

Name _____

Class _____

AP Physics Sound Waves in a Pipe

The wave pattern (pipe) in tubes can be modeled accurately with standing wave loops above the x axis. If the length of the pipe is adjustable, record the wavelength of the sound being produced by the tuning fork. In this experiment you will investigate the relationship between the frequency of vibrating fork and the length of the resonating sound waves in pipes.

Obtain the following materials: resonance hollow glass tube with adjustable length, graduated cylinder, set of 4 tuning forks with steel to be placed between pipes.

If the length of the pipe is not equal to the wavelength, find the value, what is the equation used to determine the wavelength for any closed tube or an L resonance?

..... However, the distance of the tube must also be taken into account as you change the length of the tube before using the equation you create above. Rearrange the equation, including the L value so that you are solving for L .

$$L = \dots\dots\dots$$

Measure the length L of the pipe. $L = \dots\dots\dots$

Copy problems record your data. The table should include all variables you will help you determine the wavelength and calculated frequency of all 4 tuning forks including the speed of sound in the room.

Determine the resonance in the tube. $f = \dots\dots\dots$ Hz

Calculate the speed of the sound in the room.

After collecting the data for the 4 tuning forks

Plot a graph of L vs wavelength against the actual (measured) frequency for each resonance.

- What does the graph look like (slope)?
- What kind of relationship does this graph represent?

What does the constant term in your L vs f graph represent?

- What is the relationship between wavelength and frequency for a wave of constant speed?
- Do your results agree with this relationship?

Plot a graph of the wavelength against the inverse of frequency ($1/f$).

- What does the graph look like?
- What are the units and the units of the slope and what does it represent?
- Compare your slope value of w to the theoretical speed of sound in your temperature. How does your w differ?

Using f also use your relationship L from the graph (B) of the calculated frequency of your tube compared to the actual (measured) frequency.