## Isentrope

$$dQ = dU + pdV = mc_v\,dT + pdV \overset{!}{=} 0 \implies mc_v\,dT = -pdV \qquad (1)$$

$$dQ = dH - Vdp = mc_p\,dT - Vdp \overset{!}{=} 0 \implies mc_p\,dT = Vdp \qquad (2)$$

$$\frac{(2)}{(1)} \rightsquigarrow \varkappa = -\frac{Vdp}{pdV} \implies \frac{dp}{p} = -\varkappa \frac{dV}{V} \qquad (*)$$

Annahme: $\varkappa(T) = \text{const.}$

$$\ln\left(\frac{p_2}{p_1}\right) = -\varkappa \ln\frac{V_2}{V_1} = \varkappa \ln\frac{V_1}{V_2} = \ln\left(\frac{V_1}{V_2}\right)^{\varkappa}$$

$$\frac{p_2}{p_1} = \left(\frac{V_1}{V_2}\right)^{\varkappa} \implies p_1 V_1^{\varkappa} = p_2 V_2^{\varkappa} = \text{const} \quad (\text{Adiabatengleichung})$$

$$\implies p_2 = \left(p_1 V_1^{\varkappa}\right) \cdot \frac{1}{V_2^{\varkappa}} \qquad (\varkappa > 1\,!)$$

$$\text{const} = \frac{pV}{T} \implies \frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2} \implies \frac{p_2}{p_1} = \frac{T_2}{T_1}\frac{V_1}{V_2} \implies \frac{T_2}{T_1}\left(\frac{V_1}{V_2}\right) = \left(\frac{V_1}{V_2}\right)^{\varkappa}$$

$$\frac{T_2}{T_1} = \left(\frac{p_2}{p_1}\right)^{\frac{\varkappa-1}{\varkappa}} \implies \frac{T_2}{T_1} = \left(\frac{V_1}{V_2}\right)^{\varkappa-1}$$

$$Q_{12} = 0$$

$$W_{v12} = -\int_{V_1}^{V_2} p\,dV = -p_1 V_1^{\varkappa} \int_{V_1}^{V_2} \frac{dV}{V^{\varkappa}}$$

$$= \frac{p_1 V_1}{\varkappa - 1} \left[ \left( \frac{V_1}{V_2} \right)^{\varkappa - 1} - 1 \right]$$

$$\overset{V \to T}{=} \frac{m R_i T}{\varkappa - 1} \left[ \frac{T_2}{T_1} - 1 \right] = \frac{m R_i}{\varkappa - 1} (T_2 - T_1) = m \bar{c}_v \Big|_{T_1}^{T_2} (T_2 - T_1) = U_2 - U_1$$

$$W_{t12} = H_2 - H_1 = m \bar{c}_p \Big|_{T_1}^{T_2} (T_2 - T_1) = m \frac{\bar{c}_p \Big|_{T_1}^{T_2}}{\bar{c}_v \Big|_{T_1}^{T_2}} \bar{c}_v \Big|_{T_1}^{T_2} (T_2 - T_1) = \bar{\varkappa} \Big|_{T_1}^{T_2} W_{v12}$$

$$\bar{\varkappa} \Big|_{T_1}^{T_2} = \frac{\int_{T_1}^{T_2} c_p(T)\, dT}{\int_{T_1}^{T_2} c_v(T)\, dT} = \frac{\int_{T_1}^{T_2} \varkappa(T)\, c_v(T)\, dT}{\int_{T_1}^{T_2} c_v(T)\, dT}$$