

Aufgabe 7)

a) ~~$\frac{dT}{dt} = \sum \dot{m}_i (h_i + \frac{1}{2} v_i^2 + g z_i) - \sum \dot{Q}_i$~~ $\sum \dot{Q}_i = 0$

Sied Fl. = 1 $x=0$

$$= 0 = \dot{m}_2 (h_1 - h_2) + \dot{Q}_R - \dot{Q}_{\text{ans}}$$

$$\dot{Q}_{\text{ans}} = \dot{m}_2 (h_1 - h_2) + \dot{Q}_R$$

$(h_1 - h_2) = ?$ Tabelle: $h_1 = ?$ A_2

$h_1 = h_f = 2626.8$

292.98

~~$\dot{Q}_{\text{ans}} = 999.62$~~

$99962.282 \frac{\text{kJ}}{\text{h}}$

$h_2 = ?$ A_2

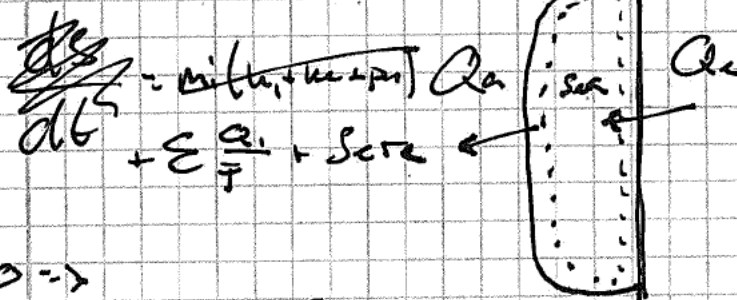
$h_2 = h_f = 419.04$

b) $\bar{T} = \frac{\int_{S_1}^2 T ds}{S_2 - S_1} \Rightarrow$ keine drachveränderung
Aus der Vorlesung

$$\Rightarrow \bar{T} = \frac{T_2 - T_1}{\ln\left(\frac{T_2}{T_1}\right)} \Rightarrow \bar{T}_K = 293.722 \text{ K}$$

c)

$\dot{Q}_R = \dot{Q}_A$



$\bar{T}_R = \text{const} = 200^\circ\text{C} = 373.15 \text{ K}$

$\frac{dT}{dt} = 0 \Rightarrow$

$$-S_{\text{err}} = \sum_i \frac{\dot{Q}_i}{\bar{T}} = \left(\frac{-1}{\bar{T}_K} + \frac{1}{\bar{T}_R} \right) \cdot \dot{Q}_{\text{ans}} = -47.56 \frac{\text{W}}{\text{K}}$$

$S_{\text{err}} = 47.56 \frac{\text{W}}{\text{K}}$

Aus Vorgabe a) = 65 kW

$$d) = T_n = 70$$

\Rightarrow für $m_n \rightarrow \Delta u$ für ~~20~~ $20^\circ \rightarrow 70^\circ$
A-2:

$$\Delta u_n = u_f(200) - u_f(20) = 292.95 - 83.95 = 209 \frac{\text{kJ}}{\text{kg}}$$

Δu_n entzogen für $m_{\text{ges.}} 200^\circ\text{C} \rightarrow 70^\circ\text{C}$
 $x = 0.005 \quad x = 0$

$$\Delta u_{\text{gas}} (u_{\text{gas}}(20) - u_{\text{gas}}(200))$$

A-2:

$$u_{\text{gas}}(200) = u_f + x(u_g - u_f) = 418.94 + 0.005(2506.5 - 418.94)$$

$$= 429.3778 \frac{\text{kJ}}{\text{kg}}$$

$$\Delta u_{\text{gas}} = 292.95 - 429.377 = -136.427$$

$$\frac{dE}{dt} = 0 = m \cdot \Delta$$

$$\frac{dE}{dt} = 0 = m_{\text{ges.}} \cdot \Delta u_{\text{ges}} + m_n \cdot \Delta u_n = 0$$

$$m_n = \frac{-m_{\text{ges.}} \cdot \Delta u_{\text{ges}}}{\Delta u_n} = \underline{\underline{3756.64 \text{ kg}}}$$

Aufgabe 3)

gas

zustand

		T	P	V		
1	5000	140. mbar				
2	Tend					

ELV

	T	P	V	X _{ELV}		
1	0		v ₁	0.6		
2	Tend		v ₂			

a)

$$p = \frac{F}{A} \Rightarrow A \text{ vom Kolben}$$

$$F \Rightarrow \text{durch } m_k = 32 \text{ kg}$$

$$A \Rightarrow D = 20 \text{ cm} = 0.1 \text{ m}$$

$$m_{ELV} = 0.1 \text{ kg}$$

$$A = \left(\frac{0.1 \text{ m}}{2} \right)^2 \cdot \pi = 0.00785$$

$$F = m \cdot a = (m_k + m_{ELV}) \cdot g = 374.9 \text{ N}$$

$$p_g = p_{amb} + \frac{F}{A} = \underline{\underline{740174 \text{ Pa}}}$$

masse:

$$p \cdot V = m \cdot R \cdot T$$

$$R = \frac{\bar{R}}{M} = 0.16628$$

$$m = \frac{pV}{RT} = \underline{\underline{3.422 \text{ kg}}}$$

$$V = 3.14 \text{ L} = 3.14 \cdot 10^{-3} \text{ m}^3$$

b) \Rightarrow Temperatur = Temperatur EU \Rightarrow

da $x_{\text{Eis}} > 0 \Rightarrow$ gibt noch Eis

$$\Rightarrow T_{\text{Eis}} = 0^\circ\text{C} = \underline{\underline{T_{\text{gr}}}}$$

$$\Rightarrow P_{\text{gr}} = P_{\text{gr}} = \underline{\underline{740 \cdot 744 \text{ Pa}}} \approx 7.4 \text{ bar}$$

da Kräfte von Außen die gleichen sind, ~~Isobarer~~ Isobare Expansion.

c)

$$\frac{d\bar{E}}{dt} = \sum m_i (\dot{h}_i + \dot{h}_{e,p,i}) + \sum \dot{Q}_i - \sum \dot{U}_i$$

$$\Delta \bar{E} = \bar{E}_2 - \bar{E}_1 = \sum Q_i - \sum W_i$$

$$\bar{E}_1 = U + \dot{h}_{e,p} = u_1$$

$$\bar{E}_2 = u_2$$

$$u_2 - u_1 = C_v (T_2 - T_1) = Q - W_v$$

Volumen Arbeit:

$$W_v = \int_{V_1}^{V_2} p dV = P_g (V_2 - V_1) = \underline{\underline{-285.83 \text{ J}}}$$

$$V_1 = \frac{m R T}{P} = 0.0011 \text{ m}^3 \quad \Rightarrow$$

$$Q = C_v (0^\circ - (500^\circ\text{C} + 273.15^\circ\text{C})) = -285.83 \text{ J}$$
$$= \underline{\underline{-775.23 \text{ J}}}$$

Aufgabe 3) d) $X_1 = 0.6$

$$m_{\text{eis}} = 0.06 \text{ kg}$$

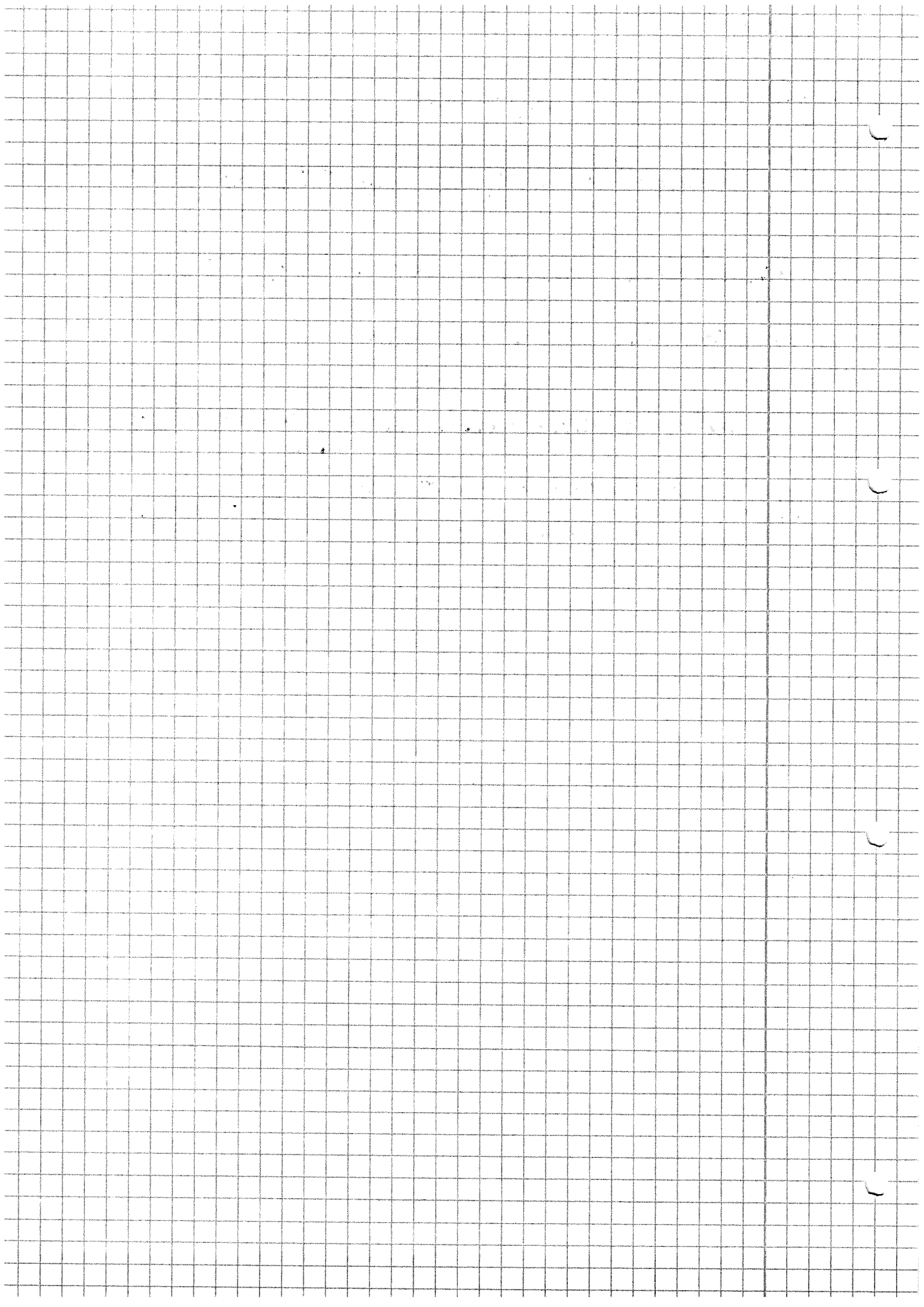
$$T_f = -333.458$$

übertragen durch $Q = +775.23 \text{ J}$

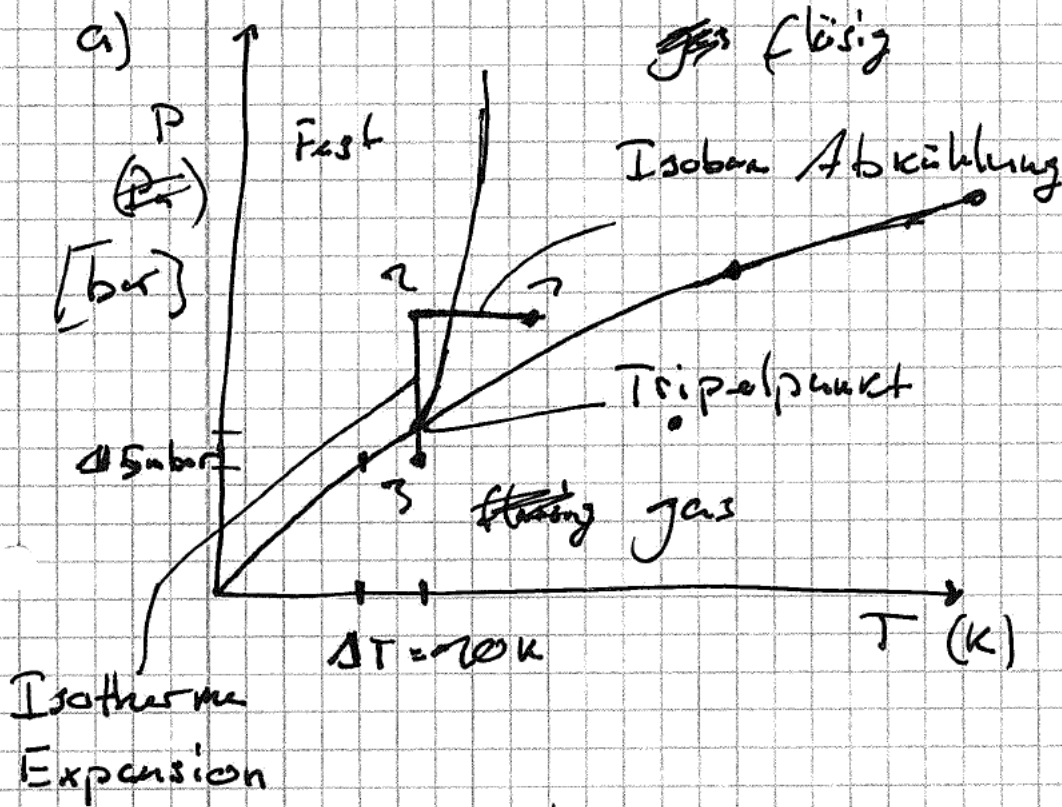
\Rightarrow kg eis geschmelzen:

$$m_{\text{fest}} - m_{\text{flüssig}} \rightarrow \Delta m \quad \Delta m = \frac{Q}{\Delta u} = -0.00232 \text{ kg}$$

$$X_2 = \frac{0.06 \text{ kg} - 0.00232 \text{ kg}}{0.1 \text{ kg}} = \underline{\underline{0.5767}}$$



Aufgabe 4)



b) $\frac{dE}{dt} = \sum \dot{m}_i (h_i + v_i + p_i) + \sum \dot{Q} - \sum \dot{W}$

$\sum \dot{Q}_i = \sum \dot{W}_i = \dot{Q}_K - \dot{Q}_{ab} = \dot{W}_K = 28 W$

Adiabot

