

$$1. \quad c_1 = 118 \text{ J/kgK} \quad \rho = 282 \text{ J/kgK}$$

$$P_1 = 10 \text{ bar} \quad T_1 = 400^\circ\text{C}$$

$$P_2 = 2 \text{ bar} \quad T_2 = 200^\circ\text{C}$$

$$c_1 = 50 \text{ m/s} \quad c_2 = 250 \text{ m/s}$$

$$z_1 - z_2 = 5 \text{ m} \quad g_{12} = -500 \text{ kJ/s}$$

$$\dot{m} = 50 \text{ kg/s}$$

$$P_t = ?$$

$$W_{t12} = q_{12} + h_1 - h_2 + \frac{1}{2} (c_1^2 - c_2^2) + g(z_1 - z_2) = \\ = q_{12} + c_p (T_1 - T_2) + \frac{1}{2} (c_1^2 - c_2^2) + g(z_1 - z_2) =$$

$$P_t = Q_{12} + \dot{m} \left(c_p (T_1 - T_2) + \frac{1}{2} (c_1^2 - c_2^2) + g(z_1 - z_2) \right) = \\ = 8.05 \text{ MW}$$

$$2. \quad c_v = 718 \text{ J/kgK} \quad R = 287 \text{ J/kgK}$$

$$P_1 = 500 \text{ kPa} \quad T = 250 \text{ K} = \text{const}$$

$$P_2 = 200 \text{ kPa} \quad m = 1 \text{ kg}$$

$$T_{0a} = 300 \text{ K}$$

$$W_{\text{grob}} = ?$$

$$W_{\text{grob}} = T_{0a} \circ S_{0a} / \text{m}$$

$$W_{\text{grob}} = T_{0a} \left(-R \ln \left(\frac{P_2}{P_1} \right) + \frac{RT \ln \left(\frac{P_1}{P_2} \right)}{T_{0a}} \right) =$$

$$\geq T_{0a} \left(R \ln \left(\frac{P_1}{P_2} \right) - RT \ln \left(\frac{P_1}{P_2} \right) \right) =$$

$$= 13148.372 \text{ J}$$

3. Rankineov rečni!

$$P_t = 500 \text{ MW}$$

$$P_1 = P_2 = 10 \text{ MPa} \quad T_2 = 700^\circ\text{C}$$

$$P_3 = P_4 = 20 \text{ kPa}$$

$$\eta_{IE} = 0.85 \quad \eta_P = 0.8$$

$$20 \text{ kPa}: \quad h' = 251.5$$

$$h'' = 261.0$$

$$v' = 0.001 \text{ m}^3/\text{kg}$$

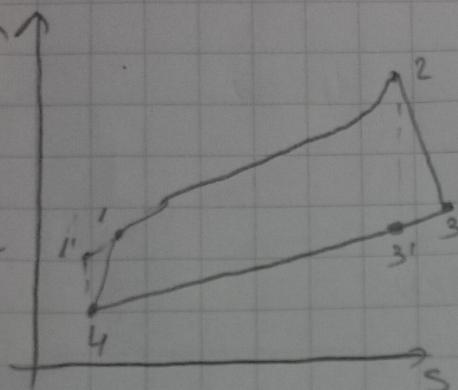
$$w_{p_{max}} = v(p_t - p_a) = 3380 \text{ J/kg}$$

$$h_r = h_u + w_p = 261.48 \text{ kJ/kg}$$

$$2: \quad h = 3867 \quad s = 7.1666$$

$$3': \quad h = 2362$$

$$\eta_b = ? \quad x = ? \quad \dot{m} = ?$$



$$b) \quad h_{31} = h' + x(h'' - h')$$

$$x = \frac{h_{31} - h'}{h'' - h'} = 0.8988$$

$$\eta_{IE} = \frac{h_2 - h_3}{h_2 - h_{31}}$$

$$\eta_P = \frac{h_{11} - h_4}{h_{11} - h_3}$$

$$h_3 = 2587.25 \text{ kJ/kg}$$

$$h_1 = 263.975 \text{ kJ/kg}$$

$$h_u = h'$$

$$w_{p_{max}} = v(p_t - p_a) = 3380 \text{ J/kg}$$

$$h_r = h_u + w_p = 261.48 \text{ kJ/kg}$$

$$a) \quad \eta_b = \frac{h_2 - h_3 - (h_u - h_n)}{h_2 - h_1} = 0.3516$$

$$c) \quad \dot{m} = \frac{P_t}{w_t} = \frac{P_t}{h_2 - h_3} = 390.85 \text{ kg/s}$$

4. Jouleov idealní!

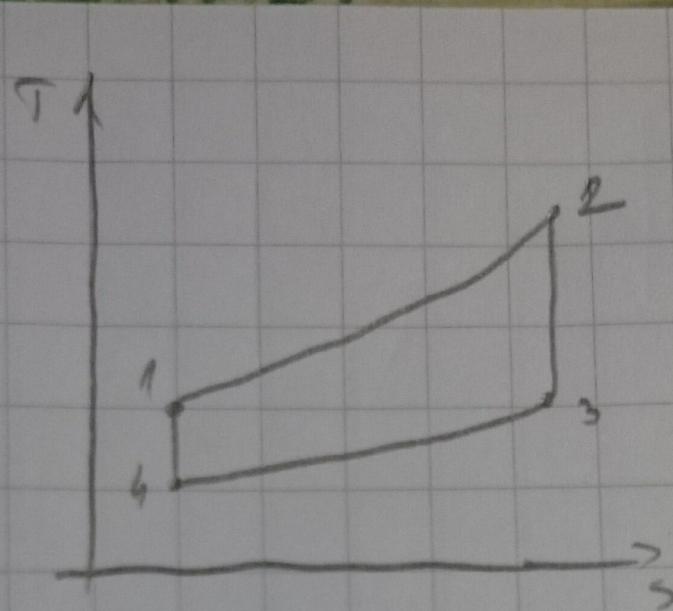
$$P_1 = P_2 = 1.1 \text{ MPa}$$

$$P_3 = P_4 = 0.1 \text{ MPa}$$

$$T_2 = 1300 \text{ K} \quad T_4 = 300 \text{ K}$$

$$R = 287$$

$$k = 1.4$$



$$\frac{T_1}{T_4} = \left(\frac{A}{P_4} \right)^{\frac{k-1}{k}}$$

$$T_1 = 595.2 \text{ K}$$

$$T_3 = 655.24 \text{ K}$$

$$q_{\text{dov}} = c_p (T_2 - T_1) = 707.972 \text{ kJ/kg}$$

$$q_{\text{odv}} = c_p (T_4 - T_3) = -356.839 \text{ kJ/kg}$$

$$\eta_t = \frac{q_{\text{dov}} + q_{\text{odv}}}{q_{\text{dov}}} = 0.49597$$

q_{dov} , q_{odv} , $\eta = ?$

$$5. \quad c_v = 4.18 \text{ kJ/kg}$$

$$\dot{m}_F = 0.2 \text{ kg/s}$$

$$g_{\text{dav}} = -100 \text{ kJ/kg}$$

$$g_{\text{dav}} = 80 \text{ kJ/kg}$$

$$\Delta T = 8^\circ\text{C}$$

$$P_{\text{komp}} = 5 \text{ kW}$$

$$\frac{|g_{\text{dav}}|}{|w|} = ?$$

a)

$$\frac{|g_{\text{dav}}|}{|w|} = 4$$

$$w = \frac{P_e}{\dot{m}_F} = 25 \text{ kW}$$

b)

$$P = g_{\text{dav}} \cdot \dot{m}_F = 16 \text{ kW}$$

$$P = \dot{m}_v c_v \Delta T$$

$$\dot{m}_v = \frac{P}{c_v \Delta T} = 0.478 \text{ kg/s}$$

6. PWR-4 petlje

$$M_0 = 93t \quad e=0.03$$

$$\phi = 3 \cdot 10^{13} \text{ n/m}^2 \text{s}$$

$$\sigma_f = 580 \cdot 10^{-28} \text{ m}^2$$

$$c = 5.7 \text{ kJ/kg K}$$

$$s = 720 \text{ kg/m}^3$$

$$T_{ua2} = 568.15 \text{ K}$$

$$T_{pa2} = 601.15 \text{ K}$$

$$h_1 = 391 \text{ kJ/kg} \quad h_e = 2756 \text{ kJ/kg}$$

$$\dot{m}_{pa2} = 423 \text{ kg/s}$$

$$P_j = ? \quad \dot{m}_{apm} = ?$$

$$P_f = ? \quad \Delta p = ?$$

$$a) N_{u_{235}} = e M_0 \frac{N_A}{235} = 7.15 \cdot 10^{27}$$

$$P_j = 200 \cdot 1.6 \cdot 10^{15} N_{u_{235}} \phi = 3380.56 \text{ MW}$$

$$b) P_T = 4 \dot{m}_{pa2} (h_2 - h_1) = 4001.58 \text{ MW}$$

$$P_p = \frac{1}{4} (P_T - P_j) = 5.255 \text{ MW}$$

$$c) P_j = m \cdot c_p \cdot \Delta T$$

$$\dot{m} = \frac{P_j}{c_p \Delta T} = 21461.9 \text{ kg/s}$$

$$d) 4 P_p = m v \Delta p$$

$$\Delta p = \frac{P_f}{m v} = 715.2 \text{ kPa}$$