STEM Sound Investigations
Can You Hear Me Now?
Student Inquiry Sheet

Name_____ Class_____ Date_____

CAUTION: When making and listening to sounds be careful to not put your ear next to a very loud sound that may damage your hearing.

1. Make a noise maker:

Take a plastic or paper cup and put a 1/16th inch or larger hole in the center of the bottom. Cut a 10 to 20 inch cotton string. Push the string into the cup through the hole in the bottom. Tie the end of the string inside the cup onto a toothpick or paperclip to keep the string from pulling out of the hole. Adjust the toothpick or paperclip so that it lies flat on the bottom of the cup when the string is pulled.

2. Make some noise:

Hold the cup in one hand. Grasp the string with two fingers from your other hand and slide your fingers down the string. **Be careful. You can cut your fingers if you grasp the string really hard.** Listen to sound vibrations in the cup. Next, get a wet piece of paper towel (not soaking wet). Hold the towel around the string and squeeze as you slide it down the string.

How do you think the noise maker makes sound? What does the string do? What does the cup do? How do they do it? Write your explanation below. Use drawings if you wish. Be prepared to share your ideas.

3. Make some more noise:

Try using something other than a cup for your noise maker. What if you used a paper plate? A pencil? A tin can? What if you used different kinds of string? Invent your own experiments and describe them below. Can you get the same results without a cup attached to the string?

4. Make even more noise:

Cut a "V" shape in one end of a straw. Put the cut end in your mouth. Use your teeth to gently squeeze the V end of the straw together as you blow through the straw. What does it sound like?

There are many types of "calls" that people invent to attract wildlife. A moose call can be made with a coffee can and string, much like the noise maker you made above. What kind of a wildlife call would you like to make?

Check Point

5. Design A Telephone System:

Working with a partner, make a telephone system using string-and-cup technology. Cut a piece of 10' to 20' cotton string. Attach cups to either end of the string by tying the string to a paper clip or toothpick inside the cup. Pull the string taunt and have one person talk into the cup. Have the other person listen with the cup held up to his/her ear. Be careful not to pull the string out of the cups.

Investigate how your telephone works by answering the following questions:

a. What do you have to do to make your phone work the best?

b. Can you hear the other person talk by just listening to the string? Explain why you can or cannot hear the other person talk?

c. How could you stop the sound from traveling through the string?

d. How could you "wire tap" phone?

e. How would you design a party line so that six or more people could be connected together? Describe your approach below.

f. What would you use to design the best string phone ever? What would be the optimal string? What would be most excellent receiver?

g. List 3 things you found out about your telephone system. How do the materials you used improve or interfere with the telephone's operation? Be prepared to share your ideas with the class.

Check Point

6. How do we hear and speak?

a. Put your fingers on your throat and say “ah”. Feel where the sound vibrations are being made. Then close your mouth and hold your nose shut and say something. Make high and low pitched sounds. What does this tell you about how you make sounds?

b. Recite a part of the alphabet as you normally would. Then, recite the alphabet again without moving your tongue. What does this tell you about how you make words?

c. Working in a small group, write a statement about how we make sounds and words when we speak. Does stroking a string on a cup help explain how vocal cords make sound? Draw pictures to help explain your ideas.

How are your ears like the cups in the cup-and-string telephone? How is your ear drum like the bottom of the cup? How does the eardrum transfer sound vibrations to the brain? Where do you hear sound, in your ear or in your brain?

For information on how the human voice works go to:
http://www.ehow.com/how-does_4587642_human-voice-box-work.html

For information on how the human ear works go to:
http://www.howstuffworks.com/hearing.htm

7. Communicating with sound!

Organisms usually make sounds because there is an advantage to being heard. The cup-and-string telephone is a model to help explain technology that helps us communicate over great distances around the globe and into space.

When you make sounds in the form of words, your brain first has to have idea. It then makes the vocal parts of you body move in a way that forms that word. That word is passed though various methods along to the brain of another person so they understand what you said. On a large piece of poster paper, draw a picture that shows every step of the transmission of idea from your brain to the brain of another person via a cup-and-string telephone. Label each step and explain what is happening to make the transmission possible.

Check Point

Extensions: Why Two Ears?

Most animals that can hear have two ears. The following activities help show the advantage of having two ears instead of one.

a. When you use two ears to listen for sound, you are listening in binaural (i.e. stereo). In this investigation, you will use both ears to locate a sound. Close your eyes and have someone make a quick sound. Point to the exact place where the sound came from. Then, open your eyes to see how accurate you were. Next, have someone sit across from you at a table. Close your eyes and have that person tap on the table. Try to reach out and touch the spot where the table was tapped. Try this about 5 times. How accurate were you?

b. When you use just one ear to listen for sound, you are listening in monaural. In this investigation, you will use one ear to locate a sound. Tightly cover one of your ears with a piece of a paper towel and conduct the same two investigations from above. How did covering one ear impact your accuracy?

c. Let's explore your binocular vision. Close your eyes and cover one eye with your hand. Have a person put a small piece of paper on the table in front of you. Open your uncovered eye and very quickly put your finger directly on the piece of paper. Do this several times. Do it again, but this time do not cover your eyes. What happened this time?

- To find out more about binaural and monaural hearing, go to http://www.youtube.com/watch?v=IUDTlvagjJA and listen to Luigi giving a virtual haircut in his barbershop. First listen to the sounds on your computer and then wear a set of stereo earphones.

- Owls catch mice by hearing them move even though they can't see them. Are two ears necessary for this to happen?

- Bats catch insects by emitting a noise and listening to the echo (sound) as it bounces off them. This echo helps the bats locate the insects. Other bats can identity flowers with nectar by listening to a specific noise that comes from the plant when wind blows across it. Two ears may be important.

- Whales locate food and capture fish to eat by making sounds and listening for the echo, i.e. SONAR. Whales also seem to be able to find other whales by using sounds to communicate, sometimes hundreds of miles apart. Do whales have 2 ears? Where are they if they have them?