Prelab 5:
Resonant Pipes & Harmonic Series

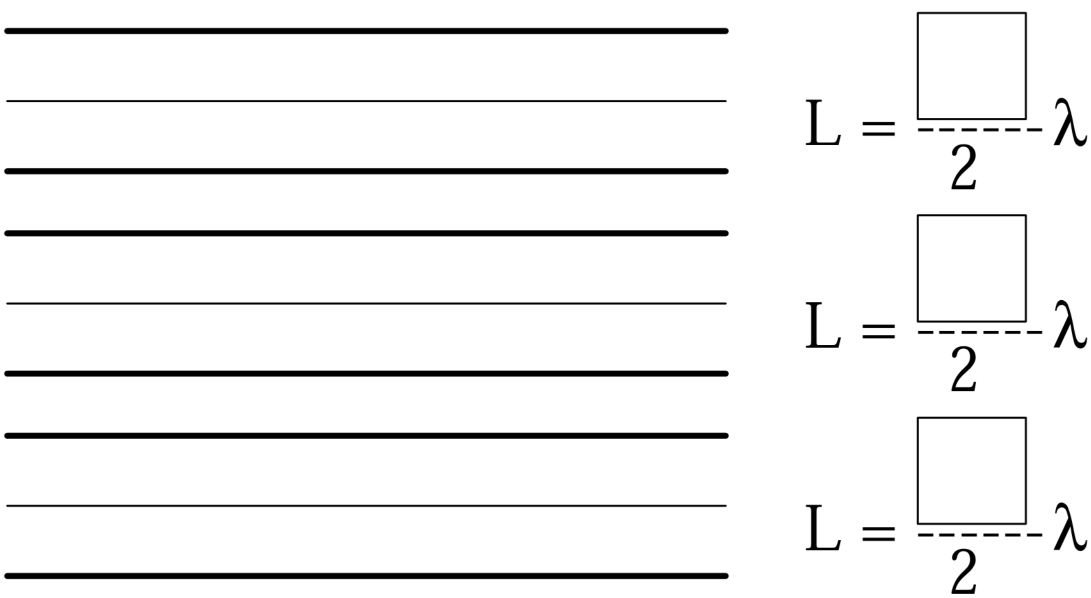
PHYS 1320
Fall 2017
Due at the beginning of class.

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

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

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 three frequencies of an OPEN pipe. (You may draw the pressure or displacement wave—your choice.)

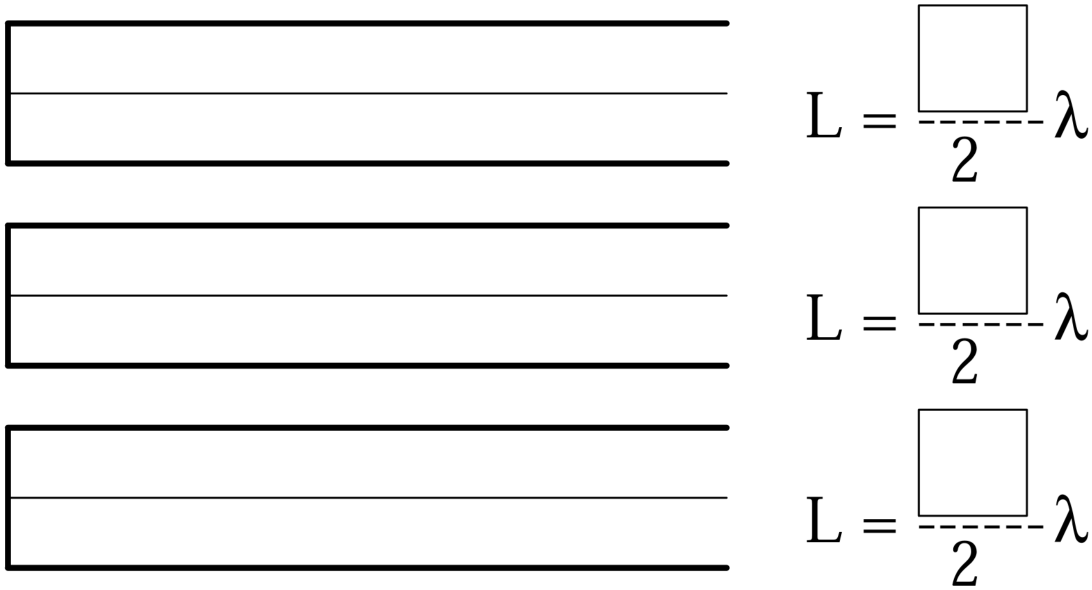


You should observe a pattern. We will now calculate the frequency. If $L = \frac{N}{2}\lambda$ where $N = 1, 2, 3, \ldots$ then $\frac{1}{\lambda} = \frac{N}{2L}$. Using $v = f\lambda$, we have:

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

Use this formula, with $v_{\text{sound}} = 400$ m/s to compute the first three 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 three frequencies of a CLOSED pipe. (You may draw the pressure or displacement wave—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 three resonant frequencies. For the length of the pipe use $L = 1$ m.

4) COMPARISON:
Fill in the following tables. (Yeah, we only calculated the first three resonances, but you're smart and can figure out the pattern—we will 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	