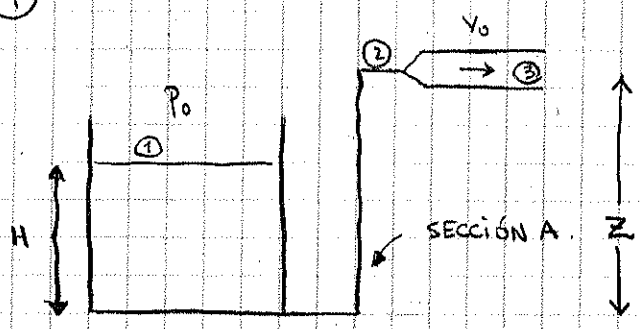
PRIMER PARCIAL F2 / 29 de ABRIL 2016

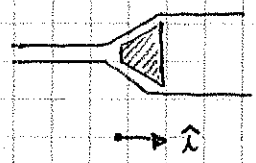
①



Ⓐ Ec Bernoulli entre ① y ③ : $P_3 = P_0$

$$P_0 + \rho g H = P_0 + \rho g z + \rho \frac{V_0^2}{2} \longrightarrow V_0^2 = 2(H-z) \geq 0 \longrightarrow \boxed{z \leq H}$$

Ⓑ



$$\Sigma F = 0 = P_2 A - P_3 5A + F_c \longrightarrow F_c = 5P_3 A - P_2 A$$

$$P_2 = P_0 + \rho g (H-z) \; ; \; P_3 = P_0$$

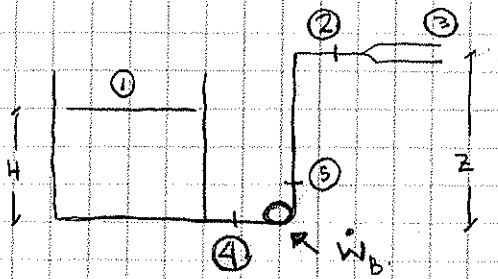
$$F_c = \left[4P_0 - \rho g (H-z)\right] A \, \hat{\imath}$$

Ⓒ $H = 10\,m \quad z = 15\,m$

$A = 2{,}0 \times 10^{-4}\,m^2 \quad \dot{V} = 1{,}0\,l/s = 1{,}0 \times 10^{-3}\,m^3/s$

$\dot{V} = 5 A V_0 \longrightarrow V_0 = \dfrac{\dot{V}}{5A}$

$V_0 = 1{,}0\,m/s$



EC. CONTINUIDAD :

$$A V_2 = 5A V_0 \longrightarrow V_2 = 5\,m/s. = V_4 = V_5$$

$$P_2 + \rho \frac{V_2^2}{2} = P_0 + \rho \frac{V_0^2}{2} \longrightarrow$$

EC. BERNOULLI ENTRE ③ y ② : $P_2 = P_0 + \dfrac{\rho}{2}(V_0^2 - V_2^2) = 89{,}325\,KPa$

EC. BERNOULLI ENTRE ⑤ y ② : $V_2 = V_5 \longrightarrow P_5 = P_2 + \rho g z = 236{,}325\,KPa$

EC. BERNOULLI ENTRE ① y ④ : $P_0 + \rho g H = P_4 + \rho \dfrac{V_4^2}{2} \;/\; V_2 = V_4$

$$P_4 = P_0 + \rho g H - \rho \frac{V_4^2}{2} = 101{,}325 \times 10^3 + 1000 \times 9{,}8 \times 10 - 1000 \times \frac{25}{2} = 186{,}825\,KPa$$

$$\dot{W}_B = \dot{V}(P_5 - P_4) = 49{,}5\,W$$

(2) (A) $\Delta P(x,t=0) = \Delta P_m \operatorname{sen}(kx)$

$\Delta P_1(x,t) = \frac{1}{2}\Delta P_m \operatorname{sen}(kx-\omega t)$

$\Delta P_2(x,t) = \frac{1}{2}\Delta P_m \operatorname{sen}(kx+\omega t)$

$\Rightarrow \Delta P_T(x,t) = \Delta P_m \operatorname{sen}(kx)\cos(\omega t)$

$\Delta P_T(x=0,t) = 0 \ \forall t$ (EXTREMO ABIERTO)

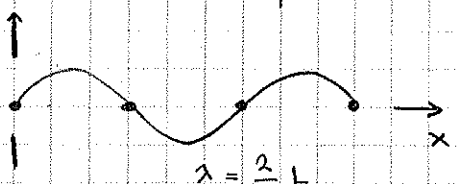
$\Delta P_T(x=H,t) = \pm \Delta P_m$ si $t=0 \longrightarrow \operatorname{sen}(kH) = \pm 1 \longrightarrow kH = \frac{(2n-1)}{2}\pi$

$v_s = \frac{\omega}{k} \longrightarrow \omega = v_s k = \frac{(2n-1)\pi}{2}\frac{v_s}{H} \longrightarrow \nu = \frac{\omega}{2\pi} = \frac{(2n-1)}{4}\frac{v_s}{H}$ $(n=1,2,..)$

(B) $m_T = 5{,}0\,g = 5{,}0\times10^{-3}\,kg$

$T = 200 \times 9{,}8 = 1960\,N$

I)



CUERDA: $kL = n\pi$ $(n=1,2,3..)$

$v_c = \frac{\omega}{k} \longrightarrow \boxed{\nu = \frac{n}{2}\frac{v_c}{L}}$ $\nu_3 = \frac{3}{2}\frac{v_c}{L}$

$\nu_3 = \frac{3}{2L}\sqrt{\frac{T}{m_T/L}} = \frac{3}{2}\sqrt{\frac{T}{L\,m_T}}$

II) $L = \frac{9}{4}\frac{T}{m_T \nu_3^2} = 2{,}22\,m$

(C)

I) $\lambda = \frac{4}{3}H$

II) Por la parte (A) $H = \frac{(2n-1)v_s}{4\nu}$ $(n=2)$

$\nu = 630\,Hz$

$H = \frac{3}{4}\frac{343}{630} = 0{,}408\,m$

(D)

$\Delta P_1(x,t) = \Delta P_m \operatorname{sen}(kx-\omega t)$

$\Delta P_2(x,t) = \Delta P_m \operatorname{sen}(k(x+\Delta x)-\omega t)$ / $\Delta x = 0{,}2\,m$

$\phi = k\,\Delta x$ / $k = \frac{\omega}{v_s} = \frac{2\pi \times 630}{343} = 11{,}54\,m^{-1} \longrightarrow \phi = 2{,}308\,rad.$

$\phi = 132{,}2°$