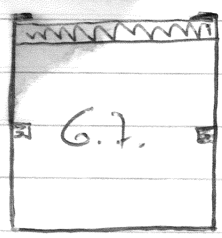
EJERCICIO 1:



(1) $P_1 = 1\,MPa$
$T_1 = 500°C = 773{,}15\,K$
$V_1 = 3\,m^3$

$\rightarrow n = \dfrac{P_1 V_1}{\bar{R} T_1}$ $\boxed{n \approx 0{,}467\ kmol}$

(2) $T_2 = 30°C = 303{,}15\,K$ | $\bar{C_v} = \dfrac{3}{2}\bar{R}$ (MONOATÓMICO)

(a) SE DEBE SABER: • SI SUELTA LOS TOPES SUPERIORES
• SI TOCA LOS TOPES INFERIORES

ESTADO A: AL MOMENTO DE SOLTAR LOS TOPES SUPERIORES $\longrightarrow$ $P_A = 700\,kPa$, $V_A = 3\,m^3$

$\rightarrow T_A = \dfrac{P_A V_A}{n\bar{R}}$

$T_A \approx 540{,}8\,K > T_2$

EL PROCESO CONTINUA!

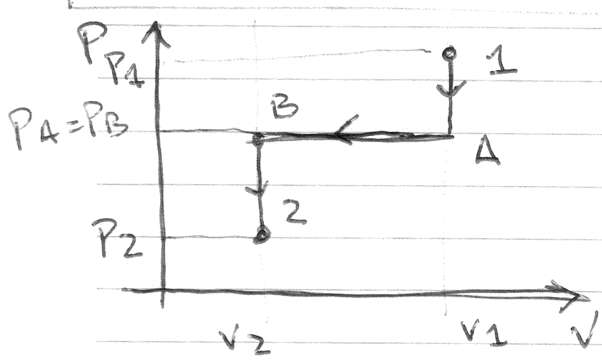
ESTADO B: AL MOMENTO DE TOCAR LOS TOPES INFERIORES $\longrightarrow$ $P_B = 700\,kPA$, $V_B = 2\,m^3$

$\rightarrow T_B = \dfrac{P_B V_B}{n\bar{R}}$

$T_B \approx 360{,}6\,K > T_2$

EL PROCESO CONTINUA!

=> MIENTRAS LA SUSTANCIA SE ENFRÍA, LA PRESIÓN DISMINUYE HASTA SOLTAR LOS TOPES SUPERIORES, LUEGO DISMINUYE el Volumen A PRESIÓN CONSTANTE HASTA TOCAR LOS TOPES INFERIORES, Y FINALMENTE CONTINUA DISMINUYENDO LA PRESIÓN.



(b) $T_2 = 30°C = 303{,}15\,K$
$V_2 = 2\,m^3$

$\Rightarrow \boxed{P_2 = \dfrac{n\bar{R}T_2}{V_2} \approx 588{,}5\,K}$

(c) ${}_1\Delta S_2^{U} = {}_1\Delta S_2^{6.2.} + {}_1\Delta S_2^{AMB} \longrightarrow {}_1\Delta S_2^{6.2} = n\bar{C_v}\,L\left(\dfrac{T_2}{T_1}\right) + n\bar{R}\,L\left(\dfrac{V_2}{V_1}\right)$

$\Rightarrow \boxed{{}_1\Delta S_2^{6.2} \approx -7{,}02\ kJ/K}$

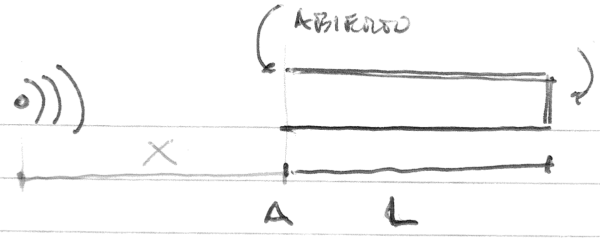
$\rightarrow {}_1\Delta S_2^{AMB} = -\dfrac{Q}{T_0}$

$\rightarrow Q = {}_1\Delta U_2 + {}_1W_2^{POR}$
$= n\bar{C_v}(T_2 - T_1) + P_A(V_2 - V_1)$

$\Rightarrow \boxed{Q \approx -3437{,}4\ kJ} \Rightarrow \boxed{\Delta S^{AMB} \approx 11{,}73\ kJ/K}$

$\Rightarrow \boxed{{}_1\Delta S_2^{U} \approx \cancel{6{,}28\ kJ/K}\ 4{,}71\ kJ/K}$

EJERCICIO 2:



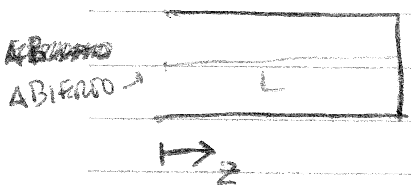
• $L = 1m$

(a) $\bar{P} = 20\,W$

$\bar{\Phi}_A = 90\,db \longrightarrow \boxed{I_A = 10^{-3}\,w/m^2}$

$$\bar{P} = I_A (4\pi x^2) \implies \boxed{x = \sqrt{\frac{\bar{P}}{4\pi I_A}} \approx 39{,}9m}$$

(b) HAY QUE HALLAR LA FRECUENCIA DE LOS TRES PRIMEROS MODOS.



CONDICIONES DE BORDE: $\Delta P(0,t) = 0 \ \forall t$; $s(L,t) = 0 \ \forall t$

• $s(z,t) = S_m \cos(kz + \delta)\cos(\omega t + \phi)$

• $\Delta P(z,t) = \Delta P_M \,\text{sen}(kz + \delta)\cos(\omega t + \phi)$

$\Delta P(z,t) = -B \frac{\partial s}{\partial z}(z,t)$

$\Delta P_m = S_m . Bk$

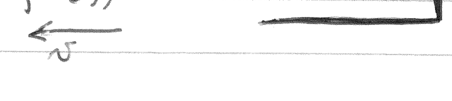
$\implies \Delta P(0,t) = \Delta P_M \,\text{sen}(\delta)\cos(\omega t + \phi) = 0 \ \forall t \implies \boxed{\delta = 0}$

$\implies s(L,t) = S_m \cos(kL)\cos(\omega t + \phi) = 0 \ \forall t \implies kL = \frac{(2n-1)\pi}{2}$

$$k = \frac{\omega}{v_s} = \frac{2\pi f}{v_s} \implies \boxed{f_n = \frac{(2n-1)\, v_s}{4L}}$$

$f_1 \approx 85{,}75\,Hz$
$f_2 \approx 257{,}25\,Hz$
$f_3 \approx 428{,}75\,Hz$

(c)



$$f_3 = f\frac{v_s}{v_s - v}, \quad f_2 = f\frac{v_s}{v_s + v} \longrightarrow \frac{f_3}{f_2} = \frac{v_s + v}{v_s - v} \longrightarrow \boxed{v = \frac{v_s(f_3 - f_2)}{f_3 + f_2}}$$

$$\boxed{v = \frac{v_s}{4} \approx 85{,}75\,m/s = 308{,}7\,km/h}$$

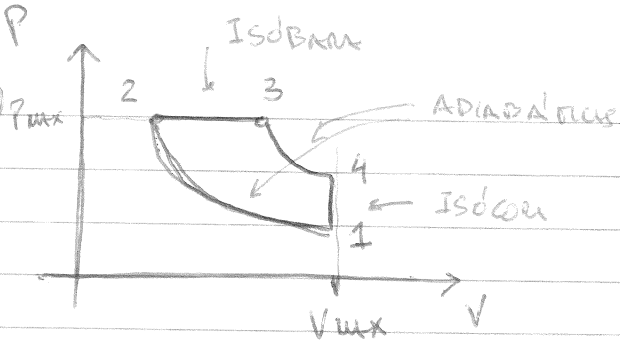
$$\implies f = f_2\frac{(v_s + v)}{v_s} = f_2\frac{(\frac{5}{4}\cancel{v_s})}{\cancel{v_s}} = \frac{5}{4}f_2 \longrightarrow \boxed{f \approx 321{,}6\,Hz}$$

PRIME

PREGUNTA A:

- $P_2 = P_3 = P_{max}$
- $V_4 = V_1 = V_{max}$

(a)



(b) $\eta = \dfrac{W}{Q_H}$

- Q_H: ETAPA ISÓBARA $\Rightarrow$ $\boxed{Q_H = mc_P(T_3 - T_2)}$
- $W = {}_1W_2 + {}_2W_3 + {}_3W_4 \quad ({}_4W_1 = 0)$

$$W = -mc_v(T_2 - T_1) - mc_v(T_4 - T_3) + \overbrace{P_{max}(V_3 - V_2)}^{mR(T_3 - T_2)}$$

$$= m\left[c_v(T_3 + T_1 - T_4 - T_2) + R(T_3 - T_2)\right]$$

$$\boxed{W = m\left[c_P(T_3 - T_2) + c_v(T_1 - T_4)\right]}$$

$$\Rightarrow \eta = \frac{W}{Q_H} = 1 + \frac{1}{\gamma}\left[\frac{(T_1 - T_4)}{T_3 - T_2}\right]$$

- $1 \to 2$ ADIABÁTICO $\Rightarrow T_1 V_1^{(\gamma-1)} = T_2 V_2^{(\gamma-1)}$
- $3 \to 4$ ADIABÁTICA $\Rightarrow T_3 V_3^{(\gamma-1)} = T_4 V_4^{(\gamma-1)}$
- $2 \to 3$ ISÓBARA $\Rightarrow T_2/V_2 = T_3/V_3$

ETAPA $4 \to 1$ ISÓCORA $\}$ $V_1 = V_4 = V_{max}$

$$\Rightarrow \eta = 1 + \frac{1}{\gamma}\left[\frac{\left(\frac{V_2}{V_3}\right)\cancel{T_3}\left(\frac{V_2}{V_1}\right)^{(\gamma-1)} - \cancel{T_3}\left(\frac{V_3}{V_4}\right)^{(\gamma-1)}}{\cancel{T_3} - \left(\frac{V_2}{V_3}\right)\cancel{T_3}}\right]$$

$$= 1 + \frac{1}{\gamma}\left[\frac{\left(\frac{V_2}{V_3}\right)\left(\frac{V_1}{V_2}\right)\left(\frac{V_2}{V_1}\right)^{\gamma} - (V_4/V_3)(V_3/V_4)^{\gamma}}{V_3 - V_2}\right]V_3$$

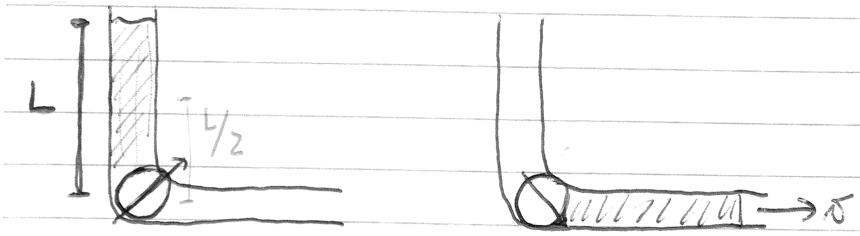
$\Rightarrow$

$$\eta = 1 + \frac{V_{max}}{\gamma}\left[\frac{(V_2/V_{max})^{\gamma} - (V_3/V_{max})^{\gamma}}{V_3 - V_2}\right]$$

$$\Rightarrow \boxed{\eta = 1 + \frac{1}{\gamma}\left[\frac{(V_2/V_{max})^{\gamma} - (V_3/V_{max})^{\gamma}}{(V_3/V_{max}) - (V_2/V_{max})}\right]}$$

norma

PREGUNTA B:



INICIAL FINAL

EL SISTEMA ES CONSERVATIVO

$$\Rightarrow \boxed{\Delta E_p + \Delta E_c = 0}$$

$$\Delta E_p = -mg\left(\frac{L}{2}\right)$$ (lo que baja el centro de masa)

$$\Delta E_c = \frac{mv^2}{2}$$

$$\Rightarrow \frac{mv^2}{2} - \frac{mgL}{2} = 0$$

$$\boxed{v = \sqrt{gL}}$$

Depende del largo de la columna y la aceleración gravitatoria.

(b) g' – aceleración gravitatoria en Marte

$$\boxed{g' = \frac{v^2}{L} \approx 3.72\ m/s^2}$$