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# Aufgabe 1

a) $\dot{Q}_{aus} = ?$

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

aus stationärer Fließprozess:

$$0 = \dot{m}\left(\Delta h + \cancel{\Delta e_k}^{0} + \cancel{\Delta e_p}^{0}\right) + \sum \dot{Q} - \cancel{\sum \dot{W}}^{0}$$

$$\dot{m}\,\Delta h + \sum \dot{Q} = 0$$

$$h_a = h_{f\,(70°)} + x_D (h_g - h_f)_{(70°)\,(70°)} = 304{,}6491 \frac{kJ}{k} \text{ (TAB A-2)}$$

$$h_e = h_{f\,(100°)} + x_D (h_g - h_f)_{(100°)\,(100°)} = 430{,}3253 \text{ (TAB A-2)}$$

$$\dot{m}\,\Delta h \underbrace{- 100\,kW}_{\dot{Q}_R} + \dot{Q}_{aus} = 0$$

$$\Rightarrow |\dot{Q}_{aus}| = \cancel{62{,}29}\ 62{,}294\ kW$$

b) $\overline{T}_{KF} = ?$

$c_{KF} = const \Rightarrow \Delta u = c_{KF} \cdot (\Delta T)$

$\Delta U = \dot{Q}_R = c_{KF} (T_{KF\,aus} - T_{KF\,ein})$

$\Rightarrow c_{KF} = 6{,}2294$

$\Delta S = \int_{T_{ein}}^{T_{aus}} \frac{c_{KF}}{T} dT$ (ideale Flüssigkeit)

$\Rightarrow \Delta S = c_{KF} \cdot (\ln(T_{aus}) - \ln(T_{ein})) =$

$= \cancel{c_{KF}} \cdot 0{,}2104$

KF ist geschlossenes System

$\Rightarrow \Delta S = \frac{\dot{Q}_R}{\bar{T}_{KF}} + \cancel{\dot{S}_{erz}}^{\,0}$

$\Rightarrow \bar{T}_{KF} = \frac{\dot{Q}_R}{\Delta S} = 295{,}123\ K$

c) das ist jetzt stationär

$\Rightarrow \dot{m}_{(w)} (\Delta S_{KF/W}) + \frac{\dot{Q}_R}{\bar{T}} + \dot{S}_{erz} = 0$

$\Rightarrow - \dot{S}_{erz} = \dot{m}_w \Delta S + \frac{\dot{Q}_R}{\bar{T}_{KF}}$

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Aufgabe 1

c) $\Rightarrow \dot{S}_{erz} = 0{,}274 \ kJ$

d) $\Delta m_{12} = ?$

$T_{ein,12} = 20°C$

$Q_{abkühle} = m_{ges1} \cdot c_w \cdot \Delta T$

$\Delta T = (T_{Recktor1} - T_{Recktor2}) = 30$

$\Rightarrow$ was auch $\Delta u \cdot m$ geeicht

$u_1 = u_{f1} + x(u_{g1} - u_{f1}) = 429{,}3778 \ \frac{kJ}{kg}$

$u_{2,\text{voriges wasser}} = u_{w(70)} + x_D (u_{g(70)} - u_{f(70)}) = 303{,}83325 \ kJ/kg$

$\Rightarrow \Delta u_{\text{voriges}} = 125{,}54455 \ kJ/kg$ (TAB A-2)

$\Delta u_{\text{neues wasser}} = u_{f(20)} - u_{f(70)} = -209 \ \frac{kJ}{kg}$

(TAB A-2)

$\Rightarrow m_{12} \cdot 209 = 125{,}5445 \cdot m_{ges}$

$\Rightarrow m_{12} = 3456{,}9789 \ kg$

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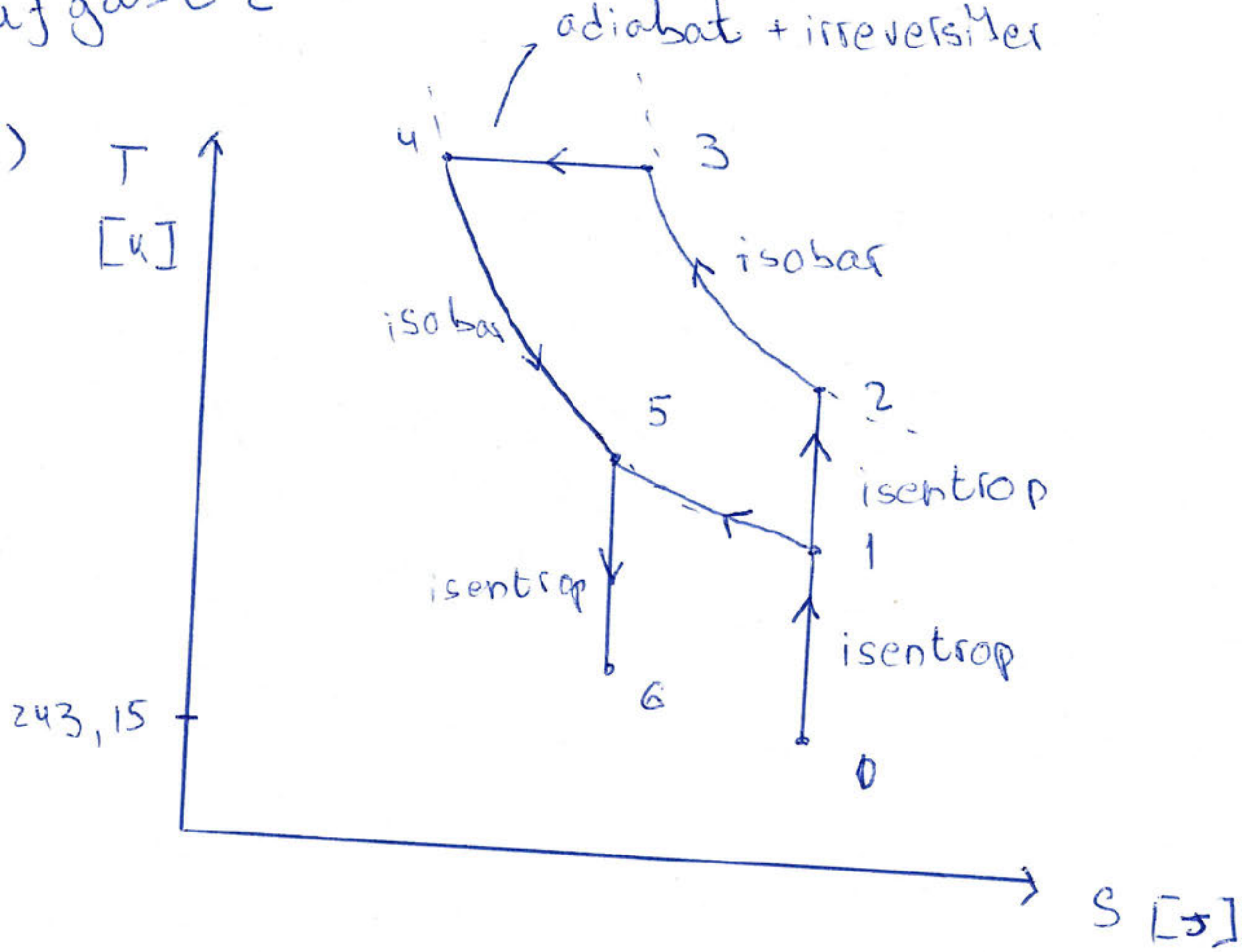
Aufgabe 2

a)




b) $w_6$ und $T_6 = ?$

$w_5 = 220 \frac{m}{s}$ $p_0 = p_6 = 0{,}191$ bar

$p_5 = 0{,}5$ bar

$T_5 = 431{,}9$ K

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

$\Rightarrow T_6 = \left( \frac{p_6}{p_5} \right)^{\frac{0{,}4}{1{,}4}} \cdot T_5 = 328{,}0746569 \text{ K}$

stationäres prozess

$$\Rightarrow \dot m_{ges}\left(\Delta h + \frac{w_6^2 - w_5^2}{2}\right) + \cancel{\sum_j \dot Q_j}^{\,0} - \cancel{\sum_n \dot W_n}^{\,0} = 0$$

$$-\Delta h = \frac{w_6^2 - w_5^2}{2}$$

$$\Delta h = \int_{T_5}^{T_6} c_p^{ig}\, dT = c_p^{ig}\left(\ln(T_6) - \ln(T_5)\right) =$$

$$= -0{,}2766024 \text{ kJ}$$

$$0{,}2766024 \cdot 2 + w_5^2 = w_6^2 = 48400{,}553 \text{ m/s}$$

$$\Rightarrow w_6 =$$

$$\Delta h = \int_{T_5}^{T_6} c_p^{ig}\, dT = c_p^{ig}\left(T_6 - T_5\right) = -104{,}4489 \text{ kJ}$$

$$\Rightarrow \Delta h \cdot 2 + w_1^2 = w_6^2 = 254294{,}912 \ \frac{m^2}{s^2}$$

$$w_6 = 504{,}2454159 \text{ m/s}$$

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Aufgabe 2

c) $\Delta e_{x,str} = e_{x,str,6} - e_{x,str,0} = ?$

$\Delta e_{x,str,\cancel{0}} = \Delta h_{06} - T_0(s_6 - s_0) + \Delta ke_{06}$

iG gesetz

$\Delta h_{06} = \int_{T_0}^{T_6} c_p^{ig}\, dT = c_p^{ig}(T_6 - T_0) = \cancel{360,273148} \frac{kJ}{kg}$

$= \cancel{102,381882}\ 85,93$

$\Delta s_{60} = \int_{T_0}^{T_6} \frac{c_p^{ig}}{T}\, dT - R\ln\left(\frac{p_6}{p_0}\right) =$

$= c_p^{ig}\left(\ln(T_6) - \ln(T_0)\right) - R\cancel{\ln(1)}^{0} =$

$= \cancel{1,4068811082496}\ \ kJ/kg$

$0,30135$

$\Delta ke_{06} = \frac{w_6^2 - w_0^2}{2} = 108,648\ kJ/kg$

$\Rightarrow \Delta e_{x,str} = \Delta h - T_0\Delta s + \Delta ke = 119,7267\ kJ/kg$

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Aufgabe 3

a) $p_{g,1} = ?$ $m_g = ?$

$$p_{g,1} = \frac{\text{Kräfte von oben, da GG}}{A}$$

$$\Rightarrow \cancel{p_{g,1}}\ F = \cancel{m_K \cdot g + p_{amb} +} \cancel{p_{EW}} = m_K \cdot g + \cancel{p_{amb}} +$$

$$m_{EW} \cdot g = \cancel{1063142,802} = \cancel{1000,8003514} \; N$$

$$= 314{,}901 \; N$$

$$A = \pi \cdot \left(\frac{d}{2}\right)^2 = \cancel{3,1415 \cdot 10^{-4} m^3}\ 7{,}853981 \cdot 10^{-4}$$

$$\Rightarrow \frac{F_{+}}{A} + p_{amb} = \cancel{1,40}\ 1{,}4 \text{ bar}$$

$\Rightarrow$ ideal Gas Gesetz

$$pV = mRT \Rightarrow \quad m = \frac{pV}{RT} = 3{,}419241 \, g$$

$$R = \frac{\bar{R}}{M_g} = 0{,}166285242$$

b) $T_{g,2} = ?$ $p_{g,2} = ?$

$x_{Eis,2} > 0$

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Aufgabe 4

a)