

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,

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

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.)



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

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

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

Use this formula, with $v_{sound} = 400m/s$ 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.)



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



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

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

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

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

4) COMPARISON:

Fill in the 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	