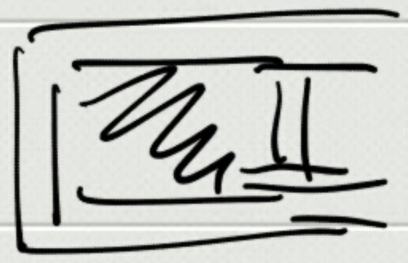
$n = 2$ mono



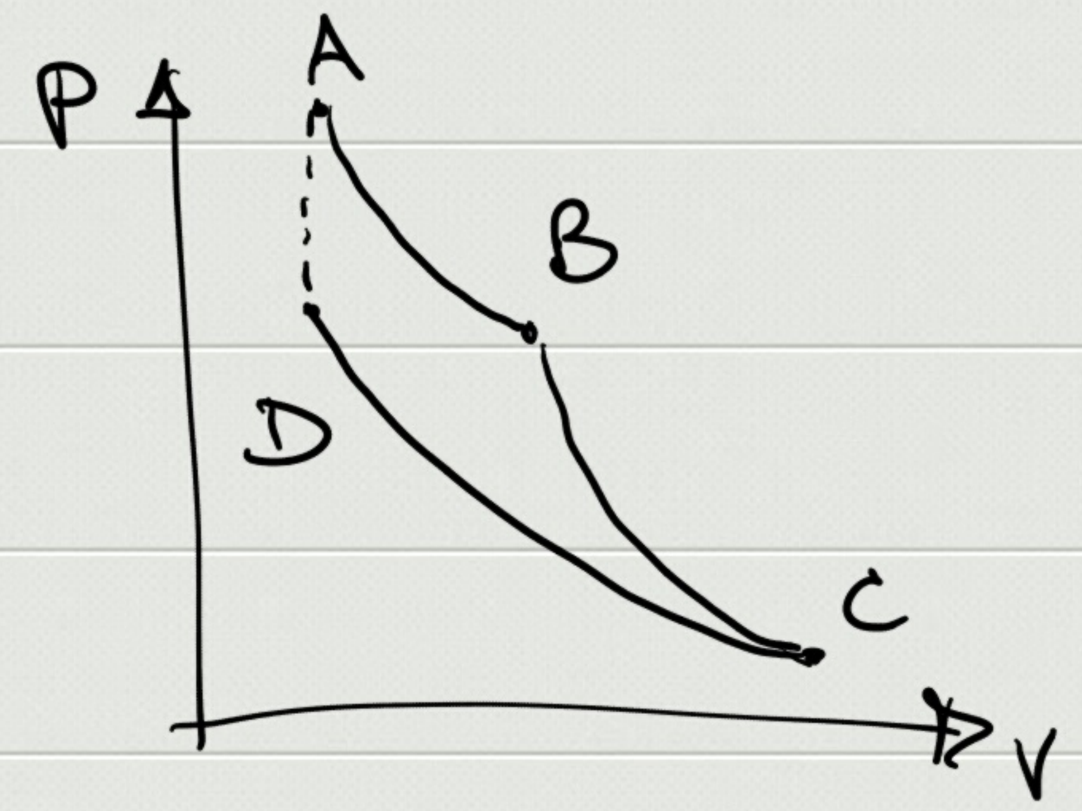
A: $T_A = 600\,K$ AB: isot. rev. $V_B = 2 V_A$

BC: adiab. rev. $V_C = 2 V_B$

CD: isot. rev. $V_D = V_A$

DA: isocora contatto termico

$W, Q, \eta, \Delta S_U$



$$W_{AB} = Q_{AB} = nRT_A \ln \frac{V_B}{V_A} = 6915\ J$$

$$W_{BC} = -\Delta U_{BC} = -nc_V (T_C - T_B) = 5538\ J$$

$$T_B V_B^{\gamma-1} = T_C V_C^{\gamma-1} \Rightarrow T_C = T_B \left(\frac{V_B}{V_C}\right)^{\gamma-1} = 378\,K$$

$$W_{CD} = Q_{CD} = nRT_C \ln \frac{V_D}{V_C} = -8713\ J$$

$$W_{DA} = 0 \qquad Q_{DA} = nc_V (T_A - T_D) = 5538\ J$$

$$\Rightarrow W = 3739\ J = Q$$

$$\eta = \frac{W}{Q_{ASS}} = \frac{W}{Q_{AB} + Q_{DA}} = 0.3$$

$$\Delta S_U = ? = \Delta S_{U,DA} = \Delta S_{gen,DA} + \Delta S_{amb,DA} =$$

$$\Delta S_{amb,DA} = -Q_{DA,gen}$$

$$= mc_V \ln \frac{T_A}{T_D} + \frac{Q_{DA,amb}}{T_A} =$$

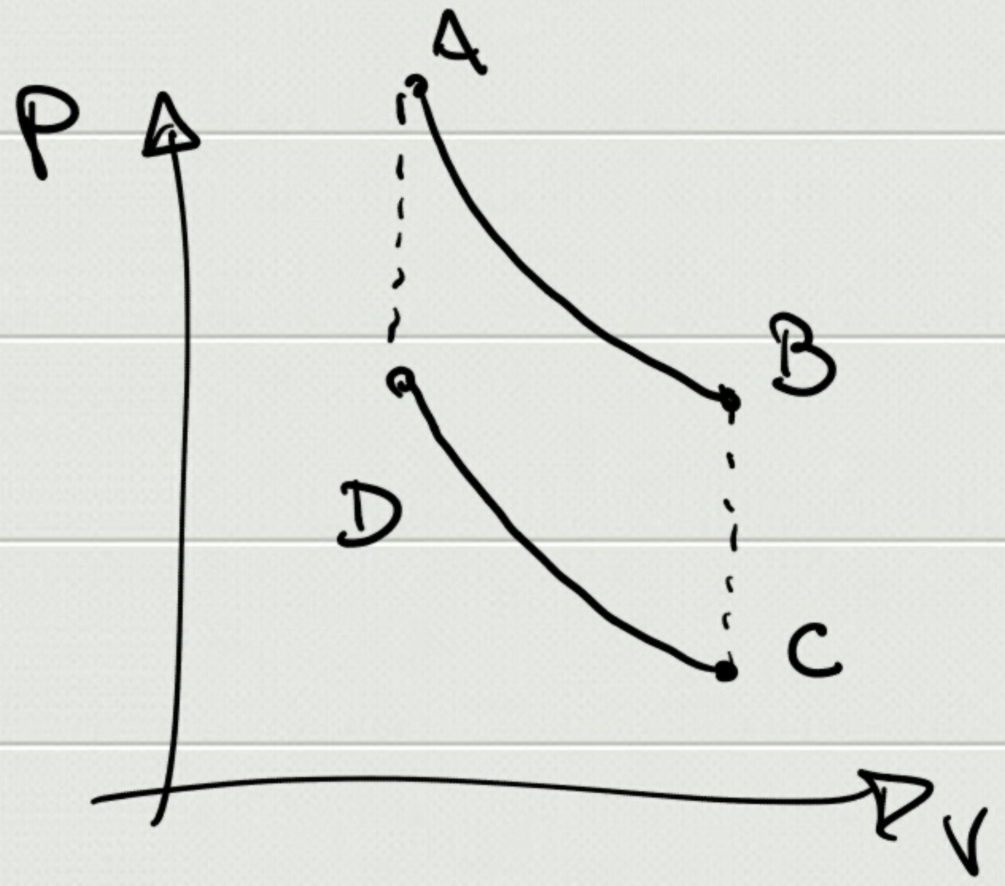
$$= mc_V \ln \frac{T_A}{T_D} + \frac{-mc_V (T_A - T_D)}{T_A} = 2.3 \text{ J/K}$$

biatomico, AB, CD isoterme rev.

BC : isocora contatto termico [T_C]

DA : " " " [T_A]

$T_A = 2T_C$ $\quad V_B = 2V_A$ $\quad \eta = ?$



$Q_{AB}, Q_{BC}, Q_{CD}, Q_{DA} \gtrless 0$?

Q_{AB}	Q_{BC}	Q_{CD}	Q_{DA}
$\vee$	$\wedge$	$\wedge$	$\vee$
0	0	0	0
*			*

$$\eta = \frac{W}{Q_{ASS}}$$

$W_{BC} = W_{DA} = 0$

$$W_{AB} = Q_{AB} = nRT_A \ln \frac{V_B}{V_A}$$

$$W_{CD} = nRT_C \ln \frac{V_D}{V_C}$$

$$Q_{DA} = nC_V (T_A - T_D)$$

$$\eta = \frac{nRT_A \ln \frac{V_B}{V_A} + nRT_C \ln \frac{V_D}{V_C}}{nRT_A \ln \frac{V_B}{V_A} + nC_V (T_A - T_D)} =$$

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

$T_A = 2T_C$

$T_D = T_C$

$$= \frac{2T_C \ln\frac{V_B}{V_A} + T_C \ln\frac{V_A}{V_B}}{2T_C \ln\frac{V_B}{V_A} + \frac{5}{2}T_C} = \frac{2\ln\frac{V_B}{V_A} - \ln\frac{V_B}{V_A}}{2\ln\frac{V_B}{V_A} + \frac{5}{2}} =$$

$$= \frac{\ln 2}{2\ln 2 + \frac{5}{2}} = 0.18$$

$n = 2 \qquad c_p = 25{,}1 \ J/kmol$

AB : isoterma rev $\qquad p_A = 10^5 \ Pa \qquad p_B = 2{,}7 \cdot 10^5 \ Pa$

$T_A = 300 \ K$

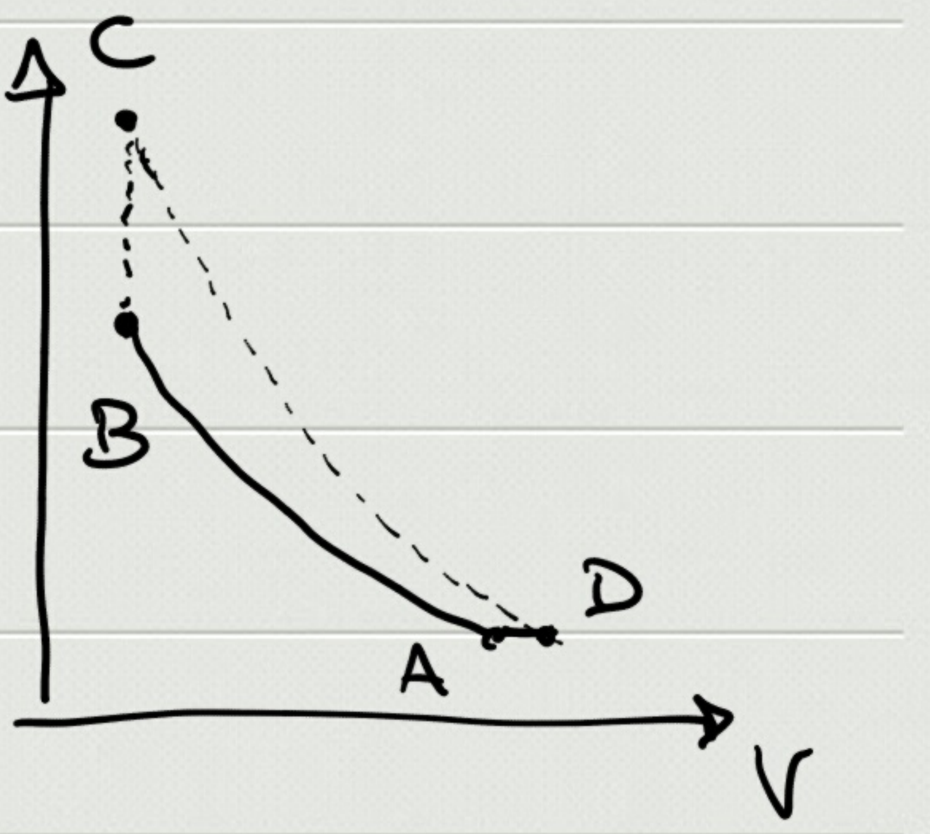
BC : isocora irrev. $\qquad Q_{BC} = 1{,}34 \cdot 10^4 \ J$

CD : adiabatica irrev. $\qquad p_D = p_A \qquad V_D = 0{,}065 \ m^3$

DA : isobara rev.

$\eta = ?$

$$\eta = \frac{W}{Q_{ASS}} = 1 + \frac{Q_{CED}}{Q_{ASS}}$$



$$Q_{AB} = W_{AB} = nRT_A \ln \frac{V_B}{V_A} = nRT_A \ln \frac{p_A}{p_B} = -5 \cdot 10^3 \ J < 0$$

$$Q_{BC} = nc_v (T_C - T_B) > 0 \quad *$$

$Q_{CD} = 0$

$\lceil \Rightarrow p_A$

$$Q_{DA} = nc_p (T_A - T_D) = \qquad T_D = \frac{p_D V_D}{nR} = 390 \ K$$

$= -4518 \ J < 0$

$$\eta = 1 + \frac{Q_{AB} + Q_{DA}}{Q_{BC}} = 0.29$$

η_{max} ?

$$Q_{BC} = n c_v (T_C - T_B) \Rightarrow T_C = T_B + \frac{Q_{BC}}{n c_v}$$

$$c_v = c_p - R \qquad \Rightarrow T_C = 700\ K$$

$$\eta_{max} = 1 - \frac{T_A}{T_C} = 0.57$$