

PRĄD ELEKTRYCZNY

def. uporządkowany ruch ładunków.

Natężenie prądu.

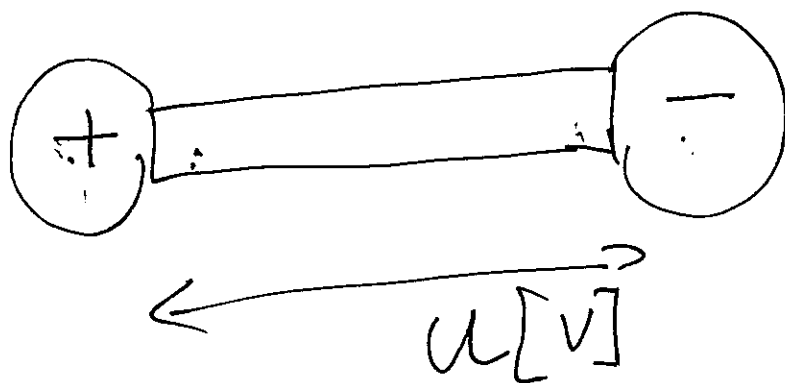
$$[A] \quad y \stackrel{\text{def}}{=} \frac{q}{t}$$

ładunek, który przepływa w czasie t [s]

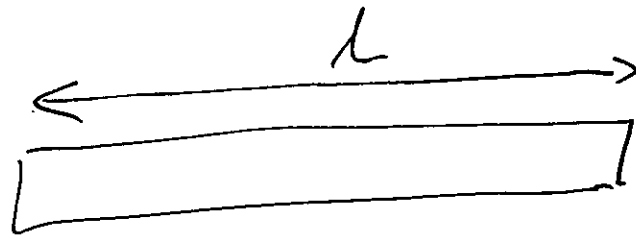
Od czego zależy natężenie prądu (Prąd)

$$y = \frac{U}{R}$$

U - napięcie elektryczne [V] między dwoma punktami.
R - opór elektryczny [Ω] Ω Ohm



Gdy $R = \frac{U}{y} = \text{const}$ to mówimy, że spełnione jest prawo Ohma.

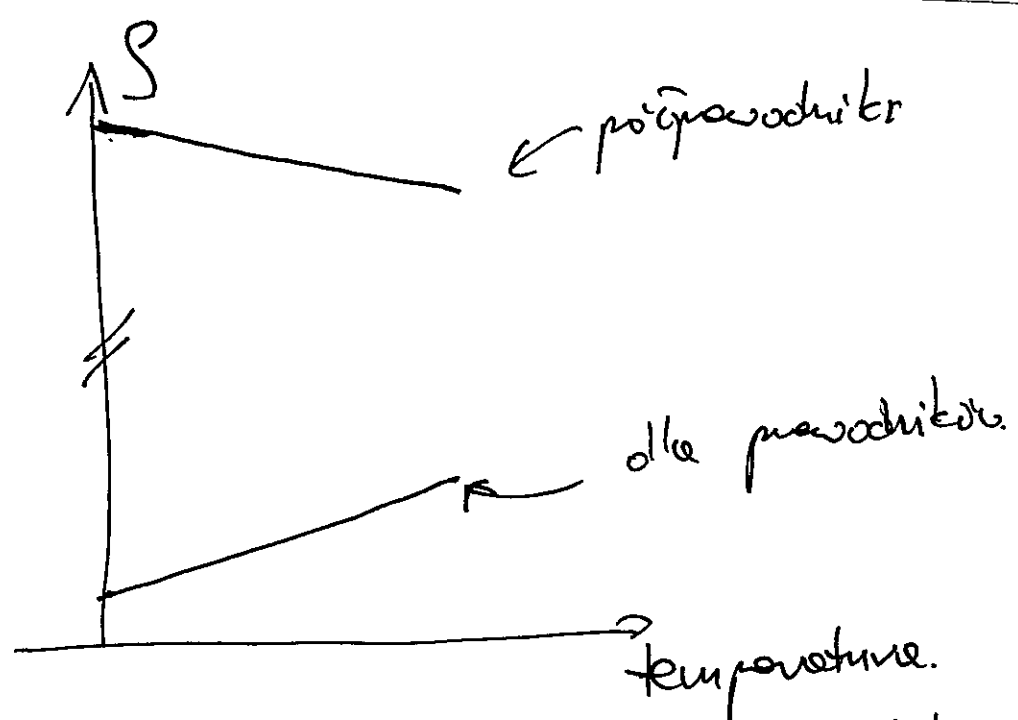
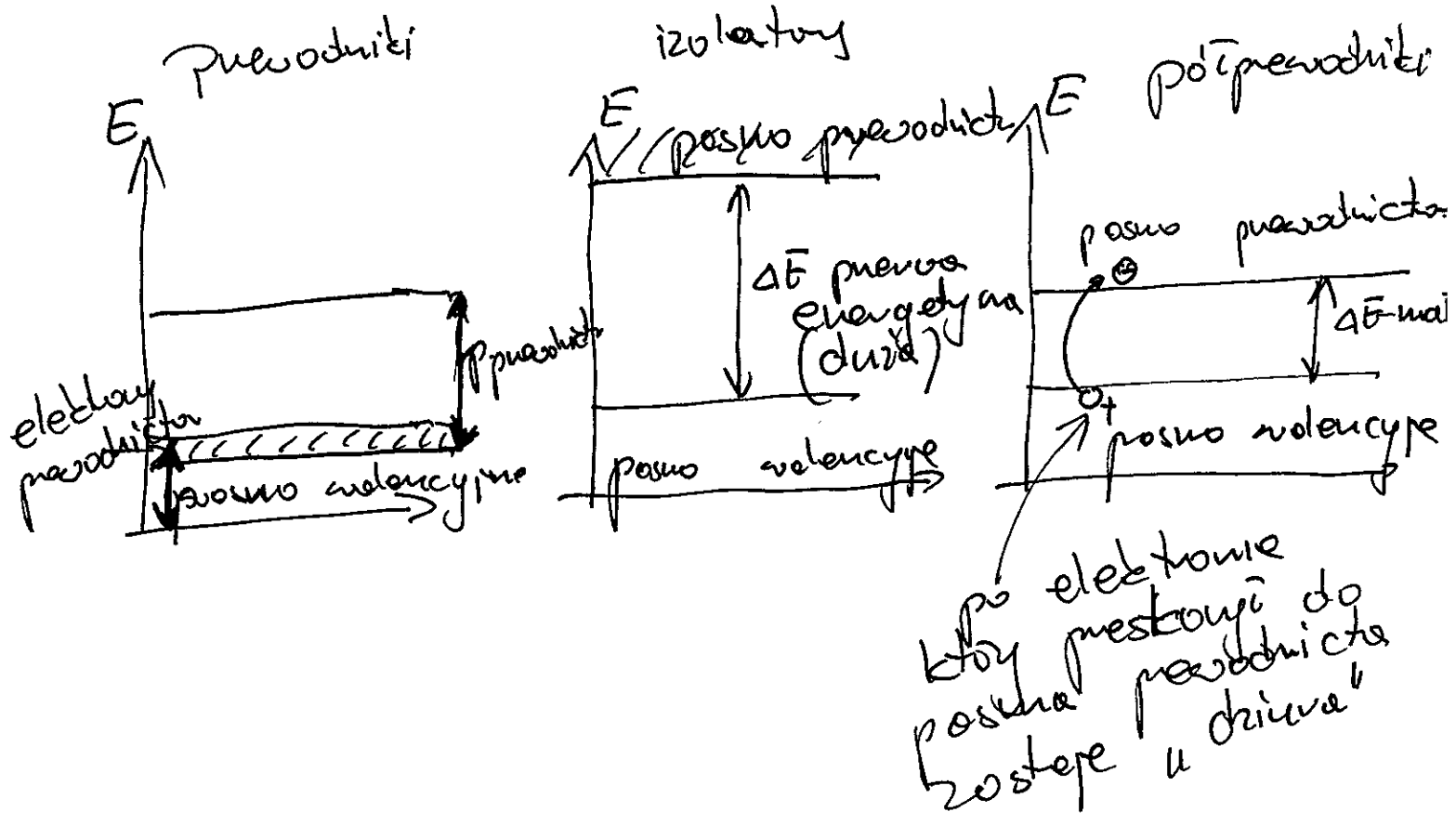


$$[\Omega] \rightarrow R = \rho \frac{l}{S}$$

l ← długość [m]
 S ← pole przekroju [m²]
 ρ ← opór właściwy (dla danej substancji) [Ω·m]

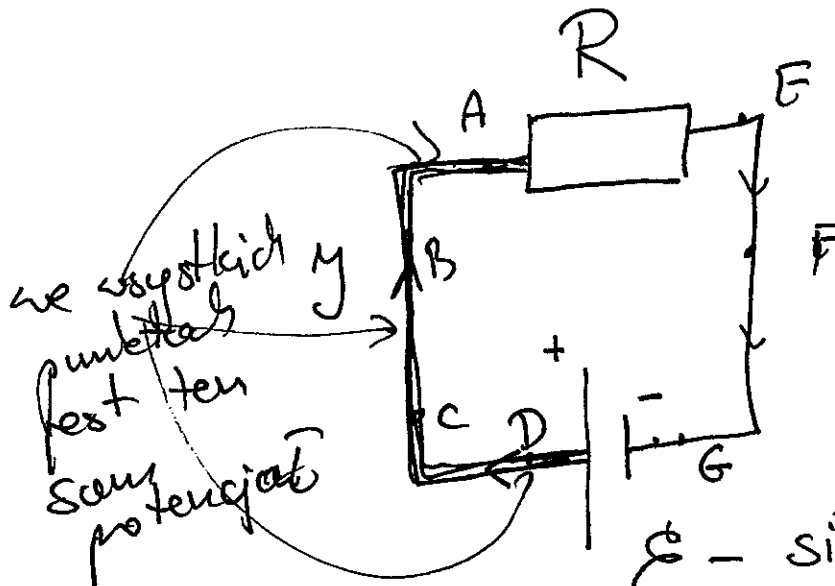
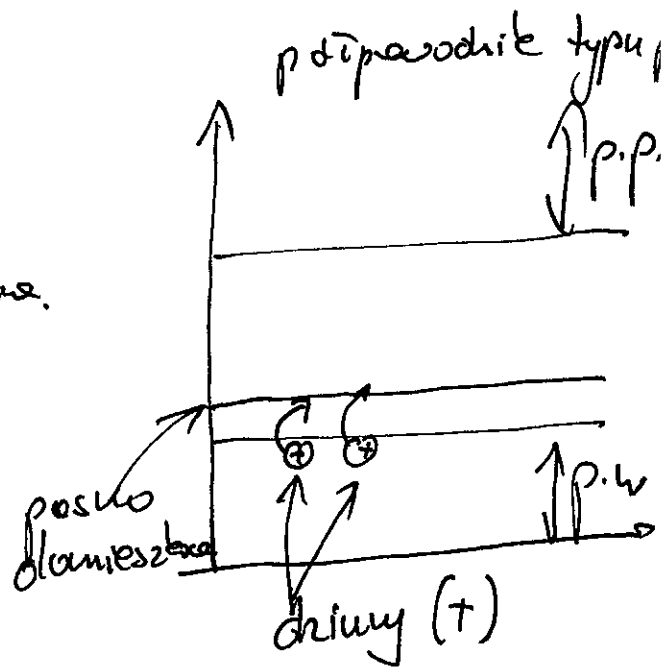
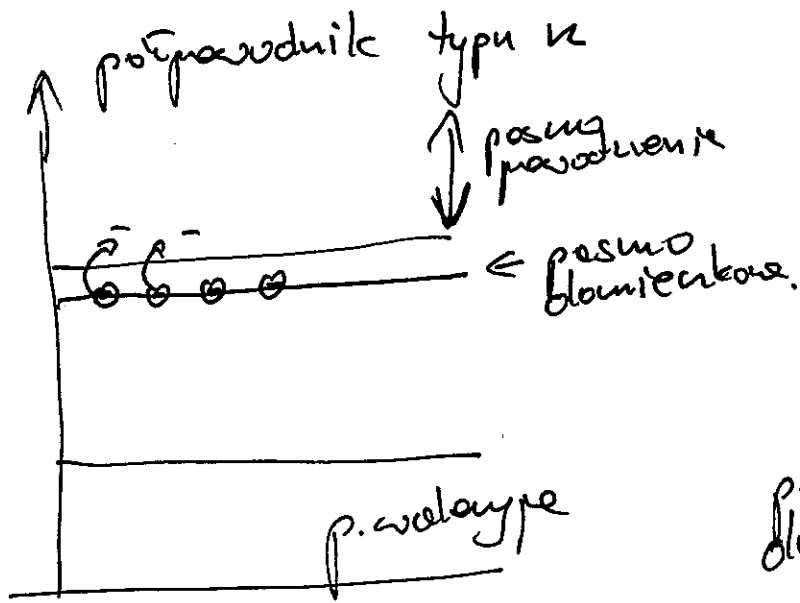
Co przewodzi przed elektrycy?
 (jakie są nośniki prądu?)

przewodniki	elektrony
ciężne (węglak)	jony dodatnie i ujemne
gazy	elektrony, jony dodatnie
półprzewodniki	elektrony, dziury



Przewodniki: $T \uparrow \Rightarrow$ wzrost długości sieci krystalicznej \Rightarrow wzrost oporu.

Półprzewodniki: $T \uparrow \Rightarrow$ wzrost długości sieci krystalicznej \Rightarrow wzrost liczby elektronów przewodzących \Rightarrow opór maleje



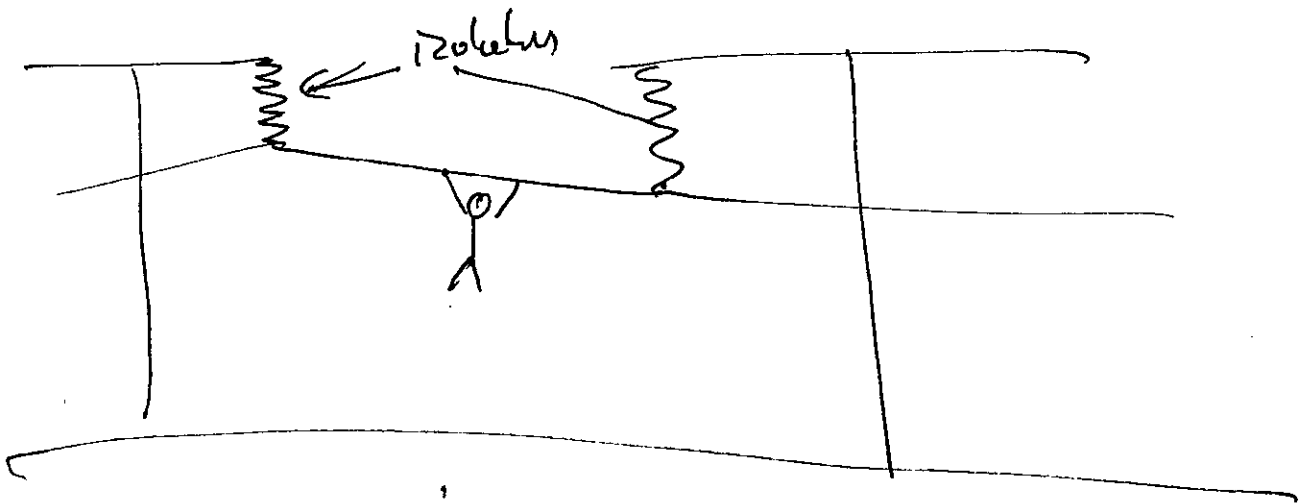
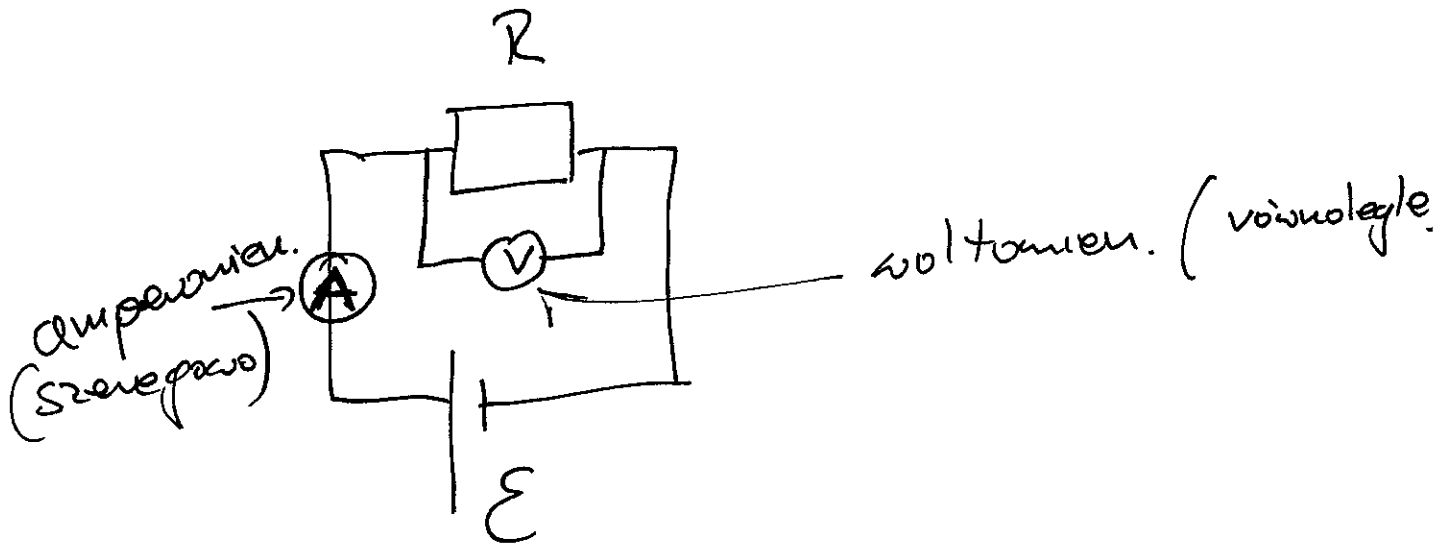
$$I = \frac{\varepsilon}{R}$$

ε - sila elektrotovyma
(Maksymalne napicje
zvoota)

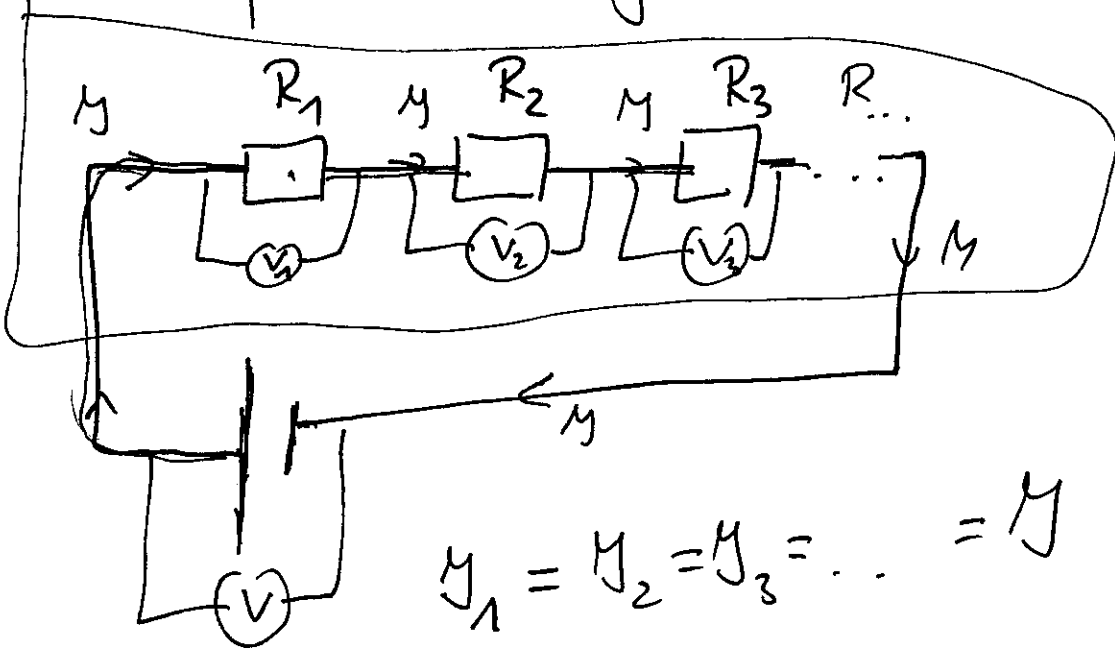
$$V_A = V_B = V_C = V_D$$

$$V_E = V_F = V_G$$

$$\varepsilon = U_{AE} = U_{AF} = U_{DG} = \dots$$



Połączenie szeregowe.



$$I_1 = I_2 = I_3 = \dots = I$$

$$U = U_1 + U_2 + U_3 + \dots$$

$I = \frac{U}{R}$ - wzorem wpisad dla kazdego opornika, bozi prudy opornikow.

$$I_1 = \frac{U_1}{R_1}$$

$$I_2 = \frac{U_2}{R_2}$$

$$I_3 = \frac{U_3}{R_3}$$

$$U_1 = I_1 R_1$$

$$U_2 = I_2 R_2$$

$$U_3 = I_3 R_3$$

$$I = \frac{U_{\text{calkowita}}}{R_{123..}} \Rightarrow U_{\text{calkowita}} = I R_{123..}$$

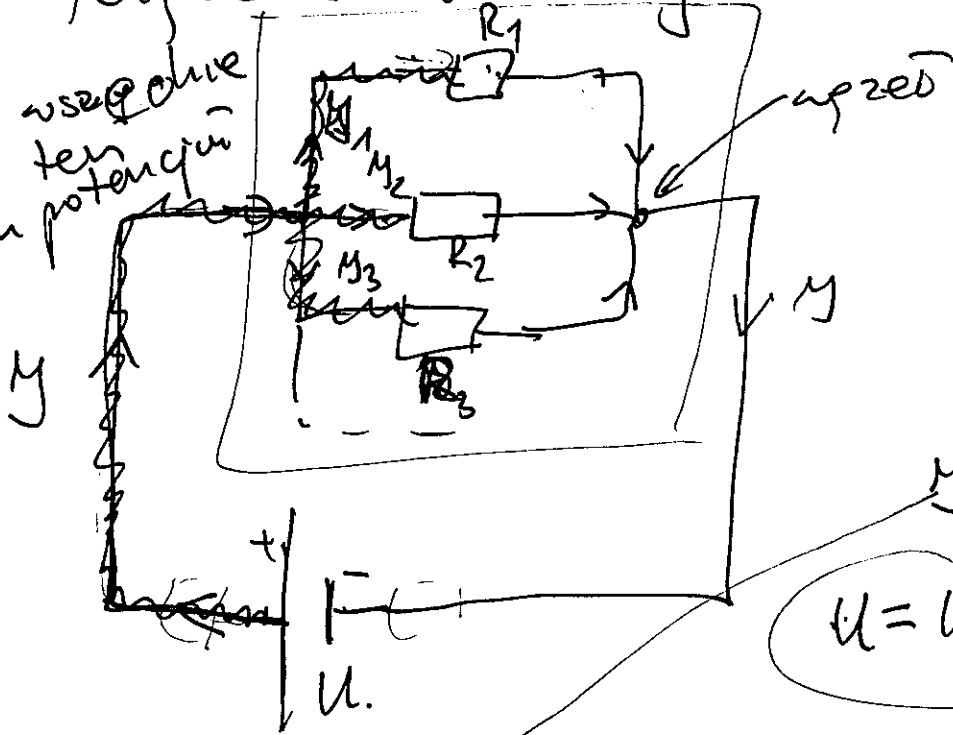
$$\Rightarrow I R_{123..} = I R_1 + I R_2 + I R_3 + \dots \quad | \quad I = I_1 = I_2 = I_3$$

$$R_{123..} = R_1 + R_2 + R_3 + \dots = \sum_{i=1}^n R_i$$

$$R_{123..} > R_1 \quad ; \quad R_{123..} > R_2 \quad ; \quad R_{123..} > R_3 \quad \dots$$

Průběhové vypočítání.

ni - vsechno
jest ten
sam potencion



$$I = I_1 + I_2 + I_3 + \dots$$

$$U = U_1 = U_2 = U_3 = \dots$$

$$I = \frac{U}{R_{123}}$$

$$I_1 = \frac{U_1}{R_1}$$

$$I_2 = \frac{U_2}{R_2}$$

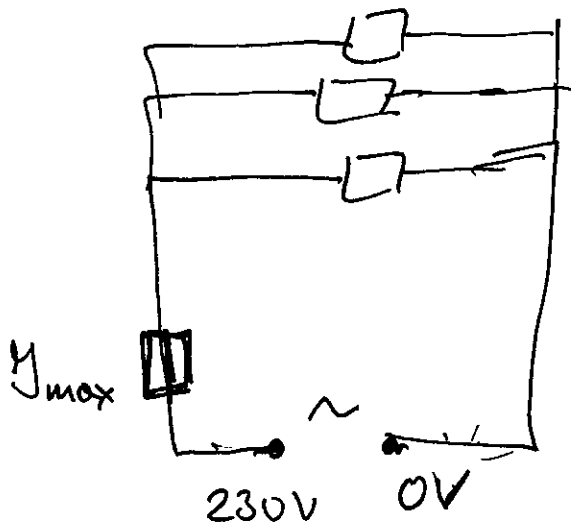
$$I_3 = \frac{U_3}{R_3}$$

$$\frac{U}{R_{123}} = \frac{U_1}{R_1} + \frac{U_2}{R_2} + \frac{U_3}{R_3} + \dots$$

$$\frac{1}{R_{123}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \sum_{i=1}^n \frac{1}{R_i}$$

$$R_{123} < R_1 \quad ; \quad R_{123} < R_2 \quad ; \quad R_{123} < R_3$$

Siec Jansan



$$y_{max} \leq y_1 + y_2 + y_3 \quad | \cdot U$$

$$y_{max} \cdot U \leq y_1 \cdot U + y_2 \cdot U + y_3 \cdot U$$

$$P_{max} \leq P_1 + P_2 + P_3 + \dots$$

$$P = U \cdot y$$

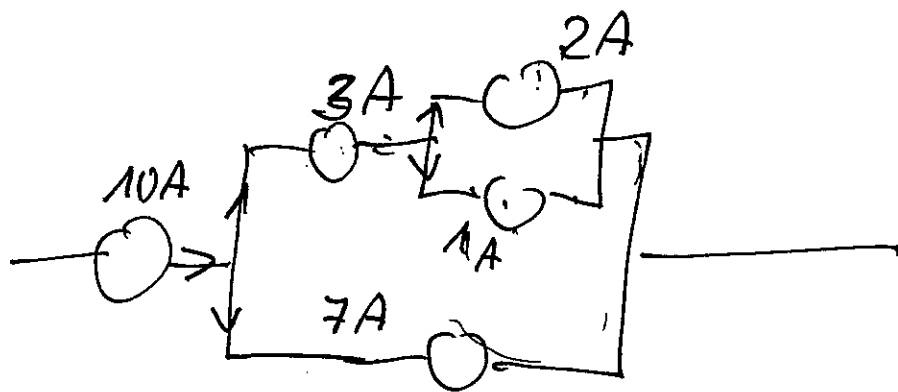
moc pody
[W]

$$y = \frac{U}{R}$$

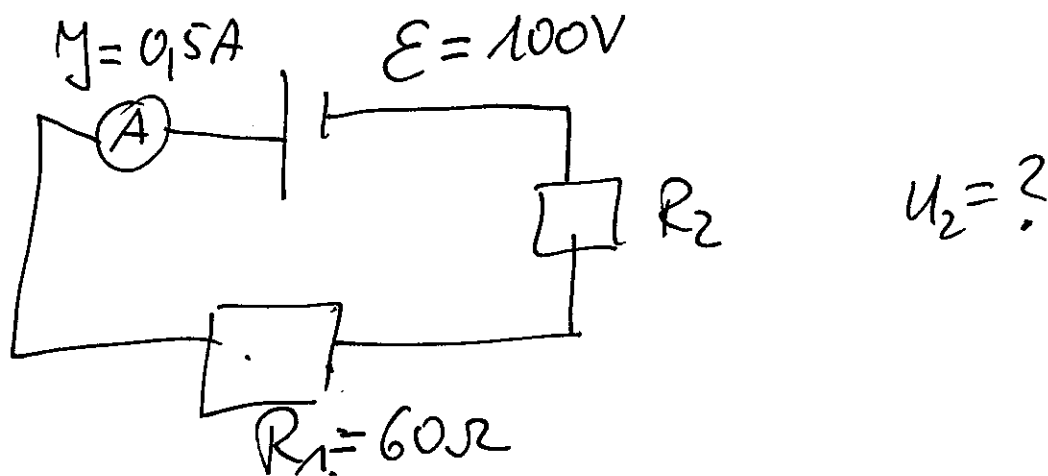
60W 230V 50Hz

$$P = \frac{U^2}{R} = y^2 R = U \cdot y$$

q.1.



q.2.



$$J = \frac{U_1}{R_1} \Rightarrow U_1 = J \cdot R_1 = 0,5 \cdot 60 = \underline{30V}$$

$$E = U_1 + U_2 \Rightarrow U_2 = E - U_1 = 100V - 30V = \underline{70V}$$

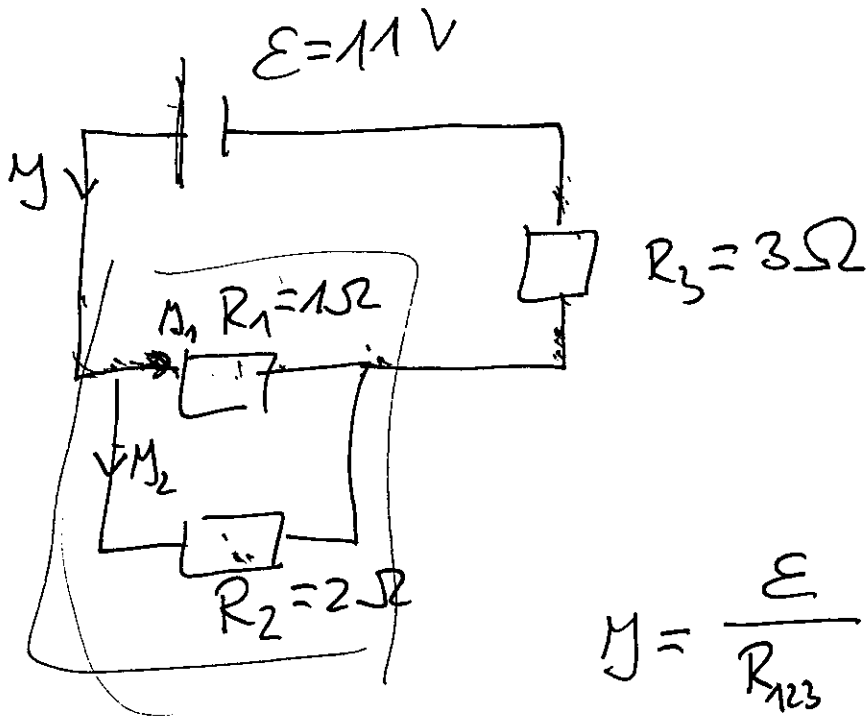
Albo

$$J = \frac{E}{R_{12}} \Rightarrow R_{12} = \frac{E}{J} = \frac{100}{0,5} = 200\Omega$$

$$R_{12} = R_1 + R_2 \Rightarrow R_2 = R_{12} - R_1 = 200 - 60 = \underline{140\Omega}$$

$$J = \frac{U_2}{R_2} \Rightarrow U_2 = J \cdot R_2 = 0,5 \cdot 140 = \underline{70V}$$

9.3.



$I_1 = ?$

$$I = \frac{\varepsilon}{R_{123}}$$

$$\frac{1}{R_{12}} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{1} + \frac{1}{2} = \frac{3}{2}$$

$$R_{12} = \frac{2}{3} \Omega$$

$$R_{123} = R_{12} + R_3 = \frac{2}{3} + 3 = \frac{11}{3} \Omega$$

$$I = \frac{11}{\frac{11}{3}} = \frac{11 \cdot 3}{11} = 3 \text{ A}$$

$$I = \frac{U_{12}}{R_{12}} \Rightarrow U_{12} = 3 \cdot \frac{2}{3} = 2 \text{ V}$$

$$U_{12} = U_1 = U_2$$

$$I_1 = \frac{U_1}{R_1} \Rightarrow I_1 = \frac{2}{1} = 2 \text{ A}$$

$$I_1 + I_2 = 3$$

$$U_1 = U_2$$

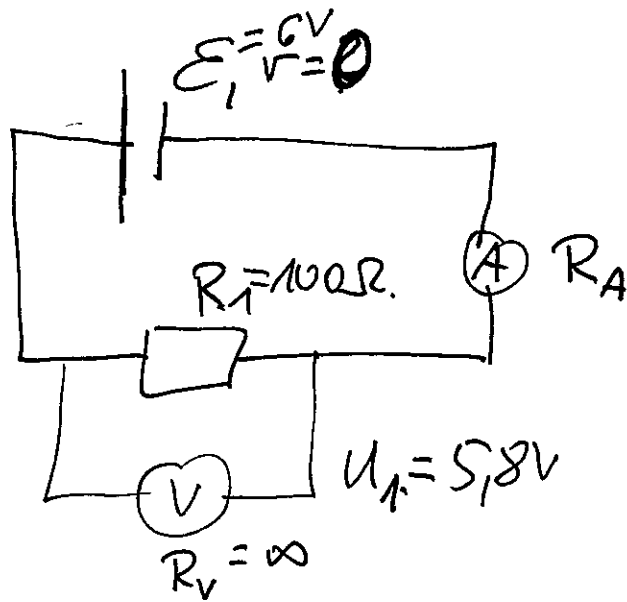
$$I_1 R_1 = I_2 R_2 \Rightarrow I_1 = 2 I_2$$

$$3 I_2 = 3$$

$$I_2 = 1 \text{ A}$$

$$I_1 = 2 \text{ A}$$

9.4.

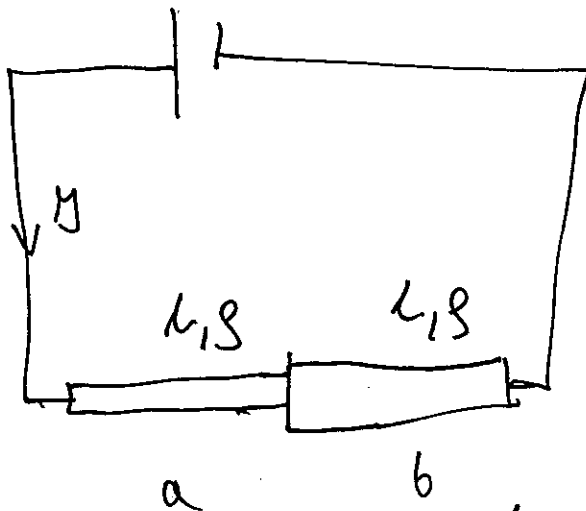


$$I_1 = I = \frac{U_1}{R_1} = \frac{5.8}{100} = 0.058A$$

$$\varepsilon = U_1 + U_A \Rightarrow U_A = \varepsilon - U_1 = 6 - 5.8 = 0.2V$$

$$I_A = I = \frac{U_A}{R_A} \Rightarrow R_A = \frac{U_A}{I} = \frac{0.2V}{0.058A} = \frac{20}{5.8} \approx 3.45\Omega$$

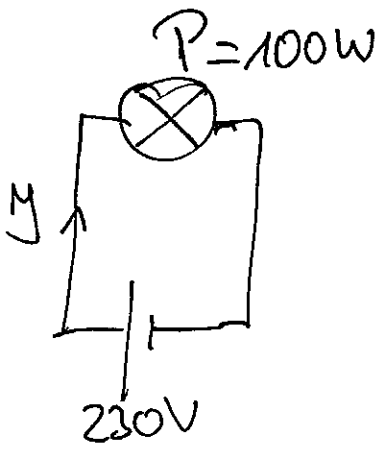
9.5.



$$2U_a = U_b$$

$$\begin{aligned} \frac{P_a}{P_b} &= \frac{U_a \cdot I_a}{U_b \cdot I_b} = \frac{U_a \cdot R_a}{U_b \cdot R_b} = \frac{\cancel{I} \cdot \frac{L}{S_a}}{\cancel{I} \cdot \frac{L}{S_b}} = \frac{\cancel{L}}{\cancel{L}} \cdot \frac{S_b}{S_a} = \frac{S_b}{S_a} \\ &= \frac{4S_a}{S_a} = 4 \quad (\Rightarrow) \quad P_a = 4P_b \end{aligned}$$

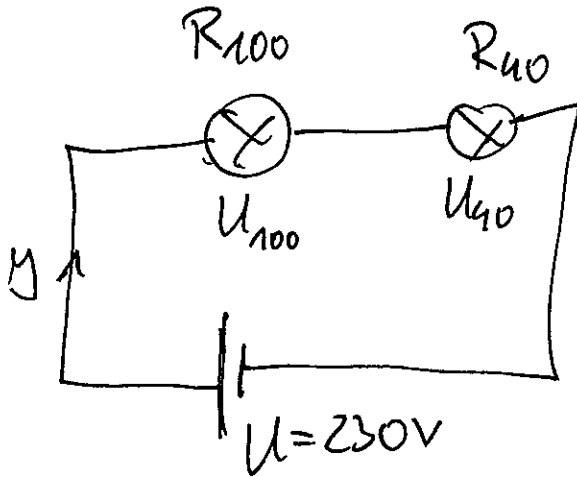
9.9.



$$P = U \cdot I \Rightarrow I = \frac{P}{U}$$

$$I = \frac{U}{R} \Rightarrow R = \frac{U}{I} = \frac{U^2}{P}$$

$$R_{100} = \frac{230^2}{100} < R_{40} = \frac{230^2}{40}$$



$$I = \frac{U}{R_{\text{Knoten}}} = \frac{U}{R_{100} + R_{40}} \dots$$

$$I = \frac{U_{100}}{R_{100}} \Rightarrow U_{100} = I \cdot R_{100} = \frac{U}{R_{100} + R_{40}} \cdot R_{100}$$

$$U_{40} = \frac{U}{R_{100} + R_{40}} \cdot R_{40}$$

$$P_{100\text{W}} = I \cdot U_{100} = \left(\frac{U}{R_{100} + R_{40}} \right)^2 \cdot R_{100}$$

$$P_{40\text{W}} = I \cdot U_{40} = \left(\frac{U}{R_{100} + R_{40}} \right)^2 \cdot R_{40}$$

$$P_{100\text{W}} < P_{40\text{W}}$$