1) a. Stationärer Fliessprozess: $0 = \dot{m}[h_{ein} - h_{aus}] + \dot{Q}_{aus} + \dot{Q}_R$

$$\dot{Q}_{aus} = \dot{m}[h_{aus} - h_{ein}] - \dot{Q}_R$$

$$h_{ein}(70°C) = (1-x)\,h_f^{20°C} + x\,h_g^{70°C} =$$

$$= (1-0.005)\,292.98\ \frac{kJ}{kg} + 0.005 \cdot 2333.8\ \frac{kJ}{kg}$$

$$= 292.68\ \frac{kJ}{kg}$$

$$h_{aus}(100°) = (1-x)\,h_f(100°C) + x\,h_g(100°C) =$$

$$= 428.23\ \frac{kJ}{kg}$$

$$\dot{Q}_{aus} = 0.3\,[428.23 - 292.68]\ \frac{kJ}{kg} = 406\,kW - 100\,kW$$

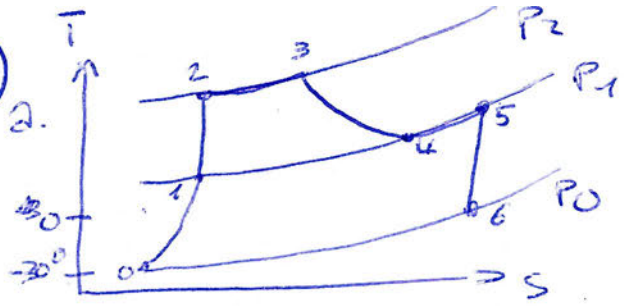
b. $= +65\ kW$

$$\overline{T}_{KF} = \frac{T_{KFaus} - T_{KFein}}{2} =$$

c. $$0 = \dot{m}[s_{ein} - s_{aus}] + \frac{\dot{Q}_i}{\overline{T}_{KF}} + \dot{s}_{erz}$$

d.

2)



$T_0 = 253.15\,K$

$T_6 = 328.07\,K$

b. Stationärer Fliessprozess: $0 = \dot{m}\left[h_0 - h_6 + \frac{w_0^2 - w_6^2}{2}\right]$

mit Massenstrom

$$\Rightarrow w_6 = \sqrt{2(h_0 - h_6) + w_0^2}$$

$$h_0 - h_6 = c_p (T_0 - T_6)$$

$$s_5 = s_6 \Rightarrow \frac{T_6}{T_5} = \left(\frac{P_6}{P_5}\right)^{\frac{1.4-1}{1.4}} \Rightarrow T_6 = T_5 \left(\frac{P_0}{P_5}\right)^{\frac{1.4-1}{1.4}} = 328.07\,K$$

$$\Rightarrow w_6 = \sqrt{1.006 \frac{kJ}{kg\,K}\,(253.15\,K - 328.07\,K) + 200^2 \left(\frac{m}{s}\right)^2}$$

$$= 199.6 \frac{m}{s}$$

c. $\Delta e_{x,str} = u_6 - u_0 - T_0(s_6 - s_0) + p_0(v_6 - v_0)$

$u_6 - u_0 = c_v (T_6 - T_0)$ $\qquad c_v = 1.4\, c_p = 1.4084 \frac{kJ}{kg}$

$s_6 - s_0 = c_p \ln\left(\frac{T_6}{T_0}\right) - R \ln\left(\frac{p_6}{p_0}\right)$

$$\Delta e_{x,str} = c_v (T_6 - T_0) - T_0 c_p \ln\left(\frac{T_6}{T_0}\right) = 39.49$$

d. $e_{x,verl} = T_0\, \dot{S}_{erz}$

$$\dot{S}_{erz} = \dot{m}\left[s_{aus} - s_{ein}\right] - \frac{\dot{Q}}{T}$$

3) a. $P_K = \frac{F_K}{A}$ $\quad A = \left(\frac{0.1\,m}{2}\right)^2 \cdot \pi = 7.85 \cdot 10^{-3}\,m^2$

$F_K = 32\,kg \cdot 9.81\,\frac{m}{s^2}$

$P_K = 0.4\,bar$

$P_{tot} = 1\,bar + 0.4\,bar = 1.4\,bar = P_{g,1}$

$m_{g,1} = \frac{P_{g,1} \cdot V_1}{R\,T_1} = \frac{1.4 \cdot 10^5\,Pa \cdot 3.14 \cdot 10^{-3}\,m^3}{0.1662\,\frac{kJ}{kg\,K} \cdot 473.15\,K} = \underline{34\,g}$

$R = \frac{8.314\,\frac{kJ}{mol\,K}}{50\,\frac{kg}{kmol}} = 0.1662\,\frac{kJ}{kg\,K}$

b. $P_{g,2} = P_{g,1}$ weil die Druck von dem Kolben ist gleich

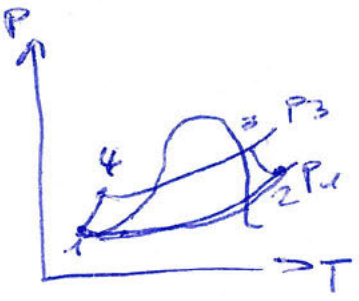
$m_{ers} \quad \Delta U_{ers} = m_g c_v (T_2 - T_1)$

c. $0 = \dot{m}[h_1 - h_2] + \dot{Q}_{12}$

$\dot{Q}_{12} = \dot{m}[h_2 - h_1] = \dot{m} c_v [T_2 - T_1] = 1134\,J$

d. $\Delta U = x_1\,U_{test_1}\,\%_1 - x_2\,U_{test_2} + (1-x_2)\,U_{gas_{24}}\,\%_2 - (1-x_1)\,U_{gas}$

4) a.



* zustand 2 : nur gas

zustand 4 : kein gas

$P_1 = P_2$

$P_3 = P_4 = 8$ bar

b. $0 = \dot{m}[h_2 - h_3] - \dot{W}_K$

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

$h_2 = 261.43 \ \frac{kJ}{kg}$

c. $h_1 = h_4 \Rightarrow T_1 = T_4$

$h_4 = 72.11 \ \frac{kJ}{kg}$

d. $\varepsilon_K = \frac{|\dot{Q}_{ab}|}{|\dot{W}_{zu}|}$