

The speed of sound in air

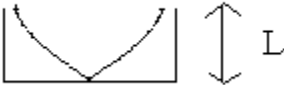
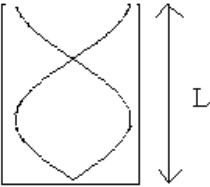
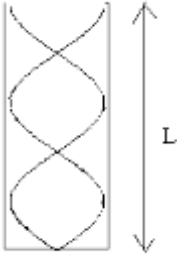
Resonance tube method

Name: _____

Include a short report including title, purpose, method, a % error (see questions on back), and a conclusion stating your result and potential sources of uncertainty. **No graphs are needed this week!**
This sheet can be turned in to show your data and calculations.

Theory: A resonant standing wave pattern produces the loudest sounds in a tube. As we've practiced in class, open pipe ends can be drawn as antinodes and the closed end of the pipe can be drawn as a node.

We will use a 1000 Hz tuning fork in this experiment. Since the frequency used is fixed, the pipe will only resonate at specific lengths. If you find the length of the resonating column (aided by the markings on the sides of the tube), you can calculate the wavelength of the sound. Once you do this, you can use the formula $v = f\lambda$ to **get the speed of sound** ($f = 1000 \text{ Hz}$).

Resonance location	Lengths (use meters!)	Wavelength: $\lambda = 4(\text{NA})$
	$L =$ $\text{NA} =$	(This will be the least accurate reading. Do not include it in your average – it is to help give an idea for where the next two will be.) $\lambda =$
	$L =$ $\text{NA} =$	$\lambda =$
	$L =$ $\text{NA} =$	$\lambda =$

See the reverse side for questions to answer in your conclusion section.

Find the *average* of the wavelength values for your last two resonance locations (they should be similar), and use $v = f\lambda$ to find the speed of sound. For your report, you will need to calculate % error:

$\% \text{ error} = \frac{|v_{\text{expt}} - v|}{v} \times 100\%$. v_{expt} is the speed of sound you got in the experiment and v is the speed you expect for the current room temperature. The instructor should tell you what that temperature is.

We say the first trial shouldn't be included because the error caused by what we call "edge effects" is largest compared to the tube length you're actually measuring. Let's try this: Notice that your last trial tube length is **2.5 loops**, and your first trial tube length is **0.5 loops**. If you *subtract* those two values, you should get a wavelength (**2 loops**) with the *systematic error* canceled out. What speed of sound do you get from calculating the wavelength in this way? Is it closer to what you expect?