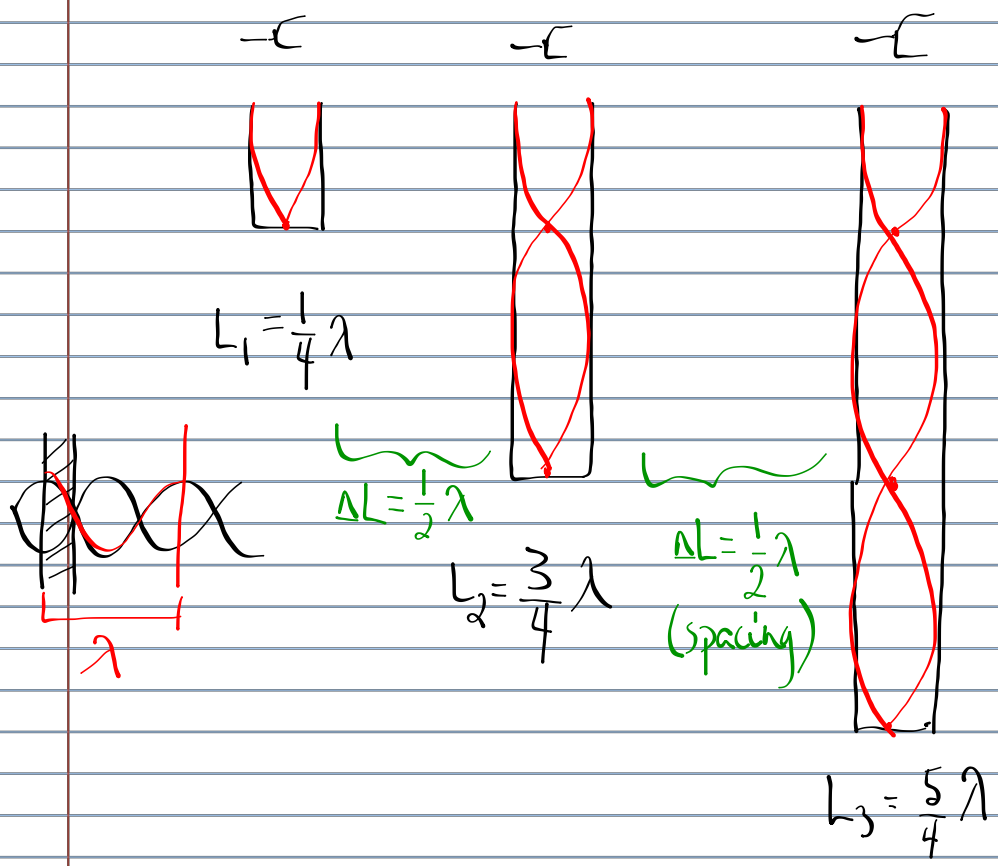
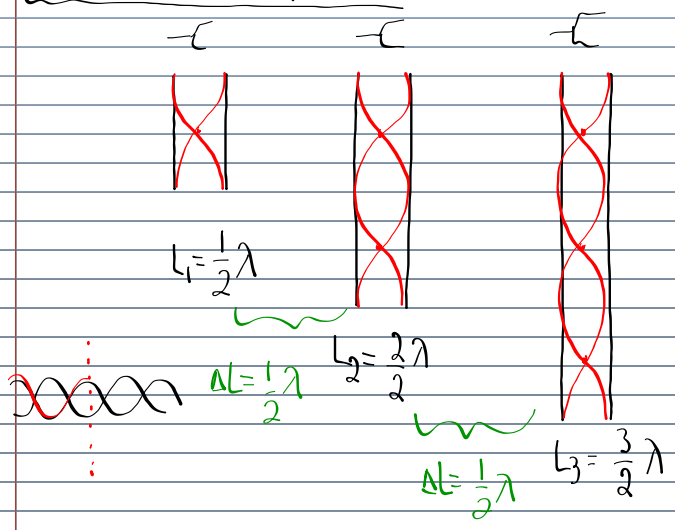
Resonance in a Closed Tube



Shortest resonance length is $L_1 = \frac{1}{4}\lambda$

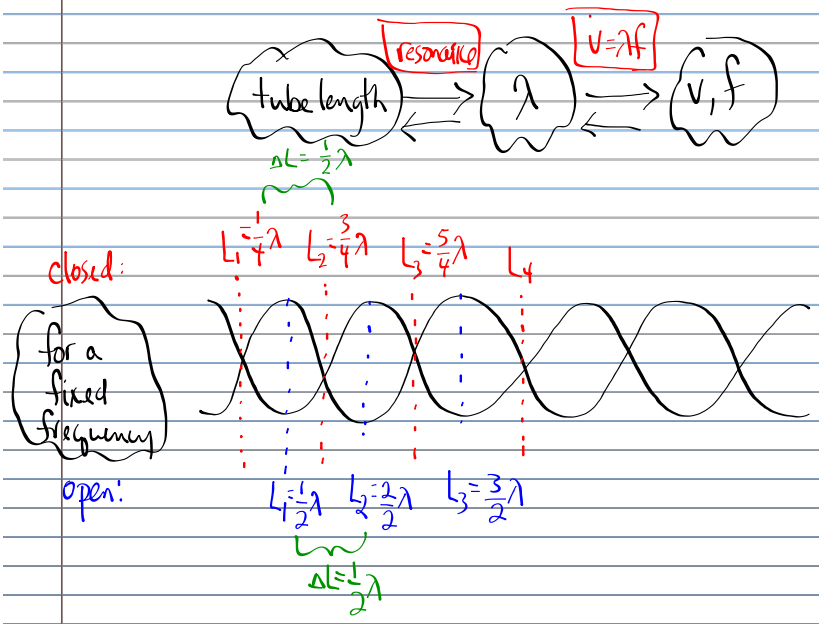
Spacing: $\Delta L = \frac{1}{2}\lambda$

Resonance in an Open Tube

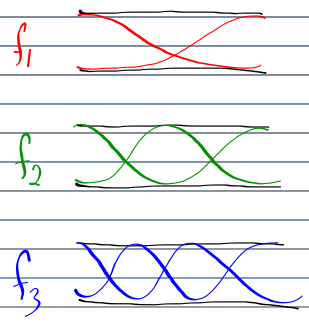


Shortest tube length: $L_1 = \frac{1}{2}\lambda$

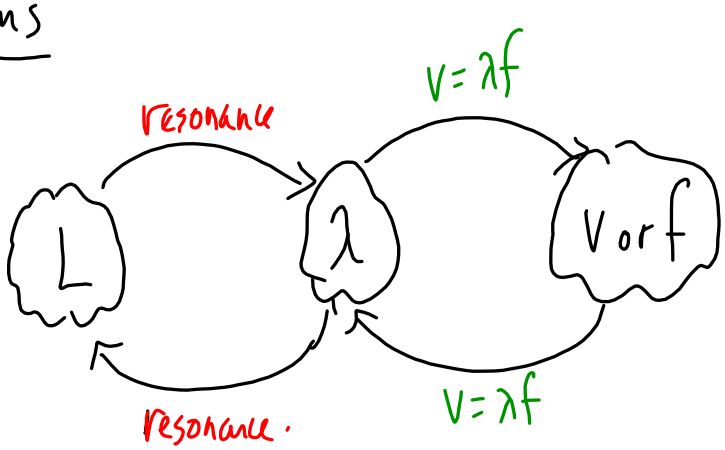
Spacing: $\Delta L = \frac{1}{2}\lambda$



for fixed length:



Resonance Problems



MP|419

$L_1 = 9.0\,cm$ (closed)

$T = 20°C \Rightarrow v = 343\,m/s$

a) $\lambda = ?$

b) L_2 and $L_3 = ?$

c) $f = ?$

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

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

$\lambda = 36\,cm$

b) $L_2 = \frac{3}{4}\lambda$ $\qquad L_3 = \frac{5}{4}\lambda$

$L_2 = \frac{3}{4}(36\,cm)$ $\qquad L_3 = \frac{5}{4}(36\,cm)$

$L_2 = 27\,cm$ $\qquad L_3 = 45\,cm$

c) $v = \lambda f$

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

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

$f = 9.5 \times 10^2\,Hz$

MP/425

$f_1 = 330Hz$ (open)

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

b) If $v = 344 m/s$, $L_1 = ?$

a) open: $f_n = nf_1$

$f_2 = 2f_1$

$f_2 = 2(330Hz)$

$f_2 = 660Hz$

$f_3 = 990Hz$

b) $v = \lambda f$

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

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

$\lambda = 1.04m$

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

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

$L_1 = 0.521 m$