

1)

a)

$$\dot{m}_w = 0,3 \frac{\text{kg}}{\text{s}}$$

$$m_{\text{ges}} = 5755 \text{ kg}$$

$$\dot{Q} = \dot{m}_w (h_{\text{ein}} - h_{\text{aus}}) + \dot{Q}_R + \dot{Q}_{\text{aus}} - \dot{W}^0$$

$$\dot{Q}_{\text{aus}} = -\dot{Q}_R + \dot{m}_w (h_{\text{aus}} - h_{\text{ein}})$$

$$h_{\text{ein}} = h_f(70^\circ\text{C}) + 0,005 (h_g(70^\circ\text{C}) - h_f(70^\circ\text{C})) = 301,65 \frac{\text{kJ}}{\text{kg}}$$

$$h_{\text{aus}} = h_f(100^\circ\text{C}) + 0,005 (h_{gf}(100^\circ\text{C})) = 430,325 \frac{\text{kJ}}{\text{kg}}$$

$$\hookrightarrow \dot{Q}_{\text{aus}} = -62,2972 \frac{\text{kJ}}{\text{s}} = \underline{\underline{-62,3 \text{ kJ}}}$$

b)

$$\overline{T}_{\text{KF}} = \frac{\int_a^b T \, ds}{S_a - S_b} = \frac{dh - \cancel{Vdp}^0}{S_a - S_b} = \frac{h_2 - h_1}{S_a - S_b} = \frac{\overline{\dot{Q}}_{\text{KF}} (T_2 - T_1)}{\overline{\dot{Q}}_{\text{KF}} \cdot \ln(\frac{T_2}{T_1})} = \underline{\underline{293,1216 \text{ K}}}$$

c)

$$\dot{Q} = \dot{m}_w (S_{\text{ein}} - S_{\text{aus}}) + \frac{|\dot{Q}_{\text{aus}}|}{\overline{T}_{\text{KF}}} + \dot{S}_{\text{erz}}$$

$$\dot{S}_{\text{erz}} = \cancel{\dot{Q}} \frac{|\dot{Q}_{\text{aus}}|}{\overline{T}_{\text{KF}}} + \dot{m}_w (S_{\text{aus}} - S_{\text{ein}})$$

$$\hookrightarrow \dot{Q} = \dot{m}_w (S_{\text{aus}} - S_{\text{ein}})$$

$$\dot{S}_{\text{erz}} = -\frac{|\dot{Q}_{\text{aus}}|}{\overline{T}_{\text{KF}}} + \dot{m}_w (S_{\text{aus}} - S_{\text{ein}})$$

d)

$$\Delta E = m_2 u_2 - m_1 \cdot u_1 = \Delta m_{12} (h_{12})_{\text{ideal}} + Q_{R,12} - \dot{W}^{\circ}$$

$$m_2 = m_1 + \Delta m_{12}$$

$$u_2 = u_w(70^\circ\text{C}) = 292,95 \frac{\text{kJ}}{\text{kg}}$$

$$u_1 = u_w(100^\circ\text{C}) = 918,99 \frac{\text{kJ}}{\text{kg}}$$

$$m_1 = 5755 \text{ kg}$$

$$m_2 = 5755 \text{ kg} + \Delta m_{12}$$

$$h_{12} = 83,96 \frac{\text{kJ}}{\text{kg}}$$

} Aus Tab-A2

~~m₁ · u₂ + Δm₁₂ · u₂ - m₁ u₁~~ → m₁ · u₂ + Δm₁₂ · u₂ - m₁ u₁ = Δm₁₂ h₁₂ + Q_{R,12}

~~m₁ · u₂ + Δm₁₂ · u₂~~

$$\Delta m_{12} (u_2 - h_{12}) = Q_{R,12} + m_1 u_1 - m_1 u_2$$

$$\underline{\underline{\Delta m_{12} = 3500 \text{ kg}}}$$

e)

$$\Delta S = m_2 s_2 - m_1 s_1$$

$$m_2 = m_1 + \Delta m_{12} = 5755 \text{ kg}$$

$$m_1 = 5755 \text{ kg}$$

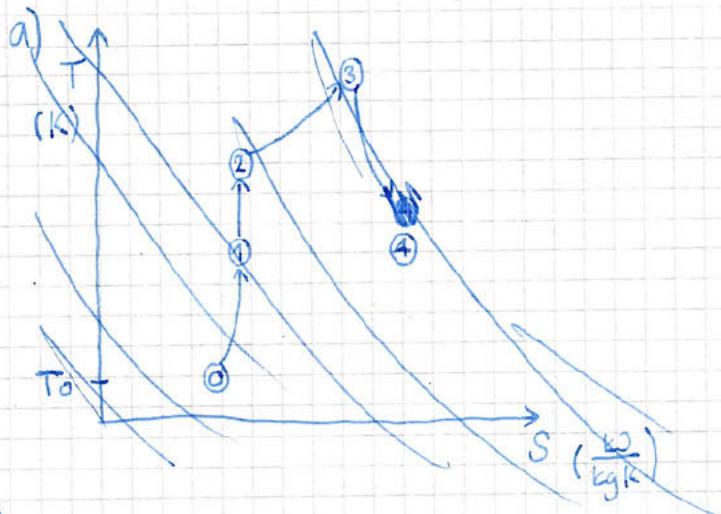
$$s_1 = s_f(100^\circ\text{C}) = 1,3069 \frac{\text{kJ}}{\text{kgK}}$$

$$s_2 = s_f(70^\circ\text{C}) = 0,9549 \frac{\text{kJ}}{\text{kgK}}$$

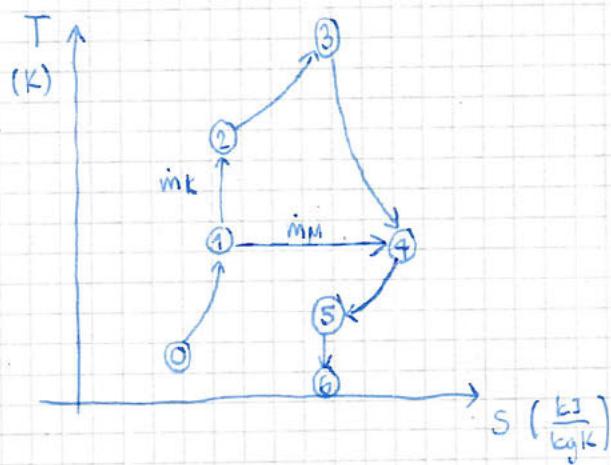
} Aus Tab A2

→ $\underline{\underline{\Delta S = 1316,39 \frac{\text{kJ}}{\text{K}}}}$

2)



a)



b)

$$\dot{m}_{\text{ges}} = \rho \cdot A \cdot w$$

$$\rho = \frac{1}{v}$$

$$0 = \dot{m}_{\text{ges}} \left(\frac{\omega_e^2 - \omega_a^2}{2} \right) - W_t$$

$$W_t = \# \int_1^2 v \, dp$$

$$\omega_e = 220 \frac{\text{m}}{\text{s}}$$

~~W_t = 100000 J~~

$$\hookrightarrow \omega_a = \omega_b = 500 \frac{\text{m}}{\text{s}}$$

$$T_b = 340 \text{ K}$$

Category	Sub-Categories	Description	Impact
Demographic	Age Group, Gender, Education Level, Income Level	Demographic factors influence consumer behavior, such as age groups preferring certain products or services based on their life stage.	High
Socio-Economic	Occupation, Household Size, Living Arrangements, Cultural Beliefs	Socio-economic factors like occupation and income level significantly impact purchasing power and consumption patterns.	Medium-High
Psychographic	Personality Traits, Lifestyles, Interests, Values	Psychographic factors shape consumer interests and values, influencing product choice and brand loyalty.	Medium
Behavioral	Purchasing Power, Consumption Patterns, Purchase Frequency, Loyalty Programs	Behavioral factors like purchase frequency and loyalty programs are key drivers of consumer engagement and retention.	Medium
Technological	Advancements in Technology, Digital Transformation, Technological Adoption	Technological advancements, particularly digital transformation, have revolutionized consumer behavior through e-commerce and mobile technology.	Medium-High
Environmental	Natural Resources, Climate Change, Environmental Awareness	Environmental concerns, such as climate change and resource scarcity, are influencing consumer choices towards more sustainable products and services.	Medium
Political	Governance, Economic Policies, International Trade	Political stability and economic policies can affect consumer confidence and spending power.	Low-Medium
Economic	Interest Rates, Inflation, Unemployment, GDP Growth	Economic indicators like inflation and interest rates play a crucial role in consumer spending decisions.	Medium
Cultural	Religious Beliefs, Social Norms, Traditional Practices, Mass Media	Cultural factors, including media influence and traditional practices, shape consumer attitudes and behaviors.	Medium
Geographic	Geographical Location, Climate, Natural Resources, Infrastructure	Geographic factors like climate and infrastructure can influence consumer needs and preferences.	Low-Medium

3)

a)

$$D = 10 \text{ cm} = 0,1 \text{ m}$$

$$R = 0,05 \text{ m}$$

$$A = 0,007854 \text{ m}^2 = R^2 \cdot \pi$$

GesW:

$$\frac{p_{g,1}}{A} = \frac{p_{\text{amb}}}{A} + m_K \cdot g + m_{EW} \cdot g$$

$$p_{g,1} = p_{\text{amb}} + A \cdot g (m_K + m_{EW})$$

$$p_{g,1} = 100 \text{ kPa} + 0,007854 \text{ m}^2 \cdot g (32 \text{ kg} + 0,1 \text{ kg}) =$$

$$p_{g,1} \cdot A = p_{\text{amb}} \cdot A + g (m_K + m_{EW})$$

$$p_{g,1} = p_{\text{amb}} + \frac{g}{A} (m_K + m_{EW})$$

$$p_{g,1} = 1,4 \text{ bar}$$

$$\hookrightarrow p_{g,1} \cdot V_{g,1} = m_g \cdot \frac{\bar{R}}{M_g} \cdot T_{g,1} \quad \text{mit} \quad V_{g,1} = 0,00314 \text{ m}^3$$

$$T_{g,1} = 773,15 \text{ K}$$

$$m_{g,1} = \frac{p_{g,1} \cdot V_{g,1} \cdot M_g}{\bar{R} \cdot T_{g,1}} = 3,4212 \text{ g}$$

b)

c)

$$T_{g,12} = 0,003^\circ\text{C} = 273,153\text{ K}$$

$$\Delta E = Q_{12} - W_{12}$$

$$U_2 - U_1 = Q_{12} - W_{12}$$

$$m_g \cdot c_v (T_2 - T_1) = Q_{12} - W_{12}$$

$$W_{12} = m_g \int p_i dV = p_{g,1} (V_{2,g} - V_{g,1}) \cdot m_g$$

$$V_{g,12} \cdot p_{g,1} = m_g \cdot \frac{R}{M_g} \cdot T_{g,12} \Rightarrow V_{g,12} = \frac{m_g}{p_{g,1}} \cdot \frac{R}{M_g} \cdot T_{g,12} = 0,00111 \text{ m}^3$$

$$\hookrightarrow W_{12} = -284,2 \text{ kJ} \cdot 0,003 \text{ kg} = -872,3 \text{ J}$$

$$Q_{12} = W_{12} + m_g \cdot c_v (T_2 - T_1) = -2055,116 \text{ J}$$

3)
d)

$$T_{g,2} = 0,003^\circ\text{C} = T_{EW}$$

$$m_{EW} = 0,1 \text{ kg}$$

RENT

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

$$U_2 - U_1 = |Q_{12}|$$

$$U_1 = -0,045 \frac{\text{kJ}}{\text{kg}} + x_{E,1} (-333,458 \frac{\text{kJ}}{\text{kg}} + 0,045 \frac{\text{kJ}}{\text{kg}}) = -200,09 \frac{\text{kJ}}{\text{kg}}$$

$$U_1 = U_1 \cdot m_1 = -20 \text{ kJ} = \underline{-20'000,3}$$

$$U_2 = |Q_{12}| + U_1 = \underline{+0,003} - 17954,16435 \text{ J} = -17,95 \text{ kJ}$$

$$U_2 = \frac{U_2}{m_{EW}} = -179,5416 \frac{\text{kJ}}{\text{kg}}$$

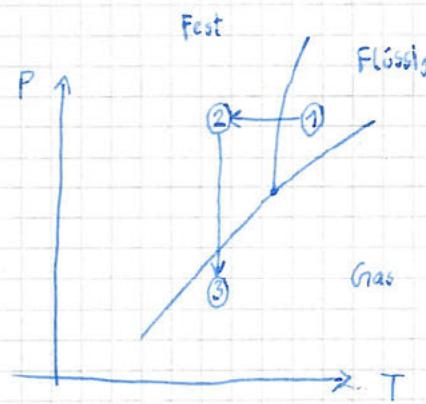
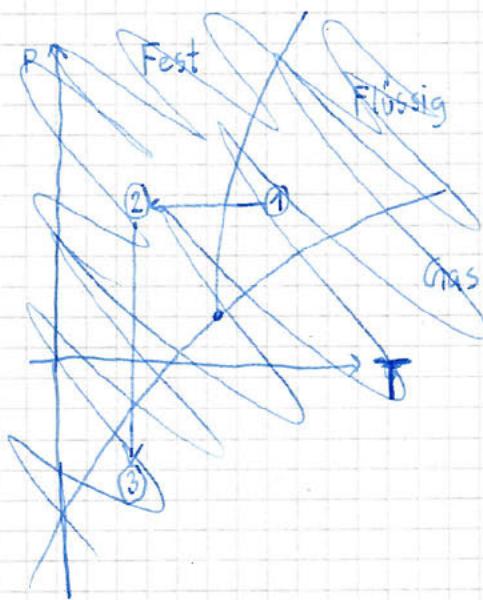
$$U_2 = U_{fi} (0,003^\circ\text{C}) + \dots$$

$$U_2 = U_{fi} (0,005^\circ\text{C}) + x_{Eis,2} (U_{fest} - U_{fi}) \Rightarrow x_{Eis,2} = \frac{U_2 - U_{fi}}{U_{fest} - U_{fi}}$$

$$x_{Eis,2} = 0,5384 \approx \underline{\underline{0,538}}$$

4)

a)



b)

$$T_i = -10^\circ\text{C}$$

$$T_{\text{verdampf}} = T_i - 6^\circ\text{C} = -16^\circ\text{C}$$

$$p_3 = 8 \text{ bar} = p_4$$

$$x_2 = 1$$

$$x_4 = 0 \quad \dot{Q}_{ab} = m_{R134a} (h_3 - h_4) + \dot{Q}_{ab}$$

$$\dot{Q} = m_{R134a} (h_2 - h_3) - \dot{W}_k$$

$$\dot{m}_{R134a} = \frac{\dot{W}_k}{h_2 - h_3}$$

$$h_3 = h(8 \text{ bar}) = 264,15 \frac{\text{kJ}}{\text{kg}}$$

$$h_2 = h(-16^\circ\text{C}) = 237,74 \frac{\text{kJ}}{\text{kg}}$$

$$\dot{m}_{R134a} = 3,8167 \frac{\text{kg}}{\text{h}}$$

4)

c)

$$p_4 = 8 \text{ bar}$$

Drossel ist isenthalp: $h_1 = h_4$

~~$h_f = h_{4f}$~~

$$h_4 = h_f$$

d)

$$\varepsilon_k = \frac{\dot{Q}_{ab}}{|\dot{W}_s|}$$

$$\dot{Q}_{ab} =$$