$n = 1$ biato

AB: esp. irrev. $V_B = 2V_A$, contatto termico $T_A = 300\,K$

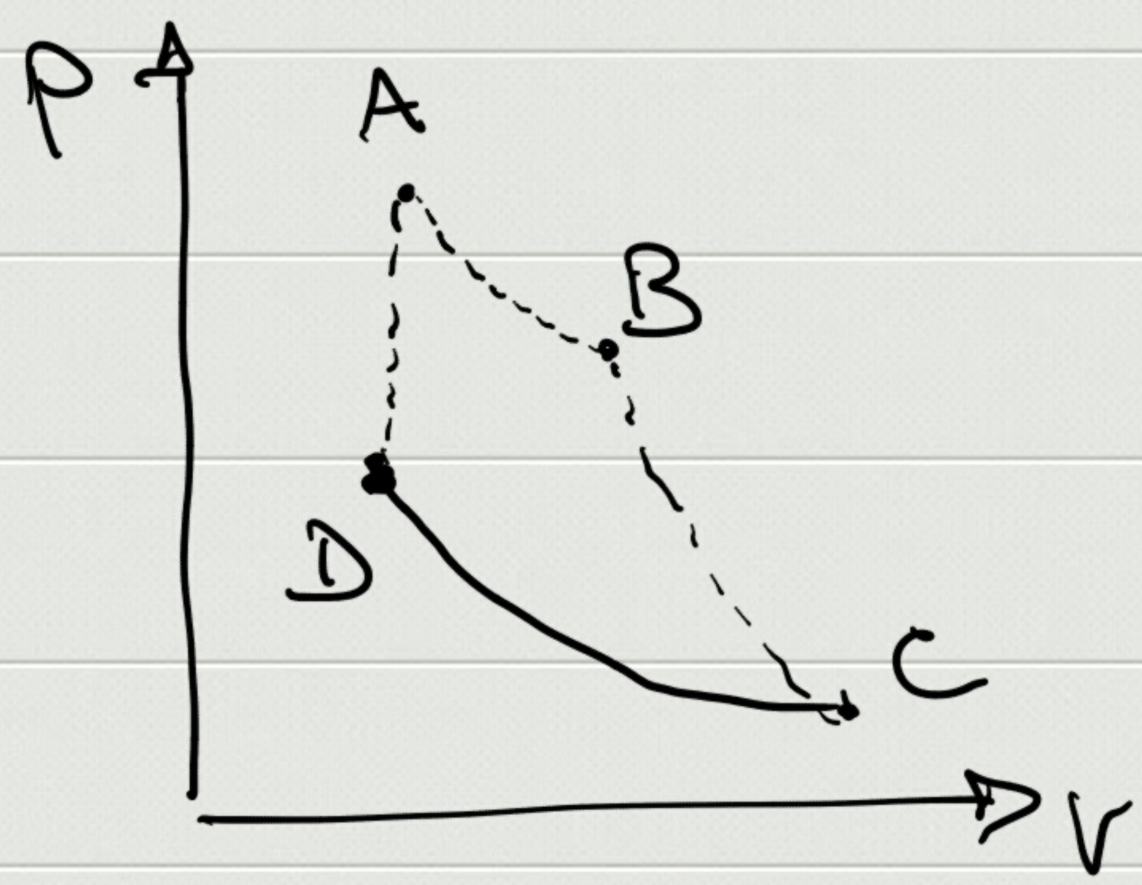
$\Delta S_{U,AB} = 2.4\ J/K$

BC: esp. irrev. $V_C = 6V_A$, adiab., $T_C = 200\,K$

CD: compr. isot. rev. $V_D = V_A$

DA: riscaldamento isocoro, cont. termico T_A

W, η, ΔS_U



$$\Delta S_{U,AB} = \Delta S_{gas,AB} + \Delta S_{amb,AB} =$$

$$= nR \ln \frac{V_B}{V_A} + \frac{-Q_{AB,gas}}{T_A}$$

$$\Rightarrow Q_{AB,gas} = T_A \left(nR \ln \frac{V_B}{V_A} - \Delta S_{U,AB} \right) = 1008\ J$$

$$\overset{!}{=} W_{AB,gas}$$

$Q_{BC} = 0$

$$W_{BC} \overset{!}{=} -\Delta U_{BC} = -mc_V (T_C - T_B) = 2077 \text{ J}$$

$$W_{CD} = Q_{CD} = nRT_C \ln \frac{V_D}{V_C} = -2978 \text{ J}$$

$$W_{DA} = 0$$

$$\Rightarrow W_{TOT} = 107 \text{ J}$$

$$\eta = \frac{W_{TOT}}{Q_{ASS}} = \frac{W_{TOT}}{Q_{AB} + Q_{DA}} = 0.035$$

$$Q_{DA} = mc_V (T_A - T_D) = 2078 \text{ J}$$

$$\Delta S_{U,ciclo} = \Delta S_{U,AB} + \Delta S_{U,BC} + \Delta S_{U,DA}$$

$$\Delta S_{U,BC} = \Delta S_{gas,BC} + \cancel{\Delta S_{amb,BC}} =$$

$$= mc_V \ln \frac{T_C}{T_B} + nR \ln \frac{V_C}{V_B} = 0.71 \text{ J/K}$$

$$\Delta S_{u,DA} = \Delta S_{gas,DA} + \Delta S_{amb,DA} =$$

$$= n c_v \ln \frac{T_A}{T_D} + \frac{-Q_{gas,DA}}{T_A} = 1.5 \ J/K$$

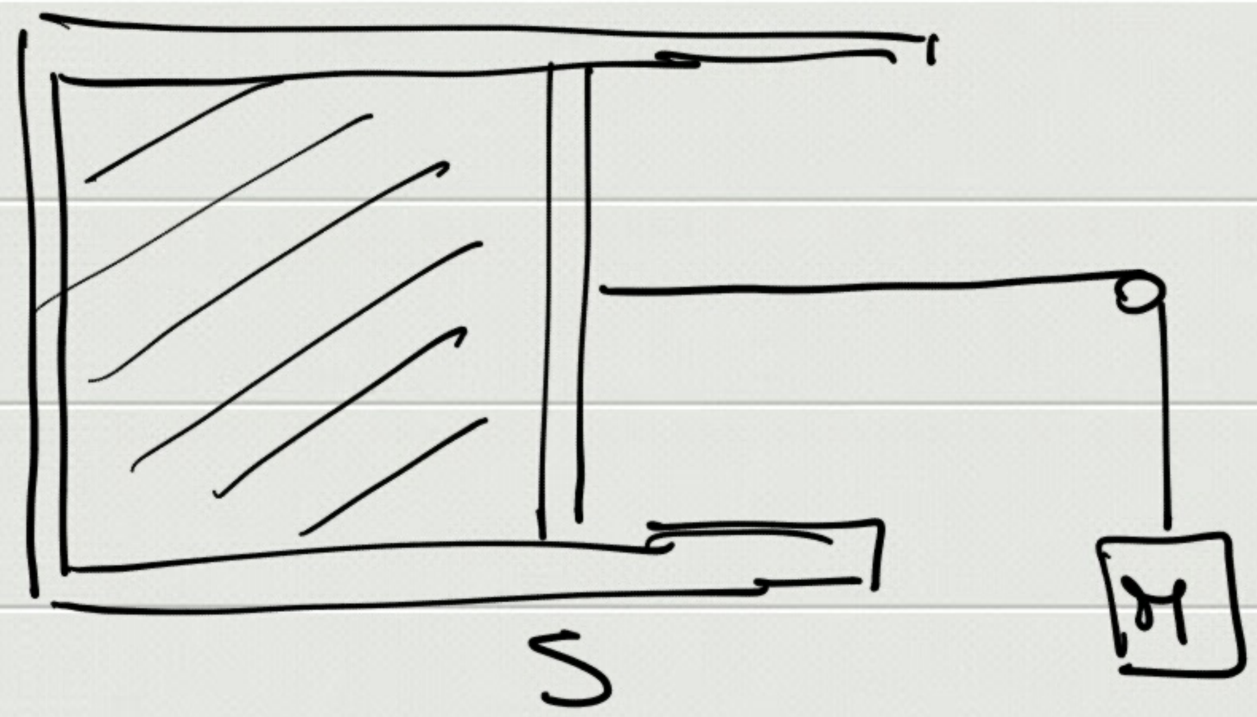
$$\Delta S_{u,ciclo} = 4.6 \ J/K$$

$$\Delta S_{u,ciclo} = \Delta S_{amb,ciclo}$$

$\hookrightarrow$ AB, CD, DA

$$\Delta S_{u,CD} = 0 = \Delta S_{gas,CD} + \Delta S_{amb,CD}$$

$$\Rightarrow \Delta S_{amb,CD} = - \Delta S_{gas,CD}$$



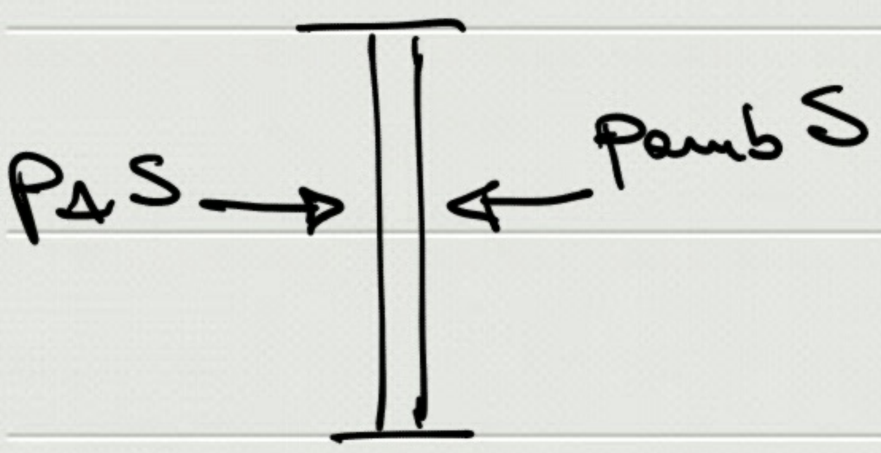
$S = 0.01\ m^2$

$M = 50\ kg$

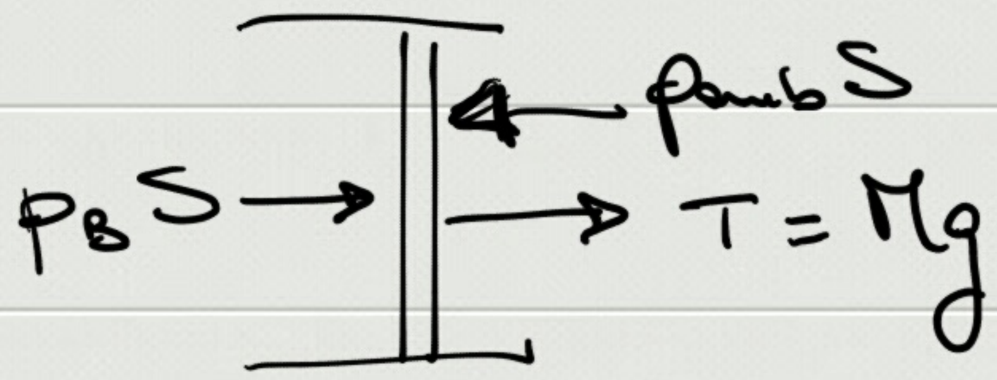
$n = 1$ mono

A: $T_A = 300\ K$ $\quad p_A = 10^5\ Pa$ $\qquad V_B, T_B = ?$

$$V_A = \frac{nRT_A}{p_A} = 0.0249\ m^3$$



$$\Rightarrow p_{amb} = p_A$$



$$p_B S + Mg - \underbrace{p_{amb}}_{= p_A} S = 0 \Rightarrow \boxed{p_B = p_A - \frac{Mg}{S}} = 5 \cdot 10^4\ Pa$$

$$Q_{AB} = 0 \quad \Rightarrow \quad W_{AB} = -\Delta U_{AB} = -mc_V(T_B - T_A)$$

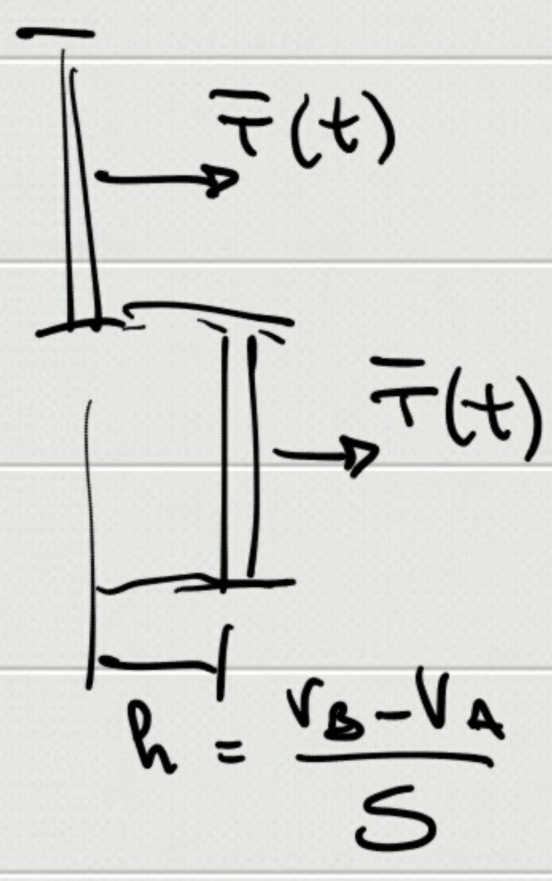
$$p_B V_B = mRT_B$$

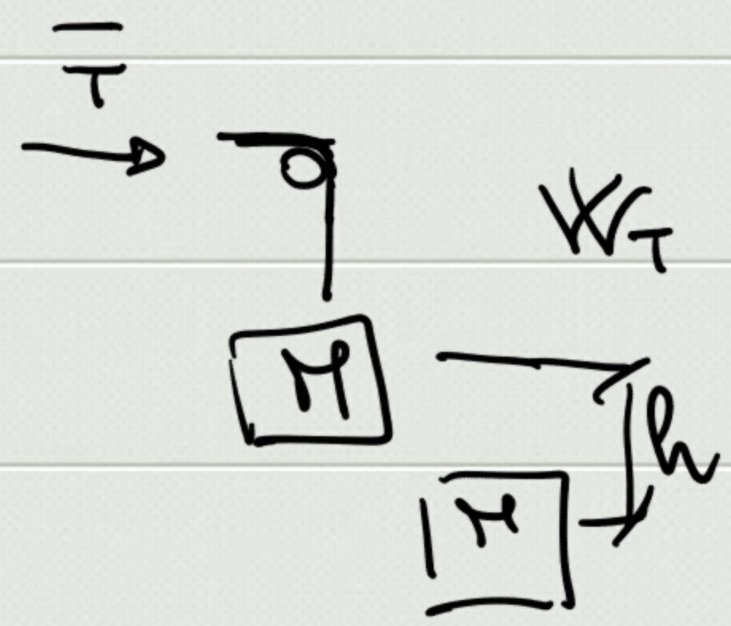
$$W_{AB,gas} = -W_{AB,ext} = -\left(W_{AB,pressamb} + W_{AB,T}\right)$$

$$\Uparrow$$

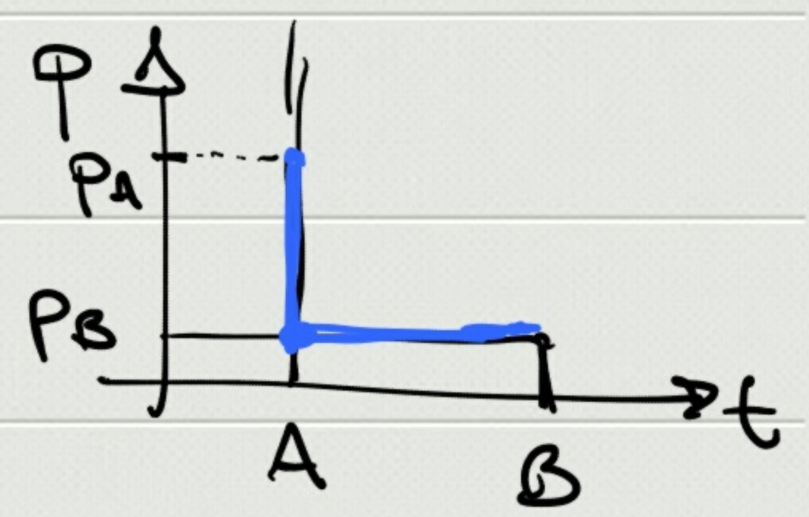
$$W_{AB,pressamb} = p_{amb}\,\Delta V_{amb} = p_A\left(-\Delta V_{AB,gas}\right) =$$

$$= -p_A(V_B - V_A)$$





$$W_T = W_{peso} = Mgh$$



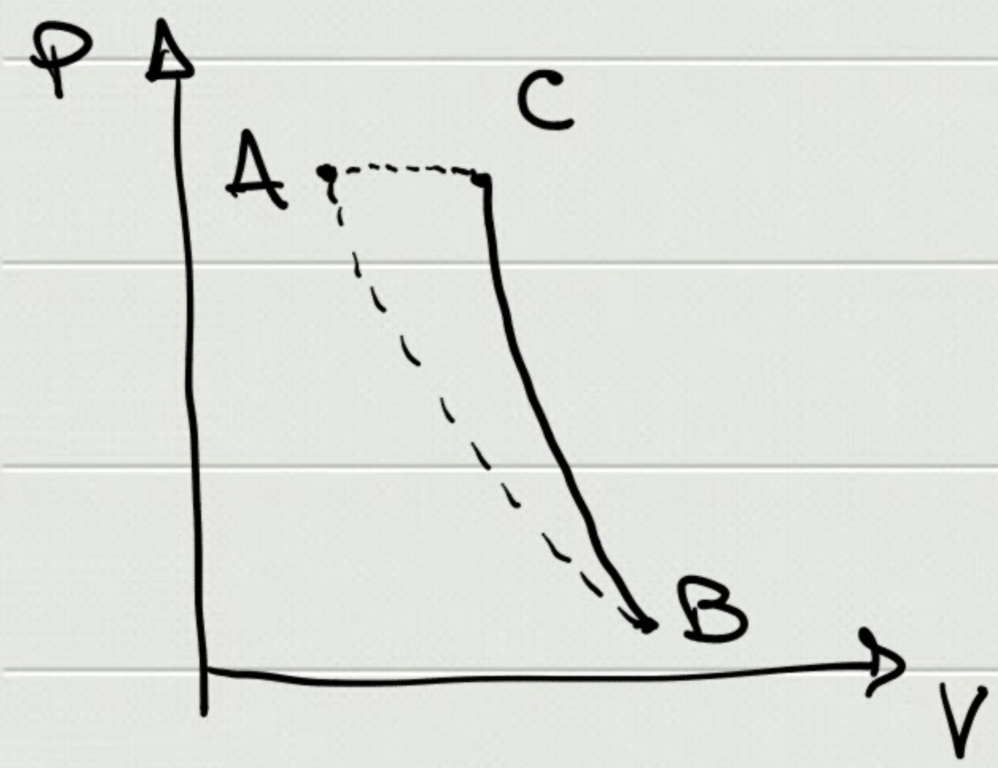
$$\Rightarrow W_{AB,gas} = -\left(-p_A(V_B - V_A) + Mgh\right) =$$

$$= p_A(V_B - V_A) - Mg\,\frac{V_B - V_A}{S} =$$

$$= \left(p_A - \frac{Mg}{S}\right)(V_B - V_A) = p_B(V_B - V_A)$$

$$\begin{cases} W_{AB} = p_B(V_B - V_A) = -mc_v(T_B - T_A) \\ p_B V_B = mRT_B \end{cases}$$

$$\Rightarrow V_B = 0.04\ m^3 \qquad T_B = 240\ K$$



$T_C = ?$

$\Delta S_U = ?$

$$T_B\, p_B^{\frac{1-\gamma}{\gamma}} = T_C\, \underbrace{p_C}_{=p_A}^{\frac{1-\gamma}{\gamma}} \Rightarrow T_C = 316.7\ K$$

$$\Delta S_U = \Delta S_{amb,\,AB+BC+CA} = \Delta S_{amb,\,CA} =$$

$$= \frac{-Q_{CA|gas}}{T_A} = \frac{-mc_p(T_A - T_C)}{T_A} = 1.16\ J/K$$