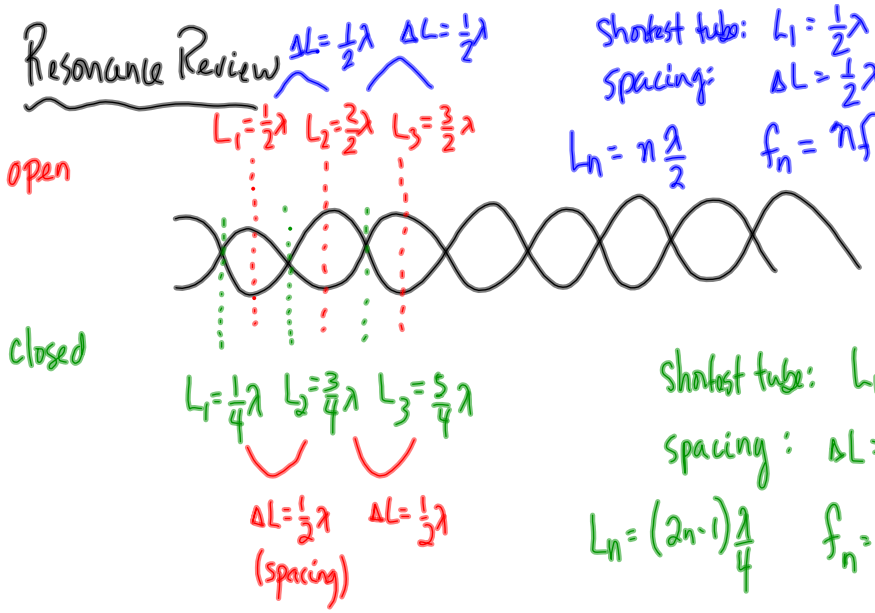
Resonance Review



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

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

$L_n = n\frac{\lambda}{2}$ $\quad f_n = nf_1$

Shortest tube: $L_1 = \frac{1}{4}\lambda$

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

$L_n = (2n-1)\frac{\lambda}{4}$ $\quad f_n = (2n-1)f_1$

mp 425

open

$f_1 = 330\text{Hz}$

a) f_2 and f_3 = ?

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

a) $f_n = nf_1$

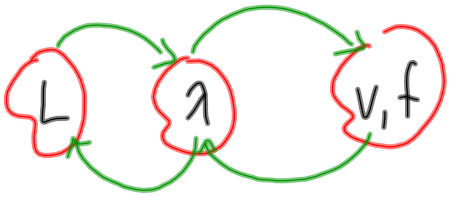
$f_2 = 2f_1$

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

$f_2 = 660\text{Hz}$

$f_3 = 3(330\text{Hz})$

$f_3 = 990\text{Hz}$



b) $v = \lambda f$

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

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

$\lambda = 1.04\text{m}$

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

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

$L_1 = 0.520\text{m}$

MP|426

$\lambda = 1.04\,m$ (from last question)

closed

$f_1 = 330\,Hz$

$L_1 = ?$

$v = 344\,m/s$

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

$L_1 = \frac{1}{4}(1.04\,m)$

$L_1 = 0.260\,m$

f_2 and $f_3 = ?$

$f_n = (2n-1)f_1$

$f_2 = (2(2)-1)\,330\,Hz$

$f_2 = (3)(330\,Hz)$

$f_2 = 990\,Hz$

$f_3 = (2(3)-1)\,330\,Hz$

$f_3 = (5)(330\,Hz)$

$f_3 = 1650\,Hz$

Use the spacing in our demo to figure out the speed of sound.

$L_2 = 24.5\,cm$

$L_3 = 42.5\,cm$

} 2 successive resonance lengths

$\Delta L = 42.5\,cm - 24.5\,cm$

$\Delta L = 18.0\,cm$

$\uparrow \frac{1}{2}\lambda$

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

$18.0\,cm = \frac{1}{2}\lambda$

$\lambda = 36.0\,cm$

$v = \lambda f$

$v = (0.360\,m)(1000\,Hz)$

$v = 360\,m/s$

$v = 331 + 0.59T$

$360\,m/s = 331\,m/s + \left(0.59\frac{m/s}{^\circ C}\right)T$

$29\,m/s = \left(0.59\frac{m/s}{^\circ C}\right)T$

$T = \frac{29\,m/s}{0.59\,m/s/^\circ C}$

$T = 49^\circ C$ ← HOT!