EXAMEN JULIO 2013 : FÍSICA 2

$|A = 5\,cm|$

EJERCICIO 1 : $Y_1(x,t) = A\,sen\,(1{,}40x + 0{,}60t)$ $\to$ $K = 1{,}40\ rad/m$, $w = 0{,}60\ rad/s$

(a) $\boxed{v = \frac{w}{K} \approx 0{,}43\ m/s}$

T' - tensión ($T' = 100N$)

T - PERIODO

(b) $P(x,t) = Fv = \left(T'\frac{\partial Y}{\partial x}(x,t)\right)\left(\frac{\partial Y}{\partial t}(x,t)\right) = T'A^2wK\cos^2(Kx+wt)$

$$\langle P\rangle = \frac{1}{T}\int_0^T P(x,t)\,dt = \frac{T'A^2wK}{T}\underbrace{\int_0^T \cos^2(Kx+wt)\,dt}_{= T/2}$$

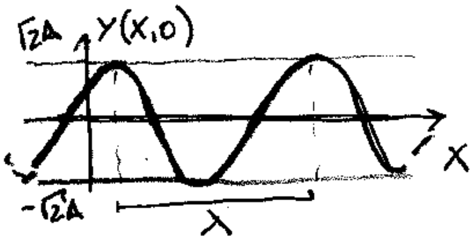
$$\Rightarrow \boxed{\langle P\rangle = \frac{T'A^2wK}{2} \approx 0{,}105\,W}$$

(c) $Y(x,t) = Y_1(x,t) + Y_2(x,t) = A\,sen\,(Kx+wt) + A\,sen(Kx - wt + \pi/2)$

$$= A\left[2\,sen\left(\frac{2Kx+\pi/2}{2}\right)\cos\left(\frac{2wt - \pi/2}{2}\right)\right]$$

$$\Rightarrow \boxed{Y(x,t) = 2A\,sen\,(Kx+\pi/4)\cos(wt-\pi/4)}$$ ONDA ESTACIONARIA.

$$\to Y(x,0) = 2A\,sen(Kx+\pi/4)\underbrace{\cos(-\pi/4)}_{\sqrt{2}/2} \Rightarrow \boxed{Y(x,0) = \sqrt{2}A\,sen(Kx+\pi/4)}$$



$\boxed{\lambda = \frac{2\pi}{K} \approx 4{,}49\,m}$

(d) $X_1 = 0{,}25\,m \to Y(X_1,t) = 2A\,sen(KX_1+\pi/4)\overbrace{\cos(wt-\pi/4)}^{\leq 1}$

$$\Rightarrow \boxed{Y^1_{MAX} = 2A\,sen\,(KX_1+\pi/4) \approx 9\,cm}$$

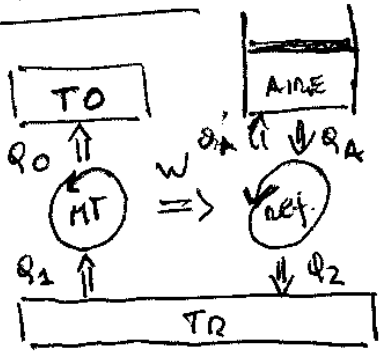
(e) LOS ANTINODOS SE UBICAN EN X TAL QUE $\to$ $KX + \pi/4 = \frac{(2n-1)}{2}\pi \Rightarrow KX = n\pi - 3\pi/4$ CONDICIÓN PARA ANTINODO

$$\Rightarrow \boxed{X = \frac{1}{K}\left[n\pi - \frac{3\pi}{4}\right]}$$ POSICIONES DE LOS ANTINODOS

$$\boxed{X_1^{ANTI} = \frac{\pi}{4K} \approx 0{,}56\,m \quad X_2^{ANTI} = \frac{5\pi}{4K} \approx 2{,}80\,m \quad X_3^{ANT} = \frac{9\pi}{4K} \approx 5{,}05\,m}$$

EJERCICIO 2

$M_A =$ [redacted] kg ; $T_R = 500^\circ C$; $T_0 = 20^\circ C$
0,5



1A) $T_{1A} = 20^\circ C$ | $Q_0 = 10\,kJ$

$P_{1A} = 200\,kPa$ | $Q_2 = 24\,kJ$

ⓐ MT rev. $T_0, T_R = cte$ $\Big\} \Rightarrow \boxed{\dfrac{Q_1}{T_R} = \dfrac{Q_0}{T_0}}$

$$W = Q_1 - Q_0 = Q_0\left(\frac{Q_1}{Q_0} - 1\right) = Q_0\left(\frac{T_R}{T_0} - 1\right)$$

$\Rightarrow \boxed{W \approx 16{,}37\,kJ} \Rightarrow \boxed{Q_1 = W + Q_0 \approx 26{,}37\,kJ}$

$\Rightarrow \boxed{Q_A = Q_2 - W \approx 7{,}63\,kJ}$ en A) PROCESO A $P = cte$

$W_A = P_{1A}(V_{2A} - V_{1A})$

ⓑ 1° ley AIRE $\longrightarrow {}_1\Delta U_2^A = +Q_A' - {}_1W_2^A = -Q_A - {}_1W_2^A$

$$\Rightarrow -Q_A = {}_1\Delta U_2^A + {}_1W_2^A = M_A c_v (T_{2A} - T_{1A}) + P_{1A}(V_{2A} - V_{1A})$$

$$= M_A c_v (T_{2A} - T_{1A}) + M_A R (T_{2A} - T_{1A})$$ ✓ EC. ESTADO

$$= M_A (c_v + R)(T_{2A} - T_{1A}) = M_A c_P \Delta T$$

$$\Rightarrow T_{2A} = T_{1A} - \frac{Q_A}{M c_P} \Rightarrow \boxed{T_{2A} \approx 4{,}8^\circ C}$$

ⓒ $${}_1\Delta S_2^A = M_A c_P L\left(T_{2A}/T_{1A}\right) - M_A R \underbrace{L\left(P_{2A}/P_{1A}\right)}_{0} \quad \boxed{P_{2A} = P_{1A}}$$

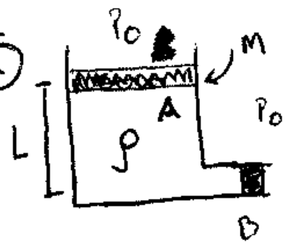
$$= M_A c_P L\left(T_{2A}/T_{1A}\right) \longrightarrow \boxed{{}_1\Delta S_2^A \approx -26{,}7\,J/K}$$

ⓓ $${}_1\Delta S_2^{UNIV} = {}_1\Delta S_2^A + \frac{Q_0}{T_0} + \frac{(Q_2 - Q_1)}{T_R}$$

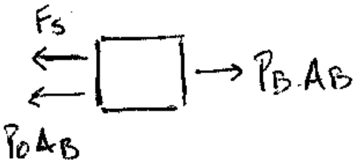
$$\approx -26{,}7\,J/K + 34{,}1\,J/K - 3{,}1\,J/K \Bigg\} \boxed{{}_1\Delta S_2^{UNIV} \approx 4{,}3\,J/K}$$

EJERCICIO 3: $r_A = 1m \longrightarrow A_A \approx 3{,}14\, m^2$
$r_B = 0{,}05m \longrightarrow A_B \approx 0{,}0078\, m^2$ } $A_A \gg A_B$!
$L = 1{,}5m$

ⓐ



NEWTON AL TAPÓN



EN EL CASO LÍMITE

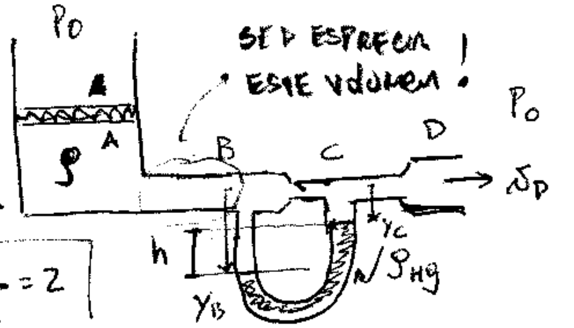
$$\boxed{P_B A_B = F_s + P_o A_B}$$

$$P_B = P_o + \rho g L + \frac{Mg}{A_A} \Rightarrow A_B\left(\cancel{P_o} + \rho g L + \frac{Mg}{A_A}\right) = F_s + \cancel{P_o} A_B$$

$$\Rightarrow \boxed{M = \frac{A_A}{g}\left[\frac{F_s}{A_B} - \rho g L\right] \approx 3{,}5\ \text{ton}}$$

MASA MÍNIMA PARA QUE SE DESPRENDA EL TAPÓN.

ⓑ



$$\boxed{\frac{A_B}{A_C} = 2}$$

$\longrightarrow V_1 = \pi r_A^2 L$

$V_2 = \pi r_A^2 L' = (0{,}4)\, V_1$

$$\Rightarrow \boxed{L' = (0{,}4)\, L \approx 0{,}6m}$$

BERNOULLI de $A \to D \Rightarrow \cancel{P_o} + \frac{Mg}{A_A} + \rho g L' = \cancel{P_o} + \frac{\rho v_D^2}{2}$ $\left(\begin{array}{c} A_A \gg A_B \\ \downarrow v_A \approx 0 \end{array}\right)$

$$\Rightarrow \boxed{v_D = \sqrt{2gL' + \frac{2Mg}{\rho A_A}} \approx 5{,}8\ m/s}$$

POR CONTINUIDAD → $A_D v_B = A_C v_C$

$\hookrightarrow \boxed{v_B = v_D}$ $\boxed{\frac{v_C}{v_B} = \frac{A_B}{A_C}}$

ⓒ BERNOULLI $A \to B \Rightarrow P_B + \frac{\rho v_B^2}{2} = P_o + \frac{Mg}{A_A} + \rho g L'$

BERNOULLI $A \to C \Rightarrow P_C + \frac{\rho v_C^2}{2} = P_o + \frac{Mg}{A_A} + \rho g L'$

} $P_B - P_C = \frac{\rho}{2}(v_C^2 - v_B^2)$

$$\Rightarrow P_B - P_C = \frac{\rho}{2} v_B^2 \left[\left(\frac{A_B}{A_C}\right)^2 - 1\right] = \frac{3}{2}\rho v_B^2$$

$$\Rightarrow P_B + \rho g y_B = P_C + \rho g y_C + \rho_{Hg}\, g h \Rightarrow P_B - P_C = \rho_{Hg}\, g h + \rho g \underbrace{(y_3 - y_2)}_{-h}$$

$$\Rightarrow \left.\begin{array}{l} P_B - P_C = \frac{3}{2}\rho v_B^2 \\ P_B - P_C = g h(\rho_{Hg} - \rho) \end{array}\right\} \Rightarrow \boxed{h = \frac{3\rho v_B^2}{2g(\rho_{Hg} - \rho)} \approx 40{,}8\ cm}$$