

Wirkungsgrad des Carnot-Prozesses

$$\eta = \frac{-Q_{12}}{Q_{23}}$$

$$Q_{23} = 0 = Q_{41}$$

$$Q_{12} = Q_{21}$$

$$Q_{34} = Q_{43}$$

$$\eta = \frac{Q_{12} + Q_{34}}{Q_{12}}$$

$$Q_{12} = n R_i T_1 \ln \frac{V_2}{V_1}$$

$$Q_{34} = n R_i T_2 \ln \frac{V_4}{V_3}$$

$c_p(T)$ const.

Isothermen:

$$\frac{T_2}{T_1} = \left(\frac{V_3}{V_2}\right)^{\alpha-1}$$

$$\frac{T_1}{T_2} = \left(\frac{V_1}{V_4}\right)^{\alpha-1}$$

$$\begin{aligned} \frac{T_1}{T_2} &= \frac{T_1}{T_2} = \left(\frac{V_1}{V_4}\right)^{\alpha-1} \\ &= \frac{T_1 T_2}{T_1 T_2} = \left(\frac{V_1}{V_3}\right)^{\alpha-1} \end{aligned}$$

$$\frac{V_1}{V_4} = \frac{V_2}{V_3} \Rightarrow \frac{V_4}{V_3} = \frac{V_1}{V_2}$$

$$\ln \frac{V_2}{V_1} = - \ln \frac{V_1}{V_2} = - \ln \frac{V_4}{V_3}$$

$$\begin{aligned} \eta &= \frac{-T_1 \ln \frac{V_4}{V_3} + T_2 \ln \frac{V_4}{V_3}}{-T_1 \ln \frac{V_4}{V_3}} = \frac{T_2 - T_1}{-T_1} = \frac{T_1 - T_2}{T_1} \\ &= 1 - \frac{T_2}{T_1} \end{aligned}$$

$$\underline{\underline{\eta_c = 1 - \frac{T_{\min}}{T_{\max}}}}}$$