Prelab 5:
Resonant Pipes & Harmonic Series

PHYS 1320

Fall 2015

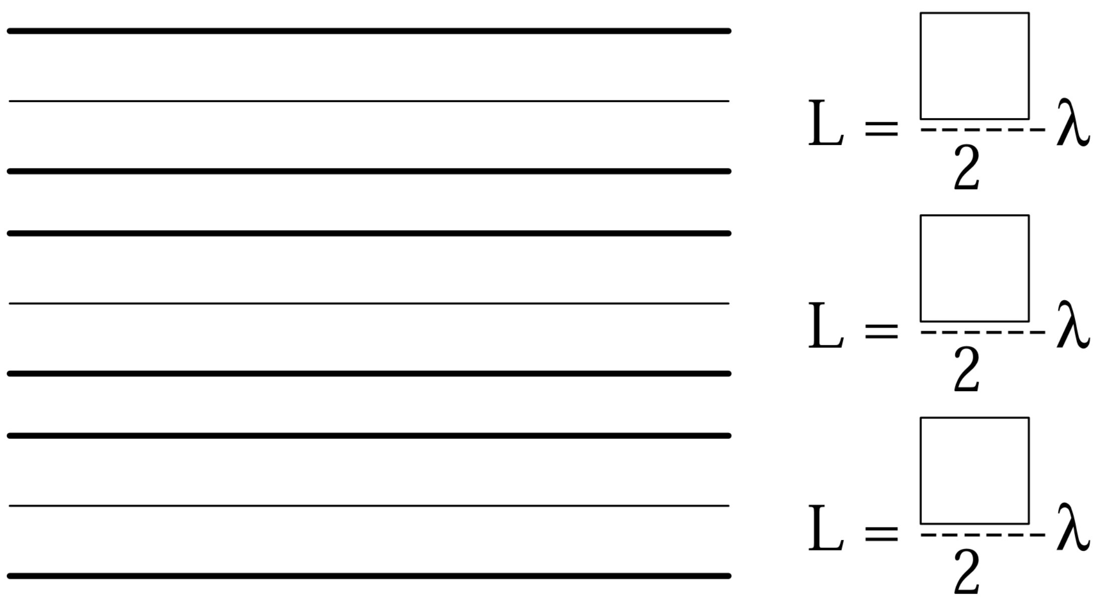
Due at the beginning of class.

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

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

determine the present temperature in Celsius. (We will use $v_{\text{sound}} = 400$ m/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.)

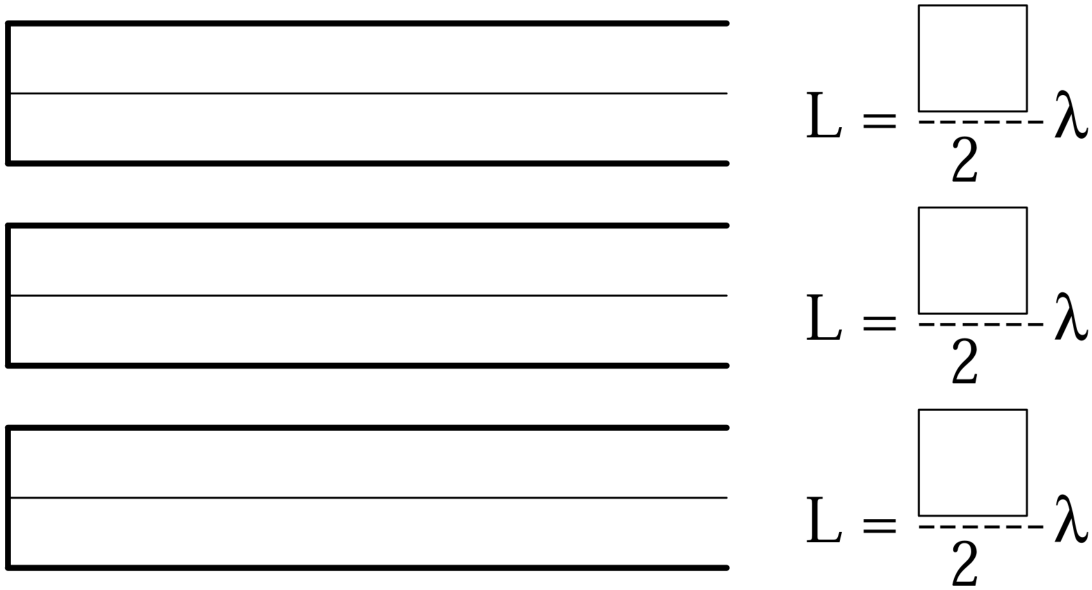


You should observe a pattern. We will now calculate the frequency. If $L = \frac{N}{2}\lambda$ where $N = 1, 2, 3, \ldots$ then $\frac{1}{\lambda} = \frac{N}{2L}$. Using $v = f\lambda$, we have:

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

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

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.)



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

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	