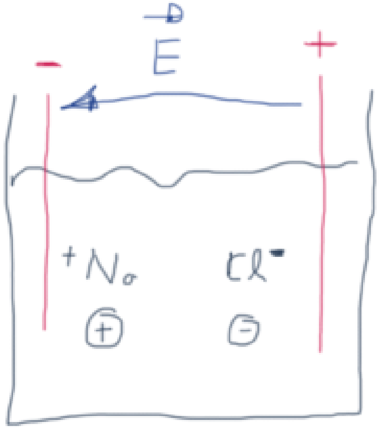
EX. 25.8, p.161



Em 1,0 s:

$2,68 \cdot 10^{16}$ Na^+

$3,92 \cdot 10^{16}$ Cl^-

a) $i = ?$

$$i_{Na^+} = \frac{q_{Na^+}}{\Delta t} = \frac{2,68 \cdot 10^{16} \cdot 1,6 \cdot 10^{-19}}{1,0}$$

$$= 4,3 \cdot 10^{-3} \text{ A}$$

$$i_{Cl^-} = \frac{q_{Cl^-}}{\Delta t} = \frac{3,92 \cdot 10^{16} \cdot 1,6 \cdot 10^{-19}}{1,0}$$

$$= 6,3 \cdot 10^{-3} \text{ A}$$

$$i = i_{Na^+} + i_{Cl^-}$$

$$i = 4,3 \cdot 10^{-3} + 6,3 \cdot 10^{-3}$$

$$\boxed{i = 11 \cdot 10^{-3} \text{ A}}$$

ou

$$\boxed{i = 11 \text{ mA}}$$

b) O sentido da corrente é o sentido da placa + para a placa − (que é o sentido do movimento das cargas positivas).

25.9, p.161

$n = ?$ $(J = n \cdot e \cdot v_d)$

peso molecular prata $= 107,87 \frac{g}{mol}$

↓

$1 \text{ g de prata} = \frac{1}{107,87} \text{ mol}$

$= \frac{6,02 \cdot 10^{23}}{107,87}$ átomos de prata

densidade da prata $= 10,49 \frac{g}{cm^3}$

↓

$$n = 10,49 \text{ g} \cdot \frac{1}{cm^3} = 10,49 \cdot \frac{6,02 \cdot 10^{23}}{107,87} \cdot \frac{1}{(10^{-2} \text{ m})^3}$$

$$\boxed{n = 5,85 \cdot 10^{28} \frac{\text{elétrons livres}}{m^3}}$$

Para condutores metálicos, observa-se que ρ (e consequentemente R) varia com a temperatura:

(MODELO)

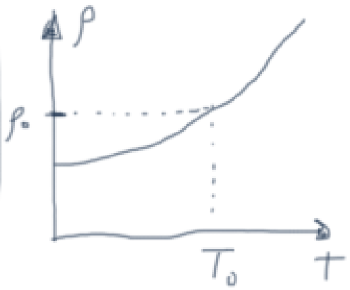
$$\rho = \rho_0 [1 + \alpha (T - T_0)]$$

- $\rho \rightarrow \rho(T)$
- $\rho_0 \rightarrow$ Tabela 25.1 (p. 140)
- $\alpha \rightarrow$ coeficiente de temperatura de resistividade $\rightarrow$ Tabela 25.2 (p. 141)
- $T_0 \rightarrow$ temperatura de referência

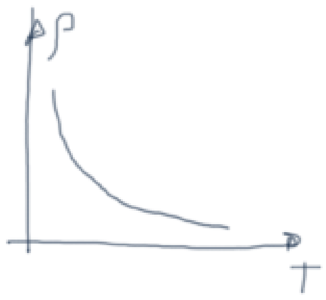
$$R = R_0 [1 + \alpha (T - T_0)]$$

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

$$R = \underbrace{\rho_0 \frac{L}{A}}_{R_0} [1 + \alpha (T - T_0)]$$

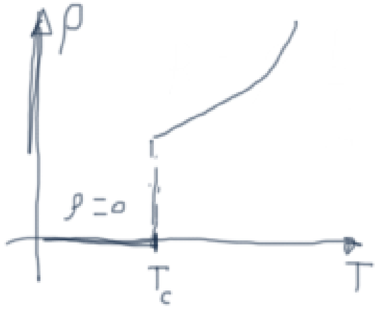


CONDUTOR METÁLICO



SEMICONDUTOR

silício
germânio



SUPERCONDUTOR

25.10, p. 161

a) $d = 2{,}05\ mm \rightarrow A = \frac{\pi d^2}{4}$

$i = 2{,}75\ A$

$E = ?$

$$J = \frac{i}{A} = \sigma E$$

$$E = \frac{1}{\sigma} \frac{i}{A} \qquad \left(\frac{1}{\sigma} = \rho\right)$$

$$E = \rho \cdot \frac{i}{A} \qquad \rho_{Cu} = 1{,}72 \cdot 10^{-8}\ \Omega \cdot m$$

$$= \frac{1{,}72 \cdot 10^{-8} \cdot 2{,}75}{\frac{\pi \cdot (2{,}05 \cdot 10^{-3})^2}{4}}$$

$$\boxed{E = 1{,}43 \cdot 10^{-2}\ \frac{V}{m}}$$

b) $\rho_{Ag} = 1,47\cdot 10^{-8}\ \Omega\cdot m$

$$E = \rho\cdot\frac{i}{A} = \frac{1,47\cdot 10^{-8}\cdot 2,75}{\frac{\pi(2,05\cdot 10^{-3})^2}{4}}$$

$$\boxed{E = 1,22\cdot 10^{-2}\ \frac{V}{m}}$$

25.11, p.161

$d = 0,500\ cm$

$\downarrow$

$A = \frac{\pi d^2}{4}$

$L = 1,50\,m$

$T_0 = 20,0°C \rightarrow i_0 = 18,5\,A$

$T = 92,0°C \rightarrow i = 17,2\,A$

a) $\rho_0 = ?$

$$\rho = \rho_0[1+\alpha(T-T_0)]$$

$$R = R_0[1+\alpha(T-T_0)]$$

$$R_0 = \rho_0\frac{L}{A}$$

$$R_0 = \rho_0\frac{L}{A} = \frac{\Delta V}{i_0}$$

$$\rho_0 = \frac{A}{L}\,\frac{\Delta V}{i_0} = \frac{\pi\cdot(0,500\cdot 10^{-2})^2\cdot 15,0}{4\cdot 1,50\cdot 18,5}$$

$$\boxed{\rho_0 = 1,06\cdot 10^{-5}\ \Omega\cdot m}$$

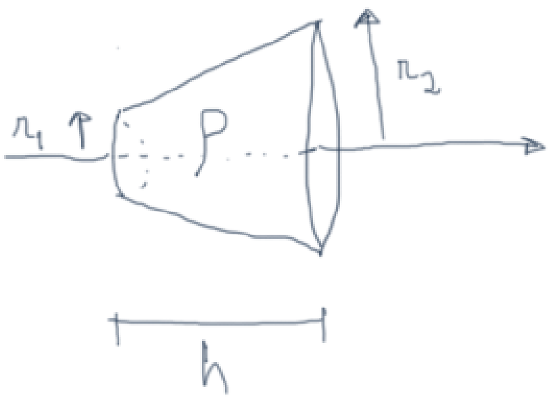
b) $R = \rho_0\frac{L}{A}[1+\alpha(T-T_0)]$

$$\frac{\Delta V}{i} = \rho_0\frac{L}{A}[1+\alpha(T-T_0)]$$

$$\frac{\frac{A\cdot\Delta V}{i\cdot\rho_0\cdot L} - 1}{T-T_0} = \alpha$$

$$\boxed{\alpha = 1,05\cdot 10^{-3}\ (°C)^{-1}}$$

25.63, p. 164



$R = ?$