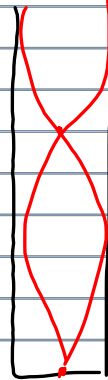


Closed Tube Resonance



$$L_1 = \frac{1}{4} \lambda$$



$$L_2 = \frac{3}{4} \lambda$$

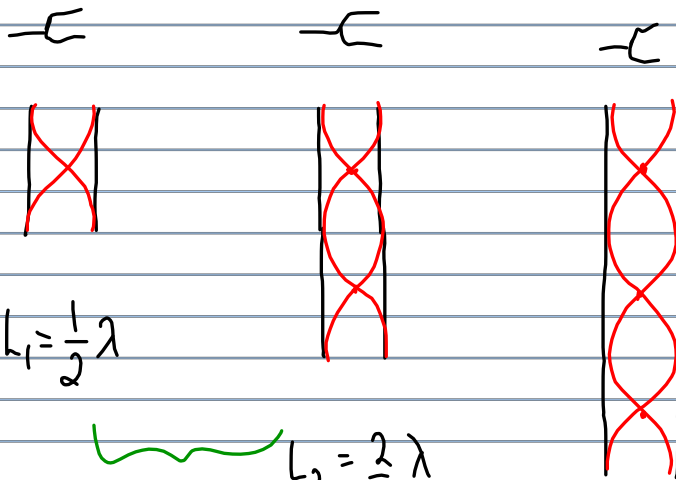
$\Delta L = \frac{1}{2} \lambda$
(spacing)



$$L_3 = \frac{5}{4} \lambda$$

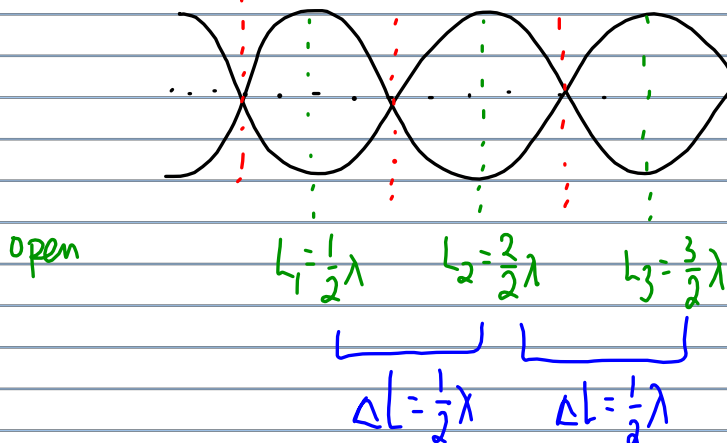
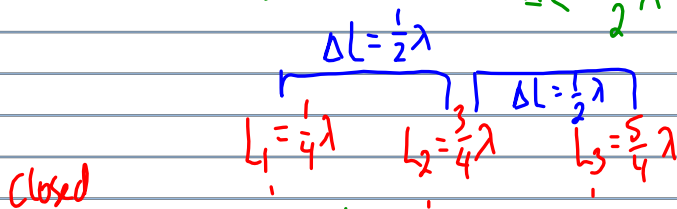
$\Delta L = \frac{1}{2} \lambda$

Open Tube Resonance

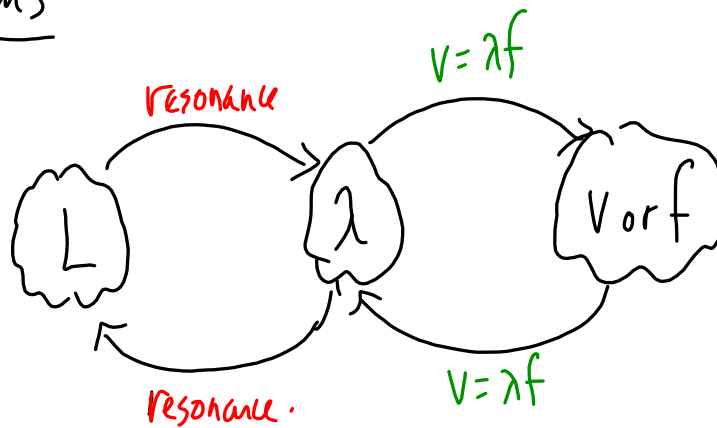


ΔL (spacing) = $\frac{1}{2}\lambda$

$L_3 = \frac{3}{2}\lambda$
 $\Delta L = \frac{1}{2}\lambda$



Resonance Problems



MP/419

$$L_1 = 9.0 \text{ cm (closed)}$$

$$T = 20^\circ\text{C} \Rightarrow v = 343 \text{ m/s}$$

a) $\lambda = ?$

a) $L_1 = \frac{1}{4} \lambda$

$$9.0 \text{ cm} = \frac{1}{4} \lambda$$

$$\lambda = 36 \text{ cm}$$

b) L_2 and $L_3 = ?$

b) $L_2 = \frac{3}{4} \lambda$

$$L_3 = \frac{5}{4} \lambda$$

$$L_2 = \frac{3}{4} (36 \text{ cm})$$

$$L_3 = \frac{5}{4} (36 \text{ cm})$$

$$L_2 = 27 \text{ cm}$$

$$L_3 = 45 \text{ cm}$$

c) $v = \lambda f$

$$f = \frac{v}{\lambda}$$

$$f = \frac{343 \text{ m/s}}{0.36 \text{ m}}$$

$$f = 9.5 \times 10^2 \text{ Hz}$$

MP/425

$$f_1 = 330 \text{ Hz (open)}$$

$$a) f_2 = ?, f_3 = ?$$

$$b) \text{ If } v = 344 \text{ m/s, } L_1 = ?$$

$$b) v = \lambda f$$

$$\lambda = \frac{v}{f}$$

$$\lambda = \frac{344 \text{ m/s}}{330 \text{ Hz}}$$

$$\lambda = 1.04 \text{ m}$$

$$a) \text{ open: } f_n = n f_1$$

$$f_2 = 2 f_1$$

$$f_2 = 2(330 \text{ Hz})$$

$$f_2 = 660 \text{ Hz}$$

$$f_3 = 990 \text{ Hz}$$

$$L_1 = \frac{1}{2} \lambda$$

$$L_1 = \frac{1}{2}(1.04 \text{ m})$$

$$L_1 = 0.521 \text{ m}$$