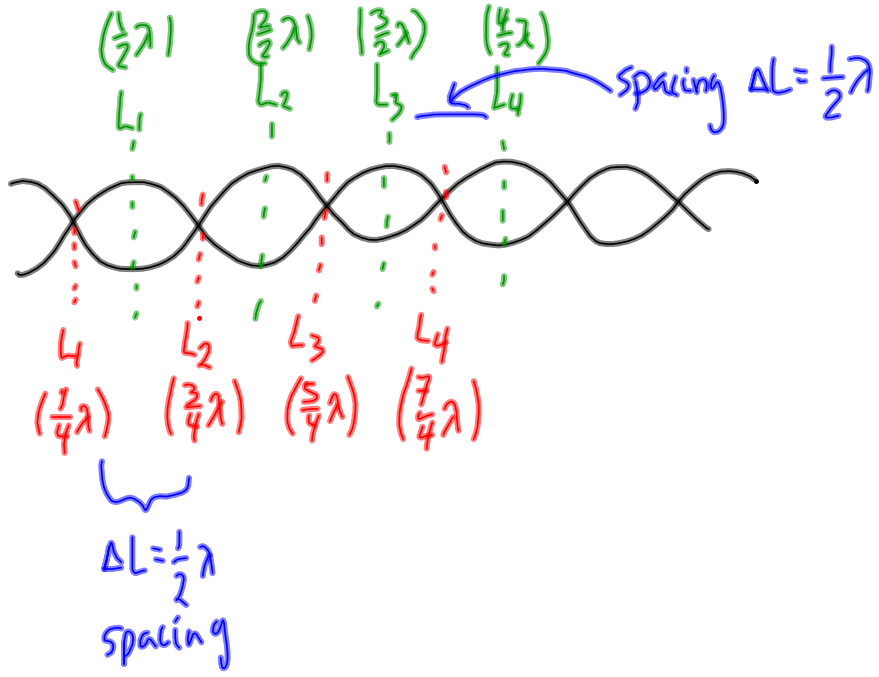
Resonance

open



closed

Closed

shortest tube is $L_1 = \frac{1}{4}\lambda$

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

$$L_n = (2n-1)\frac{\lambda}{4}$$

$$* \quad f_n = (2n-1) f_1$$

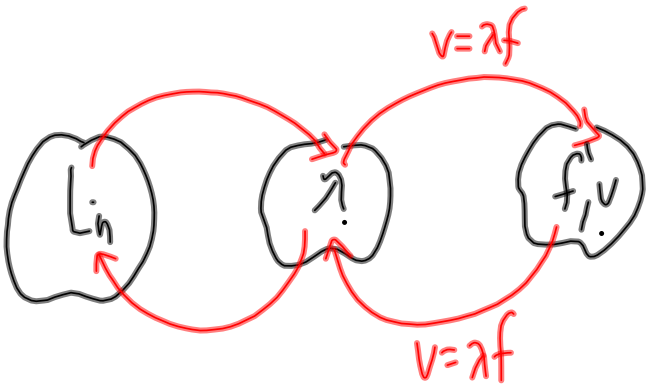
Open

shortest tube is $L_1 = \frac{1}{2}\lambda$

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

$$L_n = n\frac{\lambda}{2}$$

$$* \quad f_n = n f_1$$



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20.

$f_1 = 128\ Hz$

open

$T = 22°C$

a) $L_1 = ?$

b) f_1 if closed?

a) $v = 331\ m/s + 0.59\ \frac{m/s}{°C}(22°C)$

$v = 331\ m/s + 12.98\ m/s$

$v = 343.98\ m/s$

$v = 344\ m/s$

$v = \lambda f$

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

$\lambda = \frac{344\ m/s}{128\ s^{-1}}$

$\lambda = 2.69\ m$

(open)

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

$L_1 = \frac{1}{2}(2.69m)$

$L_1 = 1.34\ m$

b) closed tube: $L_1 = 1.34m$

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

$1.34m = \frac{1}{4}\lambda$

$\lambda = 4(1.34m)$

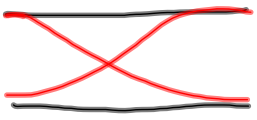
$\lambda = 5.37m$

$v = \lambda f$

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

$f = \frac{344m/s}{5.37m}$

$f = 64\ Hz$



$\lambda = 2.69$ $f = 128\ Hz$

$\lambda = 5.37m$ $f = 64\ Hz$