Física 2 - Primer semestre
Primer Parcial, 10/05/2013
SOLUCIONES

Problema 1.

$$P_{aire} + \rho_{aceite} g h_{aceite} + \rho_{agua} g h_{agua} = \rho_{mercurio} g y$$

$$30000 + 820 \times 9.8 \times 3 + 1000 \times 9.8 \times 3 = 13600 \times 9.8 \times y$$

$$\Rightarrow \boxed{y = 62.6 \text{ cm}}$$

Problema 2.

(a) $N_1 A_1 = N_2 A_2 \Rightarrow N_1 \pi \left(\frac{d_1}{2}\right)^2 = N_2 \pi \left(\frac{d_2}{2}\right)^2 \Rightarrow$

$$\Rightarrow N_1 d_1^2 = N_2 d_2^2 \Rightarrow N_2 = \frac{N_1 d_1^2}{d_2^2} = 0.6 \left(\frac{15}{10}\right)^2$$

$$\boxed{N_2 = 1.35 \text{ M/s}}$$

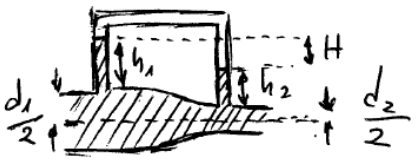
(b) Alturas con respecto al eje del tubo

$$P_1 + \rho g \frac{d_1}{2} + \frac{1}{2}\rho N_1^2 = P_2 + \rho g \frac{d_2}{2} + \frac{1}{2}\rho N_2^2 \Rightarrow$$

$$P_1 - P_2 = \rho g \frac{(d_2 - d_1)}{2} + \frac{1}{2}\rho (N_2^2 - N_1^2) = \boxed{486.25 \text{ Pa}}$$

(c) $P_1 = \rho g h_1 \quad P_2 = \rho g h_2$

$$H = \left(h_1 + \frac{d_1}{2}\right) - \left(h_2 + \frac{d_2}{2}\right)$$



$$P_1 - P_2 = \rho g (h_1 - h_2) = \rho g \left(\frac{d_2 - d_1}{2} + H\right)$$

$$H = \frac{P_1 - P_2}{\rho g} + \frac{d_1 - d_2}{2} \simeq \boxed{7.5 \text{ cm}}$$

Problema 3

(1a) Nivel sonoro (en dB): $NS = 10 \log_{10} \frac{I}{I_{ref}} \Rightarrow$

$$I = I_{ref}\, 10^{NS/10} = 10^{-12}\, 10^{100/10} = 10^{-2} \frac{watt}{m^2}$$

Fuente puntual de potencia P_0: $I = \frac{P_0}{4\pi r^2} \Rightarrow P_0 = 4\pi r^2 I$

$$P_0 = 4\pi (4.5)^2 10^{-2} = 2.54 \text{ watt}$$

$$r_{min} = \sqrt{\frac{P_0}{4\pi I_{máx}}} = \sqrt{\frac{2.54}{4\pi \times 1}} \cong \boxed{45 \text{ cm}}$$

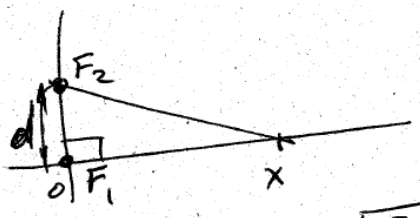
(1b) Doppler: a nuevo el observador hacia la fuente

$$f' = f \frac{v + v_0}{v} = 800 \frac{340 + 13}{340} = 830.6 \text{ Hz}$$

$$\lambda' = \frac{v}{f'} = \frac{340}{830.6} \cong \boxed{41 \text{ cm}}$$

(1c) No hay efecto Doppler. Medirá $\lambda = \frac{340}{800} = \boxed{42{,}5 \text{ cm}}$

(2)



Máximo $m \Rightarrow \Delta r = m\lambda$

$$\Delta r = \sqrt{d^2 + x^2} - x \Rightarrow$$

$$\sqrt{d^2 + x^2} - x = m\lambda \Rightarrow \sqrt{d^2 + x^2} = x + m\lambda$$

$$d^2 + x^2 = x^2 + 2m\lambda x + m^2\lambda^2 \Rightarrow x = \frac{d^2 - m^2\lambda^2}{2m\lambda}$$

$$x = \frac{3^2 - 5^2(0.425)^2}{2 \times 5 \times 0.425} = \boxed{1.06 \text{ m}}$$

Solución ejercicio 4:

a)

$$\lambda . f = v = \sqrt{\frac{T}{\sigma}} \quad \Rightarrow \quad \frac{f_1}{\sqrt{T_1}} = \frac{1}{\lambda . \sqrt{\sigma}} = \frac{f_2}{\sqrt{T_2}} \quad \Rightarrow \quad T_2 = \left(\frac{f_2}{f_1}\right)^2 . T_1 = \left(\frac{110\text{Hz}}{100\text{Hz}}\right)^2 . 71{,}6\, N \;=\; 86{,}64\, N$$

b)

$$\lambda_1 . f_1 = v = \lambda_2 . f_2 \Rightarrow \lambda_2 = \frac{f_1}{f_2} . \lambda_1 = \frac{110\text{Hz}}{150\text{Hz}} . (2 . 64{,}8\, cm) = 95{,}04\, cm$$

$$x = \frac{\lambda_2}{2} = 47{,}5\, cm$$

c)

$$\lambda . f = v = \sqrt{\frac{T}{\sigma}} \quad \Rightarrow \quad \sigma = \frac{T}{(\lambda . f)^2} = \frac{71{,}6\, N}{(2.64{,}8\, cm . 100\text{Hz})^2} = \frac{86{,}64\, N}{(2.64{,}8\, cm . 110\text{Hz})^2} = 4.26\, g/m$$

$$masa\ total = 4{,}26\, g/m . 64{,}8\, cm = 2{,}76\, g$$