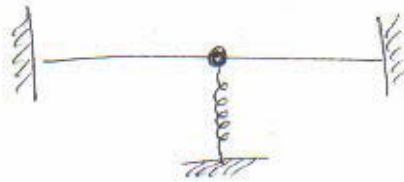


P1



$$\psi_1(x, t) = (A \sec kx + B \cos kx) \cos(\omega t + \phi) \quad -\frac{L}{2} \leq x \leq 0$$

$$\psi_2(x, t) = (C \sec kx + D \cos kx) \cos(\omega t + \phi) \quad 0 \leq x \leq \frac{L}{2}$$

Condiciones de Borde

$$① \quad \psi_1(-L, t) = 0$$

$$② \quad \psi_2(L, t) = 0$$

$$③ \quad \psi_1(0, t) = \psi_2(0, t)$$

$$④ \quad T \frac{\partial \psi_2}{\partial x}(0, t) - T \frac{\partial \psi_1}{\partial x}(0, t) - b \psi_1(0, t) = m \frac{\partial^2 \psi_1}{\partial t^2}(0, t)$$

$$① \Rightarrow -A \sec kL + B \cos kL = 0 \Rightarrow \boxed{A \tan kL = B}$$

$$② \Rightarrow C \sec kL + D \cos kL = 0 \Rightarrow \boxed{C \tan kL = -D}$$

$$③ \Rightarrow B = D$$

$$④ \Rightarrow m(-D\omega^2) = TkC - TkA - bB$$

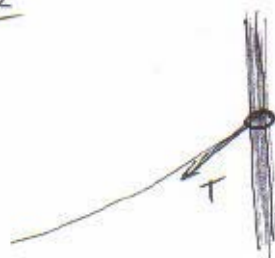
$$m(-D\omega^2) = Tk\left(\frac{-B}{\tan kL}\right) - Tk\left(\frac{B}{\tan kL}\right) - bB$$

$$m\omega^2 = \frac{2Tk}{\tan kL} + b$$

$$m\omega^2 = \frac{2T(\omega/v)}{\tan(\omega L/v)} + b$$

$$v = \sqrt{\frac{T}{\mu}}$$

$$\boxed{m\omega^2 = \frac{2T(\omega \sqrt{\mu/T})}{\tan(\omega L \sqrt{\mu/T})} + b}$$



$$\psi = A_1 e^{i(\omega t - kx)} + A_2 e^{i(\omega t + kx)}$$

$$\textcircled{1} \quad -T \frac{\partial \psi}{\partial x} - b \frac{\partial \psi}{\partial t} = 0$$

$$\frac{\partial \psi}{\partial x} = -ikA_1 e^{i(\omega t - kx)} + ikA_2 e^{i(\omega t + kx)}$$

$$\frac{\partial \psi}{\partial t} = i\omega A_1 e^{i(\omega t - kx)} + i\omega A_2 e^{i(\omega t + kx)}$$

de $\textcircled{1} \Rightarrow$

$$-T(ikA_1 e^{i(\omega t - kx)} + ikA_2 e^{i(\omega t + kx)}) = b(i\omega A_1 e^{i(\omega t - kx)} + i\omega A_2 e^{i(\omega t + kx)})$$

$$T(ikA_1 - ikA_2) = bi\omega(A_1 + A_2) \quad \text{en } x=0$$

$$Tk(A_1 - A_2) = b\omega(A_1 + A_2)$$

$$TkA_1 - b\omega A_1 = b\omega A_2 + TkA_2$$

$$A_1(Tk - b\omega) = A_2(Tk + b\omega)$$

$$A_2 = \frac{Tk - b\omega}{Tk + b\omega} A_1$$

$$A_2 = \frac{Tk/b - \omega}{Tk/b + \omega} A_1$$

$$\text{si } b \rightarrow \infty \Rightarrow A_2 = -A_1$$

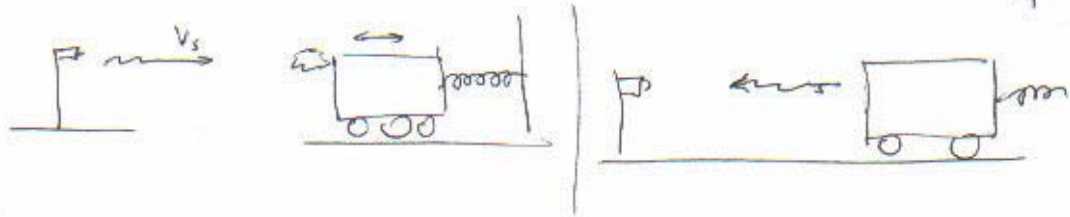
$$\text{si } b \rightarrow 0 \Rightarrow A_2 = A_1$$

$$\Rightarrow \text{No hay onda reflejada si } Tk - b\omega = 0$$

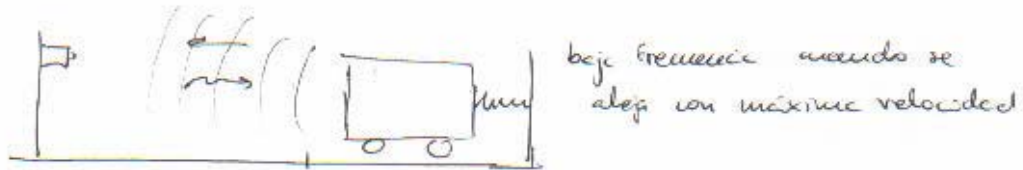
$$\Rightarrow \boxed{b = \frac{Tk}{\omega}}$$

P3

3/4



a)



La fuente está en reposo. El observador se mueve a la fuente
ante con una frecuencia de $f_0 = 8000 \text{ Hz}$

v_0 = velocidad del observador respecto a la fuente

$$f = f_0 \left(1 + \frac{v_0}{v_s} \right) \quad v_0 \text{ max} \Rightarrow f \text{ es max}$$

reemplazando

$$8003,1 = 8000 \left(1 + \frac{v_0}{340 \text{ m/s}} \right)$$

$$\Rightarrow v_0 = 0,132 \text{ m/s} \quad \text{veloc. cuando se acerca}$$

$$7996,9 = 8000 \left(1 + \frac{v_0}{340 \text{ m/s}} \right)$$

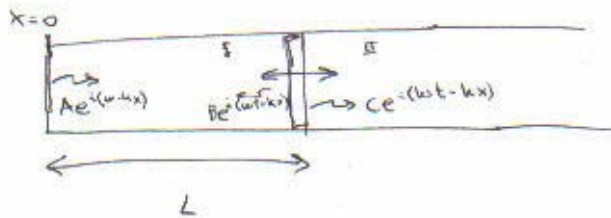
$$\Rightarrow v_0 = -0,132 \text{ m/s} \quad \text{veloc. cuando se aleja}$$

\therefore la rapidez máxima es:

$$v_0 = 0,132 \text{ m/s}$$

P4

4/4



la eq de onda.

$$\frac{\partial^2 \psi}{\partial x^2} - \frac{1}{v^2} \frac{\partial^2 \psi}{\partial t^2} = 0$$

cuya solución es:

$$\psi(x, t) = Ae^{i(\omega t - kx)} + Be^{i(\omega t + kx)}$$

$$\psi(x, t) = \begin{cases} \psi_1(x, t) = Ae^{i(\omega t - kx)} + Be^{i(\omega t + kx)} \\ \psi_2(x, t) = ce^{i(\omega t - kx)} \end{cases}$$

Condiciones de Borde.

i) $\psi_1(0, t) = 0 \quad \forall t$

ii) $\psi_1(L, t) = \psi_2(L, t) \quad \forall t$

La condición de largo infinito se impone, ya que en la zona II no hay onda reflejada.

iii) $\psi_2(L, t) = \psi_2(L, t) = A_0 e^{i\omega t}$

ya que el sistema está obligado a oscilar con frecuencia ω

(i) $A + B = 0 \quad (1)$

ii) $Ae^{-ikL} + Be^{ikL} = ce^{ikL} = A_0 \quad (2)$

(1) en (2)

$$A(\bar{e}^{ikL} - e^{ikL}) = A_0 \Rightarrow A = \frac{A_0}{\bar{e}^{ikL} - e^{ikL}}, B = -A$$

$$c = A_0 e^{ikL}$$