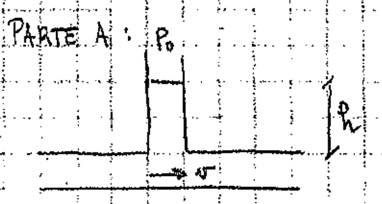
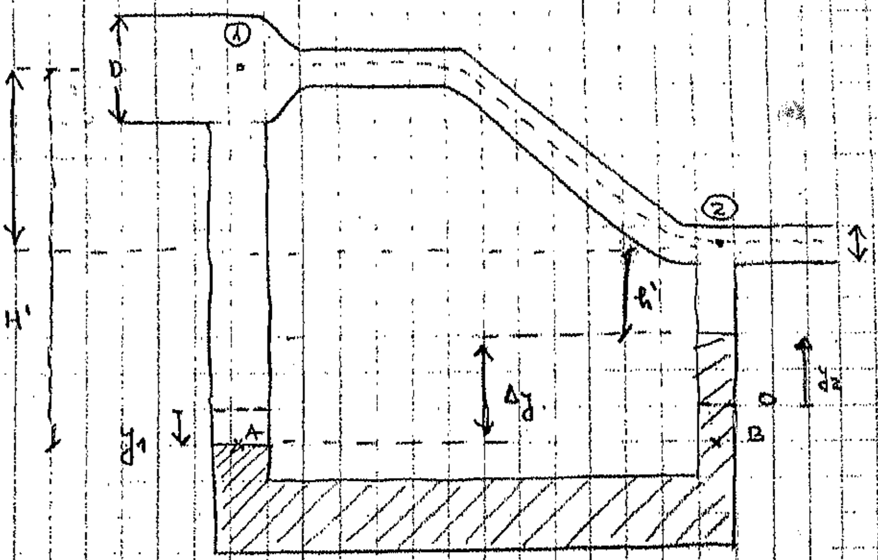
EXAMEN 29/07/2015 PROBLEMA 1

PARTE A:




$P_c = P_0 + \rho g h$

$h > 0 \longrightarrow P_C > P_0$




PARTE B: $D = 3d$

$S_1 = 2S_2$

i) Reposo: $P_2 = P_1 + \rho g (H-h) \rightarrow P_2 - P_1 = 14{,}7$ kPa

ii) Bernoulli ① y ②: $P_1 + \rho g (H-h) + \frac{\rho}{2} v_1^2 = P_2 + \frac{\rho}{2} v_2^2$

Continuidad ① y ②: $A_1 v_1 = A_2 v_2$ / $A = \frac{\pi D^2}{4} \longrightarrow v_2 = \left(\frac{D}{d}\right)^2 v_1 = 9 v_1$

$$P_1 - P_2 + \rho g (H-h) = \frac{\rho}{2}\left[\left(\frac{D}{d}\right)^4 - 1\right] v_1^2$$

Pascal Ⓐ y Ⓑ: $P_A = P_B$

$$P_1 + \rho g H' = P_2 + \rho g h' + \rho' g \Delta y \quad / \quad \rho' = \rho_{Hg}$$

$$P_1 - P_2 = \rho g (h' - H') + \rho' g \Delta y$$

Por geometría: $H' = \Delta y + h' + (H-h) \longrightarrow h' - H' = -(H-h) - \Delta y$

$$P_1 - P_2 = -\rho g (H-h) - \rho g \Delta y + \rho' g \Delta y$$

$$P_1 - P_2 + \rho g (H-h) = (\rho' - \rho) g \Delta y$$

$$\Delta y = \frac{\rho}{2g} v_1^2 \left[\left(\frac{D}{d}\right)^4 - 1\right] (\rho' - \rho)^{-1} = 8{,}1 \text{ cm}$$

EXAMEN 29/07/2015 PROBLEMA 2

a) $m = 0{,}005\ \text{kg}$ $\quad v = \sqrt{\dfrac{\tau}{\mu}} = \lambda f$

$\tau = 200\,\text{N}$

$$\lambda_n = \frac{2L}{n} \longrightarrow \frac{\tau}{\mu} = \frac{\tau}{m/L} = \frac{4L^2}{n^2} f^2 \longrightarrow L = \frac{\tau n^2}{4 m f^2}$$

$$L_p = 1{,}10\,\text{m} \longrightarrow v = \sqrt{\frac{\tau}{m/L}} = 210{,}5\ \text{m/s}.$$

b) $\lambda_n = \dfrac{4L}{(2n-1)}$ $\qquad \lambda_3 = \dfrac{4L}{5} = \dfrac{v_s}{f_3} \longrightarrow L = \dfrac{5}{4}\dfrac{v_s}{f_3} = 0{,}67\,\text{m}$

$$f_2 = \frac{v_s}{4/3 L} = 384\ \text{Hz}$$


BOQUILLA CERRADO $\qquad$ EXTREMO ABIERTO.

$\Delta P = 0$

$x = 0$ $\qquad$ $x = L$

c) $\Delta P_T = \Delta P_1 + \Delta P_2 = \Delta P_m \left[\cos(\omega_1 t + \varphi) + \cos(\omega_2 t + \varphi_2)\right]$

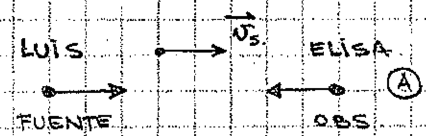
$$\Delta P_T = 2\Delta P_m \left[\cos\left(\frac{(\omega_1+\omega_2)}{2}t + \frac{(\varphi_1+\varphi_2)}{2}\right)\cos\left(\frac{(\omega_1-\omega_2)}{2}t + \frac{(\varphi_1-\varphi_2)}{2}\right)\right]$$

$\varphi$ está relacionado con la distancia desde la fuente de sonido al punto donde éste se percibe.

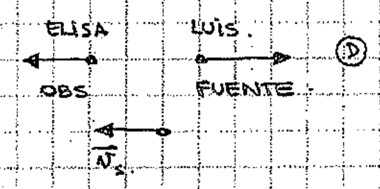
$\bar{\omega} = \dfrac{\omega_1+\omega_2}{2}$ FREQ SONIDO CONJUNTO

$\Delta\omega = \omega_1 - \omega_2$ FREQ PULSACIONES $\longrightarrow T = \dfrac{2\pi}{\Delta\omega} = \dfrac{1}{\Delta f} = 0{,}25\ \text{s}$

d) $v = 17\ \text{m/s}$



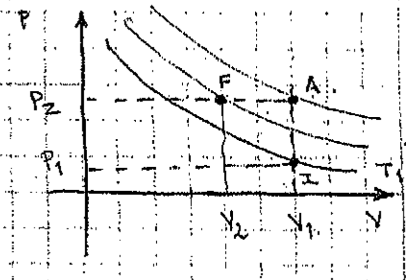

Ⓐ $f' = f\left(\dfrac{v_s + v_o}{v_s - v_F}\right) = f\left(\dfrac{343+17}{343-17}\right) = 424\ \text{Hz}$




Ⓓ $f' = f\left(\dfrac{v_s - v_o}{v_s + v_F}\right) = f\left(\dfrac{343-17}{343+17}\right) = 348\ \text{Hz}$

EXAMEN 29/07/2015 PROBLEMA 3.

PARTE A




$T_3 > T_2$

$T_2 > T_1$

INICIAL : $P_1V_1 = nRT_1$

FINAL : $P_2V_2 = nRT_2$

A : $P_2V_1 = nRT_3$

EC. GAS.

$$ds = \frac{\delta Q}{T} \rightarrow s_2 - s_1 = \int_1^2 \frac{\delta Q}{T} = \int_1^3 \frac{\delta Q_V}{T} + \int_3^2 \frac{\delta Q_P}{T} = \int_{T_1}^{T_3} nc_V \frac{dT}{T} + \int_{T_3}^{T_2} nc_p \frac{dT}{T}$$

$$s_2 - s_1 = nc_V \ln\left(T_3/T_1\right) + nc_p \ln\left(T_2/T_3\right) \underset{\text{EC. GAS}}{=} nc_V \left(\frac{P_2}{P_1}\right) + nc_p \ln\left(\frac{V_2}{V_1}\right)$$

PARTE B

$V_1 = 100$ litros

$PV^2 = P_1V_1^2 \rightarrow \frac{nRT}{V}V^2 = \frac{nRT_1}{V_1}V_1^2 \rightarrow TV = T_1V_1$

$\gamma = c_p/c_V = 7/5$

$T_1 = 300$ K

$V_2 = 2V_1$

$P_2 = \frac{nRT_2}{V_2} = \frac{P_1}{4}$

$T_F = 100$ K

$T_2 = T_1/2$.

a) $W = -\int_{V_1}^{V_2} P(V)\,dV = -\int_{V_1}^{V_2} \frac{P_1V_1^2}{V^2}\,dV = P_1V_1^2\left(\frac{1}{V_2} - \frac{1}{V_1}\right) = -\frac{nRT_1}{2} = -12{,}5$ KJ

b) $Q = \Delta U - W = \frac{5}{2}nR\,(T_2 - T_1) + \frac{nRT_1}{2} = -\frac{3}{4}nRT_1 = -18{,}7$ KJ

c) $\Delta S_u = S_2 - S_1 + \frac{|Q|}{T_F} = nR\left[\frac{5}{2}\ln\left(P_2/P_1\right) + \frac{7}{2}\ln\left(\frac{V_2}{V_1}\right)\right] + \frac{3/4\, nRT_1}{T_F}$

$\Delta S_u = \left(-\frac{3}{2}\ln 2 + \frac{3}{4}\times 3\right) nR = 1{,}21\, nR = 100{,}6$ J/K.