INSTITUTO DE FÍSICA - USP

NOME: FÍSICA II p/ IO
PROFESSOR: José Roberto
DATA: 8/04/2013
Gabarito da P1

NOTA

Q1 ____
Q2 ____
Q3 ____
Q4 ____
TOTAL

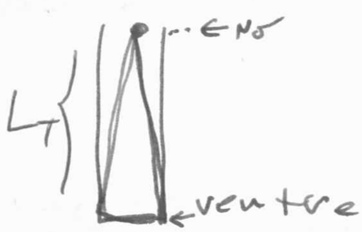
1

(a) 

$\lambda = 2L = 1{,}5\ \text{m}$ $\quad v = \lambda f = 1.5 \times 200 = 300\ \text{m/s}$ $(f = 200\ \text{Hz})$

(b) $v = \sqrt{\dfrac{T}{\mu}}$ $\quad v^2 = 9 \times 10^4 = \dfrac{360}{\mu}$

$\mu = \dfrac{360}{9 \times 10^4} = 40 \times 10^{-4} = 4 \times 10^{-3}\ \text{kg/m}$

(c) 

$L_T = \dfrac{\lambda_T}{4}$ $\quad \lambda_T = \dfrac{v_S}{f} = \dfrac{344}{200} = 1{,}7\text{m}$

$L_T = 0{,}43\text{m}$

(d) $v_S = \sqrt{\dfrac{\gamma R T}{M}}$ $\quad \dfrac{v_S'}{v_S} = \dfrac{344}{340} = \sqrt{\dfrac{T}{293}}$

$T = 293 \times \left(\dfrac{344}{340}\right)^2 = 300\ \text{K}$ $\quad T = 27°\text{C}$

(e) $y(x,t) = A \operatorname{sen}(kx) \operatorname{sen}(\omega t)$ $\quad k = \dfrac{2\pi}{\lambda} = \dfrac{2\pi}{1{,}5}$

$\begin{cases} \text{cond. cont.} & y(0,t) = y(L,t) = 0 \quad (\operatorname{sen}(0 + 4\pi) = 0) \\ \text{cond. inicial} & y(x,0) = 0 \quad \operatorname{sen} 0 = 0 \end{cases}$

$y(x,t) = 10^{-3} \operatorname{sen}\left(\dfrac{4\pi}{3} x\right) \operatorname{sen}(400\pi t)$ $\quad \boxed{\begin{array}{l} \omega = 2\pi f \\ \omega = 400\pi \end{array}}$

(f) $y = A \, \text{sen}(kx)\, \text{sen}(\omega t)$

$$\frac{\partial y}{\partial x} = kA \cos(kx)\, \text{sen}(\omega t)$$

$$\frac{\partial y}{\partial t} = \omega A\, \text{sen}(kx) \cos(\omega t)$$

$$\frac{dE_p}{dx} = \frac{1}{2} T\, k^2 A^2 \cos^2(kx)\, \text{sen}^2(\omega t)$$

$$\frac{dE_c}{dx} = \frac{1}{2} \mu\, \omega^2 A^2\, \text{sen}^2(kx) \cos^2(\omega t)$$

$$\omega = kv \Rightarrow \frac{dE_c}{dx} = \frac{1}{2} \underbrace{\mu v^2}_{T} k^2 A^2\, \text{sen}^2(kx) \cos^2(\omega t)$$

$$\mu v^2 = T$$

$$\frac{dE_c}{dx} = \frac{1}{2} T\, k^2 A^2\, \text{sen}^2(kx) \cos^2(\omega t)$$

$P/\ t = 0 \quad \dfrac{dE_p}{dx} = 0 \qquad \dfrac{dE}{dx} = \dfrac{dE_c}{dx} = \dfrac{1}{2} T k^2 A^2\, \text{sen}^2(kx)$

$$\therefore \frac{dE}{dx} = \frac{1}{2} T k^2 A^2\, \text{sen}^2(kx)$$

$$E = \frac{1}{2} T k^2 A^2 \int_0^L \text{sen}^2(kx)\, dx = \frac{1}{2} T k^2 A^2 \frac{1}{2} L$$

$A^2 \qquad (k^2)$

$$E = \frac{10^{-6}}{2} 360 \left(\frac{4}{3}\pi\right)^2 \frac{1}{2}\left(\frac{3}{4}\right) = \frac{360 \times 16 \times 3}{2 \times 9 \times 2 \times 4} \times 10^{-6}\ \text{J}$$

$$E = \frac{360 \times 10^{-6}}{3} = 1{,}2 \times 10^{-4}\ \text{J}$$

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NOTA: 2

NOME:

PROFESSOR:

DATA:

(g) 

$\lambda_1 = 2L$ $\qquad$ $\left(L = n \frac{\lambda_n}{2}, \ n \text{ ímpar} \right)$

$\lambda_3 = \frac{2}{3} L$

$\lambda_5 = \frac{2}{5} L$

3 + intensos:

$f_1 = 200 \text{ Hz} \qquad f_3 = 3 f_1 = 600 \text{ Hz}$

e $\quad f_5 = 5 f_1 = 1000 \text{ Hz}$

(h) $\beta = 10 \log \frac{I}{I_0}$

$$\beta_1 - \beta_2 = 20 \text{ dB} = 10 \left(\log \frac{I_1}{I_0} - \log \frac{I_2}{I_0} \right)$$

$$2 = \log \frac{I_1}{I_2} \qquad \frac{I_1}{I_2} = 100$$

$$I = \frac{P}{4 \pi R^2} \qquad \frac{I_1}{I_2} = \frac{(R_2)^2}{(R_1)^2} \qquad \frac{R_2}{R_1} = \sqrt{100} = 10$$

$$\underline{R_2 = 10 R_1 = 10 \text{ m}} \qquad (R_1 = 1 \text{ m})$$

(i) obs. em mov.
$\underline{\text{aprox}}$

$$f = f_0 \left(1 + \frac{v_0}{v_s} \right) = f_0 \left(1 + \frac{6{,}88}{344} \right)$$

$$f = f_0 (1 + 0{,}02) = 204 \text{ Hz}$$

$$\frac{f}{f_0} = \frac{\lambda_0}{\lambda} = \frac{L_0}{L} = \frac{0.75}{L} = \frac{204}{200} \qquad L = 0.75 / 1{,}02 =$$

$$\underline{L = 0.735 \text{ m}}$$