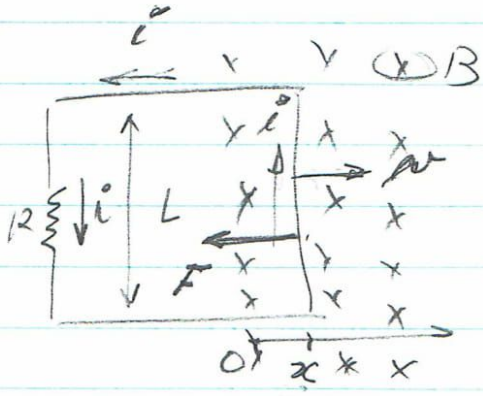
PROBLEMA 1



a) $\Phi_B = BS = BLx$

$$\frac{d\Phi_B}{dt} = BL\frac{dx}{dt} = BLv$$

$$|\mathcal{E}| = \left|\frac{d\Phi_B}{dt}\right| = iR \qquad iR = BLv \qquad F = BiL$$

$$F = \frac{B^2L^2v}{R} = -m\frac{dv}{dt} \Rightarrow \frac{dv}{dt} + \frac{B^2L^2}{mR}v(t) = 0$$

$$\boxed{v(t) = v_0 e^{-\frac{B^2L^2}{mR}t}}$$

b) $$x(t) - \underbrace{x(0)}_{0} = \int_0^t v(t)\,dt = v_0\frac{mR}{B^2L^2}\left(1 - e^{-\frac{B^2L^2}{mR}t}\right)$$

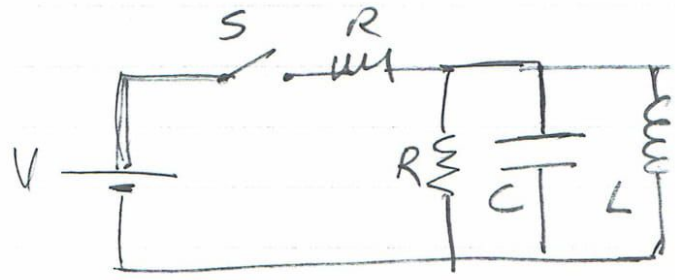
$$x(\infty) = \frac{v_0 mR}{B^2L^2} = L \Rightarrow \boxed{v_0 = \frac{B^2L^3}{mR}}$$

c) $E = -\Delta K$ → energía cinética

$$E = \frac{mv_0^2}{2} = \frac{m}{2}\left(\frac{B^2L^3}{mR}\right)^2$$

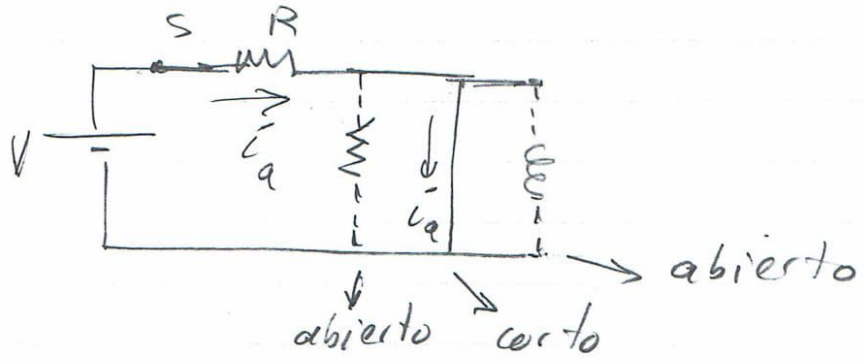
$$\boxed{E = \frac{1}{2}\frac{B^4L^6}{mR^2}}$$

PROBLEMA 2



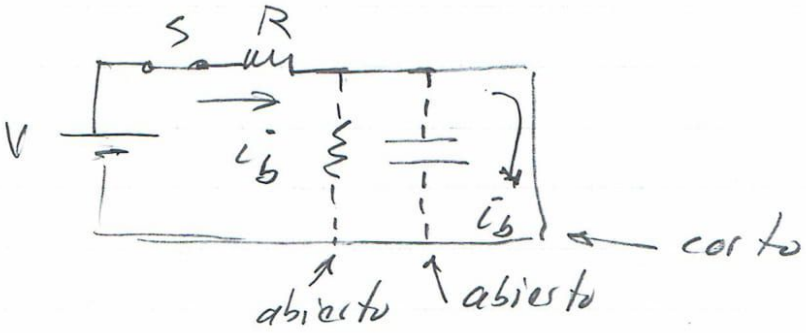
a) $(t=0)$

$i_a = \frac{V}{R}$



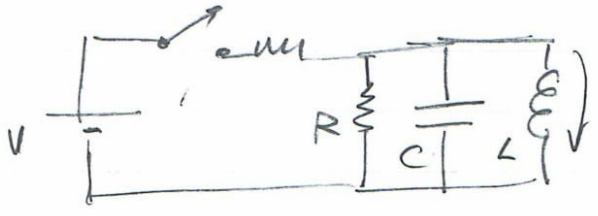
b) $(t \to \infty)$

$i_b = \frac{V}{R}$



c) $(t=0)$

$i_c = \frac{V}{R}$

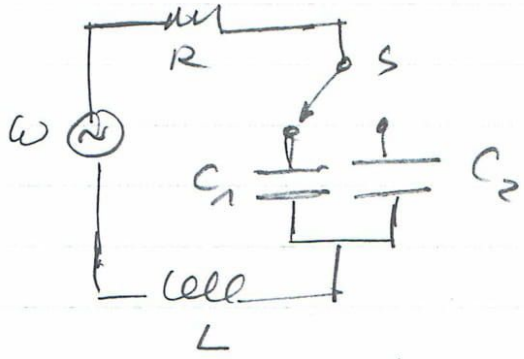


$i_c = i_b =$ final del caso anterior

PROBLEMA 3

$\omega = 500$ rad/s

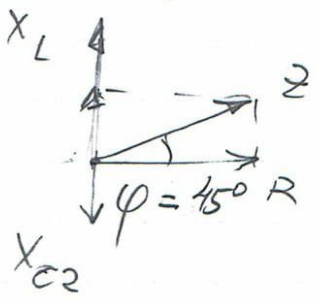
$C_1 = 2\,\mu F \quad C_2 = 10\,\mu F$



a) $RC_1L \rightarrow$ resonancia

$$\Rightarrow \omega L = \frac{1}{\omega C_1} \Rightarrow \boxed{L = \frac{1}{\omega^2 C_1} = 2\,H}$$

RC_2L.



$$Z^2 = R^2 + (X_L - X_{C_2})^2 \qquad \frac{R}{Z} = \cos\varphi$$

$$\Rightarrow \frac{R^2}{\cos^2\varphi} = R^2 + (X_L - X_{C_2})^2 \Rightarrow$$

$$R^2\left(\frac{1}{\cos^2\varphi} - 1\right) = (X_L - X_{C_2})^2 \Rightarrow$$

$$R = \frac{X_L - X_{C_2}}{\sqrt{\frac{1}{\cos^2\varphi} - 1}}$$

$X_L = \omega L = 1000\,\Omega$

$X_{C_2} = \frac{1}{\omega C_2} = 200\,\Omega$

$\cos\varphi = \cos 45^\circ = 1/\sqrt{2}$

$\boxed{R = 800\ \Omega}$

b) $P_a = i_a^2 R$, $P_b = i_b^2 R \Rightarrow \frac{i_b}{i_a} = \sqrt{\frac{P_b}{P_a}} = \sqrt{0.5}$

$\boxed{\frac{i_b}{i_a} = 0.71}$

c) $\tan\varphi = \frac{X_L - X_{C_2'}}{R} \Rightarrow -\tan 45^\circ = \frac{X_L - X_{C_2'}}{R} \Rightarrow$

$X_{C_2'} = X_L + R\tan 45^\circ = X_L + R = 1000 + 800 = 1800\,\Omega$

$\frac{1}{\omega C_2'} = 1800\,\Omega \Rightarrow \boxed{C_2' = 1{,}1\,\mu F}$