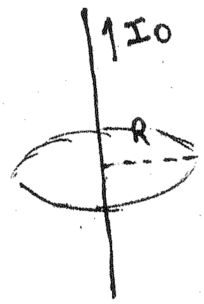
Examen - Julio 2012

Física 3 - Física General 2

1

a)

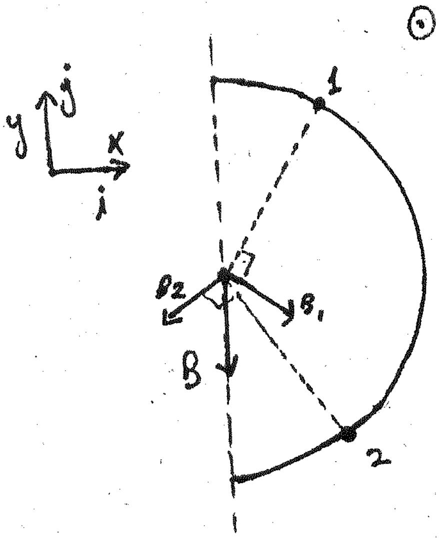


$$\oint \vec{B} \cdot d\vec{s} = \mu_0 I_0$$

$$B \cdot 2\pi R = \mu_0 I_0$$

$$\boxed{B = \frac{\mu_0 I_0}{2\pi R}}$$

b)

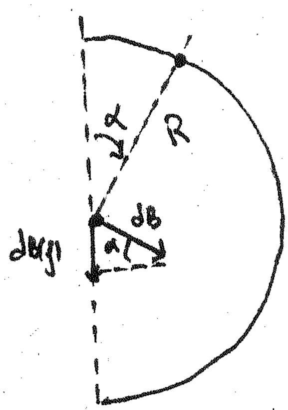


$$\vec{B} = -K\hat{j} \quad (K>0)$$

c)

$$j = \frac{I}{\left(\frac{2\pi R}{2}\right)}$$

$$dB_{(j)} = \overbrace{Rj\,d\alpha}^{I_0} \cdot \frac{\mu_0}{2\pi R} \cdot \operatorname{sen}\alpha$$



$$B = \int_0^{\pi} R \frac{I}{\pi R} \frac{\mu_0}{2\pi R} \operatorname{sen}\alpha \cdot d\alpha$$

$$B = \frac{RI\mu_0}{2(\pi R)^2} \, -\cos\alpha \Big|_0^{\pi}$$

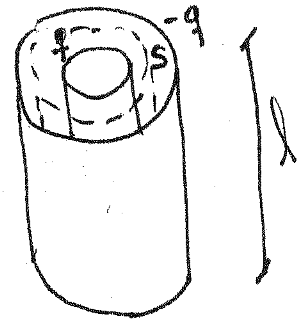
nota:

a la letra el radio se llama a en lugar de R

$$\boxed{B = \frac{I\mu_0}{\pi^2 R}}$$

ΔV

(2) a)



$$\oint \vec{E}\cdot d\vec{A} = q/\varepsilon_0$$

$$E \cdot 2\pi r l = q/\varepsilon_0$$

$$E = \frac{q}{2\pi\varepsilon_0 r l}$$

$$V_0 = \Delta V = -\int_d^D \frac{q}{2\pi\varepsilon_0 l}\,\frac{1}{r} = \frac{q}{2\pi\varepsilon_0 l}\cdot \mathrm{Ln}\left(\frac{D}{d}\right)$$

$$\Rightarrow \left.\begin{array}{l} V_0 = \dfrac{q}{2\pi\varepsilon_0 l}\,\mathrm{Ln}\left(\dfrac{D}{d}\right) \longrightarrow \\ C\cdot\Delta V = q \longrightarrow \end{array}\right\} \Rightarrow$$

$$\Rightarrow \quad C = q/\Delta V = \frac{2\pi\varepsilon_0 l}{\mathrm{Ln}\left(\frac{D}{d}\right)}$$

$$\boxed{q = V_0 \cdot \underbrace{2\pi\varepsilon_0 l/\mathrm{Ln}\left(\frac{D}{d}\right)}_{C}}$$

b) $\boxed{q \text{ cte.}} \Rightarrow \boxed{q = \dfrac{V_0\, 2\pi\varepsilon_0 l}{\mathrm{Ln}(D/d)}}$

ahora $C = K\cdot\dfrac{2\pi\varepsilon_0 l}{\mathrm{Ln}(D/d)}$ $\quad \Delta V = \dfrac{q}{C}$ $\Bigg\} \Rightarrow$

$$\Rightarrow \boxed{\Delta V = \frac{V_0}{K}}$$

② c)

$$U = \frac{C \cdot \Delta V^2}{2} = \frac{K 2\pi \varepsilon_0 l}{\ln\left(\frac{D}{d}\right)} \cdot \left(\frac{V_0}{K}\right)^2 \frac{1}{2} = \frac{V_0^2 \pi \varepsilon_0 l}{K \ln\left(\frac{D}{d}\right)}$$

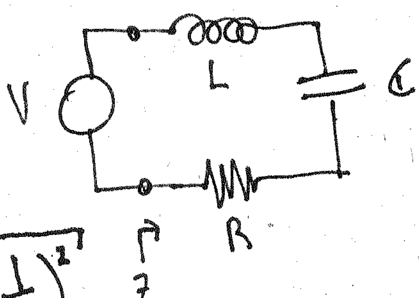
se disipa la energía almacenada en el capacitor

$$\Rightarrow \boxed{E_{dis} = \frac{V_0^2 \pi \varepsilon_0 l}{K \ln\left(\frac{D}{d}\right)}}$$

③

a) $\boxed{V_{rms} = \frac{V_0}{\sqrt{2}} = \frac{1}{\sqrt{2}} \, V}$

b)



$$\rightarrow \hat{z} = R + \left(L\omega - \frac{1}{\omega C}\right) j \quad ①$$

$$\rightarrow \hat{I} = \frac{\hat{V}}{\hat{z}} \Rightarrow |\hat{I}| = \frac{|\hat{V}|}{|\hat{z}|} \Rightarrow$$

$$i_{rms} = \frac{V_{rms}}{\sqrt{R^2 + \left(L\omega - \frac{1}{\omega C}\right)^2}}$$

$\Rightarrow |\hat{I}|$ es maximo cuando $|\hat{z}|$ es minimo ②

c)

$\left.\begin{matrix} ① \\ ② \end{matrix}\right\} \Rightarrow$ irms es maximo cuando $L\omega - \frac{1}{\omega C} = 0 \Rightarrow \boxed{L = \frac{1}{\omega^2 C}}$

$$L = \frac{1}{(10^4)^2 \cdot 1.10^{-9}} = \frac{1}{10^{-1}} = 10 \text{ H}$$

en ese caso $\hat{z} = R$

$$i_{Rms} = \frac{V_{rms}}{R} = \frac{1}{\sqrt{2}} \cdot \frac{1}{1.10^3} = \frac{1}{\sqrt{2}} \text{ mA}$$

$$\Rightarrow \boxed{i_{rms} = \frac{1}{\sqrt{2}} \text{ mA}}$$

③

d) $\bar{P} = V_{Rrms} \cdot i_{rms} \cdot \overbrace{\cos 90}^{1} = i_{rms}^{2} R \Rightarrow$

$\Rightarrow \bar{P} = \left(\frac{1}{\sqrt{2}}\right)^2 \left(10^{-3}\right)^2 \cdot 1 \cdot 10^3$

$$\boxed{\bar{P} = 0{,}5 \text{ mW}}$$

$V_{Crms} = i_{rms} \cdot \frac{1}{\omega C}$

$V_{Crms} = \frac{1}{\sqrt{2}} \cdot 10^{-3} \frac{1}{10^4 \cdot 1 \cdot 10^{-9}}$

$$\boxed{V_{Crms} = \frac{1}{\sqrt{2}} \cdot 10^2 \text{ V}}$$