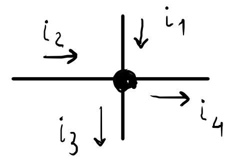
LEYES de KIRCHOFF

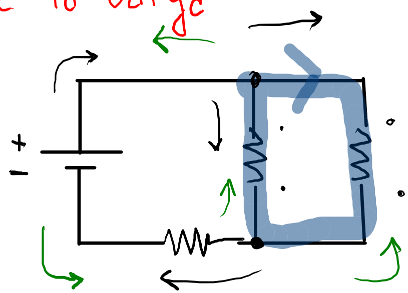
• Ley de nodos: $\sum_j i_j = 0$



$\Rightarrow \sum i_{entrante} = \sum i_{saliente}$

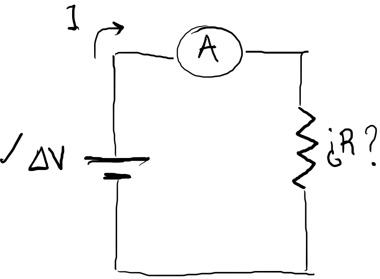
Cons de la carga

• Ley de mallas



$\sum \Delta V_{AB} = 0$

AMPERÍMETRO y VOLTÍMETRO



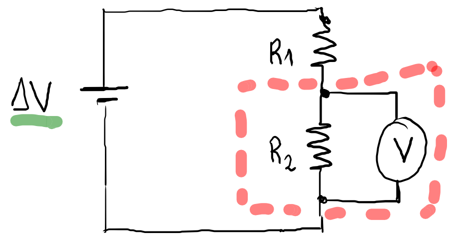
$$\Delta V = I_0 R$$

$$\frac{\Delta V}{I_0} = R$$

$$R_{TOT} = R + R_A$$

$$\frac{\Delta V}{R} \neq I' = \frac{\Delta V}{R + R_A}$$

$$\boxed{R_A \ll R}$$



$$\Delta V_1 = R_1 I$$

$$\Delta V_2 = R_2 I$$

$$\Delta V = R_{TOT} I$$

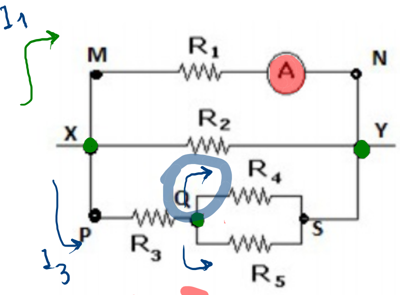
$$R_{eq} = \frac{1}{\frac{1}{R_2} + \frac{1}{R_V}} = \frac{R_2 R_V}{R_2 + R_V}$$

$$\approx R_2 : \text{si } \boxed{R_V \gg R_2}$$

$$\Rightarrow R_2 + R_V \approx R_V$$

$$\Rightarrow R_{eq} \approx \frac{R_2 R_V}{R_V} = R_2$$

2.1.12)



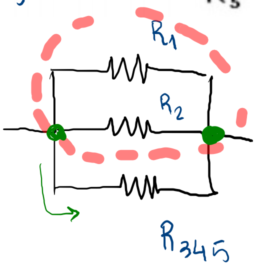
$I_1 = I_A = 500\ mA = 0{,}500 A$

$$\begin{cases} R_1 = 2{,}00\ \Omega \\ R_2 = 4\ \text{"}\ \text{"} \\ R_3 = 1\ \text{"}\ \text{"} \\ R_4 = 2\ \text{"}\ \text{"} \\ R_5 = 1\ \text{"}\ \text{"} \end{cases}$$

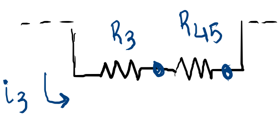
a $R_{eq\ circuito}$

$$R_{eq_{45}} = \frac{R_4 R_5}{R_4 + R_5} = \frac{2}{3}\ \Omega = 0{,}667\ \Omega$$

$$R_{eq_{345}} = R_3 + R_{eq_{45}} = \frac{5}{3}\ \Omega = 1{,}67\ \Omega$$



$$R_{eq} = \frac{1}{\sum \frac{1}{R_i}} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_{345}}} = 0{,}741\ \Omega$$



$\{\Delta V = RI\}$

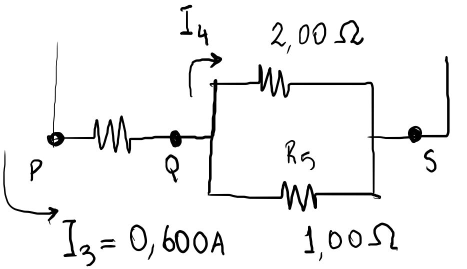
b ¿ I_4?

$$\Delta V_{xy} = R_1 I_1$$
$$= (2{,}00\ \Omega) \times (0{,}500 A)$$
$$= 1{,}00\ V$$

$$\Rightarrow \Delta V_{xy} = I_3 R_{345}$$

$$\Rightarrow I_3 = \frac{\Delta V_{xy}}{R_{345}}$$
$$= 0{,}600 A$$

$$\Delta V_{QS} = I_3 \cdot R_{45}$$
$$= 0{,}400 V$$



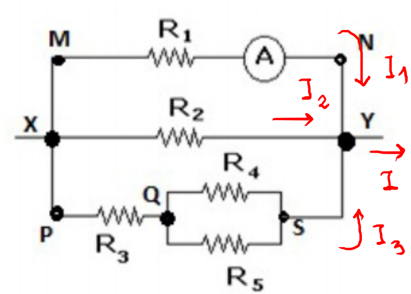
$$\Delta V_{QS} = 0,400\,V \Rightarrow I_4 = \frac{\Delta V_{QS}}{R_4} = 0,200\,A$$

$$I_5 = 0,400\,A$$

c $\Delta V_{PQ} = R_3 I_3 = 0,600\,V$

d

~

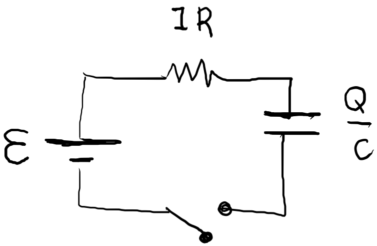


I_{TOTAL} = $I_1 + I_2 + I_3$

ø

$$\left.\begin{array}{l} Req_{TOT} = 0,741\,\Omega \\ \Delta V_{XY} = 1,00\,V \end{array}\right\} I_T = 1,35\,A$$

CIRCUITOS RC SERIE



$$\Rightarrow \varepsilon = IR + \frac{Q}{C} \qquad \frac{dQ}{dt} = I$$

τ = cte de tiempo

$\tau = RC$

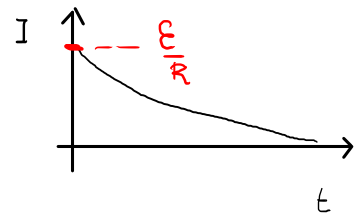
CARGA

$$Q(t) = \underbrace{C\varepsilon}_{Q_0} \left(1 - e^{-t/\tau}\right)$$

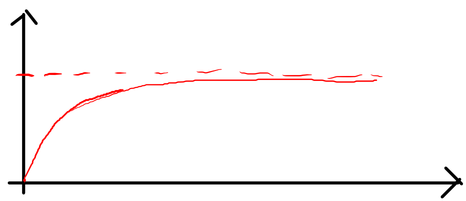
$$I(t) = \frac{\varepsilon}{R} e^{-t/\tau}$$

$x^0 = 1$

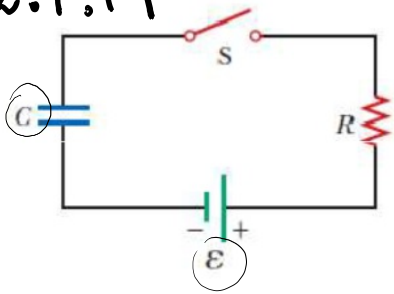
$e^{-100} \sim 0$



$C\varepsilon = Q_0$



2.1.14



$R = 1{,}00\ M\Omega$, $C = 5{,}00\ \mu F$ y $\varepsilon = 30{,}0\ V$.

$\ln(e^x) = e^{\ln(x)} = x$

a ¿τ? $\tau = RC = 5{,}00\ s = 1{,}00 \times 5{,}00 \times \underbrace{10^{6} \times 10^{-6}}_{1}$

b ¿Q_0 = carga máxima? $Q_0 = C\mathcal{E} = 0{,}150\ mC$
$= 1{,}50 \times 10^{-4}\ C$

c ¿$Q(10s)$, $I(10s)$?

d Δt para que $Q = 75\%$ de $Q_0 = \frac{3}{4} Q_0$

$\Leftarrow Q(t) = Q_0 [1 - e^{-t/\tau}] = \frac{3}{4} Q_0$

$1 - e^{-t/\tau} = \frac{3}{4}$

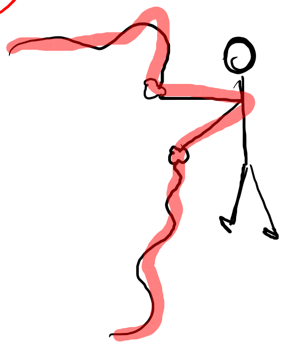
$1 - \frac{3}{4} = \frac{1}{4} = e^{-t/\tau}$

$\ln\left(\frac{1}{4}\right) = \ln\left(e^{-t/\tau}\right) = -\frac{t}{\tau}$

$+1{,}39 = +\frac{t}{\tau} \Rightarrow t = 1{,}39\,\tau$

$t \simeq 6{,}93\ s$

2.1.5

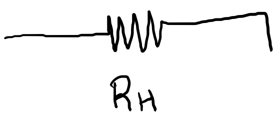


$R_{HUMANO} = 1{,}0\ k\Omega$

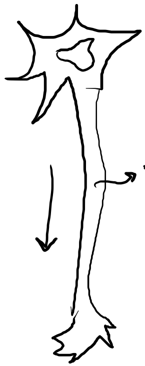
¿ΔV xa que $I = 10\ mA$?

$$\Delta V = R_H \cdot I = (1{,}0 \times 10^{3})(10 \times 10^{-3}) = 10\ V$$

$$I = 100\ mA \Rightarrow V = 100\ V$$



(2.2.1)



$\rho = 2{,}0\ \Omega m$ ← axoplasma $\rho_{Cu} = 1{,}72 \times 10^{-8}\ \Omega m$

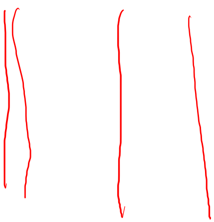
$r = 5{,}0\ \mu m = 5{,}0 \times 10^{-6}\ m \rightarrow A = \pi r^2$

$L = 2{,}5\ cm = 0{,}025\ m$

¿R?

$$R = \frac{\rho L}{A} = \frac{(2{,}0\ \Omega m)\cdot(0{,}025\ m)}{\pi \cdot (5{,}0 \times 10^{-6}\ m)^2} = 6{,}4 \times 10^{8}\ \Omega \simeq 640\ M\Omega$$

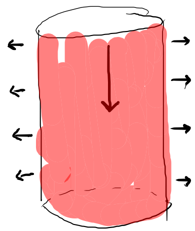
b



si r fuera más grande $R \propto \frac{1}{r^2} \rightarrow$ R disminuye

c $R = \frac{\rho_{Cu} L}{A} \rightarrow L = \frac{AR}{\rho_{Cu}} = 2900\ Km$

(2.2.2)



$h = 2{,}5\,cm$

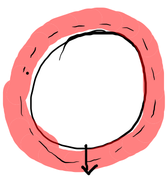
$R_o = \rho \frac{L}{A}$

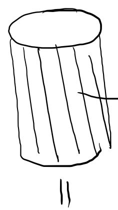
A = área membrana

L = ancho membrana

$A = 2\pi r h$

$L = d$





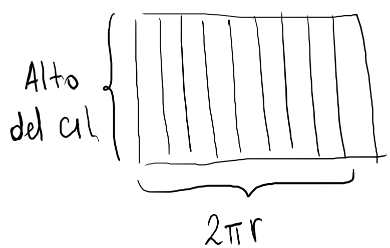
resistencia de pérdida

$\Rightarrow R_o = \frac{R_m}{A'} = \frac{R_m}{2\pi r h} = 2{,}55 \times 10^{5}\,\Omega$

R_m = resistencia metro cuadrado de membrana

$R_m = 0{,}20\ \Omega \cdot m^2$

$\stackrel{?}{=} \rho \cdot L$



$1\,m^2 \longrightarrow R_m$

¿ $A' = 2\pi r h$?

b con mielina $R_m = 40\ \Omega m^2$

$\Rightarrow R_o = 51\,M\Omega$