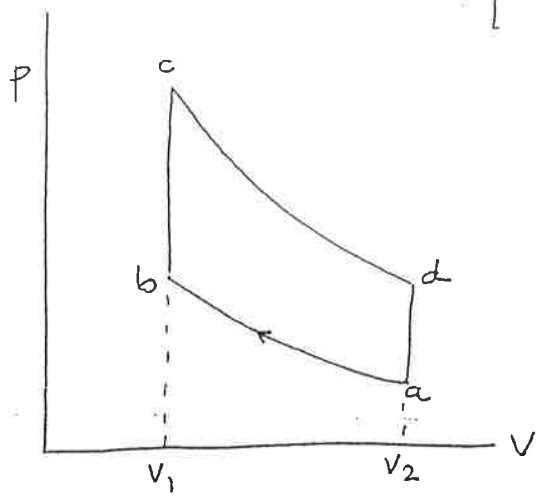

- Evolución (ab) $\Delta S_{ab} = 0$, $Q_{ab} = 0$

- Evol. (bc) V cte : $W_{bc} = 0$

$$Q_{bc} = \Delta E_i = \frac{nR}{\gamma - 1}(T_c - T_b) > 0$$

$$\Delta S_{bc} = \frac{nR}{\gamma - 1} \ln \frac{T_c}{T_b}$$

- Evol. (cd) $\Delta S_{cd} = 0$, $Q_{cd} = 0$

- Evol. (da) V cte , $W_{da} = 0$, $Q_{da} = \Delta E_i = \frac{nR}{\gamma - 1}(T_a - T_d) < 0$

$$\Delta S_{da} = \frac{nR}{\gamma - 1} \ln \frac{T_a}{T_d}$$

- Para el ciclo completo $\Delta S = 0$

$$\frac{nR}{\gamma - 1}\left(\ln \frac{T_c}{T_b} + \ln \frac{T_a}{T_d}\right) = 0 \qquad \frac{T_c}{T_b} \cdot \frac{T_a}{T_d} = 1 \quad , \quad \frac{T_a}{T_d} = \frac{T_b}{T_c}$$

$$- \eta = 1 - \frac{|Q_{da}|}{Q_{bc}} = 1 - \frac{T_d - T_a}{T_c - T_b} = 1 - \frac{T_d}{T_c} \cdot \frac{1 - \frac{T_a}{T_d}}{1 - \frac{T_b}{T_c}} = 1 - \frac{T_d}{T_c}$$

- En evolución isentrópica (cd)

$$T_c V_1^{\gamma - 1} = T_d V_2^{\gamma - 1} \quad , \quad \frac{T_d}{T_c} = \left(\frac{V_1}{V_2}\right)^{\gamma - 1} = \epsilon^{\gamma - 1}$$

Sustituyendo :

$$\eta = 1 - \epsilon^{\gamma - 1}$$