



Grade Level: **K-2**



Suggested Time: **90 minutes**

10 minutes - Introduction

5 minutes – Demonstrate building string cup phone

15 minutes – Rotation 1

15 minutes – Rotation 2

15 minutes – Rotation 3

15 minutes – Rotation 4

15 minutes – Class discussion of findings

# Sound on a String

## Center Activity

**Lesson Overview:** In this activity, students will rotate through a series of center activities to develop a hypothesis for how sound travels as they experiment with different types of string, sizes of string, types of cups and sizes of cups to determine the best method to transmit sound on a 'string cup phone'.

### Objectives:

Following this activity, students will be able to:

- Explain how sound travels.
- Demonstrate how the transmission of sound waves is affected by different materials.

### Materials:

- Multiple types of string: 2m each
- Multiple lengths of one type of string (examples: 2m, 5m, and 10m)
- Multiple pairs of various types of cups
- Pairs of various sizes of one type of cup
- Nail or screw for the teacher to punch holes in the cups
- Photocopies of Inquiry Activity Sheet (or create one age appropriate for your students)
- Large plastic baggies for grouping materials at centers (optional for student assembly)
- Chart paper
- Crayons
- Pencils

✓✓✓ Next Generation Science Standards (NGSS):

**1-PS4-1. Waves and Their Applications in Technologies for Information Transfer:** Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.

**1-PS4-4. Waves and Their Applications in Technologies for Information Transfer:** Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.

✓✓✓ Common Core Standards for Mathematics (CCSS):

**CCSS.MATH.CONTENT.1.MD.C.4. Represent and interpret data:** Organize, represent, and interpret data with up to three categories: ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

**Procedure:** At each center students will test one variable and document their findings on the Sound on a String Inquiry Activity Sheet. Following the activity, the teacher will facilitate a classroom discussion by combining the individual findings on large chart paper. This will create a class graph for each variable and allow discussion for any similarities or differences as the class comes to the conclusion of how sound travels.

For younger students, it is recommended to have the various string cup phones pre-prepared at each station. For older students, the teacher may demonstrate construction of the phones prior to the rotations. For all students, it is recommended the teacher models the proper use of a string cup phone prior to starting the center rotations. The teacher may demonstrate that the string must be pulled tightly in order for the vibration to travel through it, remind students they should whisper into the phone to allow everybody to hear their own partner, and allow time for students to practice soft talking with their partner before the rotations begin.

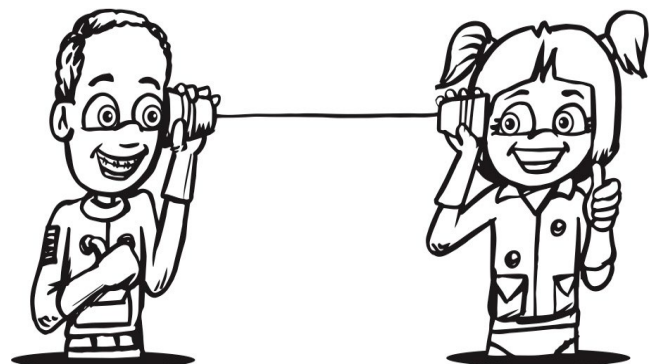
### Center Rotations

**Center 1:** Students will observe the differences due to string material.

**Center 2:** Students will observe the differences due to string length.

**Center 3:** Students will observe the differences due to cup material.

**Center 4:** Students will observe the differences due to cup size.



### **Student Procedure for Constructing String Cup Phones:**

1. Thread string up through the hole in the bottom of cup.
2. Tie a knot on the end of the string inside the cup. If needed, add a paper clip or button to help keep the string from pulling through the hole. You may need to tie several knots on the end to make the knot large enough to prevent the string from slipping out of the hole.
3. Repeat steps 1 and 2 with the second cup.
4. Stand far enough apart so the string is pulled tightly and whisper into the cup while your partner places his or her ear near the opening of the other cup.
5. Rotate through each station and record your results on the Inquiry Activity Sheet.

### **Final Discussion:**

Use the class chart to guide the following discussion questions and stimulate interest in further investigation.

- What is sound?
- How does sound get from one place to another?
- Why is vibration important?
- How do we make sound?
- How do we hear sound?

### **Assessment:**

- For older students: Collect and review completed Sound on a String Inquiry Activity Sheets.
- For younger students: Ask students to illustrate what they observe at the different center rotations
- Informal Assessment: Discuss how the materials affected the sound and ask which combination of materials may create the “best” string cup phone.

### **Extensions:**

- Give each student the opportunity to create the optimal string cup phone by selecting a string material, string length, cup material, and cup size. Assemble the phone and allow students to take it home to teach their family about sound waves.
- Have students brainstorm ideas to improve the design of the string cup phone using the same or different materials. Then have students test their designs.
- Use the web resources below to research more about sound and find additional sound activities such as the Shoebox Guitar, Musical Tube, or Super Sound Cone.
- Team up with a music teacher to let students investigate how different instruments produce sounds.

### **Additional Resources:**

Additional Commercial Crew Education Resources: <http://www.nasa.gov/stem/ccp>

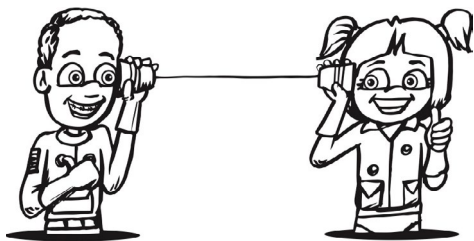
Musical Tube Activity: [www.grc.nasa.gov/WWW/K-12/TRC/Aeronautics/Musical\\_Tube.html](http://www.grc.nasa.gov/WWW/K-12/TRC/Aeronautics/Musical_Tube.html)

Collection of samples from single notes to full orchestra: [www.philharmonia.co.uk/thesoundexchange/sound\\_samples/sample\\_libraries/](http://www.philharmonia.co.uk/thesoundexchange/sound_samples/sample_libraries/)

Directions for constructing a Super Sound Cone: <https://spaceplace.nasa.gov/sound-cone/en/>

*Web sites may provide teachers and students with background information and extensions. Inclusion of a resource does not constitute an endorsement, either expressed or implied, by the National Aeronautics and Space Administration.*





## Inquiry Activity Sheet: Sound on a String!

Student Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Directions:** Fill in the blank with the best answer choice from each center.

### **Center 1: Type of string**

1. The string made of \_\_\_\_\_ made the loudest sound.
2. The string made of \_\_\_\_\_ sounded the clearest.

### **Center 2: String Length**

1. The string that was \_\_\_\_\_ long made the loudest sound.
2. The string that was \_\_\_\_\_ long sounded the clearest.

### **Center 3: Type of cup**

1. The cup made of \_\_\_\_\_ made the loudest sound.
2. The cup made of \_\_\_\_\_ sounded the clearest.

### **Center 4: Cup Size**

1. The \_\_\_\_\_ size cup made the loudest sound.
2. The \_\_\_\_\_ size cup sounded the clearest.

**Draw:** Show two students using the materials you think work best together to make sound.