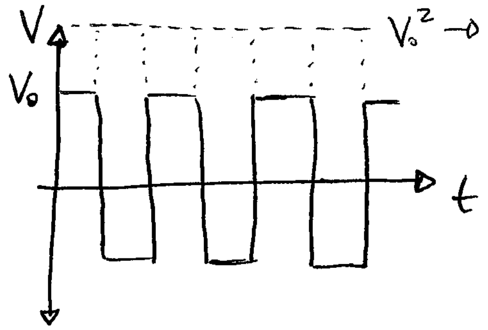
PROBLEMAS UNIDAD 8

1.



$V_0^2 \rightarrow$ valor promedio $= V_0^2$

$V_0 = 12V$

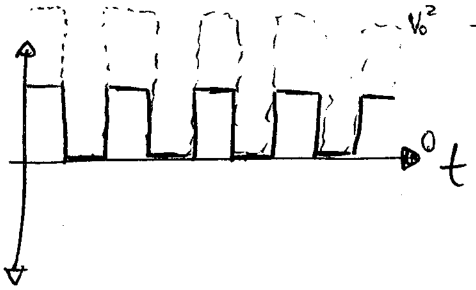
a) V_{eff} ?

b) Si se rectifica (eliminando negativos) ¿V_{eff} ?

a)

$$V_{eff} = \sqrt{\langle V^2 \rangle} = \sqrt{V_0^{\,2}} = V_0 = 12\,V$$

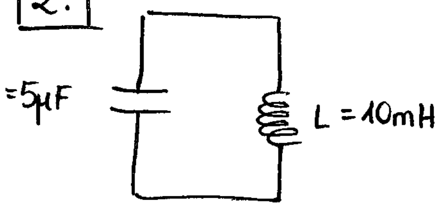
b)



$V_0^2 \rightarrow$ valor promedio $= \frac{V_0^2}{2}$

$$V_{eff} = \sqrt{\langle V^2 \rangle} = \sqrt{\frac{V_0^{\,2}}{2}} = \frac{V_0}{\sqrt{2}} = 8'48\,V$$

2.



$Q_0 \rightarrow V_i = 30V$

a) U es constante, no se disipa potencia

$$U_T = \frac{1}{2}\cdot Q \cdot V_c + \frac{1}{2}\cdot L \cdot I^2$$

La energía no varía con el tiempo, puedo eligir cualquier instante y calcularla. → varía entre el condensador y la bobina.

Cojo $t=0 \longrightarrow Q = Q_0$ y $I = 0$.

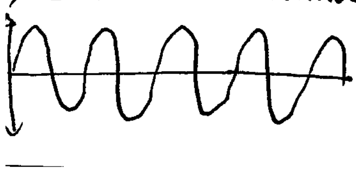
$$U_T = \frac{1}{2}\cdot Q\cdot V_c + \frac{1}{2}\cdot L\cdot 0 = \frac{1}{2}\cdot Q\cdot V_c = \frac{1}{2}\cdot C\cdot V_0^{\,2} = \frac{1}{2}\cdot 5\cdot 10^{-6}\cdot (30)^2 =$$

$$= \boxed{2'25\ mJ}$$

b) frecuencia? $\omega = 2\pi f \rightarrow f = \frac{\omega}{2\pi}$

$$\omega = 2\pi f \rightarrow f = \frac{\omega}{2\pi} = \frac{1}{2\pi}\cdot\frac{1}{\sqrt{LC}} = \boxed{712\ Hz}$$

) Corriente máxima



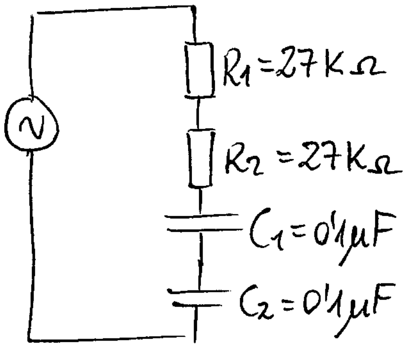
$$I_{max} = Q_{max}\cdot\omega = Q_0\cdot\omega \overset{Q_0 = C\cdot V_0}{=} C\cdot V_0\cdot\omega =$$

$$= 5\cdot 10^{-6}\cdot 30\cdot\frac{1}{\sqrt{LC}} = \boxed{0'671\ A}$$

$f = 30\,Hz$

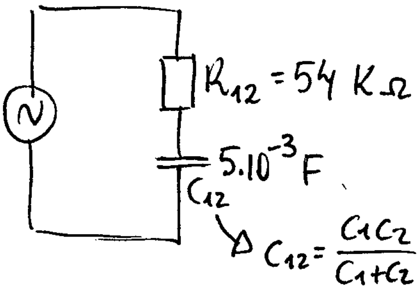
$V_{eff} = 12\,V$

a) I_{max} [...] Diferencia de fase entre I y V aplicado por la fuente.



b) P promedio que proporciona la fuente

c) Si tenemos inductancia (L) en serie con $R_{1,2}$ y $C_{1,2}$. calcular L | Pot disipada máxima a esa frecuencia (30 Hz).



a) RC en serie

$$|Z| = \sqrt{R^2 + \underbrace{(X_c)^2}_{\cancel{X_L} - X_c}} = \boxed{119000\,\Omega}$$

$$\frac{1}{\omega C} = \frac{1}{2\pi f C} \qquad X_c = \frac{1}{\omega . C} = 106000\,\Omega \qquad \omega \to 2\pi f$$

$$I_{eff} = \frac{V_{eff}}{|Z|} = \frac{12V}{119000\,\Omega} = 1.10^{-4}A \;;$$

$$I_{max} = I_{eff} \cdot \sqrt{2} = \boxed{1'42 . 10^{-4} A}$$

$$tg\,\delta = \frac{\cancel{X_L}^{0} - X_c}{R} = \frac{-X_c}{R} = -1'96 \Rightarrow \delta = -63° = -1'1\text{ rad}$$

b) $$\langle P \rangle = V_{eff} . I_{eff} . \cos\delta = I_{eff}^2 . R = 12V . 1'10^{-4}A . \cos(-63°) = \boxed{5'4 . 10^{-4}\ W}$$

c) RCL serie

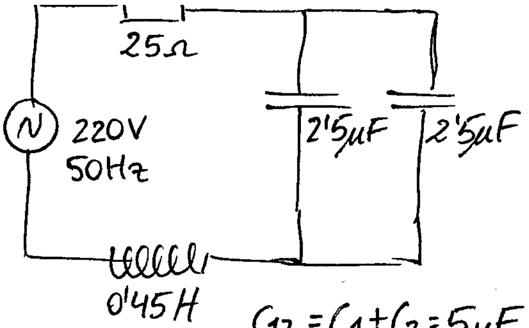
Tenemos: $\langle P \rangle = \frac{V_{eff}^2}{|Z|} \cos\delta$; $Z = \sqrt{R^2 + (X_L - X_c)^2}$; $tg\,\delta = \frac{X_L - X_c}{R}$

$\langle P \rangle$ máximo cuando $\cos\delta = 1$ ó $|Z|$ es mínimo $\Rightarrow X_L = X_c \Rightarrow$

$\Rightarrow$ condición de resonancia $\to \omega_0 = \frac{1}{\sqrt{LC}}$.

Para f fija (30 Hz) $\to$ despejar L $\Rightarrow 2\pi f = \frac{1}{\sqrt{LC}} \Rightarrow$

$$\Rightarrow 4\pi^2 f^2 = \frac{1}{LC} \Rightarrow L = \frac{1}{4\pi^2 f^2 C} = \frac{1}{4\pi^2 (30Hz)^2 \cdot 5.10^{-8}} = \boxed{562'9\ H}$$



$C_{12} = C_1 + C_2 = 5\mu F$

a) I_{eff} por el circuito?

b) $\langle P \rangle$ que proporciona la batería.

c) V_{eff} en R, L y Condensadores

d) $\langle P \rangle$ disipada en bobina

e) ω de resonancia.

a) RCL en serie

$$Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$$

$$X_C = \frac{1}{\omega C} = \frac{1}{2\pi f C} = \boxed{636'6\ \Omega} \qquad X_L = \omega L = \boxed{141'4\ \Omega}$$

$$\Rightarrow |Z| = \boxed{495'9\ \Omega}$$

$$I_{eff} = \frac{V_{eff}}{|Z|} = \frac{220V}{495'9\Omega} = \boxed{0'44\ A}$$

b) $\langle P \rangle = I_{eff}^2 \cdot R = (0'44)^2 \cdot 25\Omega = \boxed{4'84\ W}$

c) V_{eff} en $R = I_{eff} \cdot R = 0'44A \cdot 25\Omega = \boxed{11\ V}$

V_{eff} en $C = I_{eff} \cdot X_C = 0'44A \cdot 636'6\Omega = \boxed{280\ V}$ → en C_1 y C_2

V_{eff} en $L = I_{eff} \cdot X_L = 0'44A \cdot 141'4\Omega = \boxed{62'2\ V}$

d) $\langle P \rangle$ en la bobina es CERO.

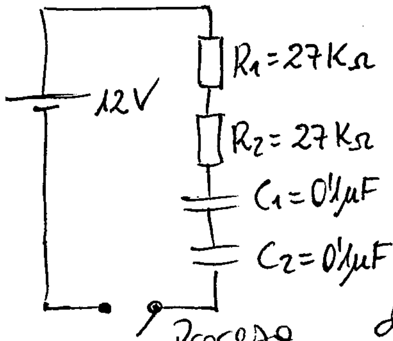
SOLO SE DISIPA POTENCIA EN LAS RESISTENCIAS

e) frecuencia de resonancia? → $X_C = X_L \Rightarrow \omega_0 = \frac{1}{\sqrt{LC}} = 666'67\ \frac{rad}{s}$

$f = 50\,Hz$ en ...

$V_{eff} = 12\,V$

a) $I(t=0)$; $I(t=\infty)$



b) t necesario para que la carga en C alcance un 70% de su valor en $t=\infty$.

Proceso de carga

$$Q(t) = \underbrace{Q_0}_{\text{carga final}}\left(1 - e^{-t/RC}\right)$$

$$I(t) = -Q_0 \cdot e^{-t/RC}\left(\frac{-1}{RC}\right) = \frac{Q_0}{RC}\cdot e^{-t/RC} \Rightarrow I(t) = \frac{\varepsilon}{R}\cdot e^{-t/RC}$$

$\boxed{t=0} \rightarrow I = \frac{V_0}{R} = \frac{12\,V}{54000\,\Omega} = \boxed{2'22 \cdot 10^{-4}\,A}$ (condensador como cortocircuito)

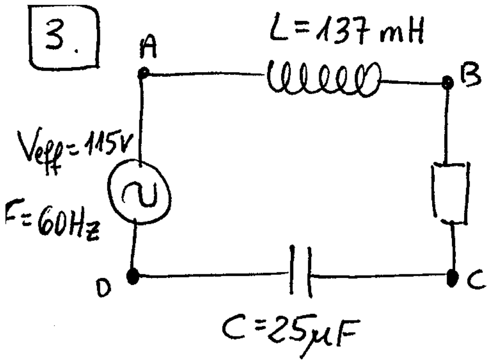
$\boxed{t=\infty} \rightarrow I = 0$ (condensador representa circuito abierto y no deja pasar I)

b) t? $Q(t) = 0'7\,Q_0$

$$0'7\,Q_0 = Q_0\left(1 - e^{-t/RC}\right) \Rightarrow 0'7 = 1 - e^{-t/RC} \Rightarrow e^{-t/RC} = 0'3 \Rightarrow$$

$$\Rightarrow \frac{-t}{RC} = \ln(0'3) \Rightarrow t = -RC\ln(0'3) = 3'25 \cdot 10^{-3}\,s = \underline{3'25\,m}$$

3.



¿ Veff AB, Veff BC, Veff CD?

1º calculamos: $I_{eff} = \dfrac{V_{eff}}{Z} = \dfrac{V_{eff}}{\sqrt{R^2 + (X_L - X_C)^2}}$

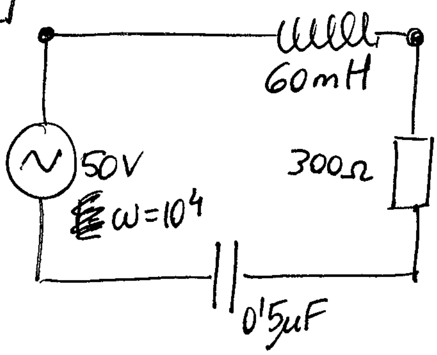
2º calculamos el resto:

$V_{eff_{AB}} = I_{eff} \cdot X_L$

$V_{eff_{BC}} = I_{eff} \cdot R$ $\qquad V_{eff_{AC}} = \sqrt{{V_{eff_{AB}}}^2 + {V_{eff_{BC}}}^2}$

$V_{eff_{CD}} = I_{eff} \cdot X_C$

4.



$X_L = \omega L = 600\,\Omega$

$X_C = \dfrac{1}{\omega . C} = 200\,\Omega$

$Z = \sqrt{R^2 + (X_C - X_L)^2} = 500\,\Omega$

$I_{max} = \dfrac{V_{max}}{Z} = \dfrac{50}{500} = 0'1\ A$

$tg\varphi = \dfrac{X_C - X_L}{Z} \Rightarrow \varphi = -38'66^\circ$

$I = 0'1 \ \cos(10^4 t - 38'66^\circ)$

$V_{R\,max} = I_{max} \cdot R = 30V$

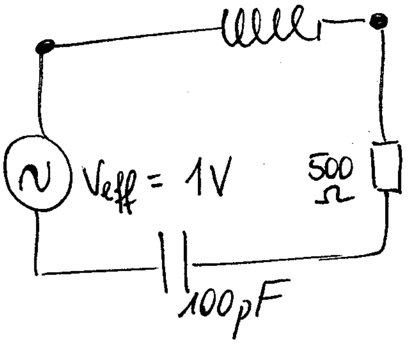
$V_{L\,max} = I_{max} \cdot X_L = 60V$

$V_{C\,max} = I_{max} \cdot X_C = 20V$

$$\boxed{\dfrac{V_{max}}{Z} = I_{max}}$$

$$\boxed{\dfrac{V_{eff}}{Z} = I_{eff}}$$

$\boxed{5.}$



a) $\omega_{res} \rightarrow \omega_{res} = \frac{1}{\sqrt{LC}} = 5 \cdot 10^{6} \ \frac{rad}{s}$

b) para ω_{res}

$X_L = \omega L = \omega_{res} L = 2 \cdot 10^3 = 2 K\Omega$

$X_C = \frac{1}{\omega C} = \dots = 2 K\Omega$

en ω_{r} $X_C = X_{L}$

$Z = \sqrt{R^2 + (X_C - X_L)^2} =$ en $\omega_{res} = R$

c) $I_{eff} = \frac{V_{eff}}{Z} = \frac{1}{500} = 2 mA$

d) $V_{eff_R} = I_{eff} \cdot R = 1V$

$V_{eff_C} = I_{eff} \cdot X_C = 4V$

$V_{eff_L} = I_{eff} \cdot X_L = 4V$