① ges: $\dot{Q}_{aus}$

$0 = \dot{m}_{ein}(h_{ein} - h_{aus}) + \dot{Q}_{aus} - \cancel{P}^{0}$

~~$0 = \dot{m}(292,58$~~

$0 = \dot{m}(h_f(70°) - h(100°)) + \dot{Q}_{aus}$

$\dot{Q}_{aus} = 0,3\frac{kg}{s}\left(292,58\frac{kJ}{kg} - 430,33\frac{kJ}{kg}\right)$

$\dot{Q}_{aus} = -41,21\,kW$

$h_f(70°) = 292,58\,kJ/kg$ ← (Tab A-2)

$h(100°) = 419,04\frac{kJ}{kg} + 0,005\left(2257,0\frac{kJ}{kg}\right)$

$= 430,33\frac{kJ}{kg}$

b) ges: $\overline{\overline{T}}_{KF}$

$\overline{\overline{T}} = \frac{\int_e^a T\,ds}{s_a - s_e}$ ideale Flüssigkeit $\Rightarrow ds = \frac{c^{it}}{T}dT$

$\Rightarrow Tds = c^{it}dT \Rightarrow \int Tds = c^{it}(T_{aus} - T_{ein})$

$s_a - s_e = c_*^{it}\ln\left(\frac{T_{aus}}{T_{ein}}\right)$

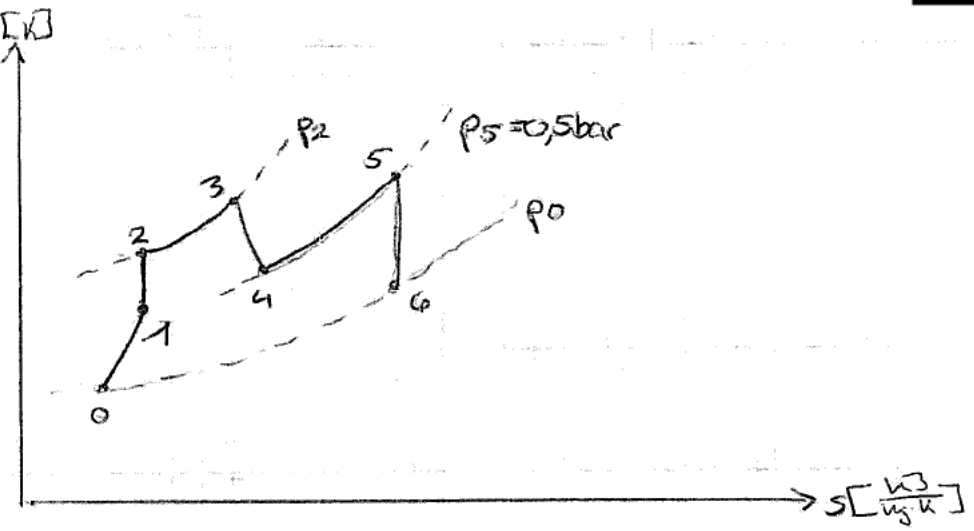
$\Rightarrow \overline{\overline{T}}_{KF} = \frac{T_{aus} - T_{ein}}{\ln\left(\frac{T_{aus}}{T_{ein}}\right)} = \frac{(298,15 - 288,15)K}{\ln\left(\frac{298,15}{288,15}\right)} = 293,66\,K$

c) $0 = \frac{\dot{Q}_j}{\overline{\overline{T}}_{KF}} + \dot{S}_{erz} \Rightarrow \dot{S}_{erz} = \frac{\dot{Q}_{aus}}{\overline{\overline{T}}_{KF}} = \frac{65kW}{295K} = 0,220\frac{kW}{K}$

d)

[redacted]

② a)



b) gesucht: w_6, T_6

$$0 = \dot{m}_{gas}\left[h_5 - h_6 + \frac{(w_5^2 - w_6^2)}{2}\right] + \cancel{\dot{Q}_{56}}^{0} + \dot{W}_{56}$$

$$0 = \dot{m}_{gas}\left[h_0 - h_6 + \frac{(w_0^2 - w_6^2)}{2}\right] + \cancel{\dot{Q}_{06}}^{0} - \cancel{\dot{W}_{06}}^{0} \qquad h_0 - h_6 = c_p(T_0 - T_6)$$

$$\frac{T_6}{T_5} = \left(\frac{p_6}{p_5}\right)^{\frac{\kappa-1}{\kappa}} \Rightarrow T_6 = T_5\left(\frac{p_6}{p_5}\right)^{\frac{\kappa-1}{\kappa}} = 431{,}5\,K\left(\frac{0{,}15\,bar}{0{,}5\,bar}\right)^{\frac{0{,}4}{1{,}4}} = \underline{\underline{328{,}07\,K = T_6}}$$

$$\Rightarrow c_p(T_0 - T_6) + \frac{(w_0^2 - w_6^2)}{2} = 0$$

$$\Rightarrow 2c_p(T_6 - T_0) + w_0^2 = -w_6^2$$

$$\Rightarrow \sqrt{w_0^2 + 2c_p(T_0 - T_6)} = w_6$$

$$\Rightarrow w_6 = \sqrt{\left(200\,\tfrac{m}{s}\right)^2 + 2 \cdot 1006\,\tfrac{J}{kgK}(243{,}15 - 328{,}07)\,K} = \underline{\underline{459{,}19\,m/s}}$$

c) $\Delta \dot{e}_{x,str} = [h_6 - h_0 - T_0(s_6 - s_0) + \Delta KE]$ $\quad \Delta ke = \frac{w_6^2}{2} - \frac{w_0^2}{2}$

~~$\Rightarrow \Delta e_{x,str}$~~

~~$\Delta e_{x,str}$~~

$\Rightarrow \Delta e_{x,str} = \left[c_p(T_6 - T_0) - T_0\left(c_p \ln\left(\frac{T_6}{T_0}\right)\right) + \frac{w_6^2 - w_0^2}{2}\right]$

$\Rightarrow \Delta e_{x,str} = \left[1{,}006 \frac{kJ}{kg \cdot K}(328{,}07 - 243{,}15)K - 243{,}15K\left(1{,}006 \frac{kJ}{kg \cdot K} \ln\left(\frac{328{,}07K}{243{,}15K}\right)\right) + \frac{(5{,}0\frac{m}{s})^2 - (200\frac{m}{s})^2}{2}\right]$

$\Rightarrow \Delta e_{x,str} = 122{,}21 \frac{kJ}{kg}$

c) $0 = \dot{m}_{gs}[\Delta e_{x,str}] - \dot{E}_{x,ver}$

$\Rightarrow 0 = [\Delta e_{x,str}] - E\, e_{x,ver}$

$\Rightarrow e_{x,ver} = 122{,}21 \frac{kJ}{kg}$

[redacted]

③a) ges: $p_{g,1}$, m_g

$T_{g,1} = 500°C$ $V_{g,1}$

$R_g = \frac{\bar{R}}{M_g} = \frac{8,314 \frac{J}{mol \cdot K}}{28 \frac{kg}{kmol}} = 166,28 \frac{J}{kg \cdot K}$ $c_p - c_v = R \Rightarrow c_p = 166,28 \frac{J}{kgK} + 0,653 \frac{kJ}{kgK}$

$\Rightarrow c_p = 825,28 \frac{J}{kgK}$

$pV = mRT$

$p_g + p_{EW} = p_{amb} + \frac{m_{KS}}{\pi r^2}$ $p_{EW} = 1,41 bar$ (Tab. A)

b)

c) ges: Q_{12}

$\Delta E = \Delta U = Q_{12} - W_{v,12}$

$\Rightarrow m_g c_p$

$\Rightarrow \Delta U_g = m_g c_v (T_2 - T_1) + W_{v,12} = Q_{12}$

$W_{v,12} =$

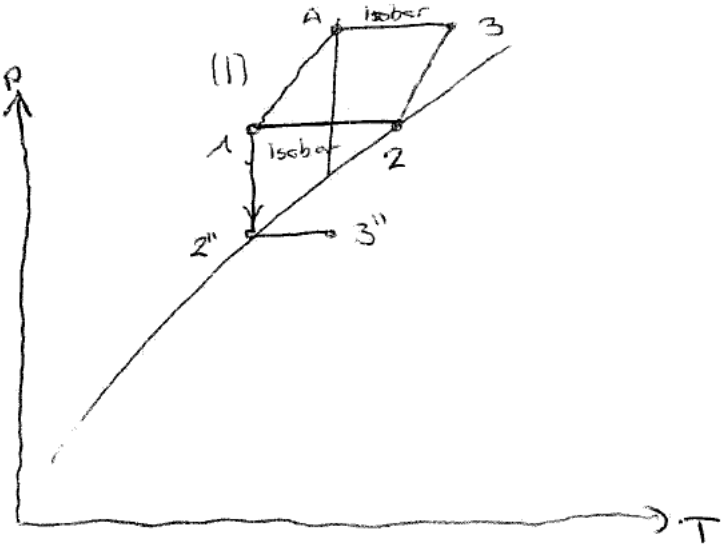
d) $\Delta E = Q_{12} - W_{v,12}$

$T_{sat} = 0,003°C$

$x_2 = \frac{m_{Eis}}{m_{EW}}$

[redacted]

(4) a)



b) $0 = \dot{m}_{12}[h_2 - h_5] - \dot{\omega}_K$

$T_i = -10°C$

$T_2 = T_i - 6K = -16°C$

$\Rightarrow h_2 = h_g = 237{,}74 \frac{kJ}{kg}$ (Tab A-10)

$p_2 = 1{,}5748 bar$ (Tab A-10)

c) $p_4 = p_3 = 1{,}5748 bar$

$T_4 = T_i = -10°C$

$x_4 =$

d) $\varepsilon_K = \frac{|\dot{Q}_{zu}|}{|\omega_L|}$ $\dot{Q}_{zu} = \dot{Q}_K$ $\dot{\omega}_L = \dot{\omega}_K = 28\omega$

e)