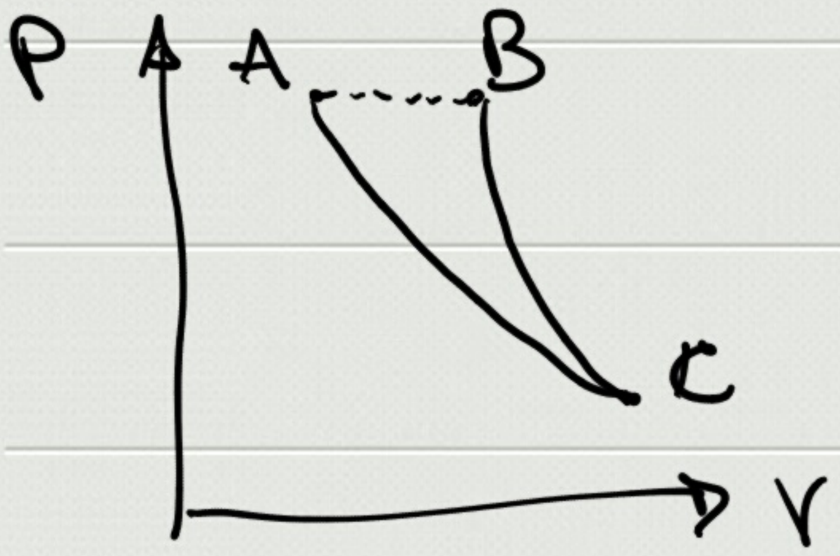
$n = 2$ biato $T_A = 300\ K$ $p_A = 10^5\ Pa$

$T_S = 550\ K$ $W_{AB} = 2.4 \cdot 10^3\ J$

BC: espansione adiab. rev. $T_C = T_A$

CA: isot. rev.

$V_A, V_B, T_B, W_{ciclo}, Q_{ciclo}, \eta, \Delta S_{U,ciclo}$



$$V_A = \frac{nRT_A}{p_A} = 0.049\ m^3$$

$$-W_{AB} = \int_{V_A}^{V_B} p\,dV$$

gas NO p non è definita

$$-V_B = \frac{nRT_B}{p_B}$$

$$-p_B V_B^{\gamma} = p_C V_C^{\gamma}$$

$$-W_{AB} = p_A (V_B - V_A) \quad *$$

$$W_{AB,gas} = -W_{AB,amb} = -p_{amb}\Delta V_{amb} = p_{amb}\Delta V_{AB,gas} =$$

$$= p_A (V_B - V_A)$$

$$V_B = V_A + \frac{W_{AB}}{p_A} = 0.073 \ m^3$$

$p = p_A$

$$T_B = \frac{p_B V_B}{nR} = 444 \ K$$

$T = T_A$

$$W_{BC} = -\Delta U_{BC} = -nC_V(T_C - T_B) = 5996 \ J$$

$$W_{CA} = nRT_C \ln \frac{V_A}{V_C} = -6854 \ J$$

$$T_B V_B^{\gamma-1} = T_C V_C^{\gamma-1} \Rightarrow V_C = V_B \left(\frac{T_B}{T_C}\right)^{\frac{1}{\gamma-1}} = 0.0195 \ m^3$$

$$W_{TOT} = Q_{TOT} = 1542 \ J$$

$$\eta = \frac{W_{TOT}}{Q_{ASS}} = \frac{W_{TOT}}{Q_{AB}} = \frac{W_{TOT}}{nC_p(T_B - T_A)} = 0.184$$

$\hookrightarrow 8396 \ J$

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

$$= \Delta S_{amb,ciclo} \quad *$$

$$= -\frac{mc_p(T_B - T_A)}{T_S} + mc_p \ln \frac{T_B}{T_A} \quad *$$

$$= -\frac{Q_{AB}}{T_S} - nR \ln \frac{V_A}{V_C} \quad *$$

$\Delta S_{CA,U} = 0$

$= \Delta S_{CA,gas+amb}$

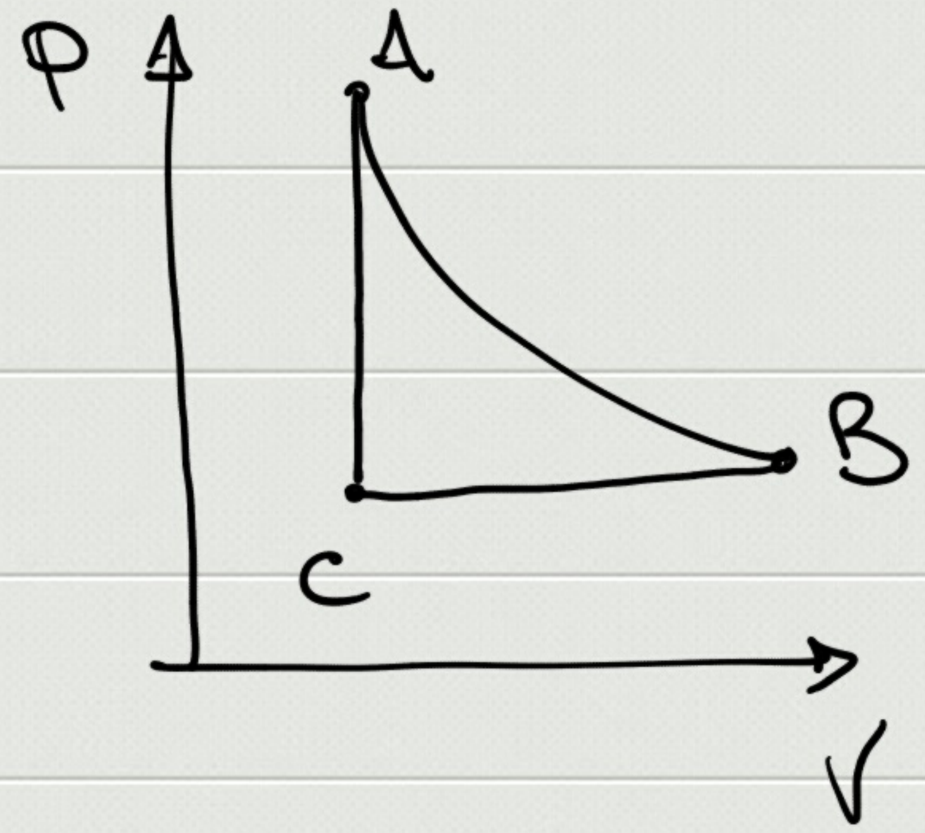
$\Delta S_U = 7.6 \ J/K$

n = 1 mono

AB : isot. rev.

BC : isobara rev

CA : isocora rev.



$V_B = 2 V_A$

$T_A = 500\ K$

$\Delta S_{ciclo,gas}$, $\Delta S_{ciclo,U}$, $\Delta S_{gas,BCA}$

Q_{AB} , Q_{BC} , Q_{CA}

W_{AB} , W_{BC} , W_{CA}

n

$\Delta S_{gas,ciclo} = 0$

$\Delta S_{U,ciclo} = 0$

$$-\Delta S_{gas,BCA} = nR \ln \frac{V_A}{V_B} = -nR \ln \frac{V_B}{V_A} \quad *$$

$$= nC_p \ln \frac{V_C}{V_B} + nC_V \ln \frac{T_A}{T_C} \quad *$$

$$= 0$$

$$= nC_V \ln \frac{V_A}{V_B^{\gamma-1}} \quad *$$

$$\Delta S_{gen,ciclo} = 0 = \Delta S_{gen,AB+BC+CA}$$

$$\Rightarrow \Delta S_{gen,AB+BC} = -\Delta S_{gen,AB}$$

$$\Delta S_{gen,BCA} = -R \ln 2 = -5.76 \ J/K$$

$$Q_{AB} = W_{AB} = nRT_A \ln \frac{V_B}{V_A} = 2881 \ J > 0$$

$$Q_{BC} = nC_p (T_C - T_B) = -5196 \ J$$

$$p_B = p_C \Rightarrow \frac{T_B}{V_B} = \frac{T_C}{V_C} \Rightarrow T_C = T_B \frac{V_C}{V_B} =$$

$$= T_A \frac{V_A}{V_B} = \frac{T_A}{2} = 250K$$

$$W_{BC} = nR(T_C - T_B) = -2078 \ J$$

$$Q_{CA} = nC_V (T_A - T_C) = 3128 \ J > 0$$

$$W_{CA} = 0$$

$$\eta = \frac{W_{TOT}}{Q_{ASS}} = \frac{W_{TOT}}{Q_{AB} + Q_{CA}} = 0,13$$

$n = 0.2$ moli mono

AB: esp. isot. rev. $T_A = 300\ K$

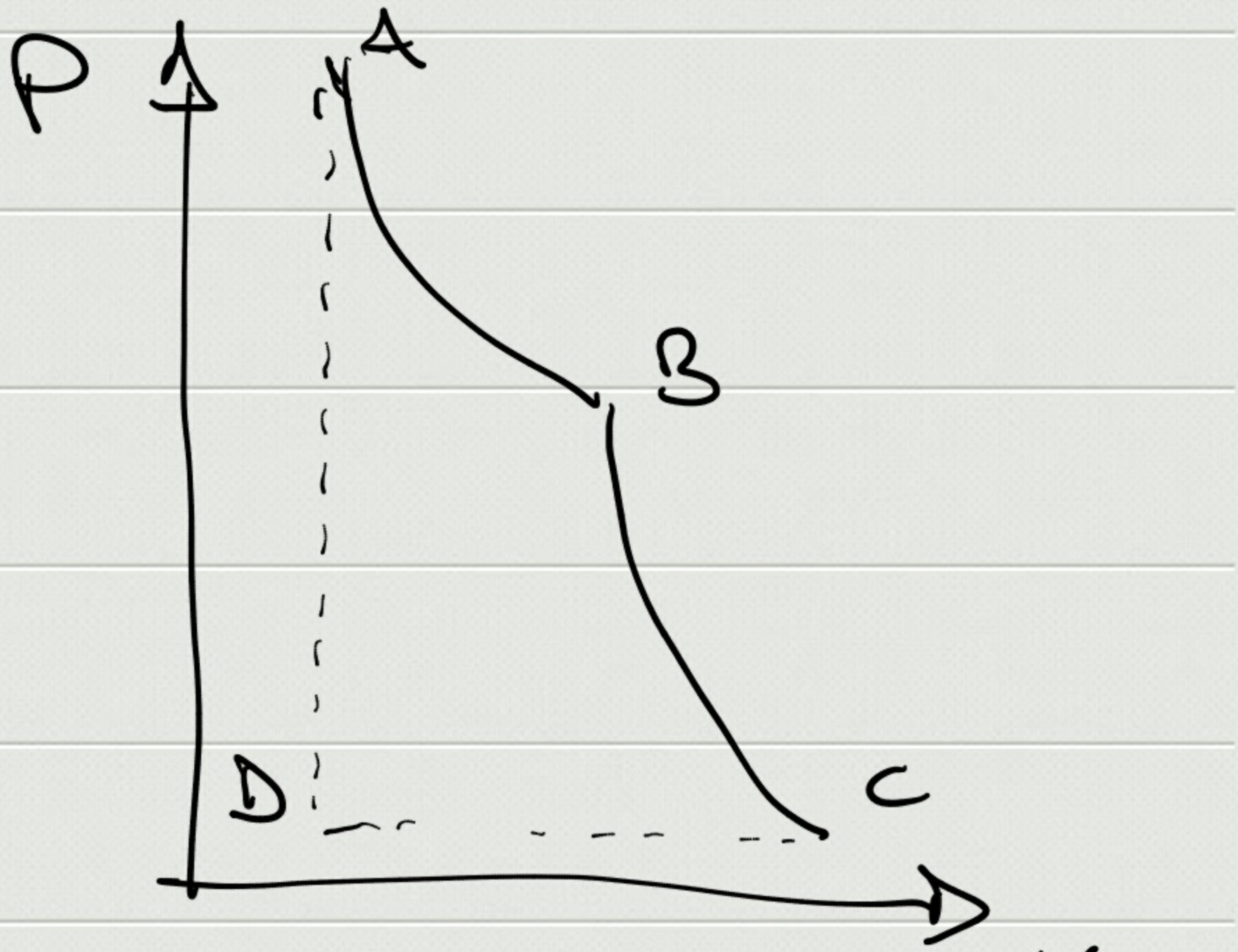
BC: esp. adiab. rev, $T_C = 250\ K$

CD: comp. isob. contatto termico $T_D = 100\ K$

DA: risc. isocoro " " T_A

$\Delta S_{gen,CD}$, $\Delta S_{gen,DA}$, $\Delta S_{gen,AB}$

η, $\Delta S_{U,ciclo}$



$$\Delta S_{gen,CD} = nC_p \ln \frac{T_D}{T_C} = -3.81\ J/K$$

$$\Delta S_{gen,DA} = nC_V \ln \frac{T_A}{T_D} = 2.75\ J/K$$

$$\Delta S_{gen,AB} = -\Delta S_{gen,CD} - \Delta S_{gen,DA} \qquad *$$

$$= 0$$

$$= nR \ln \frac{V_B}{V_A} \qquad (*)$$

$$= \Delta S_{gen,CD} + \Delta S_{gen,DA}$$

$$\Delta S_{gen,ciclo} = \Delta S_{gen,\ AB+BC+CD+DA} \Rightarrow$$

$$\Delta S_{gen,AB} = -\Delta S_{gen,\cancel{BC}+CD+DA} = 1.06\ J/K$$

$$\eta = 1 + \frac{Q_{CD}}{Q_{ASS}} = 1 + \frac{Q_{CD}}{Q_{AB} + Q_{DA}} \qquad *$$

$$\eta = \frac{W_{TOT}}{Q_{ASS}}$$

$$Q_{CD} = mc_p (T_D - T_C) \simeq -623 \text{ J}$$

$$Q_{DA} = mc_V (T_A - T_D) = 499 \text{ J}$$

$$Q_{AB} = mRT_A \ln \frac{V_B}{V_A} = T_A \Delta S_{gen,AB} = 318 \text{ J}$$

$$\Rightarrow \eta = 0.237$$

$$\simeq 3.51 \text{ J/K}$$

$$-\Delta S_U = \underbrace{\Delta S_{CD,ges} - \frac{Q_{CD}}{T_D}}_{\geq 0} + \underbrace{\Delta S_{DA,ges} - \frac{Q_{DA}}{T_A}}$$

$$\geq -\frac{Q_{AB}}{T_A} - \frac{Q_{CD}}{T_D} - \frac{Q_{DA}}{T_A} = \Delta S_{Umb,Kreis}$$

$$= \underbrace{\Delta S_{AB,ges} - \frac{Q_{AB}}{T_A}} + \underbrace{\Delta S_{CD,ges} - \frac{Q_{CD}}{T_D}} + \underbrace{\Delta S_{DA,ges} - \frac{Q_{DA}}{T_A}}$$