rho/h \Rightarrow \boxed{\tau_c = RC = \frac{\varepsilon_0 \rho L}{\alpha h} Ln\left(\frac{a+b}{a}\right)}$$

$$Q = Q_0 \, e^{-t/\tau} \qquad Si\ Q = \frac{Q_0}{2} \Rightarrow -\frac{t}{\tau} = Ln(1/2)$$

$$t = \tau \, Ln(2)$$

$$\boxed{t = \frac{\varepsilon_0 \rho L}{\alpha h} Ln(2)\, Ln\left(\frac{a+b}{a}\right)}$$

3



$\rightarrow$ (Gauss) $\quad \vec{E} = E(r)\, \vec{e_r}$

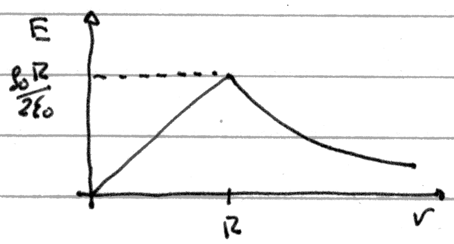
por simetría cilíndrica del problema

$$r < R \Rightarrow \phi_E = E(r) \cdot 2\pi r l = \rho_0 \frac{r^2 \pi l}{\varepsilon_0}$$

$$\boxed{\vec{E}(r) = \frac{\rho_0 r}{2\varepsilon_0} \vec{e_r}} \qquad r < R$$

$$r > R \qquad \phi_E = E(r)\, 2\pi r l = \rho_0 \frac{R^2 \pi l}{\varepsilon_0}$$

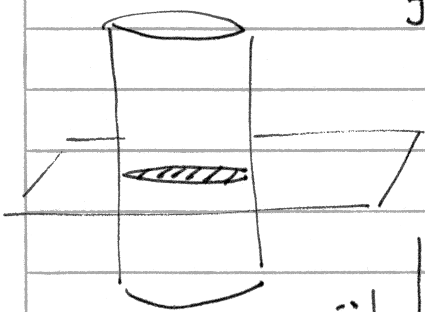
$$\boxed{\vec{E}(r) = \frac{\rho_0 R^2}{2\varepsilon_0 r} \vec{e_r}} \qquad r > R$$



$$i = \vec{J}\cdot\vec{A} = \rho v R^2 \pi$$

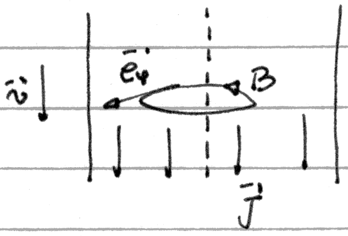
$$\vec{J} = \rho \vec{v}$$

$$\boxed{i = \rho v R^2 \pi}$$



Ampère

$r < R$



$$B(r)\, 2\pi r = \mu_0 \rho v r^2 \pi$$

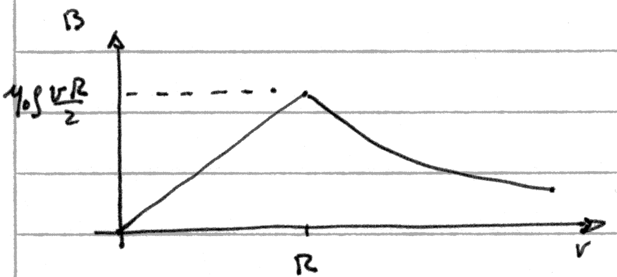
$$\boxed{\vec{B}(r) = \frac{\mu_0 \rho v r}{2} \vec{e}_\varphi} \qquad r < R$$

$\vec{e}_\varphi$ = versor tg.

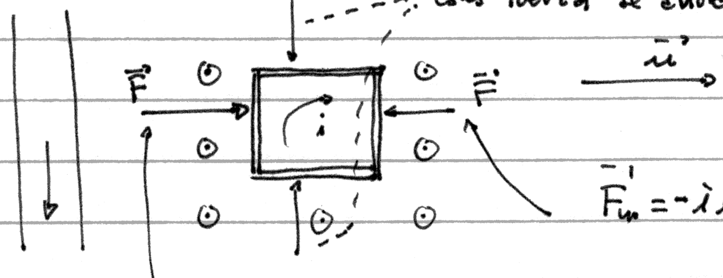
$r > R$

$$B(r)\, 2\pi r = \mu_0 \rho v R^2 \pi$$

$$\boxed{\vec{B}(r) = \frac{\mu_0 \rho v R^2}{2r} \vec{e}_\varphi} \qquad r > R$$



estas fuerzas se anulan mutuamente



$$\vec{F}'_m = -i l B(d+l) \vec{u}$$

$$\vec{F}_m = i l B(d) \vec{u}$$

$$\vec{F} = i l \left(B(d) - B(d+l)\right)\vec{u} = \frac{i l \mu_0 \rho v R^2}{2}\left(\frac{1}{d} - \frac{1}{d+l}\right)\vec{u}$$

$$\boxed{\vec{F} = \frac{i l^2 \mu_0 \rho v R^2}{2d(d+l)}\vec{u}}$$