

Name \_\_\_\_\_

Class \_\_\_\_\_

### AP Physics Sound Waves in a Pipe

The wave produced by a tube can be modeled accurately with standing wave loops above the  $x$  axis. If the length of the pipe is adjusted to match the wavelength of the sound being produced by the tuning fork, constructive interference will reinforce the relationship between the frequency of vibrating fork and the length of the standing wave inside the pipe.

Obtain the following materials: resonance tubes plus extra with different lengths, graduated cylinder, set with tuning forks with need to be placed between pipes!

If  $x$  length of the pipe is one equal to the wavelength, there are nodes, what is the equation used to determine the wavelength for any closed tube or an  $l^2$  resonance?

..... However, the distance of the tube must also be taken into account as well. Suppose you had a  $x$  distance to the length before using the equation you would obtain. Rearrange the equation, including the  $l^2$  value so that you are solving for  $l$ :

$$l = \frac{v}{2f} \dots \dots \dots$$

Measure the length  $x$  value of the pipe.  $l =$  \_\_\_\_\_

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

Determine the resonance in the tube. \_\_\_\_\_ 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 overall?
- What kind of relationship does this graph represent?

Write down the equation for distance  $x$  and  $l$  speed, wavelength and frequency.

- 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 kind of graph is this?
- What are the units and the units of the slope and what does it represent?
- Compare your slope value of  $v$  to the theoretical speed of sound in your temperature. How close is it to  $v$ .

Table 1 also used in procedure 1. Enter the value (B) of the calculated frequency of your tube compared to the actual (measured) frequency.