Physics Exploration Homework Supplement **P111-1.pdf**

Measuring the Speed of Sound through Air and Water

Go to the Physics Exploration Center. Enter through the resource room 311/312 Thaw Hall. This exploration project involves calculating the speed of sound through air and through water and then comparing them. In the PEC you will find a station with a colored blue or green PVC pipe, and a microphone connected to a computer arid a printer (Set-up P111-1A.pdf). Go to that station.

1) Click on START to get the computer ready to record the sound. Note that the microphone is located next to one end of the PVC pipe. Make a sound by snapping your fingers or clapping your hands very close to the microphone. Wait for a minute or so for the waveform to be displayed as a function of time (slow computer).

2) You should notice two distinct peaks in your wave: the larger peak corresponds to the initial sound wave that you produced by snapping your fingers and a smaller peak corresponds to the sound wave that hits the microphone after traveling through the pipe and reflects back from the other end of the pipe.

3) Print out the graph for submission with your answers. Note the time between the two peaks on the graph.

4) What is the distance traveled by the wave to go from one end of the PVC pipe to the other? Do you think it is equal to the length of the pipe or twice the length?

5) From the knowledge of the distance traveled by the wave and the time between the two peaks, how can you calculate the speed of the wave? Write down a formula and calculate the speed of the wave through air.

6) Repeat steps 1-5 of the above exploration using the hose filled with water instead of the PVC pipe (Set-up P111-1B.pdf).

7) Compare the speed of the wave through the air you calculated in step 5 with the speed through the water yon calculated in step 6. Which one is larger? Does it make sense?

8) Write down the relation we discussed in the class for the speed of sound through the gas and liquid in terms of the elastic and inertial properties of the medium. Is the density of air larger or smaller than the density of solid? Based upon considerations of inertial properties alone, does your comparison in step 7 make sense? If so, please explain. If not, what can you conclude about the elastic property of the gas vs. the elastic property of the solid (recall from the lecture that the more elastic the medium the faster the sound waves travel through that medium).

1/10/05