3)

[redacted]

a) $p_{g_1} = p_{amb} + \frac{m_K \cdot g \cdot \cancel{A}}{A} + \frac{m_{EW} g \cdot \cancel{A}}{A}$

$p = \frac{F}{A}$

$A = \pi \frac{D^2}{4} = 7.85 \cdot 10^{-3} \, m^2$

$\boxed{\cancel{p_{g_1} = 3.473 \text{ bar}}}$ $\boxed{p_{g_1} = 1.4 \text{ bar}}$

$\frac{p_{g_1} V_{g_1}}{R \, T_{g_1}} = \underline{\underline{3.42 \, g}} = m_g$ $R = \frac{\bar{R}}{M_g} = 0.16628$

b) $\cancel{\Delta E = Q - W}$

$\Delta E = Q - W$

$\Delta E = 0$

$= m_g (u_2 - u_1)$, perfektes Gas

$= m_g (c_v (T_2 - T_1$

$V_{g_1} = V_{g_2}$, ~~da isochor~~ perfektes Gas

$p_{g2} = \frac{m_g R T_{g2}}{V_{g1}}$

c) $\frac{dE}{dt} = \sum \dot{Q} - \cancel{\sum \dot{W}}^{0}$

$m_g (u_2 - u_1) = \dot{Q}$

$m_g c_v (T_2 - T_1) = \boxed{-1.07 \text{ kW} = \dot{Q}}$

b) $\bar{\bar{T}} = \frac{\Delta h}{\Delta s}$, da ideale Flüssigkeit

$$= \frac{T_2 - T_1}{\ln(T_2/T_1)} = \boxed{283.12\,K = \bar{\bar{T}}}$$

c) $0 = \dot{m}(s_{ein} - s_{aus}) + \Sigma \frac{\dot{Q}}{\bar{\bar{T}}} + \dot{S}_{erz}$

$\cancel{-\dot{S}_{erz} = \dot{m}(s_{ein} - s_{aus}) - \frac{\dot{Q}_{aus}}{\bar{\bar{T}}_R} + \frac{\dot{Q}_{aus}}{\bar{\bar{T}}_{KF}} + \frac{\dot{Q}_R}{373.15}}$

T-A2

~~$s_{ein} = s_f @ 70°C = 0.9549$~~

~~$s_{aus} = s_f @ 100°C = 1.3069$~~

$\cancel{= 0.206}\ \frac{kJ}{kg \cdot K}$

T-A2

$s_{ein} = s_f(@70°C / x_1) = 0.988\ kJ/kg \cdot K$

$s_{aus} = s_f(@100°C / x_1) = 1.3371\ \frac{kJ}{kg\,K}$

$\dot{S}_{erz} = 0 = \dot{m}(s_{ein} - s_{aus}) + \frac{\dot{Q}}{\bar{\bar{T}}} + \dot{S}_{erz}$

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

$$= 0.057\ \frac{kJ}{kg \cdot K}$$

d) $\Delta\ m_2 u_2 - m_1 u_1 = \Delta m_{12}(h_{22}) + \dot{Q} - \cancel{\dot{W}}$

$(m_1 + \Delta m_{12}) u_2 - m_1 u_1 = \Delta m_{12}(h_2 - h_1) + \dot{Q}$

$(m_1 + \Delta m_{12}) u_2 - m_1 u_1 = \Delta m_{12}\, c_p (T_2 - T_1) + \dot{Q}$

$m_1(u_2 - u_1) - \dot{Q} = \Delta m_{12}\, c_p (T_2 - T_1) + m_\Delta u_2$

$m_1 c_v (T_2 - T_1)$

Interpolations formel:

[redacted]

$$y = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1) + y_1$$

1 a)

abgeführt ⊖

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

$$\boxed{\dot{Q} = \dot{m}(h_{ein} - h_{aus}) = -37.818\ kJ}$$

T - A2

$h_{ein}(@\ 70°C) = 292.98\ kJ/kg$

$h_{aus}(@\ 100°C) = 419.04\ kJ/kg$

b)

---

1. a) $0 = \dot{m}(h_{ein} - h_{aus}) \cancel{+} \dot{Q}_{aus} - \cancel{\dot{W}}^{0}$

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

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

T-A2 FA2

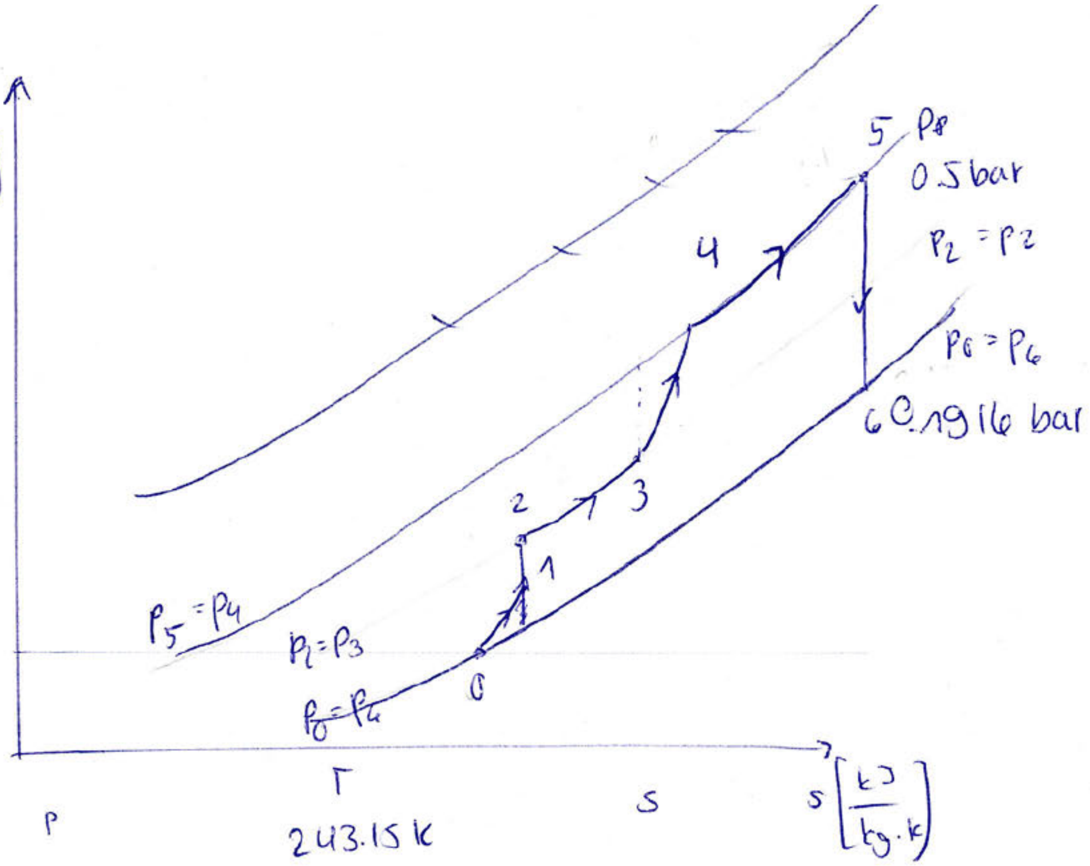
~~$h_{ein} = h_f @ 70°C$~~ $= 292.98\ kJ/kg$ $h_{ein} = h @ 70°C / x = 0.005 = 304.64\ kJ/kg$

~~$h_{aus} = h_f @ 100°C = 419.04$~~ kJ/kg $h_{aus} = h @ 100°C / x = 0.005 = 421.1\ kJ/kg$

$\boxed{\cancel{\dot{Q}_{aus} = 62.491\ kW}}$ $\boxed{\dot{Q}_{aus} = 65.05\ kW}$

[redacted]

2)



	p	T	s
		243.15 K = −30 °C	
0	0.191 bar		
1			
2			
3			
4	0.5 ba		
5	0.5 bar	431.9 K	
6	0.191 bar	328.07 K	328.07

b) 5 → 6 isentrop

$$T_6 = T_5 \left(\frac{p_6}{p_5}\right)^{\frac{n-1}{n}} = \boxed{328.07\ K = T_6}$$

Energiebilanz

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

$$2(h_6 - h_5) = w_5^2 - w_6^2 \rightarrow \cancel{w_6^2 = w_5^2 -} 2(h_6 - h_5)$$

$$\cancel{w_6^2 = w_5^2 - 2(h_6 - h_5)}$$

$$0 = \dot m_g (h_5 - h_6) + \dot m_g \left(\frac{w_5^2 - w_6^2}{2}\right) + \cancel{\dot Q}^{0} - \cancel{\dot W}^{0}$$

$$w_6^2 = 2(h_5 - h_6) + w_5^2$$

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

isobar $-\ \frac{T}{v} = $ konst

c) $\Delta e_{x,str6} = \left(h_6 - h_0 - T_0(s_6 - s_0) + \frac{w_6^2}{2}\right)$

~~$e_{x,str.0} =$~~

ideales Gas : $e_{x6} = \left(c_p(T_6 - T_0) - T_0\, c_p\left(\frac{T_6}{T_0}\right) + R \ln\left(\frac{p_6}{p_0}\right)\right)$

$$e_{x,str.0} = h_1 - \cancel{h_0} - T_0(\cancel{s_0} - s_0) + \frac{w_0^2}{2} = \frac{w_{luft}^2}{2} =$$

d) $\cancel{0 = \sum e_{x str.} + \sum e_{xq} - \sum \dot W - p_0 \frac{dV}{dt} - \dot E_{x verl.}}$

$$0 = \dot m_{gas} (s_0 - s_6) + \cancel{\frac{\dot Q}{T}}_{0} + \dot S_{erz}$$

$s_0(T_6)$

$\dot S_{erz} = s_6 - s_0$, da ideales gas

$$= s^0(T_6) - s^0(T_0) - R \ln \cancel{\left(\frac{p_6}{p_0}\right)}_{0}, \text{ da } p_6 = p_0$$

$$\dot e_{x,verl} = T_0 \cdot \dot S_{erz}$$

[redacted]

1.d)

$\cancel{m_1(u_2 - u_1)}$

$$(m_1 + \Delta m_{12}) u_2 - m_1 u_1 = \Delta m_{12} c_p (T_2 - T_1) + Q$$

$$m_1(u_2 - u_1) + Q = \Delta m_{12} \left[c_p (T_2 - T_1) + u_2 \right]$$

$\cancel{m_1(u_2 - u}$

$$\frac{m_1 c_v (T_2 - T_1) + Q}{c_p (T_2 - T_1) + u_2} = \Delta m_{12}$$

e) $m_2 = m_1 + \Delta m_{12}$

$$m_2 s_2 - m_1 s_1 = \Delta m_{12} (s_2 - s_1) + \frac{Q_R}{T_{ein}} + S_{erz}$$

$s_2 = s(x_D$

[redacted]

4)

	p	T	s	
1	1.2192	~~-22°C~~		x_1
2	1.2192	-22°C	0.9351	$x = 1$
3	8 bar	31.33°C	0.9351	x_3
4	8 bar	31.33°C	0.3242	$x = 0$

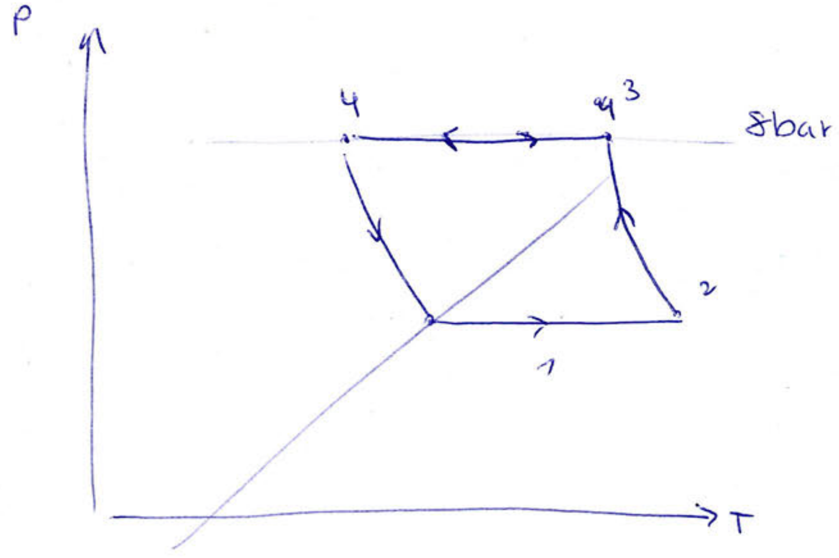
b) Energiebilanz um $2 \Rightarrow 3$

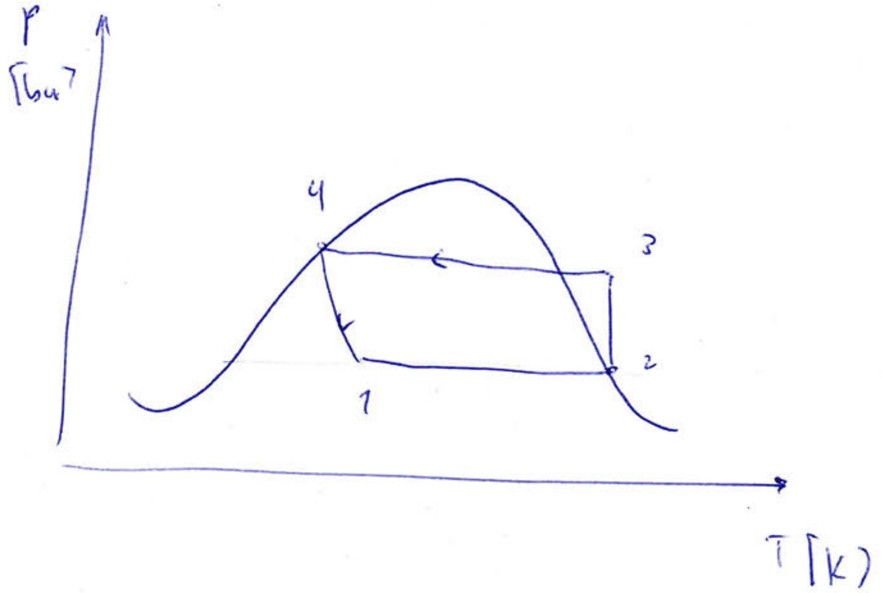
$$0 = \dot{m}_R (h_2 - h_3) + \cancel{\dot{Q}}^{0 \text{ adiabat}} + \dot{W}_K$$

$$\frac{-\dot{W}_K}{h_2 - h_3} = \dot{m}_R = \qquad h_2 = h_g @ x$$

c) $@ -22°C \rightarrow p_2 = 1.2192$ bar $= p_1$, da isobar

$h_2 = h_g @ -22°C \overset{T-A1C}{=} 234.08 \; kJ/kg = h_1$


p
4
3
8bar
2
1
T


p
[bar]
4
3
2
1
T [K)

2. d)

[redacted]

~~$s(T_6) = s^\circ(T_6)$~~

$s^\circ(240\,K)$, $s^\circ(250\,K)$ } interpolieren auf $s^\circ(243.15\,K) = 243.17\,\frac{kJ}{kg \cdot K}$

$s^\circ(325\,K)$, $s^\circ(330\,K)$ } interpolieren auf $s^\circ(328.07\,K) = 328.30\,\frac{kJ}{kg \cdot K}$

$\dot{S}_{erz} = 85.22\,\frac{kJ}{kg \cdot K}$

$\hookrightarrow ex_{verl} = T_0 \cdot \dot{S}_{erz} = \underline{\underline{20.723}}\,\frac{MJ}{kg}$