

4.3/1

$$c = 800 \text{ J/K}$$

$$V_{H_2O} = 7 \text{ l}$$

$$T_{H_2O} = 20^\circ \text{C}$$

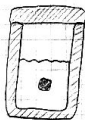
$$m_K = 7 \text{ kg}$$

$$T_K = 500^\circ \text{C}$$

$$T' = 30^\circ \text{C}$$

room temperature

$$c_{H_2O} = 4200 \text{ J/kg}\cdot\text{K}$$

Fizika vaje 3.3.2005  
(7. in 2. ura)

$$\Delta W_h = 0$$

$$W_{hK} - W_{hE} = 0$$

$$W_{hK} = W_{hH_2O,K} + W_{hK,K}$$

$$W_{hH_2O,K} = m_{H_2O} \cdot c_{H_2O} \cdot T'$$

$$W_{hK,K} = m_K \cdot c_K \cdot T'$$

$$W_{hK,K} = C \cdot T'$$

$$W_{hE} = W_{hH_2O,E} + W_{hK,E} + W_{hC,E}$$

$$W_{hH_2O,E} = m_{H_2O} \cdot c_{H_2O} \cdot T_{H_2O}$$

$$W_{hK,E} = m_K \cdot c_K \cdot T_K$$

$$W_{hC,E} = C \cdot T_{H_2O}$$

$$m_{H_2O} \cdot c_{H_2O} \cdot T' + m_K \cdot c_K \cdot T' + C \cdot T' - m_{H_2O} \cdot c_{H_2O} \cdot T_{H_2O} - m_K \cdot c_K \cdot T_K - C \cdot T_{H_2O} = 0$$

$$c_K (m_K T' - m_K T_K) = -m_{H_2O} \cdot c_{H_2O} T' + m_{H_2O} \cdot c_{H_2O} T_{H_2O} - C T' + C T_{H_2O}$$

$$c_K \cdot m_K (T' - T_K) = m_{H_2O} \cdot c_{H_2O} (-T' + T_{H_2O}) + C (-T' + T_{H_2O})$$

$$c_K m_K (T' - T_K) = (-T' + T_{H_2O}) (m_{H_2O} \cdot c_{H_2O} + C)$$

$$c_K = \frac{(-T' + T_{H_2O}) (m_{H_2O} \cdot c_{H_2O} + C)}{m_K (T' - T_K)} = 570 \text{ J/kg}\cdot\text{K}$$

note  
 $\left[ \frac{\text{J}}{\text{kg}\cdot\text{K}} = \frac{\text{J}}{\text{kg}\cdot\text{K}} \right]$

4.3/2

$$m_L = 0.5 \text{ kg}$$

$$c_L = 2700 \text{ J/kg}\cdot\text{K}$$

$$T_L = -70^\circ \text{C}$$

$$q_L = 336 \text{ kJ/kg}$$

$$m_{H_2O} = 2 \text{ kg}$$

$$c_{H_2O} = 4200 \text{ J/kg}\cdot\text{K}$$

$$T_{H_2O} = 50^\circ \text{C}$$

$$T' = ?$$

$$T_0 = 0^\circ \text{C}$$

1. korak (led se segreva, voda ohlaja)

$$\Delta W_h = 0$$

$$\Delta W_{mL} + \Delta W_{mH_2O} = 0$$

$$\Delta W_{mL} = m_L \cdot c_L \cdot (T_0 - T_L)$$

končna temp vode  
po prvem koraku

$$\Delta W_{mH_2O} = m_{H_2O} \cdot c_{H_2O} \cdot (T_{H_2O}^{(1)} - T_{H_2O})$$

$$m_L \cdot c_L (T_0 - T_L) + m_{H_2O} \cdot c_{H_2O} (T_{H_2O}^{(1)} - T_{H_2O}) = 0$$

$$T_{H_2O}^{(1)} = \frac{-m_L \cdot c_L (T_0 - T_L)}{m_{H_2O} \cdot c_{H_2O}} + T_{H_2O}$$

$$T_{H_2O} = 323 K$$

$$T_{H_2O}^{(1)} = 321.75 K$$

$$T_{H_2O}^{(2)} = 301.75 K$$

2. korak



$$\Delta X_n = 0$$

$$\Delta W_{nl} + \Delta W_{m_{H_2O}} = 0$$

$$\Delta W_{nl} = m_l \cdot g$$

$$\Delta W_{m_{H_2O}} = m_{H_2O} \cdot c_{H_2O} \cdot (T_{H_2O}^{(2)} - T_{H_2O}^{(1)})$$

$$m_l \cdot g + m_{H_2O} \cdot c_{H_2O} \cdot (T_{H_2O}^{(2)} - T_{H_2O}^{(1)}) = 0$$

$$T_{H_2O}^{(2)} = \frac{-m_l \cdot g}{m_{H_2O} \cdot c_{H_2O}} + T_{H_2O}^{(1)}$$

$$T_{H_2O}^{(2)} = 301.75 K$$

3. korak

$$\Delta W_{nl} = m_l \cdot c_{H_2O} \cdot (T' - T_0)$$

$$\Delta W_{m_{H_2O}} = m_{H_2O} \cdot c_{H_2O} \cdot (T' - T_{H_2O}^{(2)})$$

$$m_l \cdot c_{H_2O} \cdot (T' - T_0) + m_{H_2O} \cdot c_{H_2O} \cdot (T' - T_{H_2O}^{(2)}) = 0$$

$$m_l \cdot c_{H_2O} \cdot T' - m_l \cdot c_{H_2O} \cdot T_0 + m_{H_2O} \cdot c_{H_2O} \cdot T' - m_{H_2O} \cdot c_{H_2O} \cdot T_{H_2O}^{(2)} = 0$$

$$T' \cdot (m_l \cdot c_{H_2O} + m_{H_2O} \cdot c_{H_2O}) = m_l \cdot c_{H_2O} \cdot T_0 + m_{H_2O} \cdot c_{H_2O} \cdot T_{H_2O}^{(2)}$$

$$T' = \frac{m_l \cdot c_{H_2O} \cdot T_0 + m_{H_2O} \cdot c_{H_2O} \cdot T_{H_2O}^{(2)}}{m_l \cdot c_{H_2O} + m_{H_2O} \cdot c_{H_2O}}$$

$$T' = 296 K \Rightarrow 23^\circ C$$

43/3.

$$C = 750 \text{ J/K}$$

$$m_{H_2O} = 1.5 \text{ kg}$$

$$T_{H_2O} = 20^\circ\text{C}$$

$$m_{Fe} = 2.5 \text{ kg}$$

$$T_{Fe} = 800^\circ\text{C}$$

$$m_i = ?$$

$$c_{H_2O} = 4200 \text{ J/kg}\cdot\text{K}$$

$$g_i = 2.26 \cdot 10^6 \frac{\text{J}}{\text{kg}}$$

$$T_i = 100^\circ\text{C}$$

$$c_{Fe} = 457 \text{ J/kg}\cdot\text{K}$$

$$\Delta W_H = 0$$

$$\Delta W_{H_2O} + \Delta W_{mFe} + \Delta W_{m_i} + \Delta W_{c_i} = 0$$

$$m_{H_2O} \cdot c_{H_2O} (T_i - T_{H_2O}) + m_{Fe} \cdot c_{Fe} (T_i - T_{Fe}) + m_i \cdot g_i + C (T_i - T_{H_2O}) = 0$$

$$m_i = \frac{-m_{H_2O} \cdot c_{H_2O} (T_i - T_{H_2O}) - m_{Fe} \cdot c_{Fe} (T_i - T_{Fe}) - C (T_i - T_{H_2O})}{g_i}$$

enter result into:  $\left[ \frac{\text{kg} \cdot \text{J} \cdot \text{K}}{\text{kg} \cdot \text{K}} \frac{\text{kg}}{\text{J}} \right] = \text{kg}$

$$m_i = \underline{\underline{104 \text{ g}}}$$

43/4

$$m = 1 \text{ g}$$

$$T_E = 0^\circ\text{C}$$

$$N_E = ?$$

$$\eta = 0.75$$

$$c_{Pb} = 130 \text{ J/kg}\cdot\text{K}$$

$$T_{Pb} = 327^\circ\text{C}$$

$$g_{+Pb} = 22.5 \text{ kJ/kg}$$

$$\Delta W = 0$$

$$\Delta W_H + \Delta W_K \cdot \eta = 0$$

$$\Delta W_K = -\frac{1}{2} m \cdot N_E^2$$

$$\Delta W_H = m_{Pb} \cdot c_{Pb} \cdot (T_{Pb} - T_E) + m_{Pb} \cdot g_+$$

$$m_{Pb} \cdot c_{Pb} \cdot (T_{Pb} - T_E) + m_{Pb} \cdot g_+ - \frac{1}{2} m \cdot N_E^2 \cdot \eta = 0$$

$$N_E = \sqrt{\frac{(m_{Pb} \cdot c_{Pb} \cdot (T_{Pb} - T_E) + m_{Pb} \cdot g_+) \cdot 2}{m \cdot \eta}}$$

$$N_E = \underline{\underline{476 \text{ m/s}}}$$

$$P, T, V$$

$$pV = NkT$$

$$\Delta U_{th} = A + Q$$

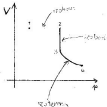
1) isotherma expansion

$$\Delta V \neq 0$$

$$A \neq 0$$

$$Q = m c_v \Delta T$$

$$\Delta U_{th} = m c_v \Delta T$$

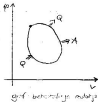


2. isotherma gas

$$\Delta p = 0$$

$$A = -p \Delta V$$

$$Q = m c_v \Delta T$$



3. isotherma gas

$$\Delta T = 0 \quad A = -p \Delta V = k_B \ln \frac{V_1}{V_2}$$

$$Q = + k_B \ln \frac{V_1}{V_2}$$

$$\Delta U_{th} = 0$$

4. adiabatik gas

$$Q = 0$$

$$A = m c_v \Delta T$$

$$\Delta U_{th} = m c_v \Delta T$$

4.4 p

$$V_1 = 2\ell$$

$$T_1 = 20^\circ\text{C} = 293\text{K}$$

$$p_1 = 1\text{bar} = 10^5\text{Pa}$$

$$c_v = 720\text{J/kg}\cdot\text{K}$$

$$M = 29\text{J/kg}\cdot\text{mol}$$

$$V_2 = \frac{1}{4} V_1$$

a) izotermno

$$\Delta T = 0$$

\*) adiabatno  $Q=0$ 

$$T_2 = ?$$

$$p_2 = ?$$

$$A = ?$$

$$a) p \cdot V = N \cdot R \cdot T$$

$$p_1 \cdot V_1 = N \cdot R \cdot T_1$$

$$p_2 \cdot V_2 = N \cdot R \cdot T_2 \Rightarrow p_2 \cdot \frac{1}{4} V_1 = N \cdot R \cdot T_2$$

$$p_2 = \frac{N \cdot R \cdot T_2}{\frac{1}{4} V_1} = \frac{p_1 \cdot V_1}{\frac{1}{4} V_1} = 4 p_1$$

$$p_2 = 4 \cdot 10^5\text{Pa}$$

$$\Delta U_n = 0$$

$$A = -p_1 \cdot V_1 \cdot \ln \frac{V_2}{V_1}$$

$$A = -10^5\text{Pa} \cdot 2 \cdot 10^{-3}\text{m}^3 \cdot \ln \frac{1}{4}$$

$$A = -277\text{J}$$

$$b) p_1 \cdot V_1^\gamma = p_2 \cdot V_2^\gamma$$

$$\gamma = \frac{c_p}{c_v} = 1.4$$

$$c_p - c_v = \frac{R}{M}$$

$$c_p = \frac{R}{M} + c_v = \frac{8300\text{J}}{29} \text{J/kg}\cdot\text{K} + 720\text{J/kg}\cdot\text{K} = 1006\text{J/kg}\cdot\text{K}$$

$$\gamma = \frac{1006}{720} = 1.39$$

$$p_2 = \frac{p_1 \cdot V_1^\gamma}{V_2^\gamma} = p_1 \left( \frac{V_1}{V_2} \right)^\gamma = 10^5\text{Pa} \cdot 4^{1.4} = 7 \cdot 10^5\text{Pa}$$

$$p_2 \cdot V_2 = N \cdot R \cdot T_2$$

$$\frac{p_1}{p_2} \cdot \frac{V_2}{V_1} = \frac{N \cdot R \cdot T_1}{N \cdot R \cdot T_2}$$

$$\frac{T_1}{T_2} = \frac{p_1 \cdot V_1}{p_2 \cdot V_2}$$

$$T_2 = \frac{p_2 \cdot V_2}{p_1 \cdot V_1} = \frac{233 \text{ K} \cdot 2 \cdot 10^{-5} \text{ Pa} \cdot 0.5 \cdot 10^{-3} \text{ m}^3}{10^5 \text{ Pa} \cdot 2 \cdot 10^{-5} \text{ m}^3}$$

$$T_2 = 512 \text{ K} = 239^\circ \text{C}$$

$$N = \frac{p_1 \cdot V_1}{R \cdot T_1} = \frac{10^5 \text{ Pa} \cdot 2 \cdot 10^{-3} \text{ m}^3}{8.314 \text{ J/mol} \cdot 233 \text{ K}}$$

$$N = 8.2 \cdot 10^{-3} \text{ K/mol}$$

$$m = N \cdot M$$

$$m = 2.9 \cdot 10^{-3} \text{ kg}$$

$$A = m \cdot c_v \cdot \Delta T$$

$$A = 2.9 \cdot 10^{-3} \text{ kg} \cdot 920 \text{ J/kg} \cdot \text{K} \cdot (512 - 233 \text{ K})$$

$$A = 379 \text{ J}$$

4.4/4

$$m = 7 \text{ kg}$$

$$M = 58 \text{ kg/mol}$$

$$T_2 = 5^\circ \text{C} = 273 \text{ K}$$

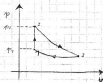
$$a) p_2 = 2 \cdot p_1 ; \Delta U = 0$$

$$b) T_2 = T_1 ; Q = 0$$

$$W = W_1 ; \Delta T = 0$$

$$\frac{A_{12} - A_{21}}{Q_{12} - Q_{21}} = \frac{A_{12}}{Q_{12}}$$

$$200 \text{ J} = 200 \text{ J}$$



$$a) A_{12} = 0$$

$$Q_{12} = m \cdot c_v \cdot \Delta T = m \cdot c_v \cdot (T_2 - T_1) = 7 \text{ kg} \cdot 260 \text{ J/kg} \cdot \text{K} \cdot (5^\circ \text{C} - 273^\circ \text{C})$$

$$M \cdot V_1 = M \cdot R \cdot T_1$$

$$p_2 \cdot V_2 = M \cdot R \cdot T_2$$

$$Q_{12} = 31 \cdot 10^3 \text{ J}$$

$$\frac{p_1 \cdot V_1}{M \cdot R} = \frac{T_1}{R}$$

$$T_2 = \frac{p_2 \cdot V_2}{p_1} = T_1 \cdot 2 = 54^\circ \text{C}$$

$$b) Q_{III} = 0$$

$$Q_{II} = m \cdot c \cdot \Delta T = m \cdot c \cdot (T_2 - T_1)$$

$$= 1 \text{ kg} \cdot 360 \frac{\text{J}}{\text{kg} \cdot \text{K}} \cdot (273 - 311) = -135 \cdot 10^3 \text{ J}$$

$$a) A_{21} = p_2 \cdot V_2 = \ln \frac{V_1}{V_2}$$

$$Q_{21} = -A_{21}$$

$$p_1 V_1 = n R T_1$$

$$p_2 V_2 = n R T_2$$

$$p_1 V_1 = p_2 V_2 = n R T_1$$

$$n = \frac{m}{M} = \frac{1 \text{ kg} \cdot 1000 \frac{\text{g}}{\text{kg}}}{58 \frac{\text{g}}{\text{mol}}} = 17.24 \text{ mol}$$

$$p_2 V_2 = p_1 V_1 = n R T_1 = 17.24 \text{ mol} \cdot 8.314 \frac{\text{J}}{\text{mol} \cdot \text{K}} \cdot 273 \text{ K} = 39520 \text{ J}$$

$$V_1 = V_2 \quad p_1 V_1 = n R T_1$$

$$p_1 V_1 = n R T_2$$

$$\frac{p_1 V_1}{p_2 V_2} = \frac{T_1}{T_2}$$

$$\frac{p_1 V_1}{p_2 V_2} = \frac{T_1}{T_2}$$

$$\frac{p_1 V_1}{p_1 V_1} = \frac{T_1}{T_2}$$

$$p_1 = 2 p_2$$

$$\frac{V_1}{V_2} = \frac{p_1}{p_2} \cdot \frac{T_2}{T_1} = \frac{p_1}{p_2} \cdot \frac{p_2}{p_1} = 2 \cdot \frac{p_2}{p_1}$$

$$p_1 V_1^\gamma = p_2 V_2^\gamma \Rightarrow \frac{p_1}{p_2} = \left( \frac{V_2}{V_1} \right)^{\frac{1}{\gamma}}$$

$$\frac{V_2}{V_1} = \left( \frac{p_1}{p_2} \right)^{\frac{1}{\gamma}}$$

$$\frac{p_1}{p_2} \cdot \left( \frac{p_1}{p_2} \right)^{\frac{1}{\gamma}} = \frac{T_1}{T_2}$$

$$\frac{p_1}{p_2} \cdot \left( \frac{p_1}{p_2} \right)^{\frac{1}{\gamma}} = \left( \frac{p_1}{p_2} \right)^{\frac{1}{\gamma} + 1} = \frac{T_1}{T_2} = \frac{T_2}{T_1}$$

$$\frac{p_1}{p_2} = \left( \frac{T_2}{T_1} \right)^{\frac{1}{1 + \frac{1}{\gamma}}} = \frac{T_2^{\frac{\gamma}{\gamma + 1}}}{T_1^{\frac{\gamma}{\gamma + 1}}}$$

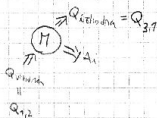
$$\frac{P_2}{P_3} = 2^{\frac{14}{0.4}} = 77.3$$

$$2^{\frac{14}{0.4}} = \frac{2}{77.3} = 0.01$$

$$\frac{W}{V} = -36520 \text{ J} \cdot \ln(0.776) = 66 \text{ kJ}$$

$$Q_{3,1} = -A_{3,1}$$

$$\eta = \frac{A_1}{Q_{12}}$$



$$A_1 = A_{2,3} + A_{3,1}$$

$$\frac{A_{2,3} + A_{3,1}}{Q_{12}} = \frac{773 \cdot 70^3 + 66}{98 \cdot 70^3} = 0.31$$

keuntungan eksterior

$$\eta_c = \frac{T_{\max} - T_{\min}}{T_{\max}} = \frac{546 - 273}{546} = 0.5$$

4.4/6

$$g_{12} = 12.6 \cdot 10^6 \text{ J/kg}$$

$$t = 3600 \text{ s}$$

$$P = 20 \text{ kW}$$

$$T_{\min} = 80^\circ \text{C} = 353^\circ \text{K}$$

$$T_{\max} = 780^\circ \text{C} = 453^\circ \text{K}$$

$$\eta = \frac{1}{3} \eta_c$$

$$\eta_c = \frac{T_{\max} - T_{\min}}{T_{\max}} = \frac{453 - 353}{453}$$

$$= 0.22$$

$$\eta = \frac{1}{3} \eta_c = 0.07$$

$$P = \frac{m \cdot g_{12}}{t} \cdot \eta = 7 \text{ m} = \frac{P \cdot t}{\eta \cdot g_{12}} = \frac{20 \cdot 10^3 \text{ W} \cdot 3600 \text{ s} \cdot \text{kg}}{0.07 \cdot 12.6 \cdot 10^6 \text{ J}} =$$

$$m = 80 \text{ kg}$$

$$T_{\max} = ?$$

$$m' = m \cdot 0.7$$

$$P \cdot t$$

$$\eta \cdot g_{12}$$



$$\eta' = \frac{1}{3} \eta_c' = \frac{1}{3} \frac{T_{\max}' - T_{\min}}{T_{\max}'}$$

$$\frac{p \cdot k}{\frac{1}{3} \frac{T_{\max}' - T_{\min}}{T_{\max}'} \cdot g_x} = m \cdot d \Rightarrow$$

$$T_{\max}' = T_{\max} + 63^{\circ}\text{C}$$

$p = \text{konst. (izobarna spr.)}$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\kappa = \frac{c_p}{c_v}$$

$V = \text{konst. (izohorna spr.)}$

$$\frac{p_1}{T_1} = \frac{p_2}{T_2}$$

$$\eta_c = 1 - \frac{T_1}{T_2} \\ = \frac{T_2 - T_1}{T_2} = \frac{\Delta T}{T_2}$$

$T = \text{konst. (izoterma)}$

$$p_1 V_1 = p_2 V_2$$

$Q = 0 \text{ (adiabatna spr.)}$

$$T_1 V_1^{\kappa-1} = T_2 V_2^{\kappa-1}$$

4.4/6

$$Q_s = 12'6 \text{ MJ/kg}$$

$$t = 7 \text{ h}$$

$$P = 20 \text{ kW}$$

$$T_1 = 80^\circ\text{C}$$

$$T_2 = 180^\circ\text{C}$$

$$\eta = \frac{7}{3} \eta$$

$$\eta_c = 1 - \frac{T_1}{T_2} = \frac{T_2 - T_1}{T_2} = \frac{\Delta T}{T_2} = \frac{780 - 80}{453}$$

$$\eta = 0,07358$$

$$\eta = \frac{|A|}{Q_d \text{ (dovodena)}}$$

$$P = \frac{A}{t}$$

$$A = P \cdot t$$

$$A = 200 \text{ kW} \cdot 3600 \text{ s}$$

$$A = 720 \text{ MJ}$$

$$Q_d = \frac{|A|}{\eta} = 987,5 \text{ MJ}$$

$$Q_d = q \cdot m$$

$$m = \frac{Q_d}{q_s} = \frac{987,5 \text{ MJ}}{12,6 \text{ MJ/kg}} = 77,7 \text{ kg}$$

4.4/7

$$T_1 = 30^\circ\text{C}$$

$$T_2 = 0^\circ\text{C}$$

$$t = 600 \text{ s}$$

$$m = 7 \text{ kg}$$

$$q = \frac{7}{2,5} \frac{\text{MJ}}{\text{kg}}$$

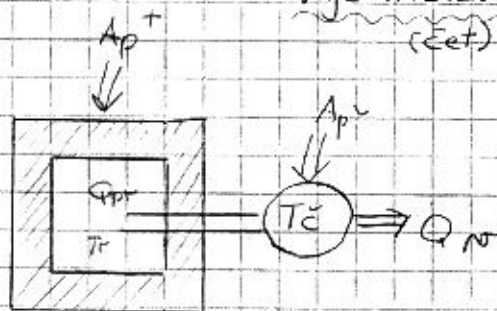
$$P_m = ?$$

$$q = 336 \cdot 10^3 \text{ J/kg}$$

$$A_{pr} = Q_{pr} \left( \frac{T_0}{T_m} - 1 \right) \text{ cangel hladilnik}$$

$$Q_p = m \cdot v \cdot g_+$$

$$P_m = \frac{A_{pr}}{t}$$



$$Q_{Tr} = A_p + Q_{pr}$$

$$A_{pr} = \frac{7}{2,5} \cdot Q_p \left( \frac{T_0}{T_m} - 1 \right)$$

$$P_m = \frac{\frac{7}{2,5} \cdot m \cdot g_+ \left( \frac{T_0}{T_m} - 1 \right)}{t} = \frac{2,5 \cdot 7 \text{ kg} \cdot 336 \cdot 10^3 \text{ J} \left( \frac{303 \text{ K}}{273 \text{ K}} - 1 \right)}{600 \text{ s}}$$

$$P_m = 153 \text{ W}$$

# TOPLOTNI TOK

Q[J]

$$P = \frac{Q}{t} [W]$$

$$j = \frac{P}{S} = \frac{Q}{t \cdot S}$$

↓  
gustota toplotnega toka

$$P = \frac{\lambda \cdot \Delta T}{l} \cdot S$$

$$(j = \frac{\lambda \cdot \Delta T}{l \cdot S})$$

$$j = \frac{\lambda \cdot \Delta T}{l}$$

4.5/1

$$S = 35 m^2$$

$$P = 4 kW$$

$$T_z = -20^\circ C$$

$$T_n = ?$$

$$\lambda_2 = 0.4 \frac{W}{m \cdot K}$$

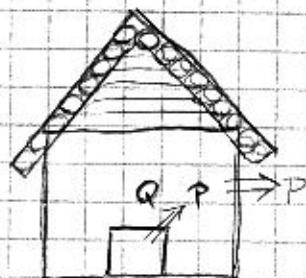
$$d = 75 cm$$

$$P = \frac{\lambda \cdot (T_b - T_z) \cdot S}{d}$$

$$\frac{P \cdot d}{S \cdot \lambda} = (T_b - T_z)$$

$$T_b = \frac{P \cdot d}{S \cdot \lambda} + T_z$$

$$T_b = \frac{4000 W \cdot 0.75 m}{35 m^2 \cdot 0.4 W/m \cdot K} + 253 K = 295 K = 22^\circ C$$



$$2.) P_s + P_o = P$$

$$\frac{\lambda \cdot (T_b - T_z) \cdot (S - S_o)}{d}$$

$$P = \frac{\lambda \cdot (T_b - T_z) \cdot (S - S_o)}{d} + P_o$$

$$\frac{(P - P_o) \cdot d}{(S - S_o) \cdot \lambda} + T_z = T_b$$

$$T_{b2} = \frac{(4000 - 7800) W \cdot 0.75 m}{25 m^2 \cdot 0.4 W/m \cdot K} + 253 K = 286 K = 13^\circ C$$

$$T_{b2} + T_{b1} = 286 K - 295 K = -9 K \Rightarrow \text{(Temperatura bo pada za } 9^\circ C)$$



4.5/2

$$S = 70 \text{ m}^2$$

$$d_1 = 0.2 \text{ m}$$

$$d_2 = 0.02 \text{ m}$$

$$\lambda_1 = 0.7 \text{ W/m}\cdot\text{K}$$

$$\lambda_2 = 0.05 \text{ W/m}\cdot\text{K}$$

$$T' = ?$$

$$T_E = -20^\circ\text{C}$$

$$T_n = 20^\circ\text{C}$$

a)  $P_p = P_o = P$

$$P_p = \frac{\lambda_2 (T_n - T') \cdot S}{d_2}$$

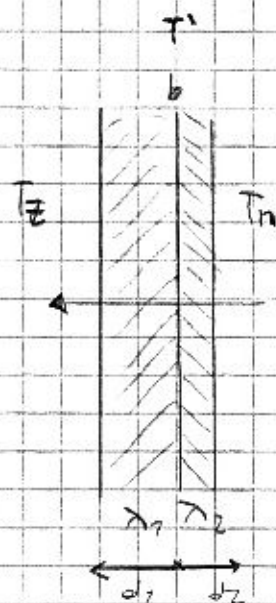
$$P_o = \frac{\lambda_1 (T' - T_E) \cdot S}{d_1}$$

$$\frac{\lambda_2 (T_n - T')}{d_2} = \frac{\lambda_1 (T' - T_E)}{d_1}$$

$$\lambda_2 \cdot d_1 \cdot T_n - \lambda_2 d_1 T' = \lambda_1 d_2 T' - \lambda_1 d_2 T_E$$

$$+ \lambda_2 d_1 T' + \lambda_1 d_2 T' = + \lambda_2 d_1 T_n + \lambda_1 d_2 T_E$$

$$T' (\lambda_2 d_1 + \lambda_1 d_2) = \lambda_2 d_1 T_n + \lambda_1 d_2 T_E$$



$$T' = \frac{\lambda_2 d_1 T_n + \lambda_1 d_2 T_E}{\lambda_2 d_1 + \lambda_1 d_2} = \frac{0.05 \text{ W/m}\cdot\text{K} \cdot 0.2 \text{ m} \cdot 293 \text{ K} + 0.7 \text{ W/m}\cdot\text{K} \cdot 0.02 \text{ m} \cdot 253 \text{ K}}{0.05 \text{ W/m}\cdot\text{K} \cdot 0.2 \text{ m} + 0.7 \text{ W/m}\cdot\text{K} \cdot 0.02 \text{ m}}$$

$$= 270 \text{ K} = \underline{\underline{-3^\circ\text{C}}}$$

$$P_S = \frac{\lambda_1 (T' - T_E) \cdot S}{d_1} = \frac{0.7 \text{ W/m}\cdot\text{K} (77 \text{ K}) \cdot 70 \text{ m}^2}{0.2 \text{ m}} = \underline{\underline{590 \text{ W}}}$$

b)  $P_S' = \frac{\lambda_2 (T_n - T_E) \cdot S}{d_2}$

$$\frac{P_S'}{P_S} = \frac{T_n - T_E}{T' - T_E} = \frac{40 \text{ K}}{77 \text{ K}} = \underline{\underline{2.4}}$$

$$P_S' = 2.4 \cdot P_S$$

4.5/3

$$d_1 = 3 \text{ cm}$$

$$T_n = 80^\circ\text{C}$$

$$T_o = 0^\circ\text{C}$$

$$l = 7 \text{ m}$$

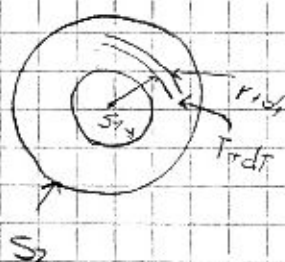
$$P = 20 \text{ W}$$

$$\lambda = 0.05 \text{ W/m}\cdot\text{K}$$

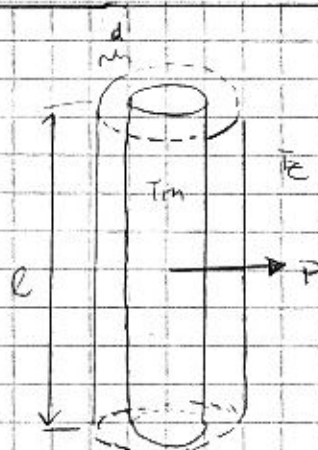
prejšnji primer



nas primer



$$S_2 > S_1$$



$$P = \frac{\lambda \cdot \Delta T}{d} \cdot S$$

Wärmeleiter

$$P = \frac{\lambda \cdot dT}{dr} \cdot \underbrace{2\pi \cdot r \cdot l}_{\text{Oberfl.}}$$

$$\frac{P}{2\pi \lambda \cdot l} \cdot \frac{dr}{r} = dT / S$$

$$\int_{r_1}^{r_2} dx = x_2 - x_1$$

$$\int \frac{dx}{x} = \ln x_2 - \ln x_1 = \ln \frac{x_2}{x_1}$$

$$\frac{P}{2\pi \lambda \cdot l} \int_{r_1}^{r_2} \frac{dr}{r} = \int_{T_1}^{T_2} dT$$

$$\frac{P}{2\pi \lambda l} \cdot \ln \frac{r_2}{r_1} = T_2 - T_1$$

$$\frac{r_2}{r_1} = l$$

$$r_2 = r_1 \cdot l$$

$$\ln \frac{r_2}{r_1} = \frac{2\pi \lambda l (T_2 - T_1)}{P}$$

$$r_2 - r_1 = r_1 \left( l \frac{2\pi \lambda l (T_2 - T_1)}{P} - 1 \right)$$

Vorge 30.01.23.2.2003

4.5/2

$$d_o = 20 \text{ cm}$$

$$d_p = 2 \text{ cm}$$

$$\lambda_o =$$

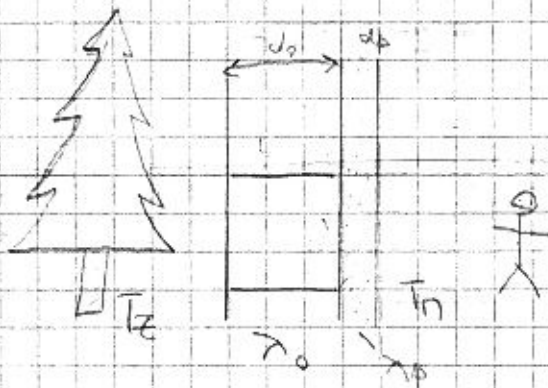
$$\lambda_p = 0$$

$$T_E = -20^\circ \text{C}$$

$$T_N = 20^\circ \text{C}$$

$$P = 2$$

$$T_A = ?$$



$$P_o = P_p$$

$$\lambda_o \frac{S}{d_o} (T_E - T_A) = \lambda_p \frac{S}{d_p} (T_A - T_N) \quad P = \lambda \cdot \frac{S}{d} (T_K - T_L)$$

$$\frac{\lambda_o \cdot T_E}{d_o} - \frac{T_A \cdot \lambda_o}{d_o} = \frac{\lambda_p \cdot T_A}{d_p} - \frac{\lambda_p \cdot T_N}{d_p}$$

$$T_A \left( \frac{\lambda_o}{d_p} + \frac{\lambda_p}{d_o} \right) = \frac{\lambda_o T_E}{d_o} + \frac{\lambda_p T_N}{d_p} \quad | \cdot d_p \cdot d_o$$

$$T_A = \frac{\lambda_o T_E \cdot d_p + \lambda_p T_N \cdot d_o}{\lambda_o d_o + \lambda_p d_p}$$

$$T_A = 270 \text{ K} = -3^\circ \text{C}$$



$$P_0 = \lambda \frac{S}{d_0} (T_E - T_N)$$

$$P_0 = 0 \Rightarrow \frac{\lambda}{m \cdot K} \cdot \frac{79 m^2}{0.2 m}$$

$$T_A = \frac{\lambda_0 \cdot T_E \cdot d_P + \lambda_P \cdot T_N \cdot d_0}{\lambda_0 d_0 + \lambda_P \cdot d_P}$$

$$T_A = 270 K = -3^\circ C$$

$$P_0 = -595 W$$

$$P_0 = 1400 W$$

$$\Delta P = \frac{1400 - 595}{195}$$

$$\Delta P = 135\%$$

4.5/3

$$P = \lambda \cdot \frac{S}{d} (T_N - T_E)$$

$$R_E = 3 cm$$

$$T_N = 89^\circ C$$

$$T_E = 0^\circ C$$

$$l = 7 m$$

$$P < 200 W$$

$$\lambda = 0.05 W / m \cdot K$$

$$\sigma = 2\pi m$$

$$\sigma = 3\pi m$$

$$S = 0.03 m \cdot \pi \cdot 1 m$$

$$= 0.03 \pi m^2$$

$$dP = \lambda S (T_N - T_E)$$

$$d = \frac{0.05 W \cdot 0.03 \pi m^2 \cdot 80 K}{m \cdot K \cdot 200 W}$$

$$d = 7.88 \cdot 10^{-3} m$$

{Ohmova zakon}

napetost

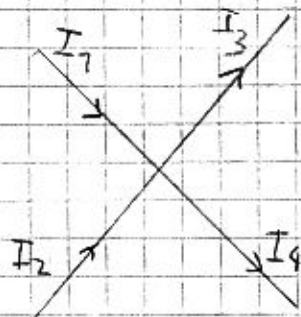
$$U = R \cdot I$$

upor tok

[V]  
Volt

[Ω]  
ohm

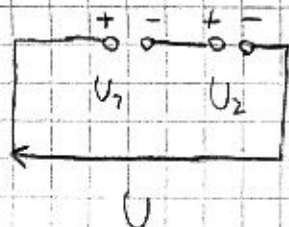
[A]  
amper



1. Kirchhoffov zakon

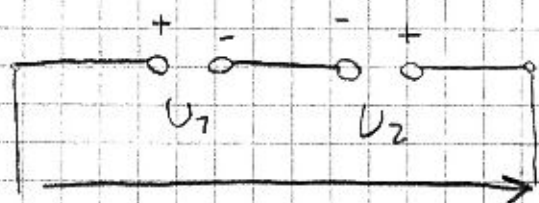
$$I_1 + I_2 = I_3 + I_4$$

$$[R] = \frac{V}{A} \quad [W] = V \cdot A$$



$$U = U_1 + U_2$$

## 2. Kirchhoffov zakon



$$U = U_1 - U_2$$



$$R = R_1 + R_2$$



$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$



$$R = \frac{\xi [ \Omega \cdot m ]}{S [ mm^2 ]}$$

$$\xi = 0,017 \frac{ \Omega \cdot mm^2 }{ m }$$

Frška vaje  
24.3.2005  
(čet-tek)

Pri zaporedni vezavi, se upori seštevajo med sabo.



53/1

$$l = 7 \text{ m}$$

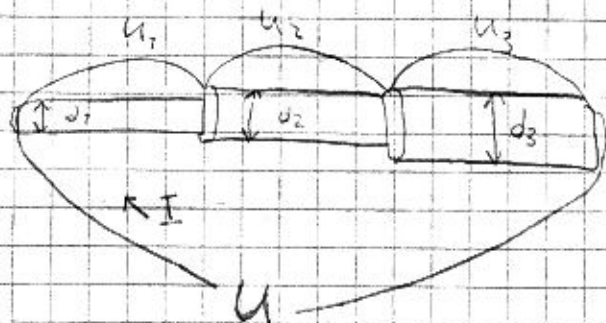
$$d_1 = 7 \text{ mm}$$

$$d_2 = 2 \text{ mm}$$

$$d_3 = 3 \text{ mm}$$

$$U = 72 \text{ V}$$

$$I = ?$$



a)

$$U = U_1 + U_2 + U_3$$

$$I_1 = I_2 = I_3 = I$$

$$R = R_1 + R_2 + R_3$$

$$U_1 = R_1 \cdot I$$

$$U_2 = R_2 \cdot I$$

$$U_3 = R_3 \cdot I$$

$$U = R \cdot I$$

$$I = \frac{U}{R} = \frac{72 \text{ V}}{0.027 \Omega} = 4444 \text{ A}$$

→ sind Faktoren

$$R_2 = \frac{R_1}{4} = 0.005 \Omega$$

$$R_3 = \frac{R_1}{9} = 2.2 \cdot 10^{-3} \Omega$$

$$R = 0.027 \Omega$$

$$S_1 = \pi \cdot r_1^2 = \pi$$

$$2r_1 = d_1$$

$$r_1 = \frac{d_1}{2}$$

$$U = R \cdot I$$

$$b) 0.027 \Omega \cdot 408 \text{ A} = 8.9 \text{ V}$$

$$U_2 = R_2 \cdot I = 0.005 \Omega \cdot 408 \text{ A}$$

$$U_3 = R_3 \cdot I =$$

$$R_1 = \frac{\sum c_i \cdot l}{S_1} = \frac{\sum c_i \cdot l \cdot 4}{\pi \cdot d_1^2} =$$

$$= \frac{0.027 \Omega \cdot \text{mm}^2 \cdot 7 \text{ m} \cdot 4}{\pi \cdot 3.14 \cdot 7 \text{ mm}^2} =$$

$$= 0.02 \Omega$$

5.3/2

$$R_1 = 10 \Omega$$

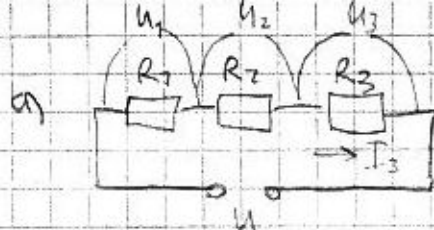
$$R_2 = 20 \Omega$$

$$R_3 = 50 \Omega$$

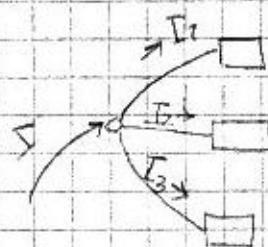
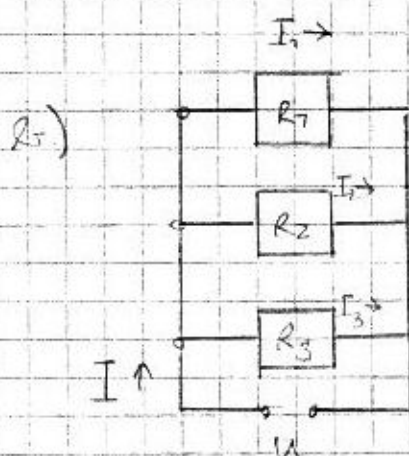
$$U = ?$$

$$I_3 = 0.16 A$$

$$R = 80 \Omega$$



$$U = I \cdot R = 0.16 A \cdot 80 \Omega = 12.8 V$$



$$I = I_1 + I_2 + I_3$$

$$U_1 = I_1 \cdot R_1$$

$$U_2 = I_2 \cdot R_2$$

$$0.16 A \cdot 50 \Omega = U_3 = I_3 \cdot R_3$$

$$= 25 V$$

$$U_1 = U_2 = U_3 = U$$

$$U = 25 V$$

$$R = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}} \Omega$$

$$R = \frac{1}{\frac{1}{10} + \frac{1}{20} + \frac{1}{50}} \Omega$$

$$= 5.8 \Omega$$

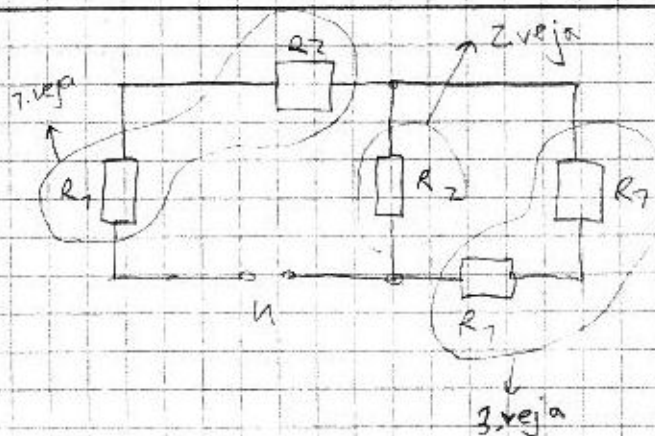
$$\Rightarrow I = \frac{U}{R} = \frac{25 V}{5.8 \Omega} = 4.3 A \text{ (mal en parth : )}$$

5.3/3

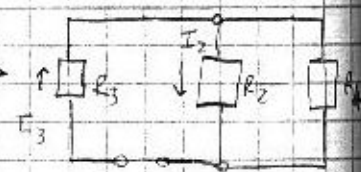
$$R_1 = 7 k \Omega$$

$$R_2 = 4 k \Omega$$

$$U = 12 V$$



1. Poenostavljena shema



$$R_3 = R_1 + R_2$$

$$R_3 = 2R_1 = 2 k \Omega$$

se idij  
2. Poenostavljena shema



se se bolj...



$$R_3 = \frac{1}{\frac{1}{R_2} + \frac{1}{R_4}} = \frac{R_2 \cdot R_4}{R_2 + R_4}$$

$$R = R_3 + R_5$$

$$R_5 = \frac{4 \text{ k}\Omega \cdot 2 \text{ k}\Omega}{2 \text{ k}\Omega + 4 \text{ k}\Omega} = 1.3 \text{ k}\Omega$$

$$R = 5 \text{ k}\Omega + 1.3 \text{ k}\Omega = 6.3 \text{ k}\Omega$$

$$U = I \cdot R \Rightarrow I = \frac{U}{R} = \frac{72 \text{ V}}{6300 \Omega} = 1.14 \cdot 10^{-3} \text{ A}$$

$I_3 / I_5$

$$U_2 = R_2 \cdot I_2 = I_2 = \frac{U_2}{R_2} = \frac{2.47 \text{ V}}{4000 \Omega} = 6.17 \cdot 10^{-4} \text{ A}$$

$$U_4 = R_4 \cdot I_4 = I_4 = \frac{U_4}{R_4} = \frac{2.47 \text{ V}}{2000 \Omega} = 1.23 \cdot 10^{-3} \text{ A}$$

$$U_2 = U_4 = U_5$$

$$U = U_3 + U_5$$

$$U_5 = R_5 \cdot I \Rightarrow 1.3 \text{ k}\Omega \cdot 1.14 \cdot 10^{-3} \text{ A} = 2.47 \text{ V}$$

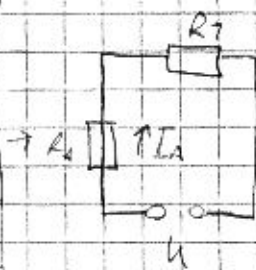
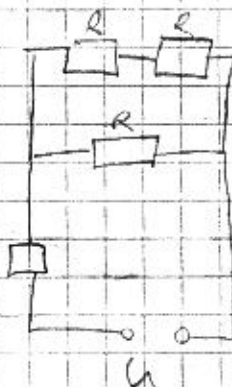
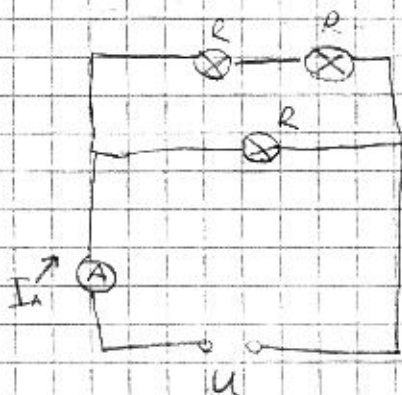
5.3/4.

$$R = 60 \Omega$$

$$R_A = 20 \Omega$$

$$I_A = 0.15 \text{ A}$$

$$U = ?$$

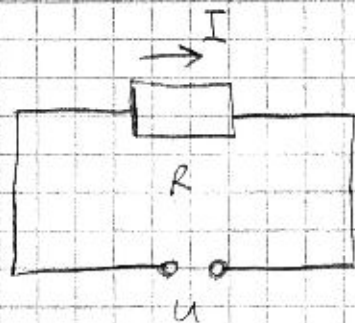


$$R_1 = \frac{2R \cdot R}{2R + R} = \frac{2R^2}{3R} = \frac{2R}{3} = \frac{2 \cdot 60 \Omega}{3} = 40 \Omega$$

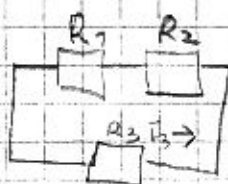
$$R_2 = R_1 + R_A = 40 \Omega + 20 \Omega = 60 \Omega$$

$$U = R_2 \cdot I_A = 60 \Omega \cdot 0.15 \text{ A} = 9 \text{ V}$$





$$P = U \cdot I \quad [V \cdot A = W]$$



$$P_3 = U_3 \cdot I_3$$

$$P = P_1 + P_2 + P_3$$

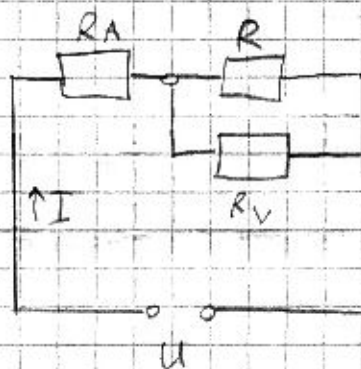
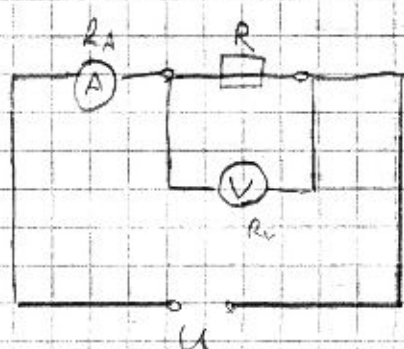
$$U = I R; \quad I = \frac{U}{R}$$

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

$$R = 300 \Omega$$

$$R_A = 25 \Omega$$

$$R_V = 800 \Omega$$



$$P_d = U_R \cdot I_R$$

$$R_c = \frac{R \cdot R_V}{R + R_V} + R_A = \frac{300 \Omega \cdot 800 \Omega}{300 \Omega + 800 \Omega} + 25 \Omega$$

$$R_c = 243,2 \Omega$$

$$I_c = \frac{U}{R_c} = I_A$$

$$U_A = I_A \cdot R_A$$

$$U_A + U_V = U$$

$$U_V = U_R$$

$$U_V = U - U_A$$

$$I_R = \frac{U_R}{R} \Rightarrow P_d = U_R \cdot \frac{U_R}{R}$$

$$= \frac{U_R^2}{R} = \frac{(U - I_A \cdot R_A)^2}{R}$$

$$U_R = U - U_A = U - I_A \cdot R_A$$

$$P_i = (U_v \cdot I_A = (U - U_A) \cdot I_A = (U - I_A R_A) \cdot I_A$$

$$\frac{P_d}{P_i} = \frac{(U - I_A R_A)^2}{R \cdot (U - I_A R_A) \cdot I_A}$$

$$\frac{P_d}{P_i} = \frac{U - I_A R_A}{R \cdot I_A} = \frac{U}{R \cdot I_A} = \frac{R_A}{R} = \frac{R_C}{R} - \frac{R_A}{R} = \frac{R_C - R_A}{R}$$

$$\frac{U}{R_C} = I_A \rightarrow \frac{U}{I_A} = R_C \quad \nearrow$$

$$= \frac{243.2 \, \Omega - 25 \, \Omega}{300 \, \Omega}$$

$$= \underline{\underline{0.73}}$$

$$\frac{P_i}{P_d} = \underline{\underline{1.38}}$$

DN/ Z. Vetriva

5.3/6

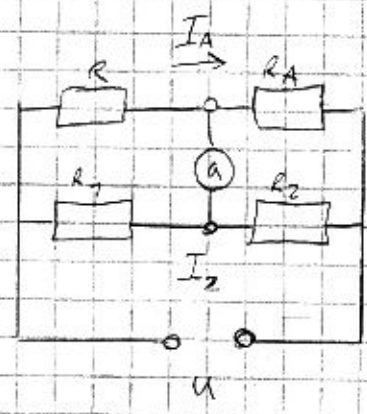
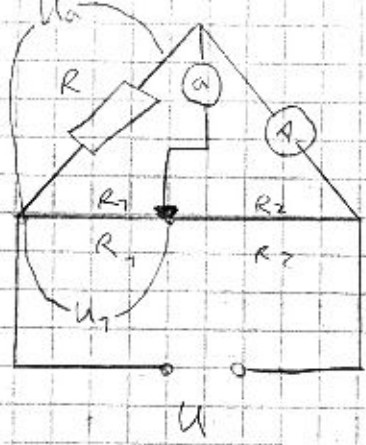
$$U = 9V$$

$$R_A = 2\Omega$$

$$\frac{R_1}{R_2} = \frac{2}{3}$$

$$R = 10\Omega$$

$$I_A = ?$$



$$U_2 = U_1$$

$$R_1 = \frac{\xi \cdot l_1}{S}$$

$$R_2 = \frac{\xi \cdot l_2}{S}$$

$$\Rightarrow \frac{R_1}{R_2} = \frac{l_1}{l_2}$$

$$\text{eg: } U = I_A \cdot (R + R_A) \Rightarrow I_A = \frac{U}{R + R_A}$$

$$\text{ph: } U = I_2 \cdot (R_1 + R_2) \Rightarrow I_2 = \frac{U}{R_1 + R_2}$$

$$U_2 = I_A \cdot R \Rightarrow$$

$$U_R = \frac{U \cdot R}{R + R_A}$$

$$U_1 = \frac{U \cdot R_1}{R_1 + R_2}$$

$$\frac{U \cdot R}{R + R_A} = \frac{U \cdot R_1}{R_1 + R_2} = \frac{R_1}{R_2 \left(1 + \frac{R_2}{R_1}\right)} = \frac{1}{1 + \frac{R_2}{R_1}} = \frac{1}{1 + \frac{2}{3}} = \frac{3}{5} = \frac{2}{5}$$

$$\frac{R}{R + R_A} = \frac{2}{5} \Rightarrow 2R + 2R_A = 5R \Rightarrow R_A = \frac{3R}{2} = 15\Omega$$

$$I_A = \frac{9V}{25\Omega} = 0.36A$$

5.3/8

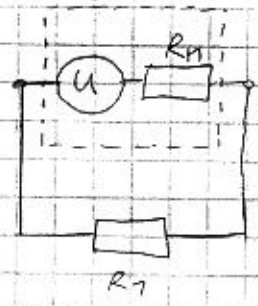
$$R_1 = 2\Omega$$

$$R_2 = 0.5\Omega$$

$$P = 2W$$

$$R_n = ?$$

$$U = ?$$



$$P_1 + P_2 = P$$

$$P_1 = I_1^2 \cdot R_1 \quad I_1 = \frac{U}{R_n + R_1}$$

$$= \left( \frac{U}{R_n + R_1} \right)^2 \cdot R_1$$



$$P_2 = I_2^2 R_2$$

$$P_1 = P_2$$

$$= \left( \frac{U}{R_1 + R_2} \right)^2$$

$$\left( \frac{U}{R_1 + R_2} \right)^2 R_1 = \left( \frac{U}{R_1 + R_2} \right)^2 \cdot R_2$$

$$\frac{1}{(R_1 + R_2)^2} \cdot R_1 = \frac{1}{(R_1 + R_2)^2} \cdot R_2$$

$$\left( \frac{R_1 + R_2}{R_1 + R_1} \right)^2 = \frac{R_2}{R_1}$$

$$\frac{R_1 + R_2}{R_1 + R_1} = \sqrt{\frac{R_2}{R_1}}$$

$$R_1 + R_2 = R_1 \sqrt{\frac{R_2}{R_1}} + R_1 \sqrt{\frac{R_2}{R_1}}$$

$$R_1 \left( 1 - \sqrt{\frac{R_2}{R_1}} \right) = R_1 \sqrt{\frac{R_2}{R_1}} - R_2$$

$$R_1 = R_1 \frac{\sqrt{\frac{R_2}{R_1}} - R_2}{1 - \sqrt{\frac{R_2}{R_1}}}$$

$$R_1 = R_2 \frac{\sqrt{\frac{R_2}{R_1}} - 1}{1 - \sqrt{\frac{R_2}{R_1}}}$$

$$R_1 - R_2 \frac{\sqrt{\frac{R_2}{R_1}} - 1}{1 - \sqrt{\frac{R_2}{R_1}}}$$

$$= 0.5 \Omega \cdot \frac{\sqrt{4} - 1}{1 - \sqrt{\frac{1}{4}}}$$

$$= 0.5 \Omega \cdot 2 + 1 \Omega$$

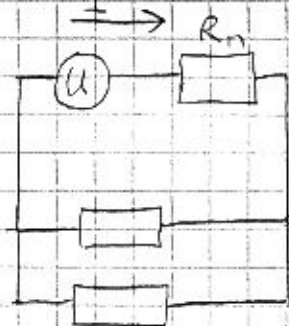
$$P_1 = R_1 \left( \frac{U}{R_1 + R_2} \right)^2$$

$$\sqrt{\frac{P_1}{R_2}} \cdot (R_1 + R_2) = U$$

$$U = \sqrt{\frac{2W}{25\Omega}} \cdot (7\Omega + 2\Omega)$$

$$\underline{\underline{U = 3V}}$$

8.)



$$R = R_n + R_1 + R_2$$

$$U = I \cdot R \Rightarrow I = \frac{U}{R} = \frac{U}{(R_n + R_1 + R_2)} = \frac{3V}{3.5\Omega} = 0.85A$$

$$R = R_A + \frac{R_1 R_2}{R_1 + R_2} = 7\Omega + \frac{7\Omega \cdot 2.5\Omega}{2.5\Omega} = 7.4\Omega$$

$$U = I \cdot R \Rightarrow I = \frac{U}{R} = \frac{3V}{7.4\Omega} = 2.74A$$

53/7

$$U_0 = 2V$$

$$l = 7m$$

$$S = 0.2mm^2$$

$$\rho = 1\Omega \cdot mm^2/m$$

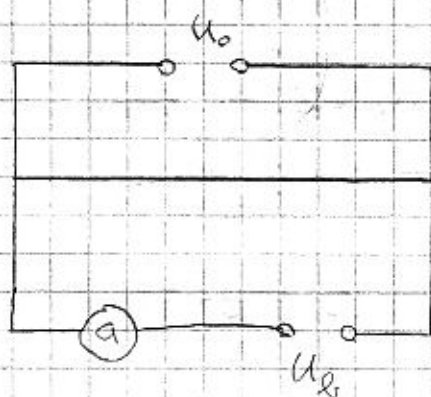
$$R_g = 5\Omega$$

$$R_0 = 7.5\Omega$$

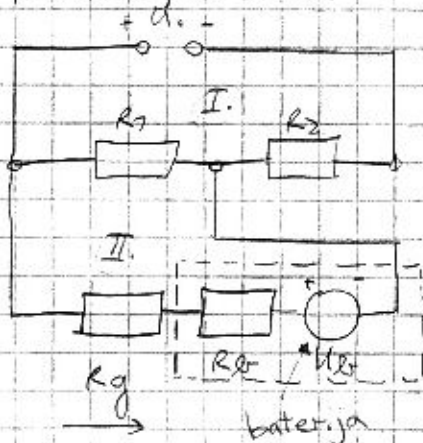
$$I_g = 0$$

$$R_1 = 65\Omega$$

$$U_{R_2} = ?$$



poenostavljena skica



$$R = \frac{\rho \cdot l}{S}$$

$$R = \frac{1\Omega \cdot mm^2}{0.2mm^2} \cdot 7m$$

$$R = 5\Omega$$

$$R_1 = \frac{65}{100} \cdot 5\Omega$$

$$R_1 = 3.25\Omega$$

$$R_2 = 5\Omega - 3.25\Omega$$

$$R_2 = 1.75\Omega$$

$$I. \quad U_0 + U_1 + U_2 = 0$$

$$II. \quad U_g = U_1 + U_g + U_{R_2}$$

$$U_g + U_{R_2} = I_g (R_g + R_{R_2})$$

$$U_g + U_{R_2} = 0$$

$$U_g = U_1$$

$$U_g = \frac{U_0 R_1}{R_1 + R_2} = \frac{2V \cdot 3.25\Omega}{5\Omega} = 73V$$

$$I_{1,2} = \frac{U_0}{R_1 + R_2}$$

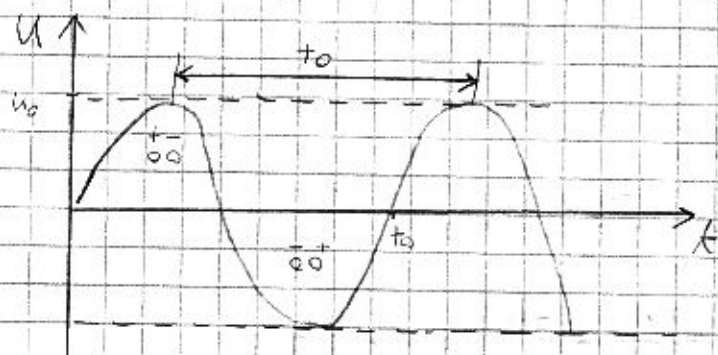
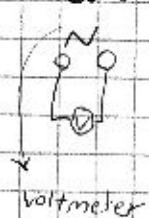
$$U_1 = I_{1,2} \cdot R_1$$

$$U_1 = \frac{U_0 R_1}{R_1 + R_2}$$



KANČEK → za razumevanje mogoč

SNovi

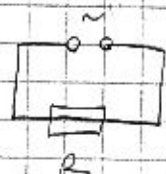


$$U = U_0 \cdot \sin \omega t$$

$$\omega = 2\pi f = \frac{2\pi}{T_0}$$

$$U_0 = 280V$$

$$U_0 = 280V (?)$$



$$U = I \cdot R$$

$$I = \frac{U}{R} = \frac{U_0}{R} \sin \omega t = I_0 \sin \omega t$$

$$I_0 = \frac{U_0}{R} ; U_0 = R \cdot I_0$$

$$P = U \cdot I = U_0 \sin \omega t \cdot I_0 \sin \omega t = U_0 \cdot I_0 \sin^2 \omega t$$

$$\sin^2 x + \cos^2 x = 1$$

$$\bar{P} = \frac{1}{2} U_0 \cdot I_0 = \frac{1}{2} U_0 \cdot \frac{1}{2} I_0$$

polprečna moč

$$P'_0 = U_0 \cdot I_0$$

maksimalna moč

$$\bar{P} = U_{eff} \cdot I_{eff}$$

efektivna napetost

efektivni tok

$$U_{eff} = \frac{1}{\sqrt{2}} U_0$$

$$I_{eff} = \frac{1}{\sqrt{2}} I_0$$

5.5/4

$$R = 30 \Omega$$

$$U_0 = 310 \text{ V}$$

$$V = 50 \text{ Hz}$$

$$I_0 = ?$$

$$I_{\text{ef}} = ?$$

$$P = P_{\text{ef}} = ?$$

$$t = 7 \text{ h} = 3600 \text{ s}$$

$$740 \text{ s.t.} \Rightarrow 7 \text{ kW/h}$$

$$I_0 = ?$$

$$U_0 = R \cdot I_0$$

$$I_0 = \frac{U_0}{R} = \frac{310 \text{ V}}{30 \Omega} = 10.3 \text{ A}$$

$$U_{\text{ef}} = \frac{U_0}{\sqrt{2}} = \frac{310 \text{ V}}{1.4} = 221.43 \text{ V}$$

$$I_{\text{ef}} = \frac{I_0}{\sqrt{2}} = \frac{10.3 \text{ A}}{1.4} = 7.4 \text{ A}$$

$$P = U_{\text{ef}} \cdot I_{\text{ef}} = 221 \text{ V} \cdot 7.4 \text{ A} = 1640 \text{ W}$$

$$W = P \cdot t = 1.64 \text{ kW} \cdot 7 \text{ h} = 11.48 \text{ kWh}$$

$$\frac{1.64 \text{ kWh}}{7 \text{ kWh}} \cdot 740 = 230 \text{ s.t.}$$

Elektrostatika (5.7) - poglavje

to je že snov  
iz 4. kolokvij

$$e [As]$$

$$I = \frac{e}{t} \left[ \frac{As}{s} = A \right]$$

$$\vec{E} = \left[ \frac{V}{m} \right]$$

$$E = \frac{e_1}{4\pi \cdot \epsilon_0 \cdot r^2}$$

$$\vec{F}_2 = e_2 \cdot \vec{E} \quad \text{sila v toč. naboju v poljubnem polju}$$

$$[As \cdot \frac{V}{m} = N]$$

Fizika vaje 7.4.2005  
(elektrika)

