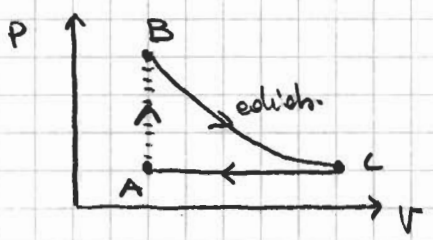
Esercizio sul ciclo 1

Sistema (non necessariamente gas!) fa



Sono dati C_p, C_v,

$\begin{cases} T_A = T_0 \\ T_B = T_1 \end{cases}$

Quant'è il lavoro fatto sul ciclo?

$$\mathcal{L}_{tot} = \mathcal{L}_{AB} + \mathcal{L}_{BC} + \mathcal{L}_{CA}$$

$\mathcal{L}_{AB} = 0$

$\mathcal{L}_{BC} = \Delta U = C_v (T_C - T_1)$

$\mathcal{L}_{CA} \rightarrow p_0 (V_A - V_C)$

} ci sono troppe incognite!

$\Rightarrow$ uso il 1° principio:

$$\Delta U_{\text{ciclo}} = 0 \Rightarrow \mathcal{L}_{tot} = \Delta Q_{tot} = \Delta Q_{AB} + \cancel{\Delta Q_{BC}}^{\,0} + \Delta Q_{CA}$$

$$\Delta Q_{AB} = C_v (T_1 - T_0)$$

$$\Delta Q_{CA} = C_p (T_0 - T_C)$$

Devo trovare solo T_C:

$$\Delta S_{\text{ciclo}} = 0 = \Delta S_{AB} + \cancel{\Delta S_{BC}}^{\,0} + \Delta S_{CA}$$

$$\Delta S_{AB} = C_v \int_A^B \frac{dT}{T} = C_v \ln \frac{T_1}{T_0}$$

$$\Delta S_{CA} = C_p \int_C^A \frac{dT}{T} = C_p \ln \frac{T_0}{T_C}$$

$$\Rightarrow \frac{C_v}{C_p} (\ln T_1 - \ln T_0) + \cancel{C_p}(\ln T_0 - \ln T_C) = 0$$

$$\ln T_C = \ln T_0 \left(1 - \frac{C_v}{C_p}\right) + \frac{C_v}{C_p} \ln T_1$$

$\Rightarrow$

$$T_c = (T_0)^{\left(1-\frac{c_v}{c_p}\right)} (T_1)^{\frac{c_v}{c_p}} = T_0 \left(\frac{T_1}{T_0}\right)^{\frac{c_v}{c_p}}$$

$$\Rightarrow \quad \ell_{tot} = C_v (T_1 - T_0) + C_p T_0 \left(1 - \left(\frac{T_1}{T_0}\right)^{\frac{c_v}{c_p}}\right)$$