1)

a) $\dot{Q}_{aus}$:

$$\dot{Q}_{aus} = \dot{Q}_r - \dot{Q}_w$$

$$\dot{Q}_w \rightarrow \quad 0 - \dot{m}(h_e - h_a) + \dot{Q}_w$$

$$\rightarrow \dot{Q}_w = \dot{m}(h_a - h_e)$$

TAB A-2

$h_e = 292{,}98 + 0{,}005(2626{,}8 - 292{,}98) = 304{,}65 \frac{kJ}{kg}$

$h_a = 419{,}04 + 0{,}005(2676{,}1 - 419{,}04) = 430{,}33 \frac{kJ}{kg}$

TAB A-2 TAB A-2

$\dot{Q}_w = 63(430{,}33 - 304{,}65) = 37{,}7$ kJ

$\rightarrow 100\,kJ - 37{,}7\,kJ = \underline{62{,}30\,kJ} = \dot{Q}_{aus}$

b) $\overline{T}_{kf} = \frac{\int_e^a T}{s_a s_e} = \frac{T_a - T_e}{s_a - s_e} = \frac{T_a - T_e}{c \cdot \ln(\frac{T_a}{T_e})} = c$ unbekannt

$s_a - s_e = c \cdot \ln\left(\frac{T_2}{T_1}\right)$ $\rightarrow 295\,k$

$\rightarrow \overline{T}_{kf} = \frac{T_1 + T_2}{2} = 293{,}15\,k$

c) mit $\overline{T} = 295\,k$

$0 = \dot{m}[s_e - s_a] + \frac{\dot{Q}_1}{\overline{T}} + \dot{S}_{GZ}$

$\rightarrow \dot{S}_{erz} = \dot{m}[s_a - s_e] - \frac{\dot{Q}_J}{\overline{T}} \Rightarrow S_{GZ} = -\frac{\dot{Q}_J}{\overline{T}} = -\frac{-37{,}7}{295k} = \underline{127{,}8 \frac{J}{k}}$

$\dot{Q}_J = 37{,}7\,kJ$

$s_a =$

d)

$$\Delta U = \Delta m(h_1 - h_2) + Q_{12} - Q_{12}$$

$$\Delta U = \Delta m(h_1 - h_2)$$

$$(m_1 + \Delta m)T_2 \cdot c_p - m_1 T_1 c_p = \Delta m(h_1 - h_2)$$

$$m_1 T_2 c_p - m_1 T_1 c = \Delta m((h_1 - h_2) - T_2 c)$$

$$\Delta m = \frac{m_1 T_2 c - m_1 T_1 c}{(h_1 - h_2) - T_2 c}$$

h_1, h_2 TAB A-2

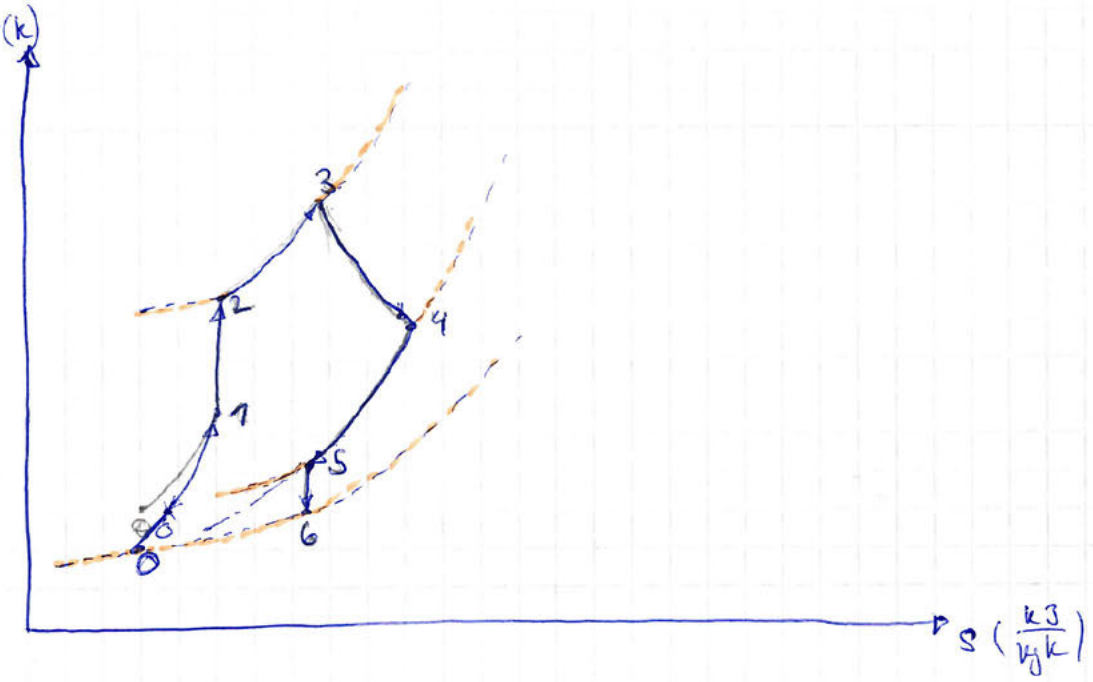
$\rightarrow$ einsetzen und Δm lösen

d)

e) $\Delta S = \Delta m \, \Delta s$

2)

a)



$$\dot{m}_{gas}\left(h_e - h_a + \frac{1}{2}w_s^2 - \frac{1}{2}w_e^2\right) = 0$$

$$h_a - h_e = c_p(T_2 - T_1) = 1{,}006 \cdot (T_6 - T_5)$$

$T_6 = ?$ $\quad p_6 = 0{,}1641$ bar

3) a)

$p_0 + p_m + p_{EW} = p_g$

$p_{EW} = \frac{m_{EW}}{A} = \frac{0,1}{0,0079} = 12,7 \frac{kg}{m^2}$ kPa

$A = 0,08^2 m \cdot \pi = 0,0079\ m^2$

$p_m = \frac{32 \cdot 9,81}{0,008} = 39,97\ kPa$

$\rightarrow p_g = 39,97 + 100 + 0,0127 = \underline{139,98\ kPa = p_{g1}} = \underline{1,40\ bar}$

$p_0 = 100\ kPa$

$pV = mRT \rightarrow m = \frac{pV}{RT} = \frac{139,98 \cdot 0,00314 \cdot 50}{8,314 \cdot 773,15} = 0,0034\ kg$

$= \underline{3,42\ g = m_g}$

b)

druck $p_2 = p_1 = 1,40\ bar$

$\rightarrow \dot{m} = 0 \rightarrow \Delta U = -W_{12}$

c) $\Delta U = Q_{12} - W_{12}$

$W_{12} = p_1 (V_2 - V_1) = 140\ kPa (0,00319\ m^3 - 0,00011\ m^3) = \underline{28,12\ J}$

$V_2 = \frac{m \cdot R \cdot T_2}{p} = \frac{0,0034 \cdot 8,314 \cdot 273,15}{139,98 \cdot 50} = 1,11\ L$

$\rightarrow Q_{12} = \Delta U + W_{12}$

$\Delta U = 0,633 \frac{kJ}{kgK} \cdot (773,15 - 273,15) = 316,498 \frac{kJ}{kg}$

$3\Delta U \cdot m = \Delta U = 1,082\ kJ$

$1,082 kJ + 0,284 kJ = \underline{1366\ J} = \underline{|Q_{12}|}$

d)) $\chi_{eis} = \frac{m_{eis}}{m_{tot}}$

$m_{tot} = 0{,}1\,kg$

$\Delta U_{tot} = 0$

$\Delta U_1 = \Delta U_2$

$\Delta U_1 = 316{,}498 + U_{1tot} = U_{2tot}$

$-\Delta U_g + U_{pw} = U_{2EW}$

$-333{,}442$

$-316{,}498 + (-0{,}095 + 0{,}6(-333{,}458 + 0{,}045)) = -516{,}56\ \frac{kJ}{kg}$

$-0{,}033$

TAB 1

$\frac{U_{2EW} - U_{fl}}{U_{fest} - U_{fl}} = \chi_{eis} \rightarrow \frac{-516{,}56 + 0{,}083}{-333{,}442 + 0{,}033} =$

ΔU_{eis}

$\Delta U_{eis} = Q_{12} + W_{12}^{0}$

$U_2 - U_1 = \frac{1500\,J}{m} \rightarrow U_2 = \frac{1500}{m} + U_1$

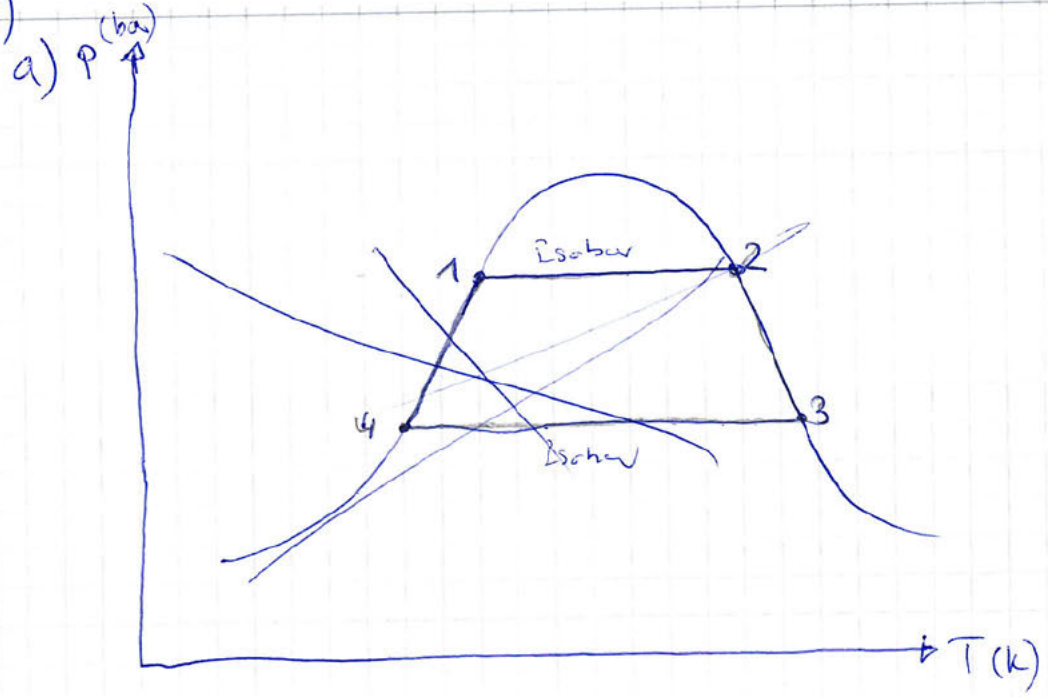
$U_2 = U_{fl} + \chi_2 (U_E - U_{fl})$

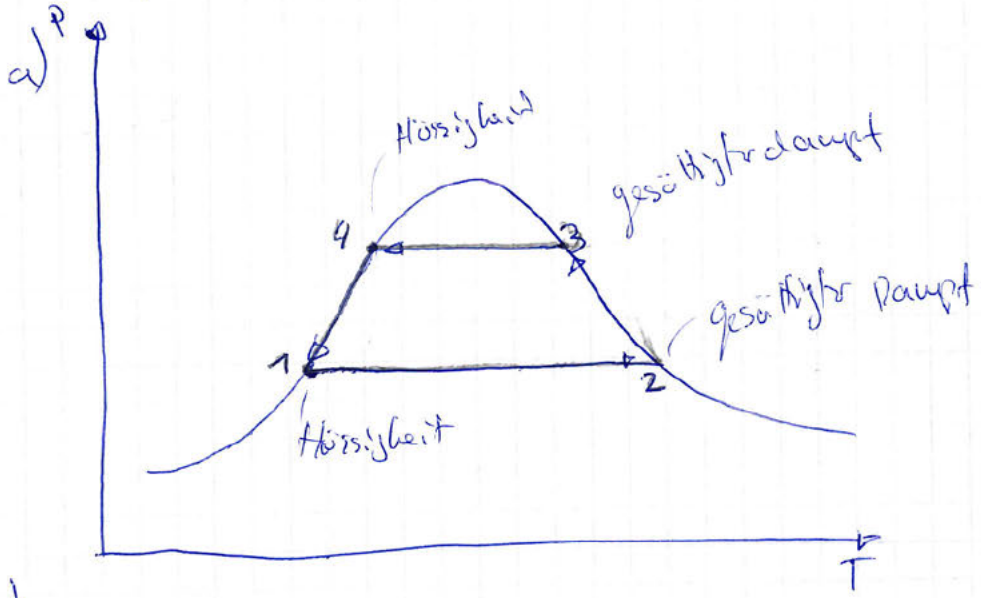
$U_1 = -0{,}095 + 0{,}6(-333{,}458 + 0{,}045) = -200{,}093$

$$\chi_2 = \frac{\frac{Q}{m} + U_1 - U_{fl}}{U_E - U_{fl}} = \frac{\frac{-1500\,J}{0{,}1\,kg} - 200{,}093 + 0{,}083}{-333{,}442 + 0{,}033}$$

$\rightarrow \chi_{eis,2} \overset{!}{=}$ kleiner als 0,6 sein, da Temperatur steigt.

4)

a) 

a) 

b)

$$\dot{m}(h_2 - h_3) = \dot{W}_K$$

$$\dot{m} = \frac{\dot{W}_K}{h_2 - h_3}$$

$p_3 = p_4 = 8\,bar$ ✓

c)

d) $\epsilon_k = \frac{\dot{Q}_{zu}}{|W_t|} = \frac{\dot{Q}_{zu}}{Q}$