Prelab 5: Resonant Pipes & Harmonic Series

PHYS 1320 Fall 2013 Due at the beginning of class.

1) It is a very hot day in Dallas, and the speed of sound is 400m/s. Given the formula,

$$v = 332 \left(\frac{m}{s}\right) + 0.6 \left(\frac{m}{s \circ C}\right) T,$$

determine the present temperature. (We will use $v_{sound} = 400m/s$ for the prelab exercise ONLY to make the numbers come out nicely.)

2) OPEN PIPE: Draw the resonant standing wave patterns corresponding to the lowest 3 frequencies of an OPEN pipe. (You may draw pressure or displacement—your choice.)

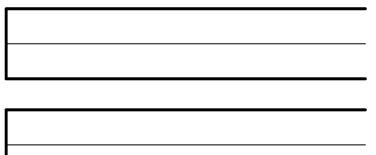
$L = \frac{1}{2} \lambda$
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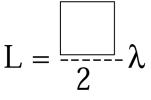
You should observe a pattern. We will now calculate the frequency. If $L=\frac{N}{2}\lambda$ where $N=1,2,3,\ldots$ then $\frac{1}{\lambda}=\frac{N}{2L}$. Using $v=f\lambda$, we have:

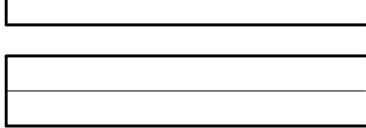
$$f = \frac{v}{\lambda} = \frac{Nv}{2L}$$

Use this formula, with $v_{sound} = 400 m/s$ to compute the first 3 resonant frequencies. For the length of the pipe use L = 1m.

3) CLOSED PIPE: Draw the resonant standing wave patterns corresponding to the lowest 3 frequencies of a CLOSED pipe. (You may draw pressure or displacement—your choice.)







$$L = \frac{\sqrt{2}}{2} \lambda$$

You should observe a pattern. We will now calculate the frequency. If $L=\frac{N}{4}\lambda$ where $N=1,2,3,\ldots$ then $\frac{1}{\lambda}=\frac{N}{4L}$. Using $v=f\lambda$, we have:

$$f = \frac{v}{\lambda} = \frac{Nv}{4L}$$

Use this formula, with $v_{sound} = 400 m/s$ to compute the first 3 resonant frequencies. For the length of the pipe use L = 1m.

4) COMPARISON:

Fill in th following tables. (Yeah, we only calculated the first 3 resonances, but you're smart and can figure out the pattern—we make use of this in the lab.)

OPEN PIPE

Resonance	Frequency
1	
2	
3	
4	
5	

CLOSED PIPE

Resonance	Frequency
1	
2	
3	
4	
5	