MiSP Light and Sound Worksheet #1, L2

Name___________________________ Date__________

THE SPEED OF SOUND

Introduction:

Light and sound can seem mysterious. It is easy to know when light and sound are present and absent but difficult to describe what they really are. Light and sound represent the two kinds of waves that exist in nature: mechanical and electromagnetic. Here are some important facts to know:

- Mechanical waves, such as sound waves, must transfer energy through a substance or medium.
- Electromagnetic waves—such as light waves, radio frequency waves, X-rays, and microwaves—can transfer energy in a vacuum, without a medium.
- Electromagnetic waves are created by electrically charged particles that move.
- All types of electromagnetic waves travel at the same speed.
- Both types of waves, mechanical and electromagnetic, are initiated by something that vibrates.

In this activity you will collect data that will allow you to calculate the speed of sound.

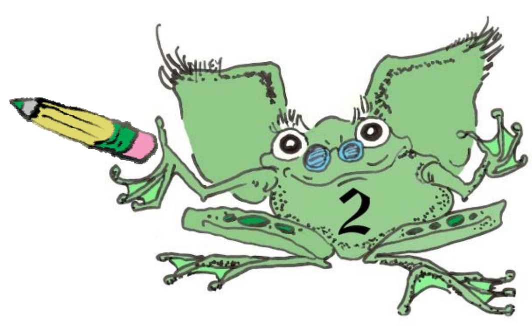
Procedures:

Check off each step as you complete it.

☐ First you must determine the length of one of your average footsteps. Start with your toe touching a starting line. Then take three normal steps without looking down, and measure the distance from the starting line to the toe of your forward foot. Record your data below and calculate your step length. Do this three times and then calculate your average step length.

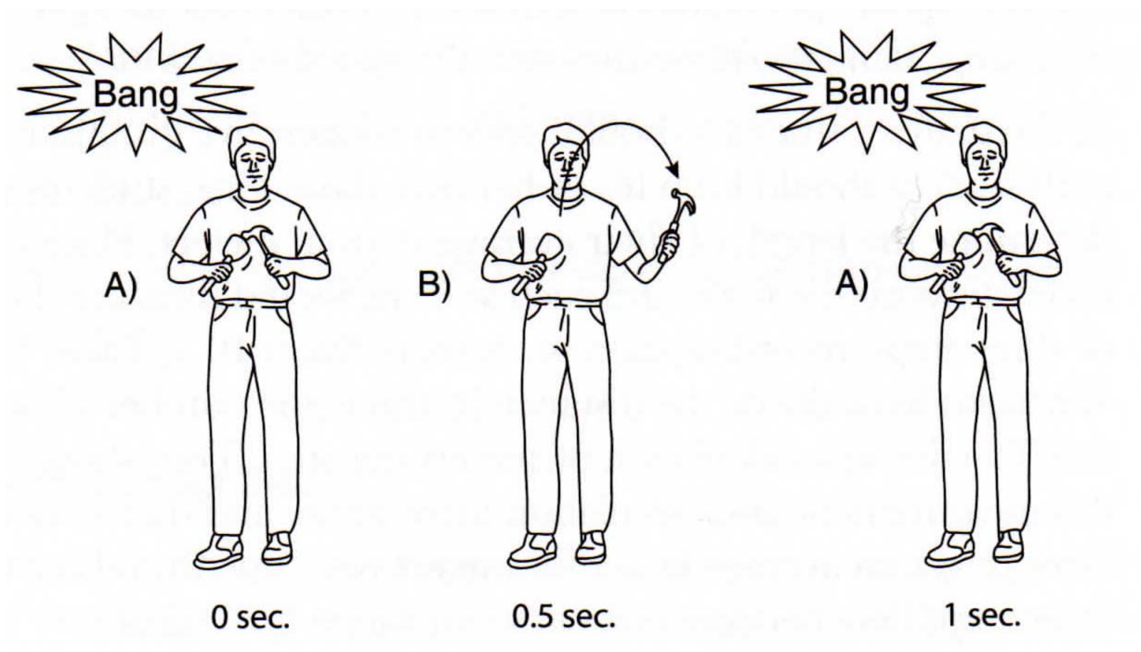
Table 1. Average Number of Meters per Step

Trials	**Distance in meters**		**Meters per Step**
Trial 1 – 3 steps		÷ 3	
Trial 2 – 3 steps		÷ 3	
Trial 3 – 3 steps		÷ 3	
Average			



☐ The class will now go to a large open area (e.g., playground, athletic field, lunchroom) to collect data. Your teacher will strike a metal plate with a hammer once per second, using an arc-like motion as shown in the figure below.

☐ Move away from your teacher, walking backward. Stop when the sound of the hammer hitting the metal is 0.5 seconds out of phase with the visual cue that the metal has been struck (you hear the bang when the hammer is at the opposite end of the arc).



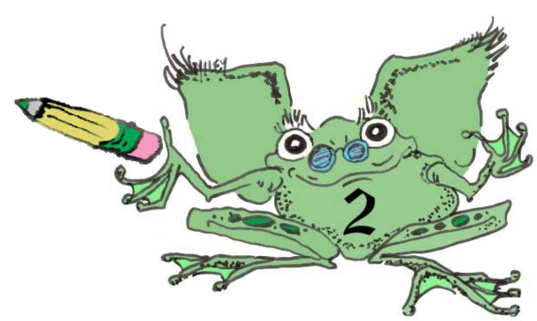
☐ Next walk back to your teacher, counting the steps. Record the number of steps in table 2.

☐ Repeat the procedure three times.

☐ Record the number of steps in table 2 and calculate the average.

Table 2. Distance from sound when 0.5 sec out of phase with visual cue

Trial	**Steps away from sound when 0.5 sec out of phase**
Trial 1	
Trial 2	
Trial 3	
Average	



1. Multiply the average number of steps you had taken from your teacher when the sound of the hammer hitting the metal was 0.5 seconds out of phase by the number of meters in each of your steps. This will give you the average distance sound travels in 0.5 seconds. Multiply this number by 2 to get the average distance sound travels in 1 second.

Average steps away from sound when 0.5 sec. out of phase	x	Average meters per step	x 2	
______________	x	____________	x 2 =	__________ m/sec

The speed of sound is __________________meters per second.

2. In air at 20˚C the speed of sound is approximately 343 m/s. How does your value for the speed of sound compare with this?

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3. Calculate the percent error.

(343 m/second – your calculated value) = ________________ =
343 m/second 343 m/second

______________ x 100 = ___________ %