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1. Reaktor

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

geg.: $\dot{m}_{ein} = 0.3\,\frac{kg}{s}$, $T_{ein} = 70\,°C$

$T_{aus} = 100\,°C$

$m_{ges,1} = 5755\,kg$, $T_R = 100\,°C$, $\dot{Q}_R = 100\,kW$

$\Delta T_{KF} = T_{KF,aus} - T_{KF,ein} = 10\,K$

$$\dot{Q}_{aus} = \dot{Q}_R \cdot \frac{T_{ein}}{T_{aus}} = 100\,kW \cdot \frac{70\,°C}{100\,°C} = \underline{\underline{70\,kW}}$$

b.)

$$\bar{T}_{KF} = \frac{T_{KF,aus} + T_{KF,ein}}{2} = \frac{298.15\,K + 288.15\,K}{2} = \underline{\underline{293.15\,K}}$$

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

c.)

$$\dot{S}_{erz} = \cancel{-\dot{m}(s_e - s_a)} - \sum \frac{\dot{Q}_j}{T_j} = -\frac{65\,kW}{295\,K} = \underline{\underline{220.339\,\frac{W}{kg\,K\,s}}}$$

d.) $$\frac{dE}{dt} = \sum \dot{m}_i(t)\left(h_i(t) + ke_i(t) + pe_i(t)\right) + \sum_j \dot{Q}_j(t) - \sum_n \dot{W}_n(t)$$

e.) $$\Delta S_{12} = S_2 - S_1$$

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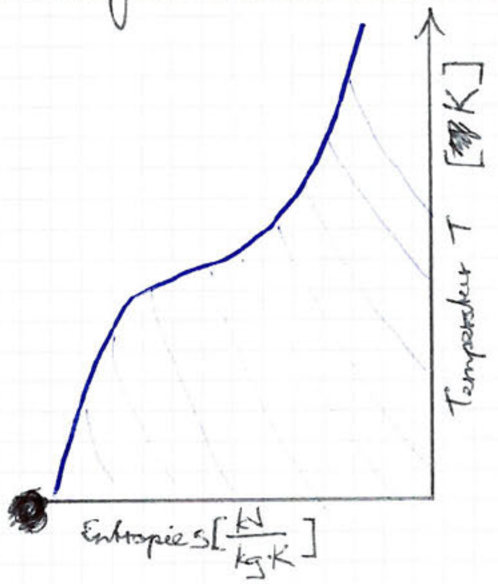
2. Exergie am Triebwerk

a.)



b.) ω_6 , T_6 ?

$$\frac{T_2}{T_1} = \left(\frac{p_2}{p_1}\right)^{\frac{n-1}{n}} = \left(\frac{V_1}{V_2}\right)^{n-1} \qquad n = 1.4$$

$$\left(\frac{p_6}{p_5}\right)^{\frac{0.4}{1.4}} = \left(\frac{\omega_5}{\omega_6}\right)^{0.4}$$

$$\left(\frac{0.191\,\text{bar}}{0.5\,\text{bar}}\right)^{\frac{0.4}{1.4}} = \left(\frac{220\,\frac{m}{s}}{\omega_6}\right)^{0.4} \Rightarrow \underline{\underline{\omega_6 = 437.471\,\frac{m}{s}}}$$

$$T_6 = T_5 \cdot \left(\frac{p_6}{p_5}\right)^{\frac{0.4}{1.4}} = 431.9\,K \left(\frac{0.191}{0.5}\right)^{\frac{0.4}{1.4}} = \underline{\underline{328.075\,K}}$$

c.) $$\dot{E}_{x,str} = \dot{m}\, e_{x,str} = \dot{m}\left(h - h_0 - T_0(s - s_0) + ke + \cancel{pe}\right)$$

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

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3. Schmelzen von Eis durch perfektes Gas

a.) $p_{g,1}$, m_g

$pV = n\bar{R}T$ $\quad$ $pv = RT$ $\quad$ $pV = mRT$

$\bar{R} = 8.314 \frac{J}{mol\,K}$ $\quad$ $R = \frac{\bar{R}}{M} = 0.16628 \frac{J}{kg}$

$T_{g,1} = 500°C = 773.15K$

$V_{g,1} = 3.14L = 0.00314\,m^3$

$$p_{g,1} = \frac{mRT}{V} = \frac{0.0036kg \cdot 0.16628\frac{J}{kg} \cdot 773.15K}{0.00314\,m^3} = \underline{\underline{147.393Pa}}$$

$$m_g = \frac{pV}{RT} = \frac{1.5 \cdot 10^5\,Pa \cdot 0.00314\,m^3}{0.16628\frac{J}{kg} \cdot 773.15K} = \underline{\underline{3.664g}}$$

b.) $x_{Eis,1} = \frac{m_{Eis}}{m_{EW}} = 0.6$ $\quad$ $m_{EW} = 0.4$

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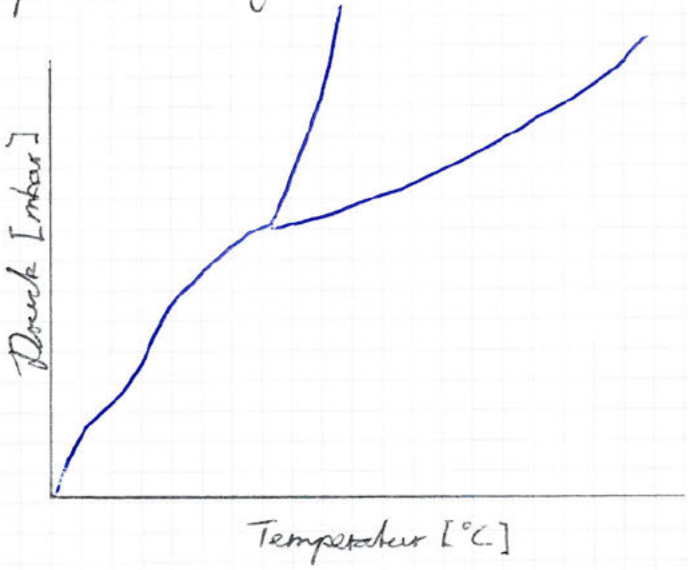
4. Gefriertrocknung

a.)



b.) $T_i = -10°C$

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