[redacted]

Aufgabe 1

a) stationär ohne ke & pe

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

$$\dot{Q}_{aus} = \dot{m}_{ein}(h_{aus} - h_{ein}) - \dot{Q}_R$$

$$\dot{Q}_{aus} = 2.69\,kW - 123.04\,kW$$

A-2

h_{ein}: $h_{fg}(70°) = 2333.8\ \frac{kJ}{kg}$

h_{aus}: $h_{fg}(100°) = 2676.1\ \frac{kJ}{kg}$ − 419.04 = 2257.0

b)

$$\dot{S}_{erz} + \dot{m}(s_e - s_a) + \sum \frac{\dot{Q}}{T} \qquad \dot{S}_{erz} = 0$$

$$\frac{\dot{m}(s_e - s_a)}{\dot{Q}_{aus}} = \frac{1}{\bar{T}}$$

$$\bar{T} = \frac{c(T_2 - T_1) = (\dot{Q}_{aus})}{\ln\left(\frac{T_2}{T_1}\right)} = 293.12\,K$$

c)

$$\dot{S}_{erz} = \dot{m}(s_{aus} - s_{ein}) + \frac{\dot{Q}}{T}$$

$$s_{aus} = \frac{(7.3585 - 1.3069)\frac{kJ}{kgK}}{(2676.1 - 419.04)\frac{kJ}{kg}} \cdot 2257.0 + 1.3069\frac{kJ}{kgK} = 7.3547\ \frac{kJ}{kgK}$$

$$s_{ein} = \frac{(7.7553 - 0.9549)\frac{kJ}{kgK}}{(2626.8 - 252.98)\frac{kJ}{kg}} \cdot 2333.8 + 0.9549 = 7.7552\ \frac{kJ}{kgK}$$

$= 0.20266$

$26.6\ \frac{kJ}{kg}$

d) $\Delta U = -\dot{Q}_{aus} + \dot{m}_{12} u$

$m_{12} = \frac{Q_{aus}}{u_{12}} + \frac{m(u_2 - u_1)}{u_{12}}$

$u_1 = u_f - x(u_g - u_f) \quad 100^\circ = 408.15 \frac{kJ}{kg}$

A-2 =

$u_{12} = \frac{}{}$ $\quad u_{12} = u_f + x(u_g - u_f) = 2333.33 \frac{kJ}{kg}$

A-2

$x_{12} = \frac{h_{fg} - h_f}{-h_f + h_g} = 0.03$

$\Delta S_{12} = \dot{m}($

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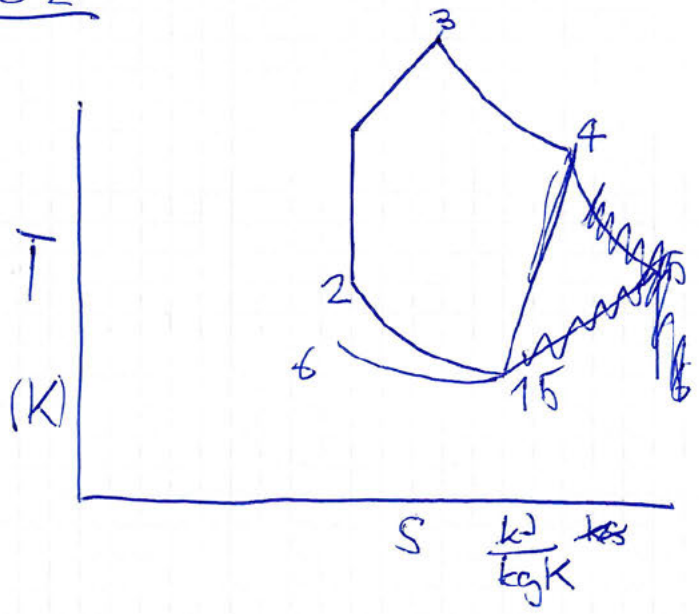
Aufgabe 2

a)



b) $\frac{T_6}{T_5} = \left(\frac{p_6}{p_5}\right)^{\frac{n-1}{n}}$

$T_6 = T_5 \left(\frac{p_6}{p_5}\right)^{\frac{n-1}{n}}$ $\quad n = 1.4$

$T_6 = 328.07\,K$

$\dot{Q} = 0 \quad \dot{W} = 0$

$0 = \dot{m}\left(h_5 - h_6 + \frac{w_5^2 - w_6^2}{2}\right) - \dot{W}_{56} \quad W_{56} = -\int_1^2 p\,dv$

$\dot{W}_{56} = \dot{m} W_{56}$

$= \frac{R(T_6 - T_5)}{1-n} \quad n = 1.4$

$= -74.6\,kJ$

$\frac{-w_5^2 + w_6^2}{2} = h_5 - h_6 - W_{56}$

$w_6 = \sqrt{2(h_5 - h_6 - W_{56}) - w_5^2}$

$= \sqrt{2c_p(T_5 - T_6) - 2W_{56} + w_5^2}$

$= 229.$

$R = c_p - c_v \qquad c_v = \frac{c_p}{\kappa}$

$R = c_p\left(1 - \frac{1}{\kappa}\right) = 0.2874\,\frac{kJ}{kgK}$

Aufgabe 4

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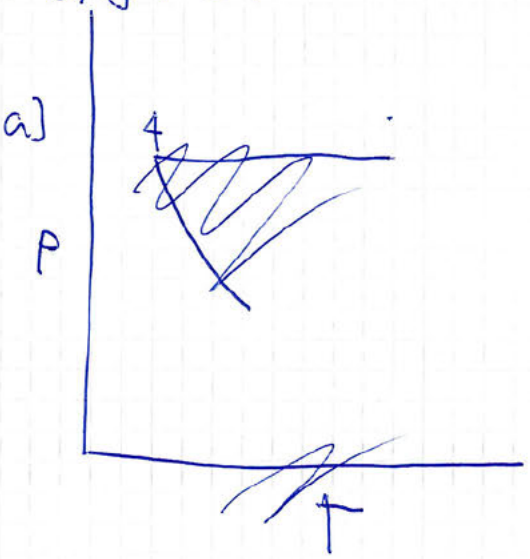
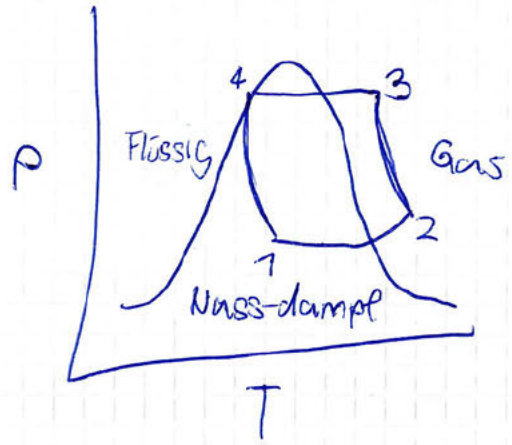
a)





b) ~~S~~ $s_2 = s_3$

~~T~~ $0 = \dot{m}(h_2 - h_3) - \dot{W}_K$ $T_1 =$

$p = 1\,mbar$

c) $h_1 = h_4$

e) Sie ~~W~~ würde ~~kl~~ grösser da mehr

~~E~~ Exergieverlust

d) $\varepsilon_K = \frac{\dot{Q}_K}{\dot{W}_K}$

[redacted]

Aufgabe 3

d) Fortsetzung

c

[redacted]

Aufgabe 3

$A = (D/2)^2 \cdot \pi = 0.00 \dots m^2$

a)

$p_{G1} = m_{EW} g / A + m_K g / A + p_{amb}$

$= 1,4$ bar

$pV = mRT$

$m_{g1} = \frac{p_{1g} V_{1g}}{R T_{g1}} =$

$m_{1g} = 3,49$ g

$R = \frac{\bar{R}}{M_g} = 0.16628 \frac{kJ}{kg K}$

$3.14 L = 0.00314 m^3$

$T_1 = 773.15$ K

b) $v_2 = v_1$

~~$p_{g2} = p_{g1}$~~ $p_{g1} = p_{g2}$

Druck von oben bleibt gleich

~~$m_{2g}(v_{2g}) = m_{2w}(v_{2w})$~~

c) $\Delta U_g = \dot{Q}_{12}$

$Q_{12} = m_L c_v (T_{2g} - T_{1g})$

$= 11095$ J

$T_{2g} = 0.003\,^{\circ}C = 273.153$ K

$T_{1g} = 773.15$ K

d) $\Delta U = Q_{12}$

$Q_{12} = 1500$ J

$v_{1w} = v_f + x(v_g - v_f) = -200.14 \frac{kJ}{kg}$

$0\,^{\circ}C \quad v(T)$

$v_2 = v_1 - \frac{Q_{12}}{m} = -215.14$

Aufgabe 2

c) $e_{x\,str_6} = (h_6 - h_0 - T_0(s - s_0) + \frac{w_6^2}{2}$

$e_{x\,str_0} = (h_0 - h_0 - T_0(s - s_0) + \frac{w_0^2}{2}$

$\Delta e_{xstr} = (h_6 - h_0 + \frac{w_6^2}{2} - \frac{w_6^2}{2})$

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

$= 110{,}04 \frac{MJ}{kg}$

$w_0 = 200 \frac{m}{s}$

$w_6 = 510 \frac{m}{s}$

$T_6 = 340\,K$

$T_0 = -30\,K$

d)

$0 = \Delta e_{xstr} - \dot{e}_{xverl} + \Delta$

e

$\dot{e}_{xverl} = \Delta e_{xstr}$

$= 100 \frac{kJ}{kg}$