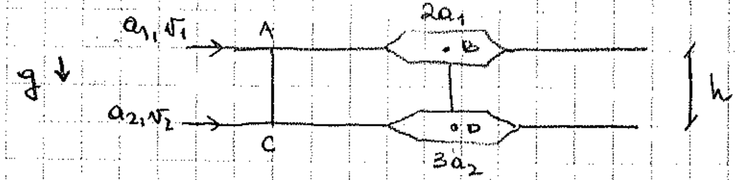
1er PARCIAL 4/05/2015

PROBLEMA 1.



PARTE A

Ec Continuidad (1) $a_1 v_1 = 2a_1 v'_1 \rightarrow v'_1 = 1/2\, v_1$

(2) $a_2 v_2 = 3a_2 v'_2 \rightarrow v'_2 = 1/3\, v_2$

Ec Hidrostática (A-C) $P_C = P_A + \rho g h \rightarrow P_C - P_A = \rho g h$

(B-D) $P_D = P_B + \rho g h \rightarrow P_D - P_B = \rho g h$

Ec Bernoulli (1) $P_A + \rho \frac{v_1^2}{2} = P_B + \rho \frac{v_1'^2}{2} \rightarrow P_B = P_A + \frac{3}{8}\rho v_1^2$

(2) $P_C + \rho \frac{v_2^2}{2} = P_D + \rho \frac{v_2'^2}{2} \rightarrow P_D = P_C + \frac{4}{9}\rho v_2^2$

$$P_D - P_B = P_C - P_A + \rho\left[\frac{4}{9} v_2^2 - \frac{3}{8} v_1^2\right]$$

$$\rho g h = \rho g h + \rho\left[\frac{4}{9} v_2^2 - \frac{3}{8} v_1^2\right]$$

ENTONCES $\frac{4}{9} v_2^2 = \frac{3}{8} v_1^2 \rightarrow \frac{v_1}{v_2} = \left(\frac{4}{9} \times \frac{8}{3}\right)^{1/2} = \frac{2}{3}\sqrt{\frac{8}{3}} = \frac{4\sqrt{2}}{3\sqrt{3}}$

$$\boxed{v_1/v_2 = 1{,}089}$$

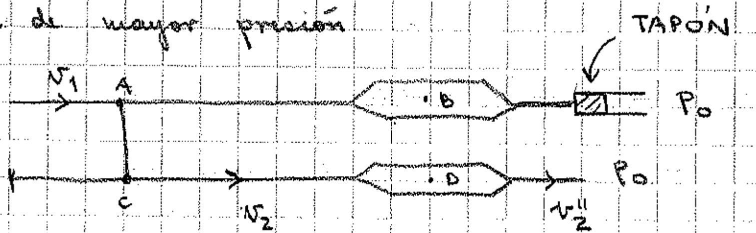
PARTE B

Ec Bernoulli (2) $P_D > P_C$ Ec Hidrostática (B-D) $P_D > P_B$

(1) $P_B > P_A$ Ec Hidrostática (AC) $P_C > P_A$

$\rightarrow$ Punto D es el de mayor presión

PARTE C

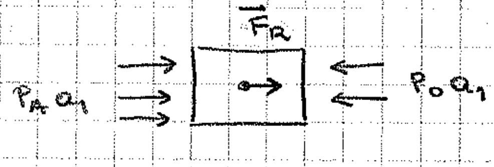


$P_A + \rho \frac{v_1^2}{2} + \rho g h = P_0 + \rho \frac{v_2''^2}{2}$ $a_1 v_1 = a_2 v_2''$ $(a_2 = 2a_1)$

$v''_2 = v_1/2$

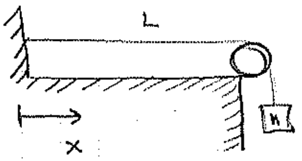
$P_A = P_0 - \rho g h - \frac{3}{8}\rho v_1^2 = 72{,}35$ KPa

Diagrama cuerpo libre TAPÓN



$F_R = (P_0 - P_A)\, a_1 = 11{,}6$ N

PROBLEMA 2



$\mu = 2{,}1\ g/m$

$L = 35\ cm$

(A) $y(x=0,t) = A\ \text{sen}(\omega t) \longrightarrow y_1(x,t) = A\ \text{sen}(\omega t - kx)$ $\quad k = \frac{\omega}{v} \quad v = \sqrt{\frac{T}{\mu}}$

$$y_2(x,t) = A\ \text{sen}(-\omega t - kx)$$

$$y_T(x,t) = 2A\ \text{sen}(-kx)\cos(\omega t)$$

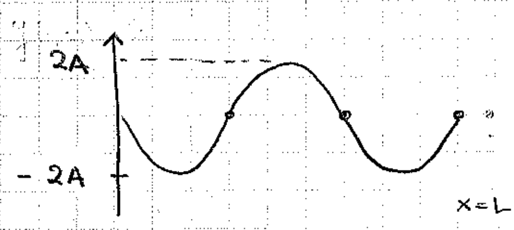
$$y_T(x,t) = -2A\ \text{sen}(kx)\cos(\omega t)$$

$$\text{sen}(kL) = 0 \rightarrow k_n L = n\pi \rightarrow k_n = \frac{n\pi}{L} = \frac{2\pi}{\lambda_n} \rightarrow \lambda_n = \frac{2L}{n}$$

(B) $\lambda f = v \longrightarrow f_3 = \frac{v}{\lambda_3}\ /\ \lambda_3 = \frac{2L}{3} \rightarrow v = f_3\lambda_3 = \sqrt{\frac{T}{\mu}}$

$f_3 = 330\,Hz$ $\quad \lambda_3 = 0{,}2\overline{3}\ m$ $\quad T = \mu(f_3\lambda_3)^2 = Mg$

$$M = \frac{\mu}{g}(f_3\lambda_3)^2 = 1{,}27\ Kg$$



$$y_T(x,t=0) = -2A\ \text{sen}\ kx$$

(C) $f_6 = \frac{v}{\lambda_6} = \frac{6v}{2L} = 6 f_1 = 660\,Hz$

$f'_5 = 660\,Hz = \frac{v'}{\lambda_5}\ /\ \lambda_5 = \frac{2L}{5}$ $\quad M + M_2 = \frac{\mu}{g}(f'_5\lambda_5)^2 = 1{,}83\ Kg$

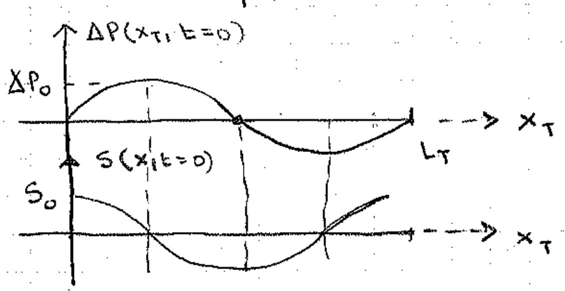
$\lambda_5 = 0{,}14\ m$ $\quad M_2 = 0{,}56\ kg$

(D) $f_1 = 110\,Hz \longrightarrow f_{2T} = 110\,Hz$

I $\begin{cases} \Delta P(x,t) = 2\Delta P_0\ \text{sen}(kx)\cos(\omega t)\ /\ \lambda_{nT} = \frac{2L_T}{n} \\ v = v_S \quad \lambda_{2T} = \frac{v_S}{f_{2T}} = \frac{2L_T}{2} \longrightarrow L_T = \frac{v_S}{f_{2T}} = 3{,}12\ m \end{cases}$

II $\Delta P(x,t) = -B_S \frac{\partial s}{\partial x}$

$S_0 = \frac{\Delta P_0}{B_S k_2}\ /\ k_2 = \frac{2\pi}{L_T}$



III Si el tubo tiene un orificio $\Delta P(x = \frac{L_T}{2}, t) = 0\ \forall t$

Es posible que resuene en su 2do armónico y resonará en todos los armónicos PARES

$$f_{nT} = \frac{v_S}{\lambda_{nT}} = \frac{v_S}{\frac{2L_T}{n}} = \frac{n v_S}{2L_T} \leq 20\,kHz \rightarrow \boxed{n \leq 362 \quad \text{PAR} \quad n \in \mathbb{N}^+}$$