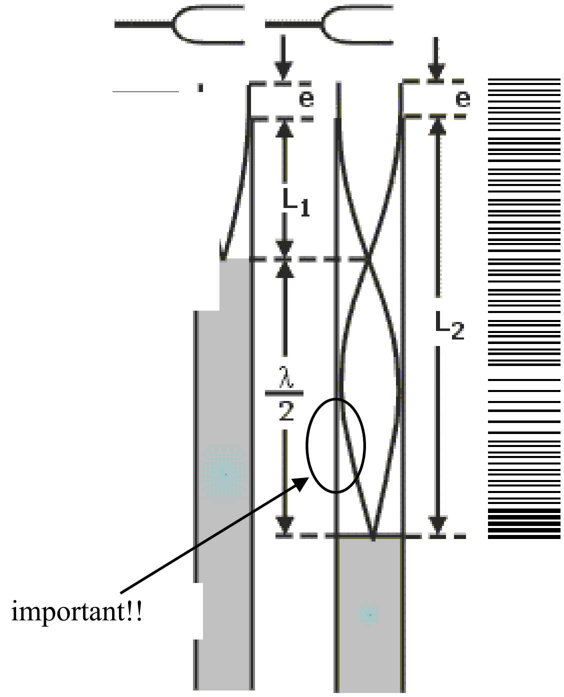
Sound Resonance Lab Instructions DAL 4/15/14 **Name** ________________________ **Block** ___ **Date** _______

Purpose:
Calculate the speed of sound using the principle of resonance in a closed tube.

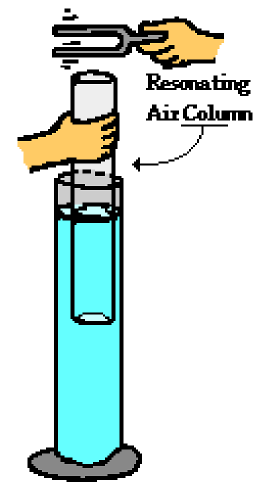
Materials, Procedure:
You will need to take notes during the lab so you can write a numbered, clear procedure in your formal lab report. (Helpful hint: you can find the second resonance more quickly by knowing that it should occur at a tube length approximately three times the length of the first resonance.)

The waves drawn in the diagram to the right represent the amplitude of the motion of the air molecules . The molecules are actually moving up and down, in a longitudinal wave, not a transverse wave.

Data and Results (60 points):
Place these in the table below.



e = "end correction"



Tuning fork forcing air coumn into resonance

These are data actually measured directly. Fill in the section below during the lab			These are calculated results. Fill in the section below **once you are done with data collection.**		
	This should equal _____ of a wavelength.	This should equal _____ of a wavelength.	This should equal _____ of a wavelength.		
Tuning fork Frequency (Hz)	**First resonance**: length of air column (m)	**Second resonance**: length of air column (m)	**Difference** between first and second resonance.	Calculated wavelength λ (m)	Calculated speed of sound v = λf

Predicted Speed of sound from formula:
$v_{accepted}$ (m/s) = 331 + 0.6t (t is temp in °C)

Average **calculated** speed of sound from your lab:

% error

Resonance Tube Conclusion Questions – Physics B
(5 points each)

1) What conditions must exist for a longitudinal wave to resonate in a tube? Where do displacement nodes have to be? Where do displacement antinodes have to be? Explain in terms of open and closed ends.

2) In our lab, the resonant lengths occurred at $\lambda/4$, $3\lambda/4$, $5\lambda/4$, etc. What is special about odd multiples of $\lambda/4$?

3) On the longitudinal standing wave animations, pressure and displacement nodes and antinodes are reversed. Why is a displacement node always a pressure antinode?

4) According to the speed equation, if the air gets warmer by 4 degrees Celsius, what should happen to the speed of sound? For a certain frequency, what should happen to the resonant tube lengths recorded for the lab? (Solve the basic wave speed equation for λ, and see how λ is related to v.)

5) What was the purpose of measuring two resonant lengths and using the <u>difference</u> to do our calculations? How did this help eliminate a source of error?

6) <u>Extra Credit</u>: Make a diagram of the first three resonant wavelengths which would fit in an open tube of set length. Calculate the first three actual resonant wavelengths, and the frequencies, which would resonate in a bugle with a length of 2.65 meters, and the speed of sound is 341 m/s.

Summary (15 points): Without simply reciting what you <u>did</u> during the lab, explain how and why someone can use a tuning fork and a meter stick to calculate the speed of sound, without actually seeing a sound wave or measuring how fast anything was moving. Use proper terms, and write in complete sentences.

USE THE TERMS WE HAVE BEEN TALKING ABOUT IN CLASS.