1a)

$$0 = \dot{m}_{ein}\left[h_1 - h_2\right] - \dot{Q}$$

$$\dot{Q} = \dot{m}_{ein}\left[h_1 - h_2\right]$$

$$h_2^{if} - h_1^{if} = c^{if}\left(T_2 - T_1\right) + v^{if}\cancel{\left(p_2 - p_1\right)}^{\,0}$$

Tabelle:

$T_1 = 288.15$

$T_2 = 253.15$

$h_f(288.15\,K) = 62.89\ kJ/kg$ Tab A-2

$h_f(288.15\,K) = 104.89\ kJ/kg$

~~Tab~~

Tab A-2

1b) $\bar{T} = \cancel{\frac{s_2 - s_1}{h_2 - h_1}} \neq \frac{\Delta h}{\Delta s} = \frac{h_2 - h_1}{s_2 - s_1}$

h_2, h_1 } von oben

$s_2^f(288.15K) = 0.2245\ kJ/kg \cdot K$

$s_1^f(298.15K) = 0.3674\ kJ/kg \cdot K$

$$\bar{T} = \frac{0.2245 - 0.3674}{\cancel{104.89 - 62.89}} = \frac{0.2245 - 0.3674}{104.89 - 28815} = 253.2\ K$$

c) $0 = \dot{m}_{KF}\left(s_2^{KF} - s_1^{KF}\right) + \dot{m}_{ein}\left(s_{2,w} - s_{1,w}\right) + \frac{\dot{Q}_R}{T_R} + \frac{\dot{Q}_{KF}}{T_{KF}} + \dot{S}_{iz}$

$$\frac{\dot{Q}_{KF}}{T_{KF}} = \frac{65\,kW}{295\,K} = 0.22 \cdot 10^3 \frac{W}{K}$$

$$\frac{\dot{Q}_R}{T_R} = \frac{100\,kW}{373.15\,K} = 267.98 \frac{W}{K}$$

$s_{1,w}$ (70°) = 0.3543 kJ/kg·K Tab-A2

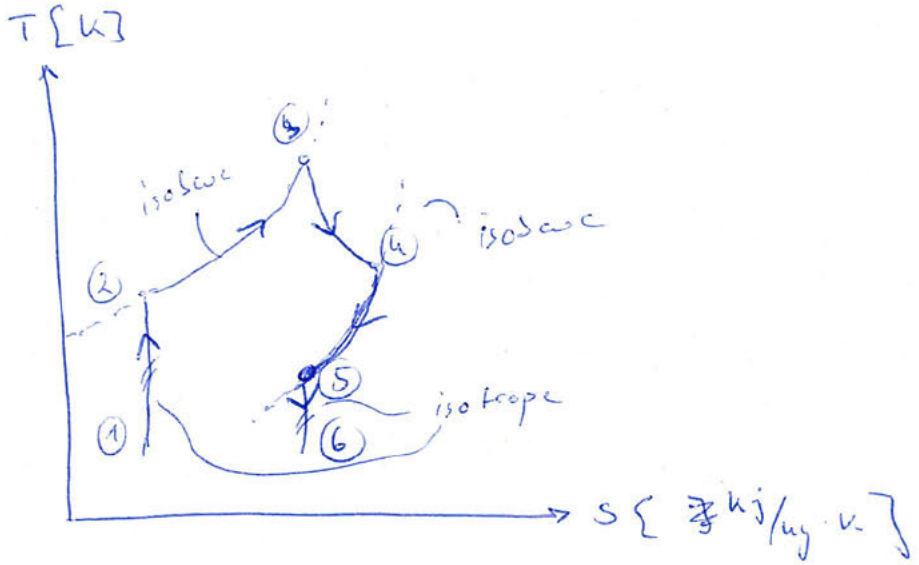
$s_{2,w}$ (100°) = 1.3069 kJ/kg·K

$$s_{2,KF}^{*} - s_{1,KF} = c^{if} \cdot \ln\left(\frac{T_2}{T_1}\right)$$

d) $\Delta E = m_2 \cdot u_2 - m_1 \cdot u_1 = \Delta m_{12} \cdot [h_1 - h_2] + Q$

e) $\Delta S_{12} = \Delta m_{12}\left(s_2 - s_1\right)$

2a)



b) T_5 , p_5 , w_s

~~$\dot{m}_{ges}$~~

$$\dot{m}_{ges} \cdot (s_5 - s_6) + \frac{\dot{Q}}{\dot{m}} + s_{irr} = 0$$

$$\dot{m}\{h_5 - h_6 - T_6(s_5 - s_6) + k_e\}$$

$k_e =$

2 c)

[redacted]

$$\dot{E}_{x,str,6} = \dot{m} e_{x,str,6} = \dot{m} \left[h_6 - h_0 - T_0 (s_6 - s_0) + ke_{,6} \right]$$

$$ke_{,6} = \frac{1}{2} m_i v^2 = \frac{1}{2} m_6 w_6^2$$

$$\dot{E}_{x,str,0} = \dot{m} e_{x\,str,0} = \dot{m} \left[h_0 - \right.$$

→ ⊘ ≠

$$\Delta \dot{E}_{x,str} = \dot{E}_{x\,str,6} - \dot{E}_{x,str,0}$$

$$= \dot{m} \left[h_0 - h_6 - T_0 (s_0 - s_6) + \Delta ke \right]$$

$$\Delta ke = \frac{1}{2} m_{Gas} \cdot (w_6 - w_0)^2 = \frac{1}{2} m_6$$

$$= \frac{1}{2} m_{Gas} \cdot \left(510 \frac{m}{s} - 200 \frac{m}{s} \right)^2$$

TAB A-22:

$$h_0 \left(243\,K,\ 0.1618\,bar \right) = \frac{250.05 - 240.02}{250 - 240} \cdot (250 - 243) + 240.02$$

$$= 247.041 \, kJ/kg$$

$$S_0 - S_6 = S^\circ(T_0) - S^\circ(T_6) - R \ln \left(\frac{P_0}{P_6} \right)$$

Aufgabe 3

a) $p_{g,1}$?

Druck ggw: $p_{g1} = p_{g\,aussen}$

$$p_{g\,aussen} = p_{aus} + \frac{(m_K + m_{EW}) \cdot g}{A}$$

$$A = \pi \cdot r^2 = \pi \cdot (5\,cm)^2 = \pi \cdot 0.05^2\,m^2$$

$$\Rightarrow p_{g1} = 10^5\,Pa + \frac{32\,kg + 0.1\,kg}{\pi \cdot 5^2\,cm^2} \cdot 9.81\,m/s^2 = 1.046\,bar$$

$$M_g = \frac{p_1 V_1}{R T_1} = \frac{1.04 \cdot 10^5\,P \cdot 3.14 \cdot 10^{-3}\,m^3}{\frac{8.314\,J/mol\,K}{50 \cdot \frac{kg}{mol} \cdot 10^{-3}} \cdot 377.15\,K} = 0.00254\,kg = \underline{2.54\,g} = M_g$$

$R = \frac{\bar{R}}{\bar{M}}$

b) $p_{g,2} = p_{g,1} = 1.048\,bar$, da sich die Masse bzw. der Gegendruck nicht geändert hat.

c) $0 = \dot{Q} - \dot{W}$

$0 = Zu$

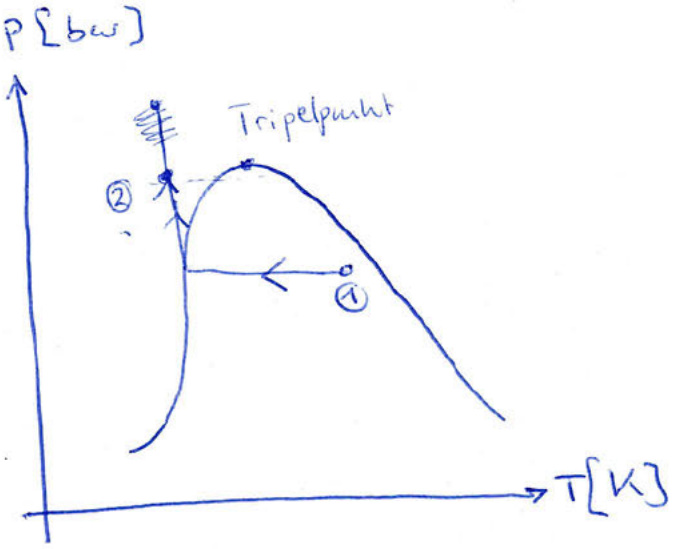
$$\tilde{W} = \int_1^2 p\,dv = p_{1,G} \cdot (V_2 - V_1)$$

d) $p_{1,g} = p_{2,g}$ $\quad E = U$

$$\Delta E = u_2 - u_1 = Q - W$$

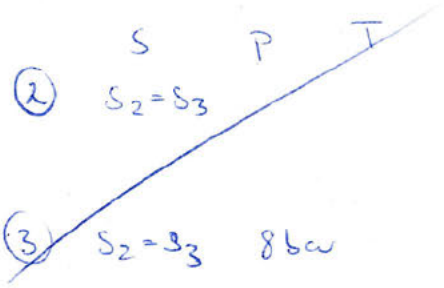
(4)

a)



b) ~~Entropie~~ Energie

~~Energie~~bilanz um Verdichter



TAS A M

	p	T	s	h	x	
1	1.2192					) isobar
2		-22°C			$x_2 = 1$	) isotherm
3	8bar					) isentrop
4	8bar	51.33	0.3453	93.42	$x_4 = 0$	) isobar

(4)

[redacted]

& fortsetzung:

$$0 = \dot{m}_{R134a} \left[h_2 - h_3 \right] + \dot{W}$$

Tab A 11

$h_f(8.0\,bar, x=0) = 93.42\ kJ/kg = h_4$

$\Rightarrow T_4 = 31.33°C$

c) $x_2 = 1 \qquad T_2 = -22°C$

$\Rightarrow$ TAB A 10

$p_2 = 1.2192$

$h_g = 234.08\ kJ/kg$

$s_{g2} = 0.9351\ kJ/kg$

$\Rightarrow$ isobar $\Rightarrow \quad p_2 = p_1 = 1.2192$

$$x_1 = \frac{s - s_f}{s_g - s_f} = \frac{s - s_f}{s_g - s_f}$$

d) $$\varepsilon_k = \frac{|\dot{Q}_{2k}|}{|\dot{Q}_{ad}| - |\dot{Q}_{2k}|} = \frac{|\dot{Q}_{2k}|}{|\dot{W}_{+}|} = \frac{|\dot{Q}_k|}{|\dot{W}_k|}$$