

ESERCITAZIONE

ESERCIZIO 4 (20)

$$V_2, \quad C_V = \frac{5}{2} R \quad M = 28 \text{ g/mol}$$

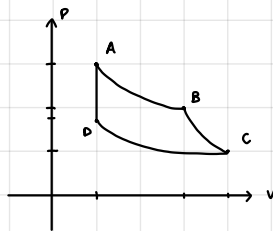
$$m = 1 \text{ g} \rightarrow n = \frac{1}{28} \text{ mol}$$

A → B isoterma da V_A , $V_B = 3V_A$ a $T_1 = 380^\circ\text{C}$

B → C adiabatica da V_B , V_C con $T_2 = 327^\circ\text{C}$ finale

C → D isoterma da V_C , V_D

D → A isocora fino a p_A



$$A \rightarrow B: \quad W_{AB} = nRT_1 \ln \frac{V_B}{V_A} = nRT_1 \ln 3 \text{ J}$$

$$B \rightarrow C: \quad \Delta U = -W_{BC} \rightarrow W_{BC} = -nC_V(T_2 - T_1) \text{ J}$$

$$C \rightarrow D: \quad W_{CD} = nRT_2 \ln \frac{V_D}{V_C} = nRT_2 \left[-\ln 3 + \frac{5}{2} \ln \frac{T_1}{T_2} \right]$$

$$D \rightarrow A: \quad W_{DA} = 0$$

↓

$$W_{\text{Tot}} = nRT_1 \ln 3 - nC_V T_2 + nC_V T_1 - nRT_2 + \frac{5}{2} nRT_2 \ln \frac{T_1}{T_2} = \dots = 19,38 \text{ J}$$

$$T_1 V_B^{\gamma-1} = T_2 V_C^{\gamma-1} \rightarrow \frac{T_1}{T_2} = \left(\frac{3V_A}{V_C} \right)^{\gamma-1} \rightarrow \frac{3V_A}{V_C} = \left(\frac{T_1}{T_2} \right)^{\frac{1}{\gamma-1}} \rightarrow \frac{V_A}{V_C} = \frac{1}{3} \left(\frac{T_1}{T_2} \right)^{\frac{5}{2}}$$

ESERCIZIO 1

$$T \cdot V = \text{cost}$$

$$C_V = \frac{5}{2} R$$

$$T_A, \quad \frac{V_A}{V_B}$$

$$\Delta U = nC_V(T_B - T_A) = nC_V T_A \left(\frac{T_B}{T_A} - 1 \right) = nC_V T_A \left(\frac{V_B}{V_A} - 1 \right)$$

$$\hookrightarrow T_B V_B = T_A V_A \Rightarrow \frac{T_B}{T_A} = \frac{V_A}{V_B}$$

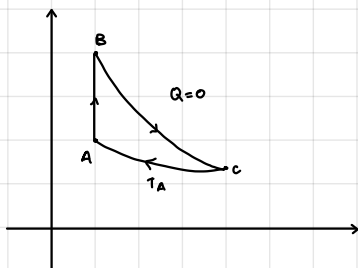
$$Q = \Delta U + W = \frac{5}{2} nRT_A \left(\frac{V_B}{V_A} - 1 \right) - nRT_A \left(\frac{V_B}{V_A} - 1 \right) = \frac{3}{2} nRT_A \left(\frac{V_B}{V_A} - 1 \right)$$

$$\begin{aligned} \hookrightarrow W &= \int_A^B P dV = \int_A^B \frac{nRT}{V} dV = nR \int_A^B \frac{T}{V} dV = nR \int_A^B \frac{T_A V_A}{V^2} dV \\ &= nRT_A V_A \left[-\frac{1}{V} \right]_A^B = nRT_A V_A \left[\frac{1}{V_A} - \frac{1}{V_B} \right] = \frac{nRT_A V_A}{V_B} + nRT_A = \\ &= -nRT_A \left(\frac{V_A}{V_B} - 1 \right) \end{aligned}$$

ESERCIZIO 2

$$\frac{T_B}{T_A} = 2$$

$$C_V = \frac{5}{2} R$$



meno -
↑

$$Q_{AB} = nC_V(T_B - T_A)$$

$$\Rightarrow \eta = 1 - \frac{Q_C}{Q_A} = 1 - \frac{|L_{CA}|}{|L_{AB}|} = 1 - \frac{nRT_A \ln \frac{V_C}{V_A}}{nC_V(T_B - T_A)} = 1 - \frac{R}{C_V} \cdot \left(\frac{1}{\frac{T_B}{T_A} - 1} \right) \ln \frac{V_C}{V_A} = 1 - \frac{R}{C_V} \cdot \left(\frac{1}{\frac{T_B}{T_A} - 1} \right) \ln \frac{T_B}{T_A} = \dots = 0,307$$

$$Q_{CA} = L_{CA} = nRT_A \ln \frac{V_C}{V_A}$$

< 0 → calore

$$B \rightarrow C: \quad T_A V_C^{\gamma-1} = T_B V_B^{\gamma-1} \rightarrow \frac{T_B}{T_A} = \left(\frac{V_C}{V_B} \right)^{\gamma-1} \rightarrow \frac{T_B}{T_A} = \left(\frac{V_C}{V_A} \right)^{\gamma-1} \rightarrow \left(\frac{T_B}{T_A} \right)^{\frac{1}{\gamma-1}} = \frac{V_C}{V_A}$$

$$\text{In caso di monoatomico: } \eta = 1 - \frac{R}{C_V} \left(\frac{1}{\frac{T_B}{T_A} - 1} \right) \ln \frac{T_B}{T_A} = 0,304$$