Aufgabe 1

a)

b) $\overline{\overline{T}} = \frac{\int_a^b T\,ds}{s_a - s_c} = \frac{\int dH}{s_a - s_c}$ (da isobar)

$= \frac{h_e - h_a}{s_a - s_c} = \frac{c_{if}\,dT}{\frac{c_{if}}{T}\,dT} = \frac{c_{if}(T_2 - T_1)}{c_{if} \cdot \ln\left(\frac{T_2}{T_1}\right)}$

$= 293{,}12\ K$

c) stationär → $0 = \dot{m}[s_2 - s_1] + \sum \frac{\dot{Q}}{T} + \dot{S}_{er2}$

$$\dot{S}_{er2} = \frac{\dot{Q}_{aus}}{T} = \frac{6500\ W}{255\ K} = 220.3\ \frac{J}{K\,s}$$

d) $\Delta E = m_2 u_2 - m_2 u_1 = \sum \Delta m_i h_i + \sum Q - \sum W$

$m_2 u_2 - m_{ges1} u_1 = \sum \Delta m_i h_i - Q$

$h_i = 2525.8$

$u_2 = 2525.5$

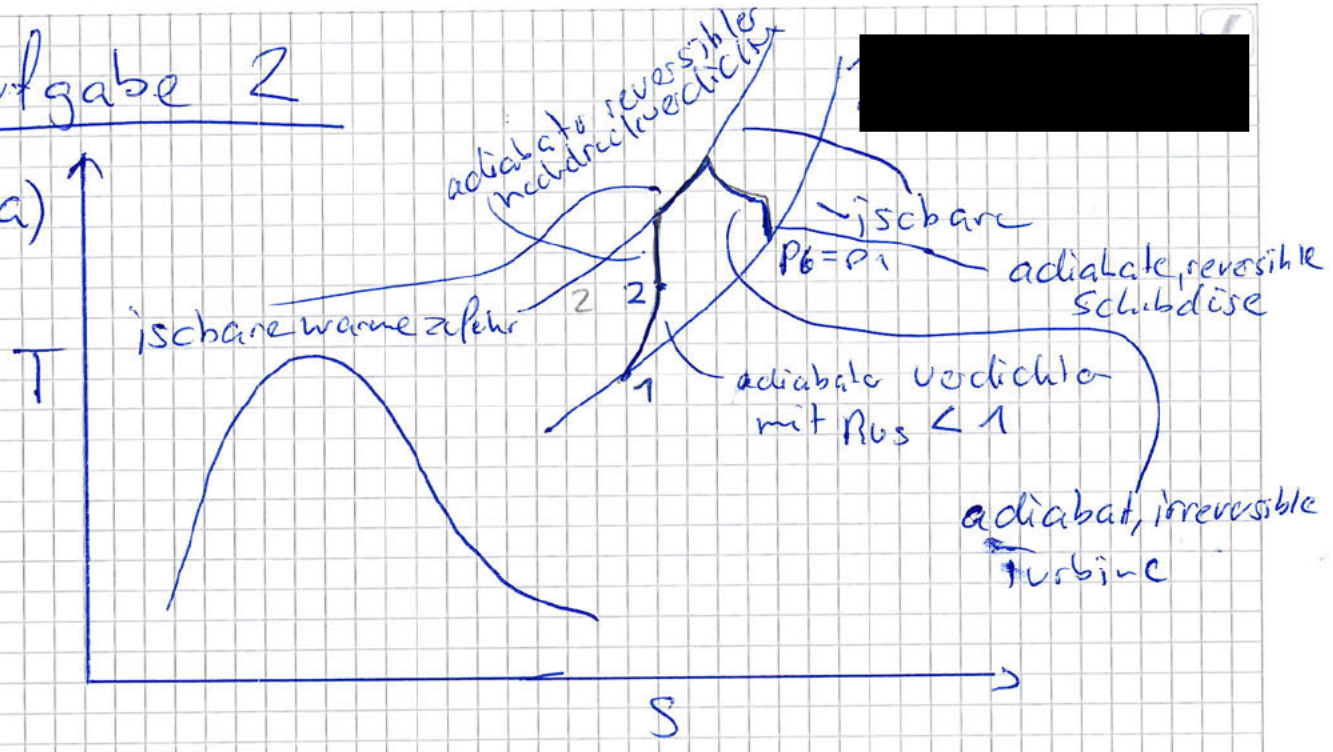
$u_1 = 418.94 + 0.05\,(2506.5 - 418.94)$

$= 425.377$

e)

Aufgabe 2

a)



b) $p_a = p_6$ Schubdüse adiabat reversible

$$T_6 = T_5 \left(\frac{p_a}{p_5}\right)^{\frac{n-1}{n}}$$

$$\underline{T_6 = 325.07\ K}$$

$n = \chi = 1{,}4$

$p_4 = 15100$

$p_5 = 50000$

$$0 = h_e - h_a + \frac{w_e^2 - w_a^2}{2}$$

adiabat & leistet keine Arbeit

$$0 = c_p (T_e - T_a) + \frac{w_e^2 - w_a^2}{2}$$

$$\underline{w_6 = 507.25\ \frac{m}{s}}$$

c) $$e_{x,str} = h_e - h_a - T_0 (s_e - s_a) + \Delta ke$$

$$= c_p (T_e - T_a) - T_e \left(\int \frac{c_p}{T} dT + R \cancel{\ln\left(\frac{p_2}{p_1}\right)}^{\ln(1)=0}\right) + \Delta ke$$

$$= \underline{26400\ \frac{kJ}{kg}}$$

e) ~~$\dot{Q} = \dot{m}$~~

$\dot{C} = \dot{e}_{xStr} - \dot{W}_{tm} - \dot{e}_{xver}$ adiabat & stationär

Aufgabe 3

a) $p_{g1} = p_{amb} + \frac{32\,kg \cdot 5.81\,\frac{m}{s^2}}{0.1\,m^2} + \frac{0.1\,kg \cdot 5.81\,\frac{m}{s^2}}{0.1\,m^2}$

$(0.05\,m)^2 \cdot \pi$

$= [illegible]$

$m_1 = \frac{p \cdot V}{R \cdot T} = \frac{p_{g1} \cdot V_{g1}}{R \cdot T_{g1}}$ ← $R = \frac{\bar{R}}{M}$

$= \frac{8314\,\frac{J}{kmol \cdot K}}{50\,\frac{kg}{kmol}}$

$= 166.28\,\frac{J}{kg \cdot K}$

$m_1 = [illegible]\,kg$

$= [illegible]$

$T_{g1} = 773.15\,K$

$\Rightarrow p_{1g} = 1.4\,bar$

$m_{1g} = 0.00342\,kg$

$= 3.42\,g$

c) geschlossenes System

$\frac{dE}{dt} =$

d) $\frac{dE}{dt} = \sum \dot{Q}_j - \dot{W}_{vol} = 0$ kann sich nicht verschieben

$dU = Q_{12}$

$m \cdot (u_2 - u_1) = Q_{12}$

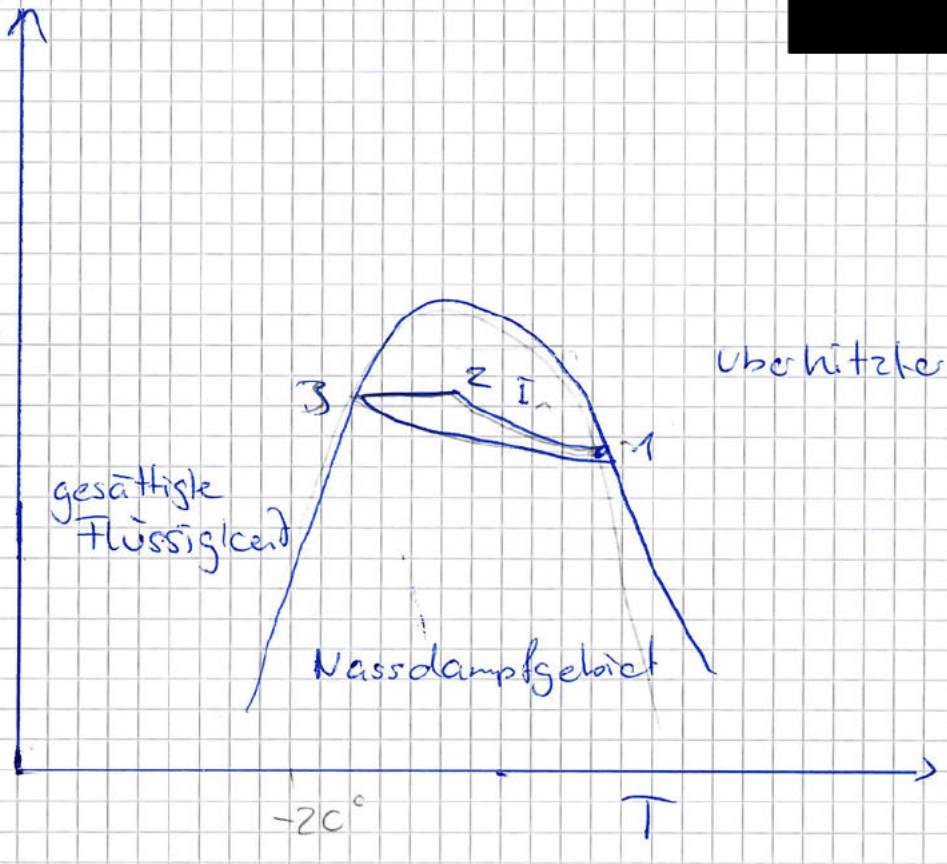
$u_1 = -333.458 + 0.6\,(-0.005 - 333.458)$

$= -133.426$

$u_2 = \frac{Q_{12}}{m}$

Aufgabe 4

a)



b) stationärer Fliessprozess

$$0 = \dot{m}\left[h_e - h_a\right] + \sum Q - \sum W$$

$$W = \dot{m}\left[h_e - h_a\right]$$

c) $x_1 =$

Drossel ist adiabat & verrichtet keine Arbeit

$$0 = \dot{m}\left[h_c - h_a\right] \rightarrow T_4 = T_1$$
$$h_4 = h_1$$

$$h_4 = 93.42 \frac{kJ}{kg} \triangleq \text{TAB A-11} = h_1$$

$$T_4 \triangleq T_1 = 31.33\,°C$$

$p_2 - p_1 = 6.08$ bar

b nicht gesucht

bei $-22°C$ & $x = 1$

$$p_2 = \frac{6.4566\,\text{bar} - 5.716\,\text{bar}}{24°C - 20°C}(22°C - 20°C) + 5.716\,\text{bar}$$

$= 605.630$ Pa