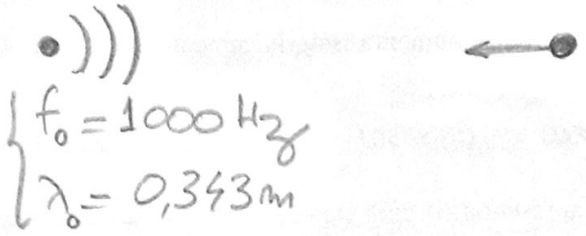
GABARITO P3 (FÍSICA 3)
2-2015

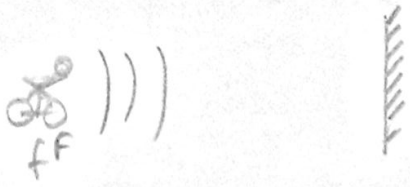
1-



$$f' = f_0 \underbrace{\frac{v^{onda} + v^{obs}}{v^{onda} \pm v^{fonte}}}_{>1} \Rightarrow f' > f_0$$

Como v^{onda} só depende do meio, $\lambda' = \underbrace{\frac{v^{onda}}{f}}_{<1} < \lambda_0$

2-



Neste tipo de problema, o objeto (a parede) reflete a onda que nela chega com frequência

$$f_p = \frac{v^{onda} \pm v^{obs}}{v^{onda} - v^{F}} \cdot f_0 = \frac{340}{340 - v^{garoto}} \cdot 400.$$

O menino capta o som refletido com frequência

$$f^{captada} = 408 = \frac{v^{onda} + v^{garoto}}{v^{onda} \pm v^{parede}} f_p = \frac{340 + v^{garoto}}{340} f_p$$

$v^{parede} = 0$

IGUALANDO AS DUAS eqs:

$$f_p = \frac{340 \cdot 400}{340 - v^{garoto}} = \frac{f^{captada} \cdot 340}{340 + v^{garoto}}$$

$$340 + v^{garoto} = \frac{f^{captada}}{400}(340 - v^{garoto})$$

$$\left(1 + \frac{f^{capt}}{400}\right) v^{garoto} = \left(\frac{f^{capt}}{400} - 1\right) 340$$

$$v^{garoto} = \frac{\frac{f^{capt}}{400} - 1}{\frac{f^{capt}}{400} + 1} 340$$

PROVA A → $f^{capt} = 408 Hz \rightarrow v^{garoto} = 5,37 m/s = 12 km/h$

PROVA B → $f^{capt} = 404 Hz \rightarrow v^{garoto} = 1,67 m/s = 6 km/h$

PROVA C → $f^{capt} = 412 Hz \rightarrow v^{garoto} = 5,02 m/s = 18 km/h$

3- $f_{bat} = f_2 - f_1 \Rightarrow \frac{1}{T_{bat}} = \frac{1}{T_2} - \frac{1}{T_1} \Rightarrow \frac{1}{T_{bat}} = \frac{T_1 - T_2}{T_1 \cdot T_2} \Rightarrow$

$$\Rightarrow T_{bat} = \frac{T_1 \cdot T_2}{T_1 - T_2} = \frac{1,54 \cdot 1,50}{1,54 - 1,50} =$$

PROVA A → $T_1 = 1,54 ms \rightarrow T_{bat} = 58 ms$

PROVA B → $T_1 = 1,51 ms \rightarrow T_{bat} = 226 ms$

PROVA C → $T_1 = 1,54 ms \rightarrow T_{bat} = 58 ms$

4 - pontos frios → D = 0 (nodos)

separação entre 2 nodos: $\frac{\lambda}{2} = 6{,}0$ cm

Daí: $\lambda = 12{,}0$ cm $= 1{,}2 \cdot 10^{-1}$ m

microondas ⇒ onda eletromagnética ⇒

⇒ $V_{onda} = c = 3{,}0 \cdot 10^{8}$ m/s

$c = \lambda \cdot f \Rightarrow f = \frac{c}{\lambda} = \frac{3{,}0 \cdot 10^{8}}{1{,}2 \cdot 10^{-1}} = 2{,}5 \cdot 10^{9}$ Hz =

$= \underline{\underline{2{,}5 \text{ GHz}}}$

5- De acordo com a figura,

i) $3\frac{\lambda}{2} = 60\,cm \rightarrow \lambda = 40\,cm.$

ii) $T = 8\,\delta t$ onde $\delta t = \frac{60\lambda}{5000} = 0{,}012\lambda$

$$\Rightarrow T = 8 \cdot 0{,}012 = 0{,}096\lambda$$

De forma que,

$$v_{\text{onda progressiva}} = \lambda f = \frac{0{,}4}{0{,}96} = 4{,}17\,m/s.$$

Lembrando que $v = \sqrt{T/\mu} \rightarrow \mu = \frac{m}{L} = \frac{I}{v^2}$

$$\Rightarrow m = \frac{TL}{v^2}$$

PROVA A $\rightarrow$ $T = 1{,}0\,N \rightarrow$ $m = 34\,g$

PROVA B $\rightarrow$ $T = 1{,}5\,N \rightarrow$ $m = 52\,g$

PROVA C $\rightarrow$ $T = 5{,}1\,N \rightarrow$ $m = 176\,g$

6- fenda circular: $\theta_1 = 1{,}22 \frac{\lambda}{D}$

Largura do máximo central: $w = 2L\theta_1$

$\therefore w = 2{,}44 \frac{\lambda L}{D}$

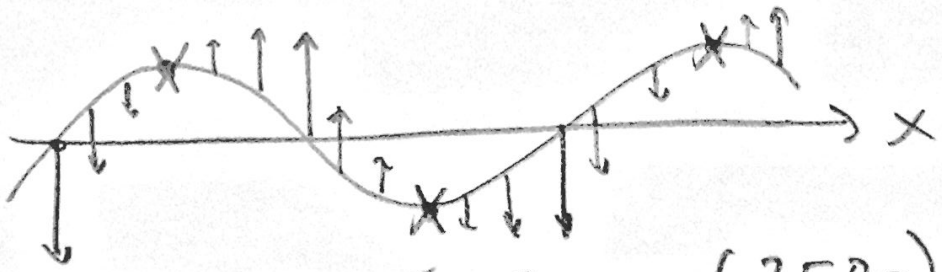
$D = w \Rightarrow D = 2{,}44 \frac{\lambda L}{D} \Rightarrow D = \sqrt{2{,}44 \lambda L}$

Prova A $\begin{cases} \lambda = 633\ nm \\ L = 50\ cm \end{cases} \Big\rangle D = 0{,}88\ mm$

Prova B $\begin{cases} \lambda = 500\ nm \\ L = 50\ cm \end{cases} \Big\rangle D = 0{,}78\ mm$

Prova C $\begin{cases} \lambda = 633\ nm \\ L = 30\ cm \end{cases} \Big\rangle D = 0{,}68\ mm$

7- Referência: Figura 20.16 do Livro



Velocidade é mínima (ZERO) onde o deslocamento é MÁXIMO (ver os x na figura)

8 – para tubos Aberto-Fechado,

$$\left(f_m = m \frac{v}{4L} \qquad m = 1, 3, 5 \ldots \right)$$

$$f_0^{A-F} = 1 \cdot \frac{v}{4L} = \frac{v}{4L}.$$

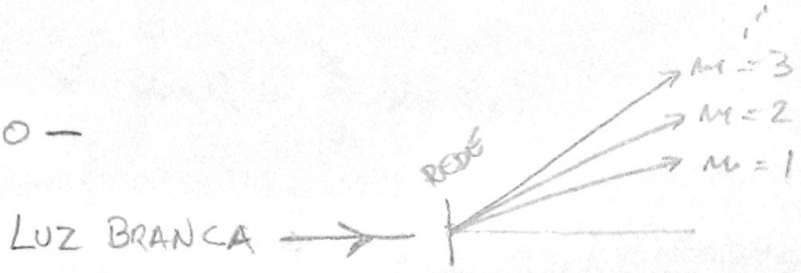
para tubos ABERTO-ABERTO

$$\left(f_m = m \frac{v}{2L}, \quad m = 1, 2 \ldots \right)$$

$$f_0^{A-A} = 1 \cdot \frac{v}{2L} = \frac{v}{2L} = 2 f_0^{A-F}$$

Assim, ao se abrir a extremidade fechada, a frequência do modo fundamental dobra.

10 –



$d \operatorname{sen}\theta_m = m\lambda$

p/ violeta → $\operatorname{sen}\theta_1^{vio} = \frac{400\,nm}{d} \therefore \operatorname{sen}\theta_2^{vio} = \frac{2 \cdot 400\,nm}{d}$

p/ vermelho → $\operatorname{sen}\theta_1^{ver} = \frac{700\,nm}{d} \therefore \operatorname{sen}\theta_2^{ver} = \frac{2 \cdot 700\,nm}{d}$

$\Rightarrow \operatorname{sen}\theta_1^{verm} < \operatorname{sen}\theta_2^{vio} \rightarrow \theta_2^{vio} > \theta_1^{verm}$

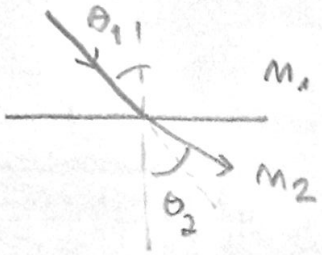
Se $s \to f$.

$$\lim_{s \to f} s' = \lim_{s \to f} \frac{sf}{s-f} \to \infty$$

Se $s \to 2f$.

$$\lim_{s \to 2f} s' = \lim_{s \to 2f} \frac{2f}{2f-f} = 2f$$

14 -



$n_1 > n_2 = 1$ (VÁCUO)

$$n_1 \operatorname{sen}\theta_1 = n_2 \operatorname{sen}\theta_2$$

$$\frac{c}{v_1} \operatorname{sen}\theta_1 = \frac{c}{c} \operatorname{sen}\theta_2$$

$$c \operatorname{sen}\theta_1 = v_1 \operatorname{sen}\theta_2$$

No caso crítico, na iminência de RIT, $\theta_2 = 90°$ e

$$\theta_1 = \operatorname{arc\,sen}\left(\frac{v_1}{c}\right)$$

PROVA A → $v_1 = 0{,}53c$ → $\theta_1 = 32°$
PROVA B → $v_1 = 0{,}58c$ → $\theta_1 = 35°$
PROVA C → $v_1 = 0{,}63c$ → $\theta_1 = 39°$

12- Ver exemplo 23.2 do livro

menor tamanho = $\frac{\lambda}{2} = \frac{1,60}{2} = \underline{0,80\,m}$

15- Fenda simples, largura do máximo central:

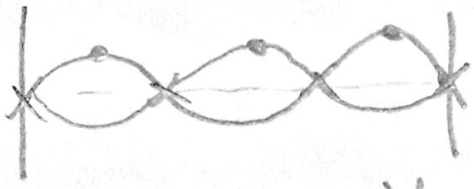
$$w = \frac{2\lambda L}{a}$$

Se $\underline{d}$ diminui, w diminui

16- 3° harmônico $\Rightarrow n = 3$

n é o nº de antinodos $\Rightarrow$ 3 antinodos $\Rightarrow$

$\Rightarrow$ 3 máximos:



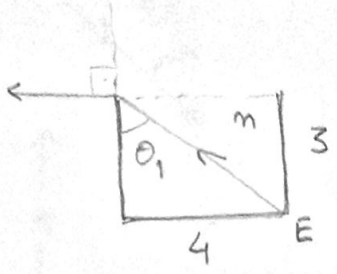
nodos (x) $\Rightarrow$ 4 $\Rightarrow$ 2 nas extremidades fixas da corda + $\underline{2\,nodos}$

$d_m = \frac{2L}{m} \xrightarrow{m=3} d_3 = \frac{2L}{3} = \frac{2 \cdot 0,45}{3} = 0,30\,m =$

$= \underline{30,0\,cm}$

Assim, p/ radiação visível, as linhas referentes a 1ª ordem nunca sobrepõem as linhas de 2ª ordem.

11-



Pela Lei de Snell

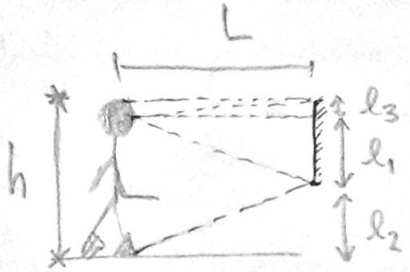
$n \operatorname{sen}\theta_1 = 1 \cdot \operatorname{sen} 90°$

PROVA (A) $n = \dfrac{1}{\operatorname{sen}\theta_1} = \dfrac{1}{4/5} = \dfrac{5}{4} = 1{,}25$ (A)

PROVA (B) $n = \dfrac{1}{\frac{3}{5}} = \dfrac{5}{3} = 1{,}67$ (B)

PROVA (C) $n = \dfrac{1}{3/3\sqrt{2}} = \dfrac{3\sqrt{2}}{3} = 1{,}41$ (C)

12-



Sabendo que $\theta_{inc} = \theta_{reflex}$,

$l_1 = l_2$.

Assim

$h = 2l_1 + 2l_3 = 2(l_1 + l_3)$

Tamanho do espelho

NÃO DEPENDE DE L !!!

13- $\dfrac{1}{f} = \dfrac{1}{s} + \dfrac{1}{s'} \rightarrow \dfrac{1}{s'} = \dfrac{1}{f} - \dfrac{1}{s} \rightarrow \dfrac{1}{s'} = \dfrac{s-f}{s \cdot f}$

$s' = \dfrac{s \cdot f}{s-f}$

Qto $s > s \rightarrow$ + próximo de f a imagem se localiza!

$\lim_{s \to \infty} s' = \dfrac{s \cdot f}{s-f} \overset{RL}{=} \lim_{s \to \infty} \dfrac{f}{1} = f$

17 - Tubo aberto-aberto:

$$\lambda_m = \frac{2L}{m}$$

menores frequências $\Rightarrow m = 1, 2, 3$

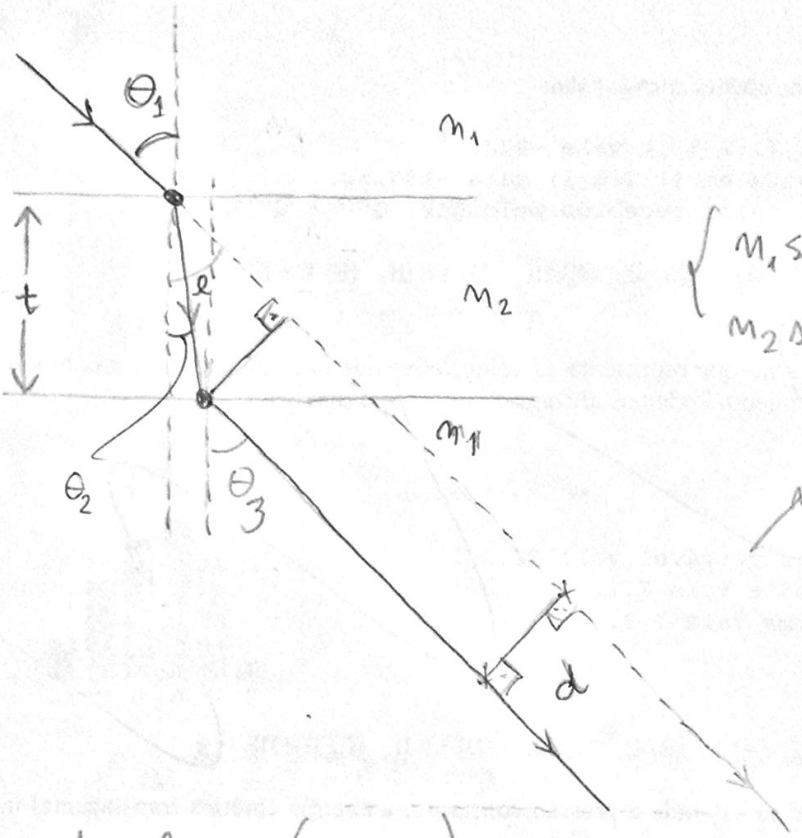
$m = 1 \rightarrow \lambda = \lambda_1 = 2L$

$m = 2 \rightarrow \lambda = \lambda_2 = \frac{2L}{2} = L$

$m = 3 \rightarrow \lambda = \lambda_3 = \frac{2L}{3}$

18—

18-



$$\begin{cases} n_1 \operatorname{sen}\theta_1 = n_2 \operatorname{sen}\theta_2 \\ n_2 \operatorname{sen}\theta_2 = n_1 \operatorname{sen}\theta_3 \end{cases}$$

$$\Downarrow$$

$$\cancel{n_1} \operatorname{sen}\theta_1 = \cancel{n_1} \operatorname{sen}\theta_3$$

$$\Downarrow$$

$$\boxed{\theta_1 = \theta_3}$$

$$d = \ell \operatorname{sen}(\theta_1 - \theta_2)$$

Mas $\cos\theta_2 = \dfrac{t}{\ell} \rightarrow \ell = \dfrac{t}{\cos\theta_2} \rightarrow d = \dfrac{t \operatorname{sen}(\theta_1 - \theta_2)}{\cos\theta_2}$.

$$n_1 \operatorname{sen}\theta_1 = n_2 \operatorname{sen}\theta_2$$

$$\theta_2 = \operatorname{arcsen}\left(\frac{\operatorname{sen}\theta_1}{n_2}\right)$$

PROVA A →
$$\begin{cases} n_2^{A} = 1{,}514 \rightarrow \theta_2 = \operatorname{arcsen}\left(\dfrac{\operatorname{sen}56^\circ}{1{,}514}\right) = 33{,}20121^\circ \\ n_2^{B} = 1{,}528 \rightarrow \theta_2 = \operatorname{arcsen}\left(\dfrac{\operatorname{sen}56^\circ}{1{,}528}\right) = 32{,}85834^\circ \end{cases}$$

$$d^A = \frac{3 \cdot \operatorname{sen}(56 - 33{,}2)}{\cos 33{,}2} = 1{,}389 \text{ mm}$$

$$d^B = \frac{3 \cdot \operatorname{sen}(56^\circ - 32{,}8^\circ)}{\cos 32{,}8^\circ} = 1{,}403 \text{ mm}$$

$$d^B - d^A = 0{,}014 \text{ mm}$$

PROVA ~~A~~ C

$$\begin{cases} n_2^A = 1,514 \rightarrow \theta_2 = 33,20121° \rightarrow d^A = 1,389\ mm \\ n_2^B = 1,558 \rightarrow \theta_2 = 32,14857° \rightarrow d^B = 1,433\ mm \end{cases}$$

$$d^B - d^A = 0,044\ mm$$

PROVA ~~X~~ B

$$\begin{cases} n_2^A = 1,528 \rightarrow d^A = 1,403\ mm \\ n_2^B = 1,558 \rightarrow d^B = 1,433\ mm \end{cases}$$

$$d^B - d^A = 0,030\ mm$$