# Aufgabe 1

$\dot{m}_{ein} = \dot{m}_{aus} = 0{,}3 \frac{kg}{s}$

a) $\dot{Q}_{aus}$ $\quad \dot{Q}_R = 100\,000\,W \quad T_R = 100\,°C = 373{,}15\,K$

Stat. Fließprozess: $0 = \dot{m}[h_e - h_a] + \dot{Q}_R - \dot{Q}_{aus}$ (Reaktor)

$0 = \dot{m}_K[h_{eR} - h_{aK}] + \dot{Q}_{aus}$

$m_{ges} = 5755\,kg$

$x_D = 0{,}005$

b) $\bar{T} = \frac{\int_e^a T\,ds}{s_a - s_e}$

c) $\dot{s}_{erz} = -\frac{\dot{Q}_{aus}}{\bar{T}}$

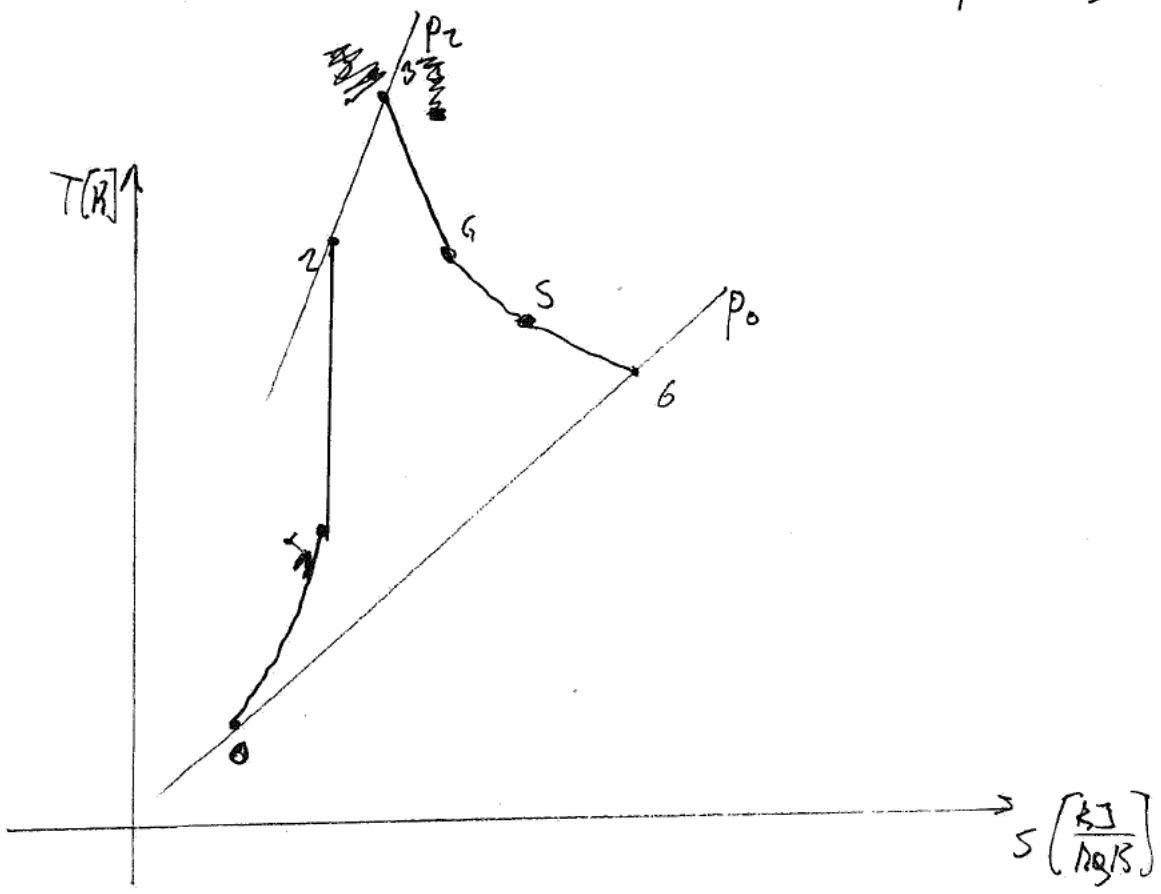
d) $\Delta E = \sum \dot{m}_i[h_i] + \sum Q_i$

Aufgabe 7

| | 1 | 2 | 3 | 4 | 5 | 6 | 0 |
|---|---|---|---|---|---|---|---|
| T | | | | | 431,8K | 328,075K | 293,15K |
| p | | | | | $5 \cdot 10^4$ Pa | $131 \cdot 10^3$ Pa | $191 \cdot 10^3$ Pa |
| h | | | | | | | |
| s | | | | | | | |
| w | | | | | 220 $\frac{m}{s}$ | 507,24 m/s | 200 |

Luft $w_{Luft} = 200$ m/s $\dot{m}_{ges} = ?$ $\frac{kg}{s}$ $n = 1,4$ $c_p = 1,006 \frac{kJ}{kgK} = 1006 \frac{J}{kgK}$

a)



Aufgabe 2

b) $T_6, w_6$

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

$T_6 = 378{,}075\ K$

Düse: $h_e + \frac{w_e^2}{2} = h_a + \frac{w_a^2}{2}$

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

$h_5 - h_6 = \int_{T_6}^{T_5} c_p \, dT$

$h_5 - h_6 = c_p (T_5 - T_6) = 109467{,}55 \frac{J}{kg}$

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

$w_6 = 507{,}24\ m/s$

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

$h_6 = c_p \cdot T_6 = 330063{,}45 \frac{J}{kg}$

$h_0 = c_p \cdot T_0 = 299608{,}9 \frac{J}{kg}$

$c_V = c_p - \frac{R}{M}$

$c_V = 719{,}01 \frac{J}{kgK}$

$R = \frac{\bar{R}}{M} = 286{,}987 \frac{J}{kgK}$

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

$s_6 - s_0 = 301{,}361 \frac{J}{kgK}$

$e_{x,stA} = 156234{,}168 \frac{J}{kg}$

Aufgabe 2

d) $\Delta e_{x,stat} = 100 \frac{kJ}{kg}$ (aus Angabe)

$e_{x,rev} = T_0 \cdot s_{erz}$

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# Aufgabe 3

$$A = \left(\frac{0{,}1}{2}\right)^2 \cdot \pi = 7{,}8539 \cdot 10^{-3}\ m^2$$

a) $p_{g1}, m_g$ gesucht $\quad T_{g1} = 773{,}15\ K \quad V_{g1} = 3{,}14 \cdot 10^{-4}\ m^3 \quad pV = mRT$

$m_k = 32\ kg \quad m_{EW} = 0{,}1\ kg \quad R = \frac{1}{M_g} \cdot \bar{R} = 166{,}28\ \frac{J}{kg\,K}$

GGW: $0 = m_k \cdot g + m_{EW} \cdot g \frac{p_{g1}}{A} + \frac{p_{amb}}{A}$

$p_{g1} = (m_{ges} + m_{EW} \cdot g) \cdot A = 2{,}473\ Pa$

$m_g = \frac{R \cdot T_{g1}}{p_{g1} \cdot V}$ $\quad p_{g1} = A \cdot g (m_k + m_{EW}) + p_{amb}$

$p_{g1} = 100002{,}473\ Pa$

GGW:

$0 = (m_k + m_{EW}) \cdot g + A \cdot p_{amb} - A \cdot p_{g1}$

$p_{g1} = p_{amb} + \frac{g}{A}(m_k + m_{EW})$

$m_g = \frac{R \cdot T_{g1}}{p_{g1} \cdot V} =$

$p_{g1} = 100099{,}8573\ Pa$

b) $p_{g1} = 1{,}5 \cdot 10^5\ Pa \quad m_g = 3{,}6\ g \Rightarrow$ (aus Angabe)

$T_{EW} = T_g \Rightarrow$ gGW

$\Delta U_{EW} = Q_{12} \qquad \Delta U_g$

$u_{2EW} - u_{1EW} = u_{1g} - u_{2g}$

$u_{2EW} + 200097{,}8 = c_v (T_1 - T_2)$

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

$u_{1EW} = x \cdot u_{Fest} + (1-x) \cdot u_{Fl\ddot{u}}$

$u_{1EW} = -200097{,}8\ \frac{J}{kg}$

$u_{1g} - u_{2g} = \int_{T_2}^{T_1} c_v\, dT = c_v (T_1 - T_2)$

$p_{g2} = p_{g1} \rightarrow T_{g2} = T_1 \left(\frac{p_{2g}}{p_{1g}}\right)^{\frac{n-1}{n}}$

$n = \frac{c_p}{c_v} = \frac{c_p}{c_p - R} = \frac{c_v + R}{c_v}$

$n = 1{,}16269$

$T_{g2} =$

Aufgabe 3

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c) $Q_{12}$ $T_{32} = 0{,}003\,^{\circ}C = 273{,}15 + 0{,}003\,K$

$Q_{12} = \Delta U_{12}$

# Aufgabe 1

a)