

Pauta ej. #1

• 1 mol

(a) exp. isotérmica $(P_1, V_1, T_1) \rightarrow (P_2, V_2, T_2)$

• $T = \text{cte} \Rightarrow \Delta E_a = 0$

• $W_a = \int_{V_1}^{V_2} P dV = \int_{V_1}^{V_2} (PV) \cdot \frac{dV}{V} = P_1 V_1 \ln(V_2/V_1) \quad \left/ \begin{array}{l} \text{g.c.} \\ PV = RT \end{array} \right.$
 $= RT_1 \ln(V_2/V_1)$

• 1° ley: $dE = dQ - dW \Rightarrow Q_a = W_a = RT_1 \ln(V_2/V_1)$

(b) (i) exp. adiabática $(P_1, V_1, T_1) \rightarrow (P_3, V_2, T_2)$
(ii) Calent. a Vcte $(P_3, V_2, T_2) \rightarrow (P_2, V_2, T_1)$

(i) Proceso B: • $Q_B = 0$

• $\Delta E_B = C_V (T_2 - T_1)$

• 1° ley $\rightarrow \Delta E_B = Q_B - W_B \Rightarrow W_B = C_V (T_1 - T_2)$

(ii) Proceso C: • Vcte $\rightarrow W_C = \int P dV = 0$

• $\Delta E_C = C_V (T_1 - T_2)$

• 1° ley $\rightarrow Q_C = C_V (T_1 - T_2)$

$\Rightarrow$ Para (B+C): $Q_{B+C} = C_V (T_1 - T_2) + 0 = C_V (T_1 - T_2)$

$W_{B+C} = C_V (T_1 - T_2) + 0 = C_V (T_1 - T_2)$

$\Delta E_{B+C} = C_V (T_1 - T_2) - C_V (T_1 - T_2) = 0$

- (C) (i) exp. Pcte $(P_1, V_1, T_1) \rightarrow (P_1, V_2, T_3)$
 (ii) enfriam. Vcte $(P_1, V_2, T_3) \rightarrow (P_2, V_2, T_1)$

(C) Proceso D: Pcte

$$\Delta E_D = C_V(T_3 - T_1) \quad / \text{ donde } T_3 = \frac{P_1 \cdot V_2}{R}$$

$$W_D = \int_{V_1}^{V_2} P_1 dV = P_1(V_2 - V_1)$$

$$1^\circ \text{ ley} \Rightarrow Q_D = C_V(T_3 - T_1) + P_1(V_2 - V_1)$$

(ii) Proceso E: Vcte

$$W_E = \int P dV = 0$$

$$\Delta E_E = C_V(T_1 - T_3)$$

$$Q_E = C_V(T_1 - T_3)$$

(1º ley)

$$\Rightarrow \text{Para (D+E)}: Q_{D+E} = C_V(T_3 - T_1) + P_1(V_2 - V_1) + C_V(T_1 - T_3) = P_1(V_2 - V_1)$$

$$W_{D+E} = P_1(V_2 - V_1) + 0 = P_1(V_2 - V_1)$$

$$\Delta E_{D+E} = C_V(T_3 - T_1) + C_V(T_1 - T_3) = 0$$

(d) Ciclo (B + C + E + D)

$$\Delta E_t = 0 \text{ (ciclo cerrado)}$$

$$Q_t = \sum Q_i = Q_B + Q_C + Q_E + Q_D$$

$$W_t = W_B + W_C + W_E + W_D$$

$$\left. \begin{array}{l} 1^\circ \text{ ley sist. completa} \\ \Delta E_t = Q_t - W_t \\ Q_t = W_t \end{array} \right\} \text{ ó } \Delta E_t = 0$$