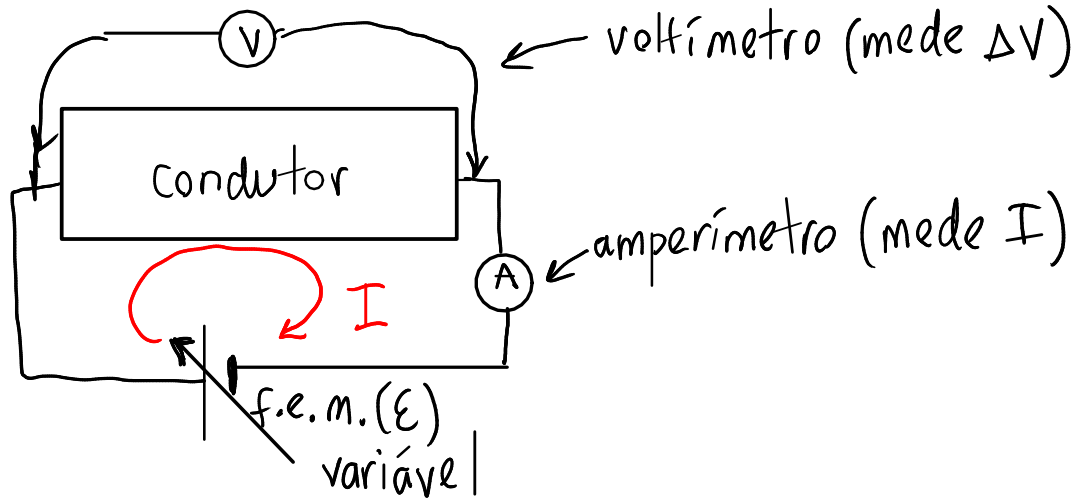
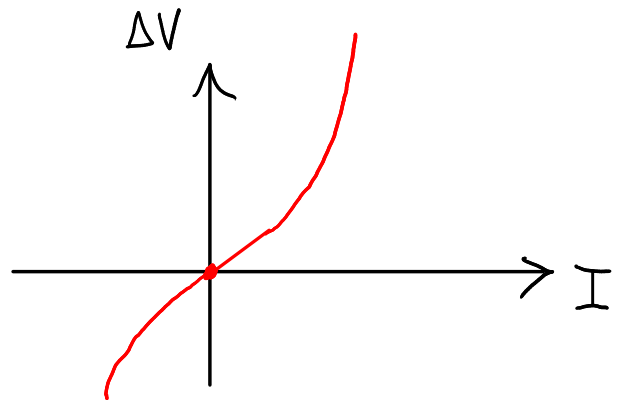
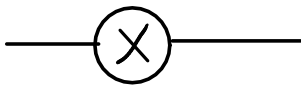


CURVAS DE VOLTAGEM-CORRENTE (caraterísticas)

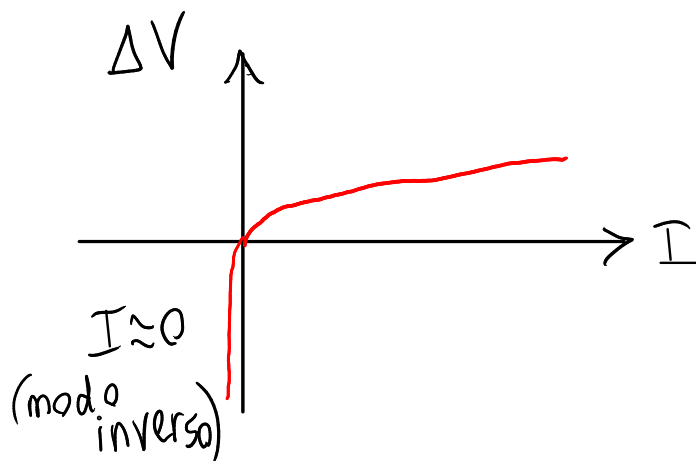
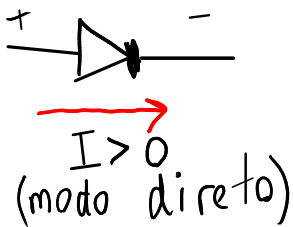


Exemplos:

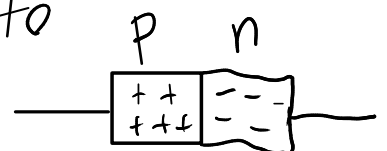
① lâmpada incandescentes



② Díodos



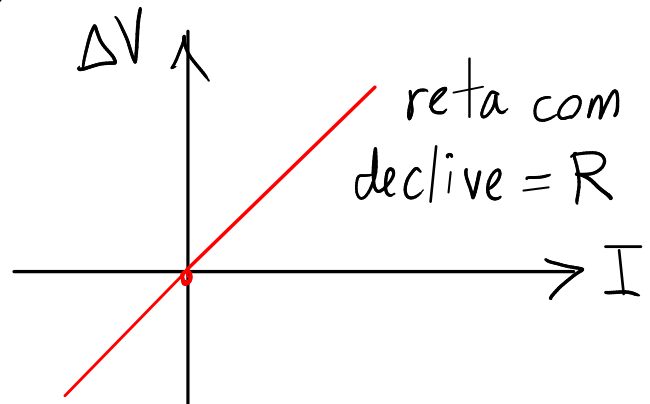
deixa passar corrente no modo direito
No modo inverso, $I \approx 0$



③ Resistências (em inglês resistor) (dispositivo)



R = resistência
(propriedade física
(em inglês resistance))



Exemplos: metais, grafite, ... (condutores em que toda a energia elétrica dissipada é convertida em calor)

Lei de Ohm

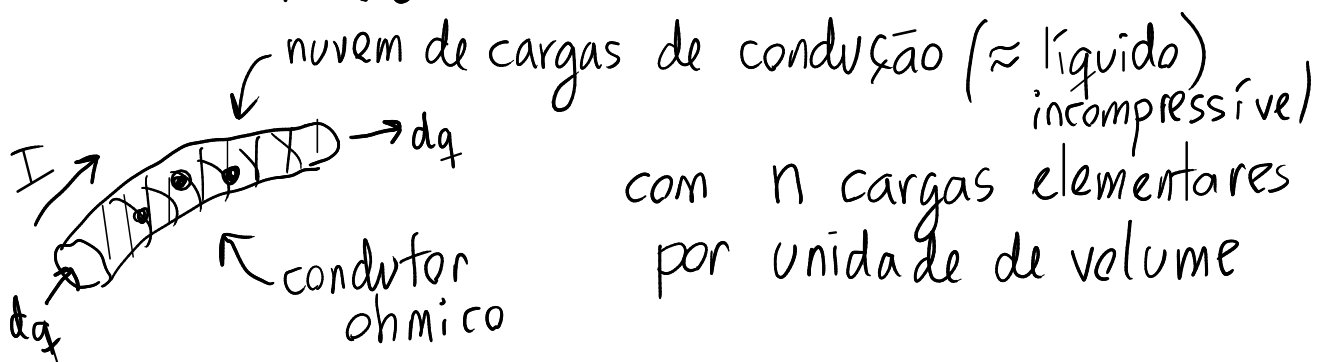
$$\Delta V = R I$$

R = resistência

Unidade SI de resistência:

$$1 \frac{V}{A} = 1 \Omega \text{ (ohm)}$$

RESISTIVIDADE



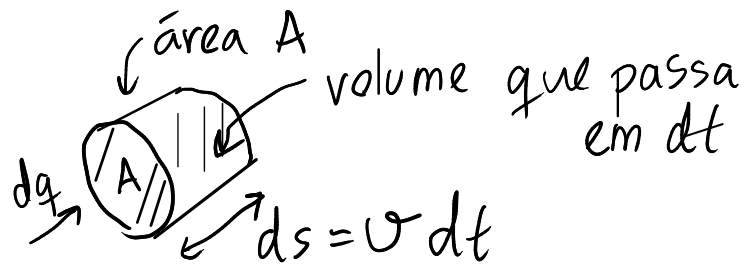
com n cargas elementares por unidade de volume

$$I = \frac{dq}{dt}$$

$dq = I dt$ carga transferida num intervalo dt

$$dq = (ne) \times \text{volume que passa no intervalo } dt$$

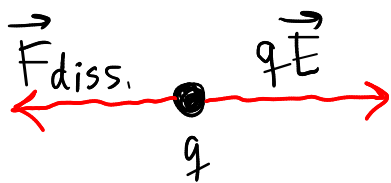
↑
carga por unidade de volume



$$dq = ne(Av dt)$$

$$I = neAv$$

Forças sobre cada carga de condução



$$F_{diss} = kv \quad \left(\begin{array}{l} \text{número de} \\ \text{Reynolds} \\ \text{baixo} \end{array} \right)$$

$$\Rightarrow v_{\text{limite}} : kv = qE$$

$$v = \frac{q}{k} E$$

$$\Rightarrow I = neA \left(\frac{q}{k} E \right)$$

$$\bar{E} = \frac{\Delta V}{L}$$

↑
média

↑
médio

$L =$ comprimento do condutor

$\Delta V =$ voltagem no condutor

← constante R^{-1}

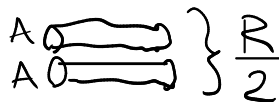
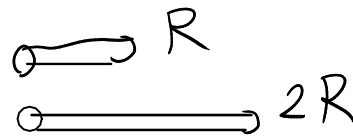
$$I = \left(\frac{neq}{k} \right) \frac{A}{L} \Delta V$$

lei de Ohm

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

$$\rho = \frac{k}{neq} = \text{resistividade do material}$$

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

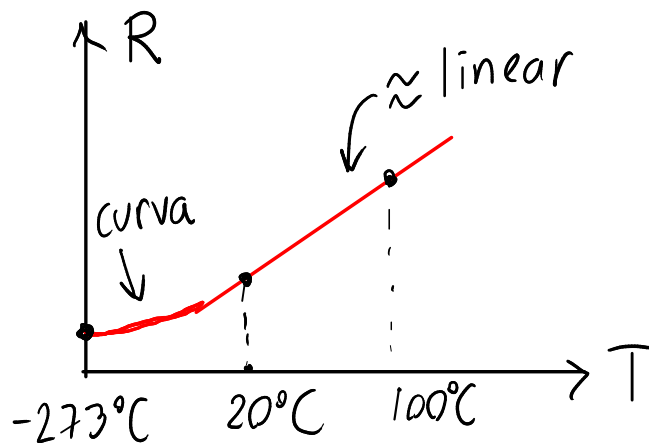


$\rho \rightarrow$ depende do material (propriedade física)
 $R \rightarrow$ propriedade geométrica/física

ρ também depende da temperatura T
 se T aumenta, as forças dissipativas aumentam

RESISTÊNCIA VS TEMPERATURA

Numa resistência:



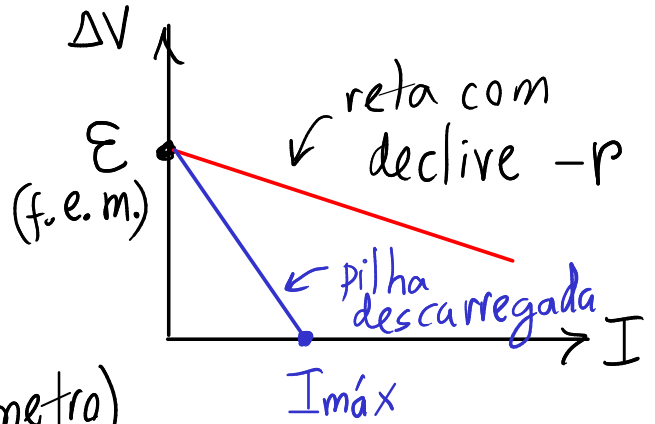
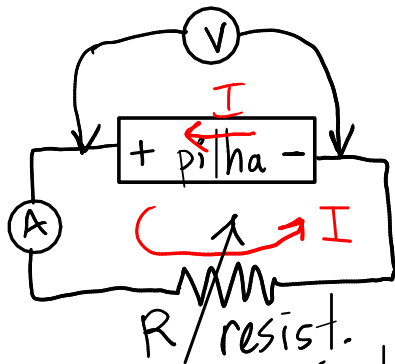
$$R(T) = R_{20} (1 + \alpha_{20}(T - 20))$$

valor a 20°C

declive = $R_{20} \alpha_{20}$

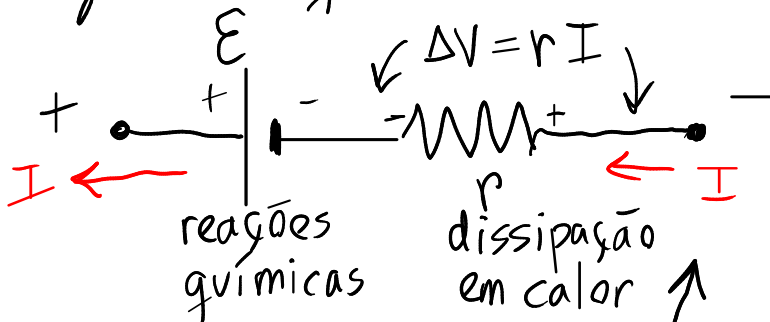
$\alpha_{20} =$ coeficiente de temperatura do material ($^\circ\text{C}^{-1}$)

CARACTERÍSTICA DE UMA BATERIA (pilha)



r = resistência interna da pilha
(baixa se a pilha tiver carga máxima)

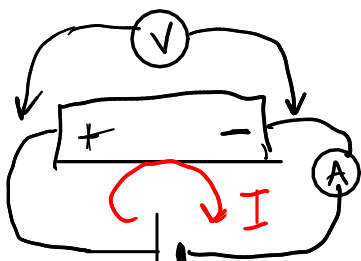
Diagrama equivalente



$$\Delta V = \varepsilon - rI$$

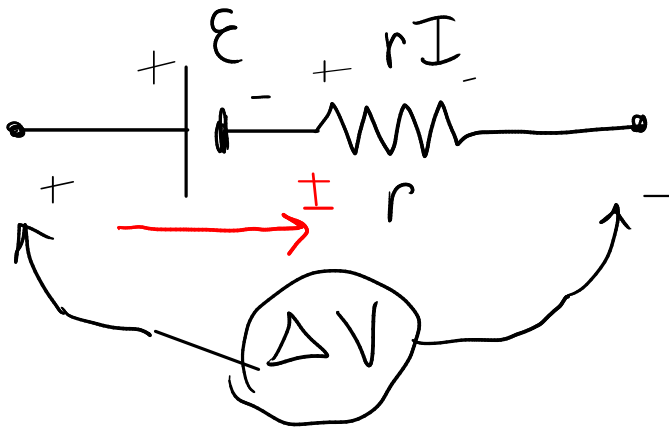
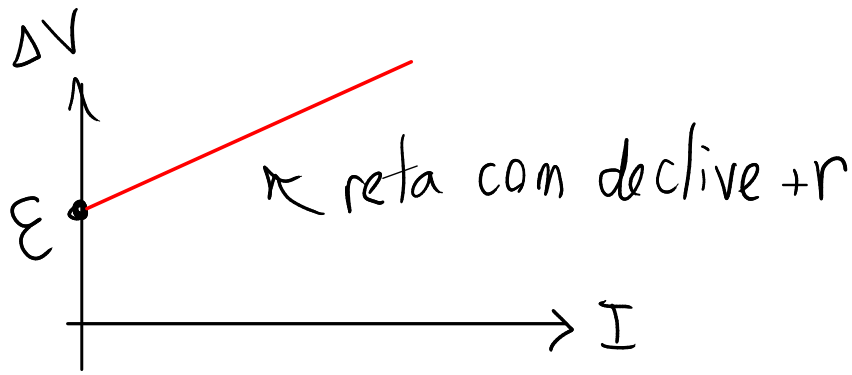
pilha em modo gerador

Modo recetor (pilha recarregável)



I de + para -

fonte externa com f.e.m. maior que a da pilha



$$\Delta V = \mathcal{E} + rI$$