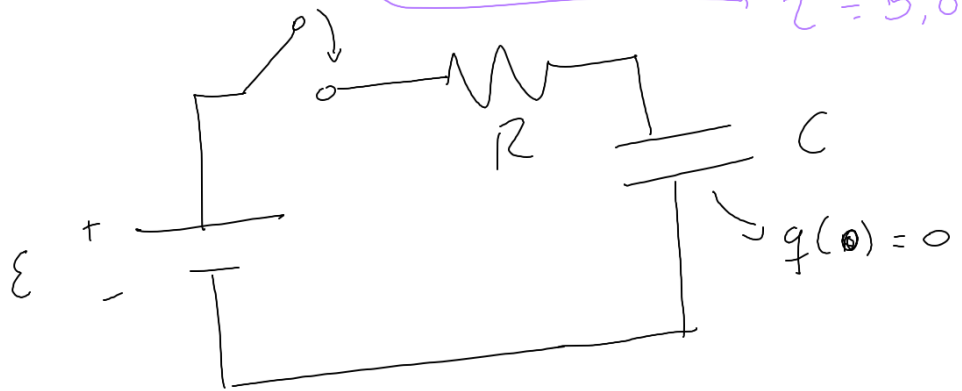
2.1.14)

$C = 5{,}00 \times 10^{-6}\ F \qquad \mathcal{E} = 30{,}0\ V$

$R = 1{,}00 \times 10^{6}\ \Omega \rightarrow \tau = 5{,}00\ s$



Carga:

$$\begin{cases} q(0) = 0 \\ q(t) = C\mathcal{E}\left(1 - e^{-t/RC}\right) \end{cases}$$

$q_{máx} = C\mathcal{E}$

Tiempo característico: $\tau = RC\ (\Omega F = s)$

C: Capacitancia

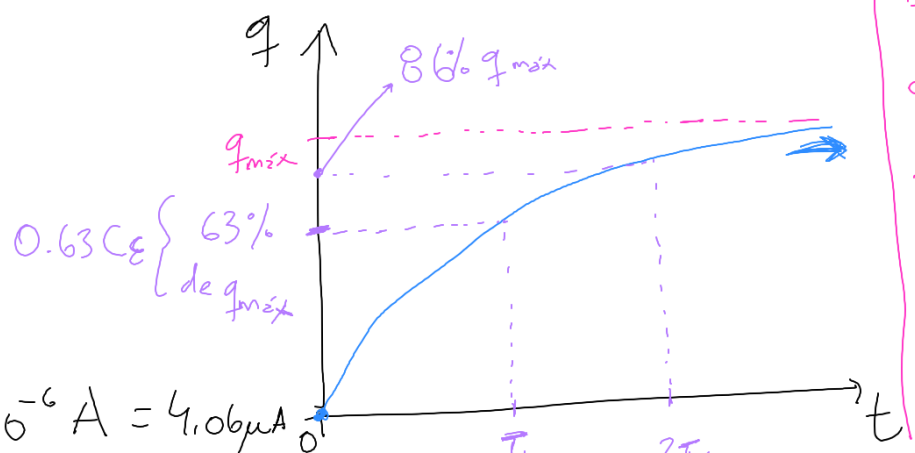
$\mathcal{E}$: Fem de la batería

R: Resistencia

$$q(10) = \underbrace{C\mathcal{E}}_{1{,}50 \times 10^{-4}\ C}\underbrace{\left(1 - e^{-10/RC}\right)}_{0.865} = 1{,}29 \times 10^{-4}\ C$$

$$i(t) = \frac{\mathcal{E}}{R} e^{-t/RC} = \frac{dq}{dt}$$

$$i(10) = \frac{\mathcal{E}}{R} e^{-2} = \frac{\mathcal{E}}{R}(0.135) = 4{,}06 \times 10^{-6}\ A = 4{,}06\ \mu A$$



En la práctica decimos que está "cargado" después de $t = 4 \sim 5\tau$ (99,3%) (98,2%)

t^* / $q(t^*) = 0.75\, q_{máx}$

$\log \neq \log_{10}$

$$q(t) = q_{máx}\left(1 - e^{-t/RC}\right) \Rightarrow 1 - e^{-t/RC} = 0.75$$

$$e^{-t/RC} = 0.25$$

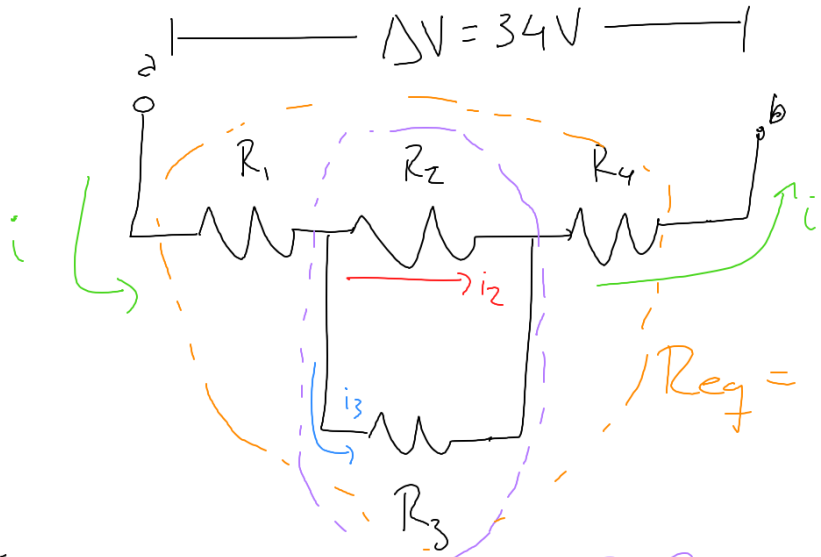
$$\log\left(e^{-t/RC}\right) = \log(0.25)$$

$$-t/RC = \log(0.25)$$

$$\boxed{t = -RC\log(0.25) = 6.93\ s}$$

$RC = 5{,}005$

2.1.6)



$R_1 = 4k\Omega$

$R_2 = 7k\Omega$

$R_3 = 10k\Omega$

$R_4 = 9k\Omega$

$$i = \frac{\Delta V}{R_{eq}} = 2\times10^{-3}\,A = i_{R_1} = i_{R_4}$$

↳ 1 cifra (2)

$$R_{eq} = R_1 + R_{23} + R_4 = 17k\Omega = 2\times10^{1}\,k\Omega$$

↳ 1 cifra

$$R_{23} = \frac{R_2 R_3}{R_2 + R_3} = 4{,}1k\Omega = 4k\Omega$$

↓

1 cifra

$$\boxed{P = \Delta V i = i^2 R}$$

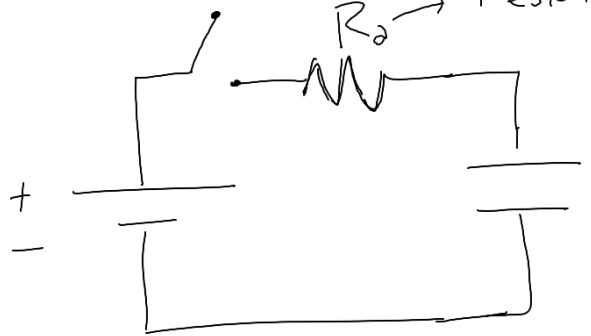
$$i_{R_{23}} = i = 2\times10^{-3}\,A$$

$$\Delta V_{R_{23}} = R_{23}\, i_{R_{23}} = 8V = \Delta V_{R_2} = \Delta V_{R_3}$$

$$i_2 = \frac{\Delta V_{R_2}}{R_2} = 1\times10^{-3}\,A$$

$$i_3 = \frac{\Delta V_3}{R_3} = 8\times10^{-4}\,A$$

2.2.6)



$l = 2{,}5\,cm = 2{,}5\times10^{-2}\,m$

$r_a = 5{,}0\,\mu m = 5{,}0\times10^{-6}\,m$

$R_m = 40\,\Omega m^2$

$d = 10\,nm = 10\times10^{-9}\,m$

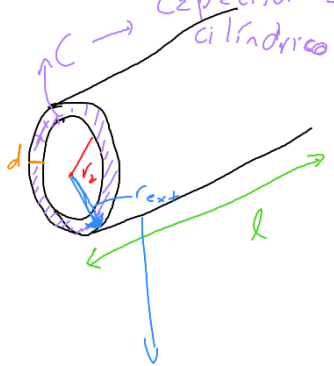
$k_e = 7{,}0$

$\rho_2 = 2{,}0\,\Omega m$

$\tau = RC$

$$R_a = \frac{\rho_2 l}{\pi r_a^2} = \frac{\rho L}{A} = 6{,}36\times10^{8}\,\Omega$$

Capacitor cilíndrico → $C = \frac{2\pi k\varepsilon_0 l}{\ln\left(\frac{r_b}{r_a}\right)}$



$r_{ext} = r_a + d \approx r_a$

(2.2.3)

$$C = \frac{k_e\varepsilon_0 A}{d} = \frac{k_e\varepsilon_0 2\pi(r_a + d)\,l}{d} = 4{,}9\times10^{-9}\,F$$

($r_a + d \approx r_a$)

↳ Podemos calcular como $C_{||}$

Capacitor de ||

$\tau = 3{,}1\,s$

$$q(t) = q_m \left(1 - e^{-t/\tau}\right)$$

$$t^* \,/\, q(t^*) = \frac{1}{2} q_m \Rightarrow \quad 1 - e^{-t^*/\tau} = \frac{1}{2} \Rightarrow t^* = -\tau \log\left(1 - 1/2\right)$$

$$\boxed{t^* = 2.15\,s}$$

$$t^{**} \,/\, q(t^{**}) = 0.99\, q_m \Rightarrow \quad 1 - e^{-t^{**}/\tau} = 0.99 \Rightarrow t^{**} = -\tau \log\left(1 - 0.99\right)$$

$$\boxed{t^{**} = 14,3\,s}$$