

(1)

#1 es werden drei Werte aus der Aufgaben genommen

$$\text{z.B. } \dot{Q}_{205} = 65 \text{ kW}$$

d)

$$\Theta = m_{\text{ern}} (h_{\text{ern}}^w - h_{205}^w) + \dot{Q}_2 - \dot{Q}_{205}$$

$$h_{\text{ern}}^w = h_f(70^\circ\text{C}) = 292.98 \frac{\text{kJ}}{\text{kg}} \quad (\text{A2})$$

$$h_{205}^w = h_f(100^\circ\text{C}) = 410.04 \frac{\text{kJ}}{\text{kg}} \quad (\text{A2})$$

$$\dot{Q}_{205} = \underline{\underline{62.182 \text{ kW}}}$$

$$b) \quad \overline{T}_{\text{KF}} = \frac{\int e \cdot T ds}{s_2 - s_1} = \frac{(h_{205}^{\text{KF}} - h_{\text{ern}})}{c_{\text{it}} \ln\left(\frac{T_{205}}{T_{\text{ern}}}\right)} = \frac{c_{\text{it}} \cdot (T_{205}^{\text{KF}} - T_{\text{ern}}^{\text{KF}})}{c_{\text{it}} \ln\left(\frac{T_{205}}{T_{\text{ern}}}\right)} = \underline{\underline{293.122 \text{ K}}}$$

c)

$$\Theta = m (h_{\text{ern}}^w - h_{205}^w)$$

$$\Theta = m (s_{\text{ern}}^w - s_{205}^w) - \frac{\dot{Q}_{205}}{\overline{T}_{\text{KF}}} + \dot{s}_{\text{ern}} \rightarrow \underline{\underline{s_{\text{ern}} = 0.326 \frac{\text{kJ}}{\text{K}}}}$$

$$s_{\text{ern}}^w = s_f(70^\circ\text{C}) = 0.9549 \frac{\text{kJ}}{\text{kg K}}$$

$$s_{205}^w = s_f(100^\circ\text{C}) = 1.3060 \frac{\text{kJ}}{\text{kg K}}$$

d)

$$\Delta U = \cancel{\dot{m}_{12} h_{\text{ern}}^w} + \cancel{\dot{Q}_{1212}} - \cancel{\dot{Q}_{20512}} = 0$$

$$h_{\text{ern}}^w = h_f(20^\circ\text{C}) = 83.96 \frac{\text{kJ}}{\text{kg}}$$

(A2)

$$\Delta U = m_{\text{ges}} v_1 - (m_{\text{ges}} + \Delta m_{12}) v_2$$

$$v_1 = v_f(100^\circ) + x (v_g - v_f) = 429.3778 \frac{\text{m}}{\text{s}} \quad (\text{A2})$$

$$v_2 = v_f(70^\circ\text{C}) = 292.95 \frac{\text{m}}{\text{s}} \quad (\text{A2})$$

c)

$$\Delta S_{12} = (m_{\text{ges}} + \Delta m_{12}) s_2 - m_{\text{ges}} s_1 = 1237.8988 \frac{\text{J}}{\text{K}}$$

$$s_2 = s_f (20^\circ\text{C}) = 0.9549 \frac{\text{J}}{\text{kg K}}$$

(A2)

$$s_1 = s_f + x (s_g - s_f) = 1337.14 \frac{\text{J}}{\text{kg K}}$$

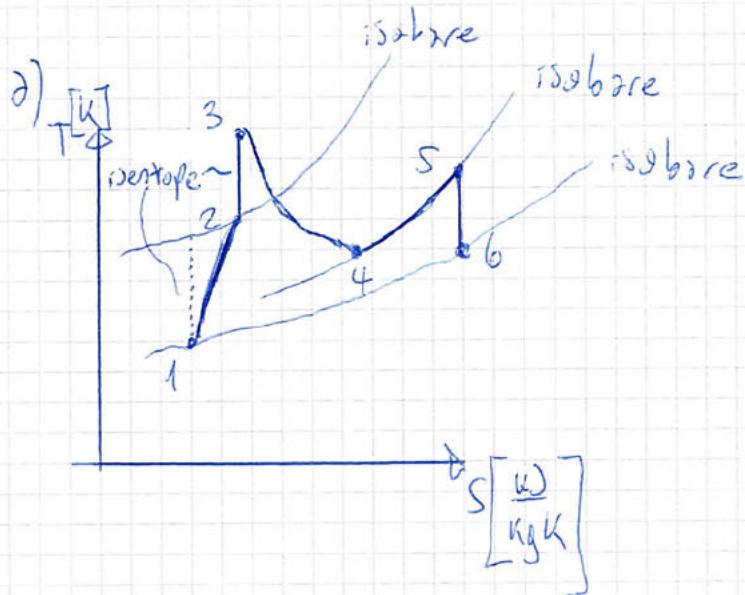
d)

$$m_{\text{ges}} (v_1 - v_2) - \Delta m_{12} v_2 = \Delta m_{12} h_{e,n}^w$$

$$\Delta m_{12} = \frac{m_{\text{ges}} (v_1 - v_2)}{h_{e,n}^w + v_2} = 6.108 \text{ T}$$

#2

2



$$[12x]$$

$$p_0 = 0.191$$

$$p_1 =$$

$$p_2 =$$

$$p_3 =$$

$$p_4 =$$

$$p_5 = 0.5$$

$$p_6 = 0.191$$

$$[^\circ C]$$

$$T = 30$$

$$\frac{p}{p_1} =$$

$$\frac{T}{T_1} =$$

$$\frac{T}{T_2} =$$

$$\frac{T}{T_3} =$$

$$\frac{T}{T_4} =$$

$$T_5 = 431.9 K$$

$$T_6 = 328.075 K \quad s_5 = s_6$$

b)

$$\underline{\underline{\theta = m_{\text{gas}} (h_5 - h_6) - T_5}} \quad M_L = 28.02 \frac{g}{m_{\text{mol}}}$$

$$m_{\text{gas}} = w_{\text{net}} +$$

$$s_5 = s_6 \Rightarrow s_5 - s_6 = 0 = c_p \ln \left( \frac{T_5}{T_6} \right) - \frac{\bar{R}}{M_L} v_n \left( \frac{p_5}{p_6} \right)$$

$$\rightarrow \underline{\underline{v_n \ln \left( \frac{T_5}{T_6} \right) = \frac{\bar{R}}{M_L c_p} \ln \left( \frac{p_5}{p_6} \right)}} \rightarrow \frac{T_5}{T_6} = \frac{p_5}{p_6}$$

$$\frac{T_6}{T_5} = \left( \frac{p_6}{p_5} \right)^{\frac{K-1}{K}} \rightarrow T_6 = 328.075 K$$

$$\underline{\underline{\theta = m_{\text{gas}} \left( h_5 - h_6 + \frac{w_5^2 - w_6^2}{2} \right)}}$$

adiabat, reversibel + isentrop +  $w=0$ ,  $Q_5=0$

$$\frac{w_6^2}{2} = \underbrace{h_5 - h_6}_{c_p(T_5 - T_6)} + \frac{w_5^2}{2} \rightarrow \underline{\underline{w_6 = 507.24 \frac{m}{s}}}$$

$$\underline{\underline{C) \Delta e_{x, \text{str}} = m_{\text{gas}} (h_6 - h_0 - T_0 (s_6 - s_0) + \frac{w_6^2 - w_0^2}{2})}}$$

ingresos

d)

$$\dot{E}_{x,vui} = T_0 \dot{S}_{erz} = T_0 m_{gres} c_p v_n \left( \frac{T_0}{T_0} \right)$$

$$0 = m_{gres} (s_0 - s_6) + \dot{S}_{erz}$$

$$c_p v_n \left( \frac{T_0}{T_6} \right)$$

③

#3

$$2) A = \pi \frac{D^2}{4} = 0.007854 \text{ m}^2$$

$$p_{G1} = \frac{m_{Ew} g}{A} + \frac{m_K g}{A} + p_{0,m} = 1.4 \text{ bar}$$

$$p_{G1} \frac{V_{G1}}{m_G} = \frac{\bar{R}}{M_G} T_{G1}$$

$\left\{ \frac{V_{G1}}{m_G} \right\} \quad \left\{ m_G^2 = \frac{p_{G1} V_{G1} M_G}{\bar{R} T_{G1}} \rightarrow m_G = 0.108 \text{ kg} \right.$

b)

$$V_{2ew} = V_{1ew} \quad p_{2G} = p_{1G} = 1.4 \text{ bar}, \rightarrow \text{sich } m_{Ew}, m_K \text{ und } p_0 \text{ nicht verändert}$$

$$m_{Ew} (v_2^{Ew} - v_1^{Ew}) = \dot{Q}$$

$$\downarrow T_{2G} = \frac{p_{2G} V_{2G} M_G}{m_G \bar{R}}$$

$$pV = \frac{\bar{R}}{M_G} T_G$$

c)

$$m_G (v_2 - v_1) = \dot{Q} = -1.139 \text{ kJ}$$

$$\underbrace{c_v}_{\text{kJ}} (T_2 - T_1)$$

d)

$$\text{Mischung}$$

$$p_1^{Ew} = p_2^{Ew}$$

$$m_{Ew} (v_2^{Ew} - v_1^{Ew}) = \dot{Q} \rightarrow v_2^{Ew} = \frac{\dot{Q}}{m_{Ew}} + v_1 = v_{fL2} + x_2 (v_{fe2} - v_{fL2})$$

$$v_1 = v_{fL1} + x_1 (v_{fe1} - v_{fL1}) = -200.1168 \frac{\text{kJ}}{\text{kg}}$$

$\downarrow$   
-333.498  $\frac{\text{kJ}}{\text{kg}}$

$-0.048 \frac{\text{kJ}}{\text{kg}}$

$$x_2 = \frac{\dot{Q}}{m_{Ew} (v_{fe2} - v_{fL2})} + \frac{v_1}{v_{fe2} - v_{fL2}} - v_{fL2}$$

=

$$v_2^{Ew} = v_{fL} + x_2 (v_{fe} - v_{fL}) \quad \text{mit } g \text{ erg. } p_{2G}$$

$$p_2^{Ew} = p_0 + \frac{m_K g}{A} + p_{2G} = 2.9 \text{ bar} \rightarrow v_{fL2} = -\frac{-0.322 + 0.079}{10-2} (2.0 - 2) - 0.079 = -0.106 \frac{\text{kJ}}{\text{kg}}$$

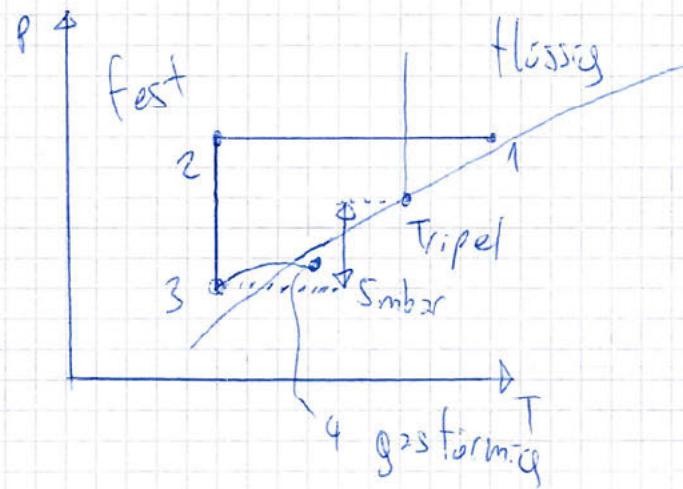
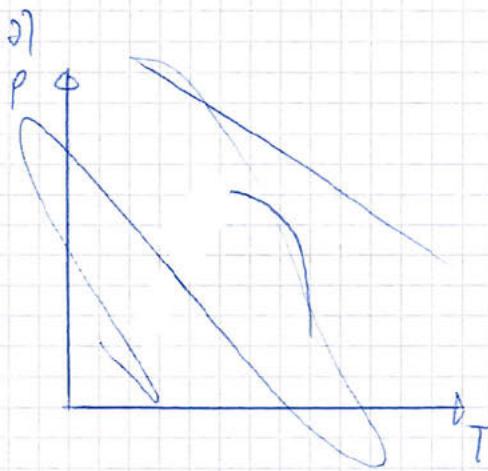
$$U_{f22} = \frac{-333.812 + 333.498}{10-2} (2.0 - 2) - 333.498 = -333.533 \frac{\text{kJ}}{\text{kg}}$$

#4

#4

$$\begin{aligned}
 p_1 &= p_2 = 1.2192 \quad T_1 = 0^\circ C \\
 p_2 &= p_4 = 1.2102 \quad T_2 = -22^\circ C \\
 f_3 &= 8 \quad T_s = x_2 = 1 \\
 p_4 &= 8 \quad T_4 = 31,33 \quad x_3 = 1 \\
 & \quad \quad \quad x_4 = 0
 \end{aligned}$$

[REDACTED]



b)

$$s_2 = s_3$$

$$\Theta = m_R (h_2 - h_3) + \dot{w}_K$$

d)

$$\epsilon_K = \frac{|\dot{Q}_{2b}|}{|\dot{Q}_{2b} - \dot{Q}_{2d}|} = \frac{\dot{Q}_K}{|\dot{Q}_{2b}|}$$

$$\Theta = m_R (h_4 - h_3) - \dot{Q}_{2b} \rightarrow \dot{Q}_{2b} = 0.1897 \text{ kW}$$

$$h_4 = 03,42 \frac{\text{kJ}}{\text{kg}}$$

$$h_3 = h_g (8 \text{ bar}) = 260,15 \frac{\text{kJ}}{\text{kg}} \quad (\text{AA})$$

$$\dot{Q}_K = m (h_2 - h_1)$$

9)

$$\text{O} \times \text{m}_2 (h_4 - h_1)$$

$$\text{adiabat} \rightarrow h_4 = h_1 = h_f \text{ (8 bar)} = 93.42 \frac{\text{kJ}}{\text{kg}} \quad (\text{AM})$$

at 1.2192 bar  
 $h_1 = h_f + x_1(h_g - h_f)$

$$p_1 = p_2 \quad T_2 = -22^\circ\text{C} \rightarrow h_2 = h_g (-22^\circ\text{C}) = 234.08 \frac{\text{kJ}}{\text{kg}}$$

$= 1.2192 \text{ bar}$  (A10)

$$h_f = \frac{25.77 - 21.32}{1.4 - 1.2} (1.2192 - 1.2) + 21.32 = 21.7472 \frac{\text{kJ}}{\text{kg}}$$

$$h_g = \frac{236.04 - 233.86}{1.4 - 1.2} (1.2192 - 1.2) + 233.86 = 234.069 \frac{\text{kJ}}{\text{kg}}$$

$$x_1 = 0.338$$

e)

Die Temperatur würde sich zuerst nicht verändern, da man im Phasenwechsel ist.