

Entregable grupal 3.

1. a)



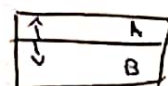
$$V_{Ai} = V_{Bi} = 5 \text{ l}$$

$$T_{Ai} = T_{Bi} = 293 \text{ K}$$

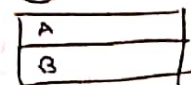
$$P_{Ai} = 3 \cdot 10^5 \text{ Pa}$$

$$P_{Bi} = 2 \cdot 10^5 \text{ Pa}$$

2



3



a) $\dot{c} T_{Af}, T_{Bf}$? $\dot{c} P_{Af}, P_{Bf}$? $\dot{c} V_{Af}, V_{Bf}$?

El sistema es un depósito adiabático cuyo volumen no cambia $\Rightarrow Q=0$; $dV=0$

$\Downarrow$

$$dV=0 \Rightarrow W=0 \Rightarrow \Delta U = Q + W = 0 + 0 \Rightarrow \Delta U = 0 \Rightarrow \Delta U = n \underbrace{C_{v,m}}_{\text{de}} \Delta T = 0 \Rightarrow \Delta T = 0$$

Es un proceso isoterma $\Rightarrow \Delta T_A = \Delta T_B = 0$

Por tanto $\Rightarrow T_{Af} = T_{Ai} = T_{Bf} = T_{Bi} = 293 \text{ K}$

Cuando el émbolo alcanza el equilibrio $\Rightarrow P_{Af} = P_{Bf}$

$$PV = nRT \Rightarrow P_{Af} = \frac{n_A R T_{Af}}{V_{Af}} ; P_{Bf} = \frac{n_B R T_{Bf}}{V_{Bf}} \Rightarrow \frac{n_A R T_{Af}}{V_{Af}} = \frac{n_B R T_{Bf}}{V_{Bf}} \Rightarrow n_A \frac{T_{Af}}{V_{Af}} = n_B \frac{T_{Bf}}{V_{Bf}}$$

$$\frac{n_A}{V_{Af}} = \frac{n_B}{V_{Bf}}$$

$\Rightarrow n_{Af} = n_{Ai} = n_A$ y $n_{Bf} = n_{Bi} = n_B$ porque la masa se conserva.

$$n_A = \frac{P_{Af} V_{Af}}{R T_{Af}} = \frac{P_{Ai} V_{Ai}}{R T_{Ai}} = 0.6158 \text{ mol} ; n_B = \frac{P_{Bf} V_{Bf}}{R T_{Bf}} = \frac{P_{Bi} V_{Bi}}{R T_{Bi}} = 0.4105 \text{ mol}$$

$$\frac{n_A}{V_{Af}} = \frac{n_B}{V_{Bf}} \Rightarrow V_A = \frac{n_A}{n_B} V_{Bf} \Rightarrow \text{El volumen del depósito no varía: } V_{Af} + V_{Bf} = 10 \text{ l}$$

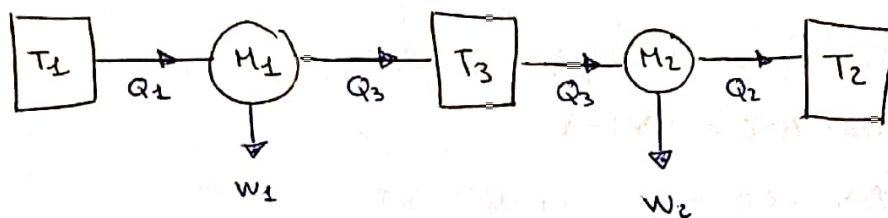
$$V_{Af} = 0.01 - V_{Bf} = \frac{n_A}{n_B} V_{Bf} \Rightarrow V_{Bf} \left(\frac{n_A}{n_B} + 1 \right) = 0.01 \Rightarrow V_{Bf} = 0.004 \text{ m}^3 \Rightarrow V_{Ai} = 0.006 \text{ m}^3$$

$$P_{Af} = \frac{n_A R T_{Af}}{V_{Af}} = 2.5 \cdot 10^5 \text{ Pa} = P_{Bf} \Rightarrow P_{Af} = P_{Bf} = 2.5 \cdot 10^5 \text{ Pa}$$

b) $\Delta S = \frac{Q}{T} = 0$ por ser adiabático (el sistema).

Es un proceso reversible porque no se realiza de forma brusca y el gas se acostumbra a los cambios en el sistema.

Entregable grupal 3.



$$T_1 = 490 \text{ K}$$

$$T_2 = 250 \text{ K}$$

$$\eta_1 = \eta_2$$

$$\dot{Q}_3? \quad \dot{W}_1, \dot{W}_2? \quad \dot{Q}_2? \quad Q_1 = 147 \text{ KJ}$$

Máquina 1: absorbe energía (Q_1) y la cede (W_1, Q_3) $\Rightarrow |Q_1| - |W_1| = |Q_3|$

$$|W_1| = |Q_1| - |Q_3|$$

Máquina 2: absorbe energía (Q_3) y la cede (Q_2, W_2) $\Rightarrow |Q_3| - |W_2| = |Q_2|$

$$|W_2| = |Q_3| - |Q_2|$$

$$\text{Rendimiento de un ciclo} \equiv \eta_1 = \frac{Q_3}{W_1} = \frac{Q_3}{Q_1 - Q_3} \quad ; \quad \eta_2 = \frac{Q_2}{W_2} = \frac{Q_2}{Q_3 - Q_2}$$

$$\eta_1 = \eta_2 \Rightarrow \frac{Q_3}{Q_1 - Q_3} = \frac{Q_2}{Q_3 - Q_2} \Rightarrow Q_3(Q_3 - Q_2) = Q_2(Q_1 - Q_3) \Rightarrow Q_3^2 - Q_3Q_2 + Q_3Q_2 = Q_2Q_1$$

$$Q_3^2 = Q_2Q_1$$

$$\Delta S = \frac{Q}{T} \equiv \text{cte en un ciclo} \Rightarrow \frac{Q_1}{T_1} = \frac{Q_3}{T_3} = \frac{Q_2}{T_2} \Rightarrow$$

$$Q_3 = Q_1 \frac{T_3}{T_1}$$

$$Q_2 = Q_1 \frac{T_2}{T_1} = 147 \cdot 10^3 \frac{250}{490}$$

$$Q_2 = 75 \text{ KJ} \Rightarrow Q_3^2 = Q_2Q_1 \Rightarrow Q_3 = 105 \text{ KJ}$$

$$T_3 = Q_3 \frac{T_1}{Q_1} = 105 \cdot 10^3 \frac{490}{147 \cdot 10^3} \Rightarrow T_3 = 350 \text{ K}$$

$$W_1 = Q_1 - Q_3 = 147 - 105$$

$$W_2 = Q_3 - Q_2 = 105 - 75$$

$$W_1 = 42 \text{ KJ}$$

$$W_2 = 30 \text{ KJ}$$

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