HOJA N°

FECHA

PRÁCTICO 4

1 i

a) datos
$$\begin{cases} \ell = 1Km \\ V = 6\,V \\ \rho = 1{,}7 \cdot 10^{-8}\,\Omega m \\ n_e = 8 \cdot 10^{28}\,m^{-3} \end{cases}$$

$\mathcal{V} = \frac{i}{n_e A . e}$, sabemos que $E = \frac{\varepsilon}{\ell} = \frac{V}{\ell}$ y que $\sigma = \frac{1}{\rho} = \frac{j}{E} \Rightarrow j = \frac{E}{\rho}$

Entonces

$$\mathcal{V} = \frac{i}{n_e A . e} = \frac{jA}{n_e A e} = \frac{j}{n_e . e} = \frac{\frac{E}{\rho}}{n_e . e} = \frac{V}{\ell . \rho n_e . e}$$

$$= 6 \cdot \frac{1}{1} \cdot \frac{10^8}{1{,}7} \cdot \frac{10^{19}}{-1{,}602}\ V . Km^{-1} . \Omega^{-1} . m^{-1} . m^3 . C^{-1}$$

$$= \frac{6 . 10^{-4}}{(1{,}7) . 8 . (-1{,}602)} \frac{V . m}{\Omega . C} = -0{,}00002 \cdot \frac{m^2 Kg}{s^3 A} \frac{s^3 A^2}{m^2 Kg} \cdot m \cdot \frac{1}{s . A}$$

$$= -0{,}00002\ \frac{m}{s}$$

b) $\tau_\ell = \frac{\ell}{-\mathcal{V}} = \frac{1000\,m}{0{,}00002\,\frac{m}{s}} = 50000000\ s$

NOTA

ii

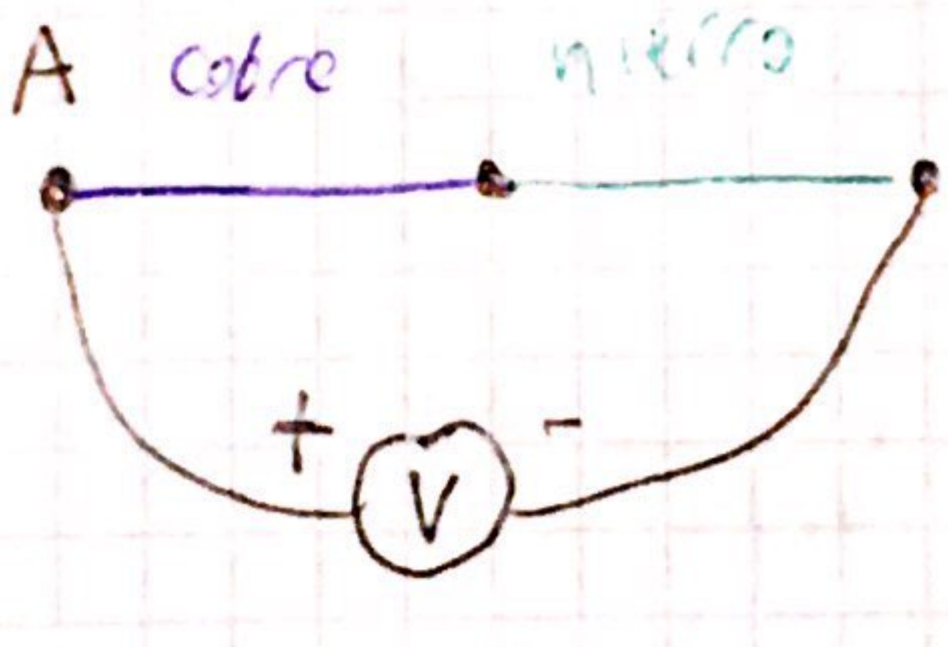
a) datos:
$$\begin{cases} l = 2m \\ V = 12V \\ \rho = 0{,}25\,\Omega m \\ n_e = 3.10^{26}\,m^{-3} \end{cases}$$

$$v = \frac{V}{l\rho . n_e . e} = 12 . \frac{1}{2} . 4 . \frac{1}{3\,10^{26}} . \frac{1}{(-1{,}602).10^{-19}} . V m^{-1} . \Omega^{-1} m^{-1} m^{3} C^{-1}$$

$$= \frac{8}{(-1{,}602)\,10^{7}} . \frac{V\,m}{\Omega C} = -5.10^{-7}\,\frac{m}{s}$$

b) $$\tau_l = \frac{l}{-v} = \frac{2m}{5\,10^{-7}\,\frac{m}{s}} = 4000000\ s$$

2



a) $\Delta V = \Delta V_c + \Delta V_H$

• $\Delta V_H = i . R_H = \frac{i . \rho_H . l}{A} \Rightarrow i = \frac{\Delta V_H . A}{\rho_H . l}$

• $\Delta V_c = i . R_c = \frac{i\, \rho_c\, l}{A}$

Entonces:

NOTA

HOJA N°

FECHA

$$\Delta V = \Delta V_c + \Delta V_H = \frac{i\,\rho_c\, l}{A} + \Delta V_H = \frac{\Delta V_H A}{\rho_H l}\cdot\frac{\rho_c l}{A} + \Delta V_H$$

$$= \Delta V_H\left(\frac{\rho_c}{\rho_H} + 1\right) = \left(\frac{\rho_c + \rho_H}{\rho_H}\right)\Delta V_H$$

$$\Longrightarrow \boxed{\Delta V_H = \Delta V\left(\frac{\rho_H}{\rho_c+\rho_H}\right)}$$

Luego:

$$\Delta V = \Delta V_c + \Delta V\,\frac{\rho_H}{\rho_c+\rho_H}$$

$$\Delta V\left(1 - \frac{\rho_H}{\rho_c+\rho_H}\right) = \Delta V_c \quad\Longrightarrow\quad \boxed{\Delta V_c = \frac{\rho_c}{\rho_c+\rho_H}\cdot\Delta V}$$

b)

$$|E_c| = \frac{\Delta V_c}{l} = \frac{\Delta V}{l}\left(\frac{\rho_c}{\rho_c+\rho_H}\right)$$

$$|E_H| = \frac{\Delta V_H}{l} = \frac{\Delta V}{l}\left(\frac{\rho_H}{\rho_c+\rho_H}\right)$$

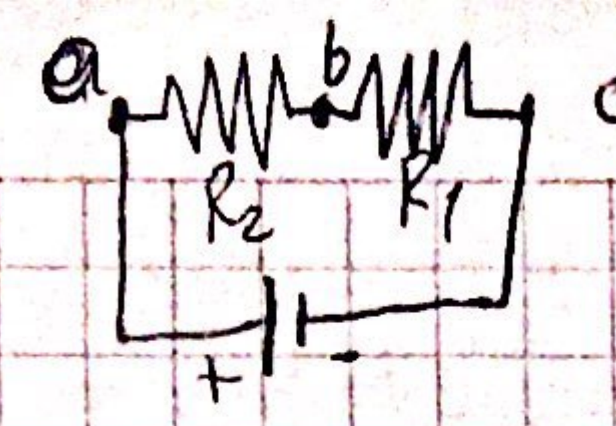
c)

$$i = \frac{\Delta V_H A}{\rho_H l} = \Delta V\left(\frac{\rho_H}{\rho_c+\rho_H}\right)\cdot\frac{A}{\rho_H l} = \frac{\Delta V\, A}{l(\rho_c+\rho_H)}$$

$$j = \frac{i}{A} = \frac{\Delta V}{l(\rho_c+\rho_H)}$$

NOTA

③



a) La corriente es la misma en todo el circuito porque no se concentra carga en ningun lado.

b)

$$\begin{cases} 8V = i \cdot R_1 & \rightsquigarrow i = \frac{8V}{R_1} \\ 4V = i \cdot R_2 & \rightsquigarrow i = \frac{4V}{R_2} \end{cases} \Rightarrow \quad \begin{aligned} 8V \cdot R_2 &= 4V \cdot R_1 \\ 2R_2 = R_1 &\Rightarrow R_1 > R_2 \end{aligned}$$

c)

$$V_0 = V_{ab} + V_{bc} = 12V$$

d)

$$8V = 0{,}5A \cdot R_1 \qquad , \qquad 4V = 0{,}5A \cdot R_2$$

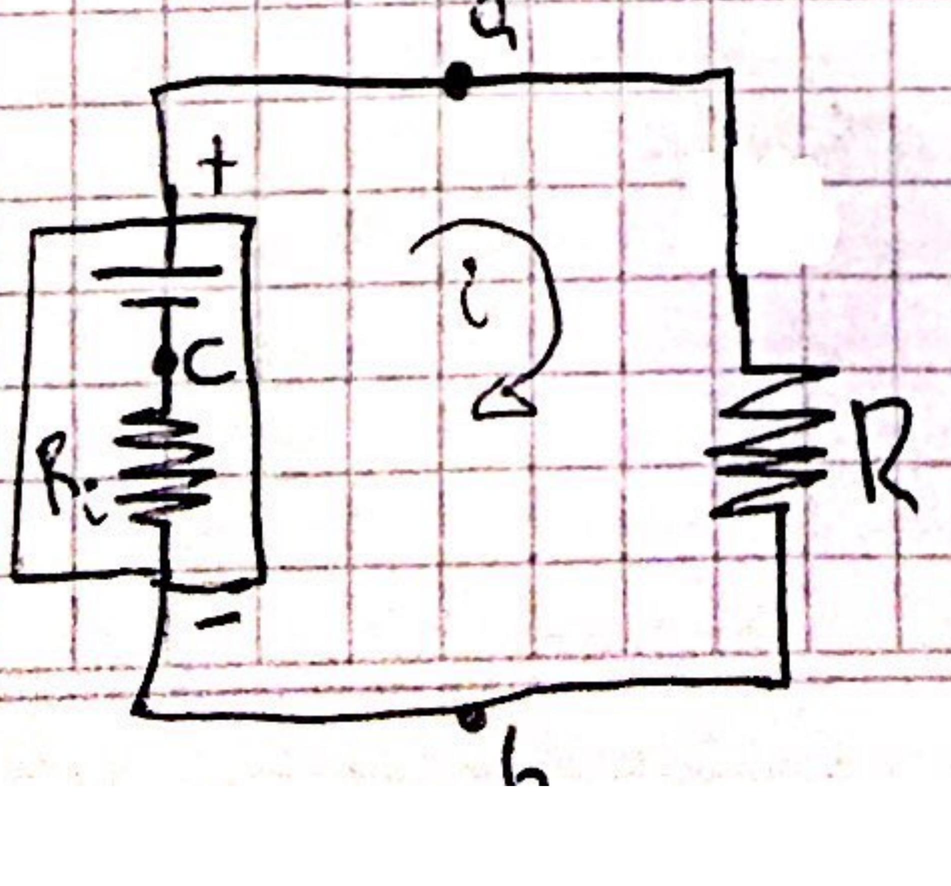
$$\underline{16\Omega = R_1} \qquad \qquad \underline{8\Omega = R_2}$$

$$P_1 = i^2 \cdot R_1 = 0{,}25A^2 \cdot 16\Omega = 4A^2\Omega$$

$$P_2 = i^2 R_2 = 0{,}25A^2 \cdot 8\Omega = 2A^2\Omega$$

④ a)

Es de notar que

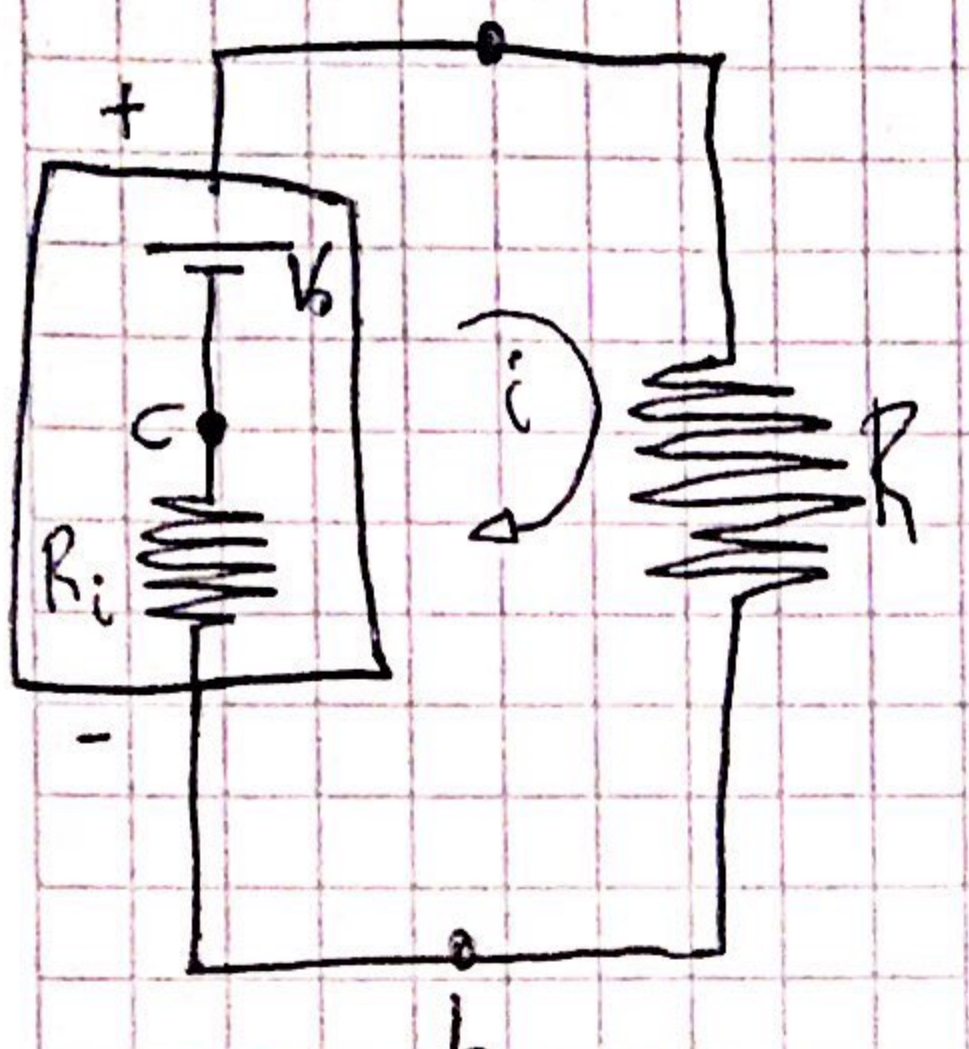


$$V_{ab} = 9{,}8V = V_a - V_b = i \cdot R$$

$$\Rightarrow i = \frac{9{,}8V}{0{,}5\Omega} = 19{,}6A$$

Si la corriente va antihorario, $V_{ba} \neq i.R$.

Ahora si:



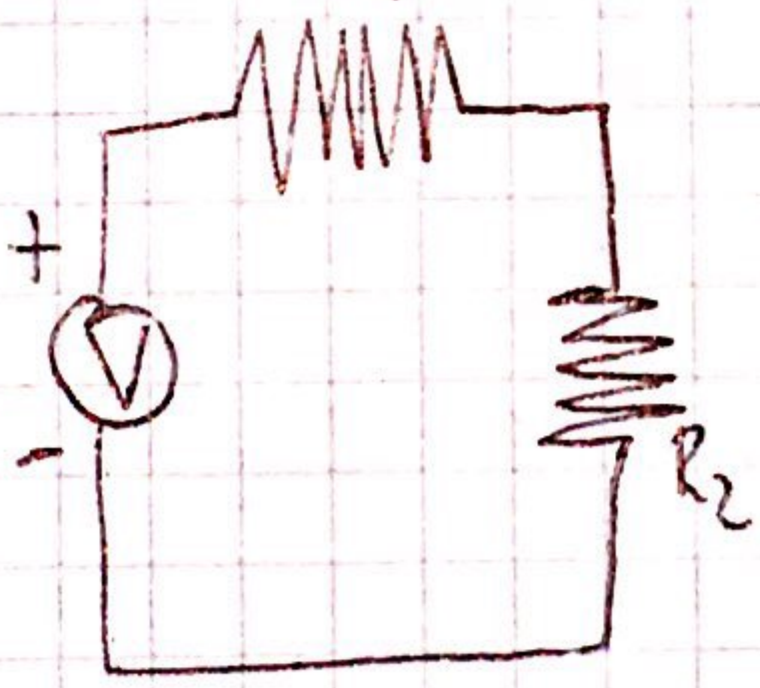
$$V_{ab} = V_a - V_b = V_a - V_b + V_c - V_c$$
$$= V_a - V_c + V_c - V_b$$
$$= V_b - i.R_i$$

$$\Rightarrow 9{,}8V = 12{,}3V - 19{,}6A.R_i$$

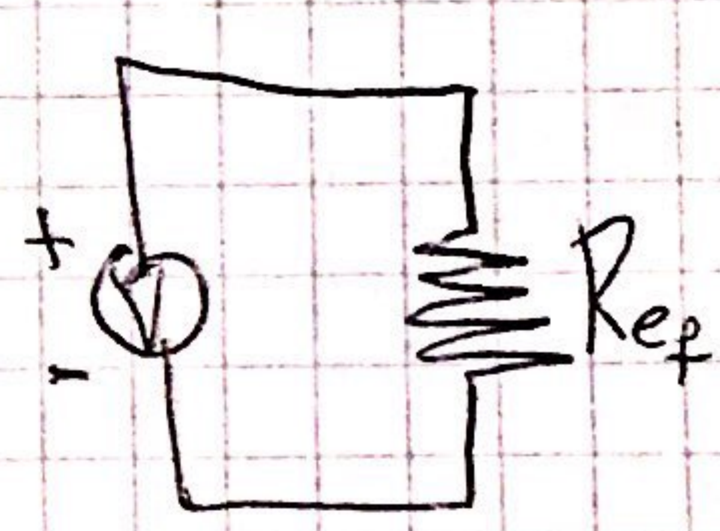
$$\Rightarrow \boxed{R_i = 0{,}1\,\Omega}$$

b)

Un circuito de la forma



es equivalente a



donde $R_{ef} = R_1 + R_2$

Por lo tanto podemos pensar a nuestro circuito como una R_{ef} conectada a una batería ideal, donde $R_{ef} = R + R_i$

$$P = i^2 R = \frac{\varepsilon^2}{(R+R_i)^2} \cdot R = \frac{\varepsilon^2 R}{(R+R_i)^2}$$

$$\frac{dP}{dR} = \frac{\varepsilon^2 (R+R_i)^2 - \varepsilon^2 R\, 2(R+R_i)}{(R+R_i)^4} = 0$$

$$(R+R_i)^2 = R(2R+2R_i)$$

$$R^2+2RR_i+R_i^2 = 2R^2+2RR_i$$

$$R^2-R_i^2=0$$

$$R^2=R_i^2$$

$\boxed{R=R_i} \rightsquigarrow$ punto crítico

$$\frac{d^2P}{dR^2} = -\frac{2\varepsilon^2(-R+2R_i)}{(R+R_i)}$$

Si Valuo en R_i : $-\dfrac{2\varepsilon^2(-R_i+2R_i)}{R+R_i} \overset{?}{<} 0$

$$-2\varepsilon^2(-R_i+2R_i) \overset{?}{<} 0$$

$-4\varepsilon^2 R_i < 0$ Verdadero, pues $\varepsilon, R_i > 0$

$\Longrightarrow R=R_i$ hacen que P sea máximo.

NOTA