Physical Science 9 Lab

SOUND

INTRODUCTION - All sounds are produced by matter that vibrates. The vibrations set up wavelike disturbances in the medium. These repeating compressions and rarefactions, called longitudinal waves, carry the energy of the vibrations through the medium. In this lab, you will study some of the properties of sound waves.

MATERIALS: tuning fork, rubber mallet, string instrument, metal cup, plastic wrap, salt, rubber band, Ping-Pong ball with string

PROCEDURE:

1. Determining that sound is caused by vibrations.

A. Touch your Adam's Apple as you hum a low noise.
B. Stretch the rubber band between two fingers. Pluck the rubber band.
C. Place a few grains of salt on the plastic wrap. Strike the tuning fork and place it close to the plastic wrap without touching it.

What happens to materials (tuning forks, vocal cords, rubber bands) as they produce sound?

2. Relating the loudness of sound to the amplitude (size) of the vibration.

Suspend the Ping-Pong ball over the counter. Touch a tuning fork to it:

a. while the fork is sounding softly.
b. while the fork is sounding loudly.

How is the loudness of the tuning fork related to the amplitude (size) of its vibration? Explain your reasoning.

3. Comparing sound as it travels through a gas (air) and a solid.

Place the metal rod on the corner of your lab table. Gently tap the rod with the handle of the tuning fork. Remember this sound.

Next, place your ear at one end of the metal rod and have someone gently tap the rod again.

Is there any difference in the loudness of the sound? What can you conclude about the mediums of gases (air) and solids (metal)?

a. Sound travels better in air than metal.
b. Sound travels better in metal than in air.
c. Sound travels the same in both air and metal.

4. **RESONANCE** Create a standing sound wave by doing the following:

1. Slide the shorter cardboard tube inside the longer one.
2. Strike the tuning fork. Quickly move it to one end of the tubes. Slide the tubes apart and together again. Note that varying the length of the tubes changes loudness.
3. Listen carefully and repeat the process until a tube position is located where the resonant sound is the loudest. You have now produced a standing wave inside the tube.
4. Measure the length of the tube at the location of the loudest sound.
5. Calculate the wavelength of the loudest wave = length of tube x 2.

What was the wavelength of the loudest sound?

5. Observing Interference

Bring the prongs of a humming tuning fork 2 to 3 cm from your ear. As you rotate the fork in your hand 360 degrees, does the sound get louder and softer?

Have a partner describe the position of the prongs when you hear the sound the loudest and when you hear it the softest.

6. Observing the Effects of Tightening a string

Pluck the string on the string instrument and remember the sound. Carefully tighten the string by turning the adjuster knob (**do not overtighten**). Pluck the string again.

What happens to the pitch of the sound after the string is tightened?

Loosen the string and pluck it again.

What happens to the pitch of the sound after the string is loosened?

7. Observing the Effects of Changing the Length of a string

Place the bridge under the string by the number 8 on the base of the string instrument. Pluck the string between the bridge and the end opposite the adjuster. Remember the sound. Now shorten the string by moving the bridge to the number 14. Pluck the string again between the bridge and the end opposite the adjuster.

What happened to the pitch of the sound after the string was shortened?

SOUND LAB REPORT

Name ______________________________
Hour _____

1. What was the purpose for doing this lab?

2. Briefly described what took place in this lab.

ANSWER THE QUESTIONS FROM EACH PROCEDURE BELOW. USE COMPLETE SENTENCES WHEN NECESSARY.

Procedure 1:

Procedure 2:

Procedure 3:

Procedure 4:

Procedure 5:

Procedure 6:

Procedure 7:

UNDERSTANDING RESONANCE

Study Figure A. Answer the questions.

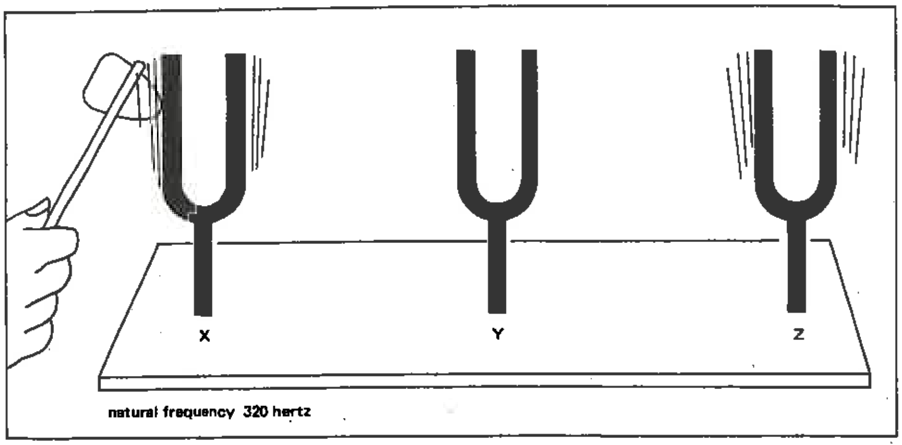

Figure A

1. Which tuning fork is being struck? ____________
2. What is its *natural frequency of vibration?* ____________
3. a) Which of the other forks has the same natural frequency? ____________
   b) How do you know? ________________________________
4. a) Which other fork does *not* have the same natural frequency? ____________
   b) How do you know? ________________________________
5. Which fork would you strike to make fork X vibrate? ____________

UNDERSTANDING INTERFERENCE

A tuning fork produces a *pure* sound. A pure sound has just *one* frequency.

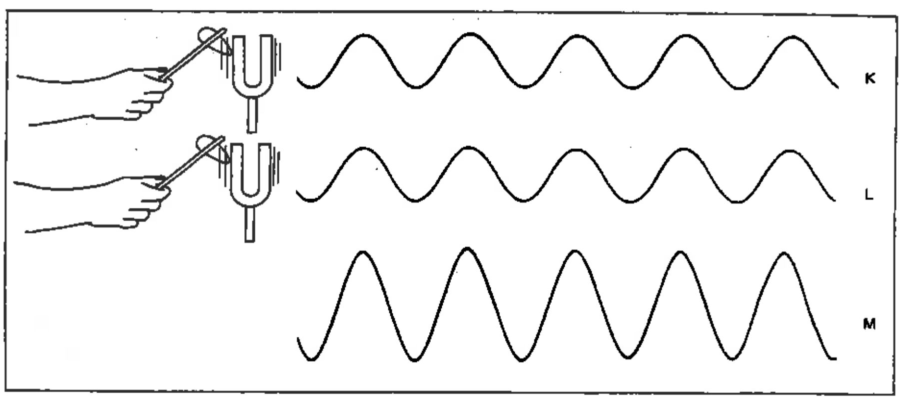

Figure A

In Figure A, tuning forks K and L are producing pure sounds of the *same* frequency. They interfere with one another. The new sound M is produced.

1. Look at the waves produced by K and L. Their crests and troughs ______________ (are, are not) lined up.
2. All the waves are ______________ (in, out of) phase.
3. The waves ______________ (help, work against) each other.
4. This is ______________ (constructive, destructive) interference.
5. The sound becomes ______________ (louder, softer).