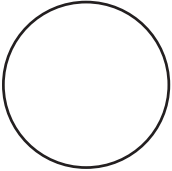
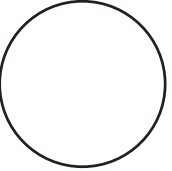
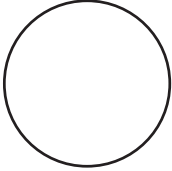
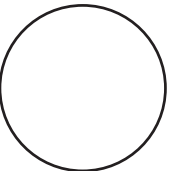
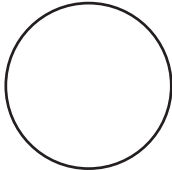
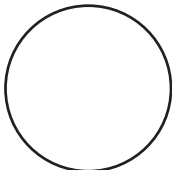
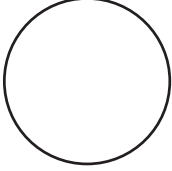
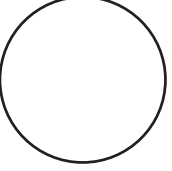


**SORTING MAT**



## RESPONSE SHEET—DROPPING IN

.....

Two students wanted to invent a new code to use with the drop chamber so they could practice their multiplication facts. Anthony said the washer was easy to identify, so they should use only metal objects like coins and washers to make their code. Neha said she thought they should use objects that were made of different materials, like a Ping-Pong ball, a wooden stick, a washer, and so forth.

Which student do you think has the better idea? Explain why you think so.

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## THE TUNING FORK

### MATERIALS FOR A GROUP

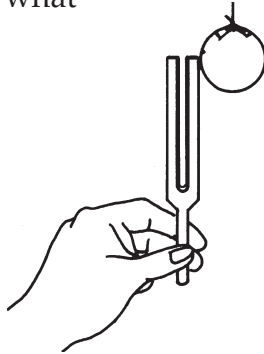
- 1 Tuning fork
- 1 Cup of water
  - Paper towels
- 1 Ping-Pong ball on a thread

### REMEMBER

Strike the tuning fork on the wood or on the bottom of your shoe before doing each step.

### INVESTIGATION

1. Dip just the ends of the tuning fork into a cup of water. Watch and listen.
2. Touch the ends of the tuning fork to the edge of a piece of paper. Watch and listen.
3. Touch the ends of the tuning fork to your cheek. Describe what you feel.
4. Hold the thread so the Ping-Pong ball hangs in the air. Touch the tuning fork to the ball. Keep the tuning fork in one position and watch what happens to the ball.



### RECORD

Describe how you know that a tuning fork vibrates.

### GO FURTHER

- Hit the tuning fork again. Press the end of the handle down on the table, the floor, a book, and other objects. Listen to the different sounds.

## THE TUNING FORK

### MATERIALS FOR A GROUP

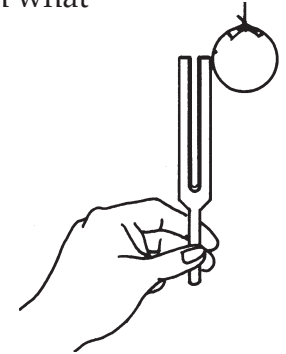
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### GO FURTHER

- Hit the tuning fork again. Press the end of the handle down on the table, the floor, a book, and other objects. Listen to the different sounds.

## THE LONG GONG

### MATERIALS FOR A GROUP

2 Long gongs

### INVESTIGATION

1. Place the plastic cup to your ear. Let the long gong hang freely, away from your body.
2. Have your partner hit the metal wire with a pencil so that it vibrates. Listen.
3. Make the sound stop.
4. Take turns using the long gong.
5. Discuss your observations.



### RECORD

Describe how you can tell that the vibrations cause the sound.  
How did you stop the sound?

### GO FURTHER

- Use different objects to strike the long gong. How does the sound change?
- Place the plastic cup over your partner's ear. Pull the string tight and pluck the string. Have your partner listen and describe the sound.

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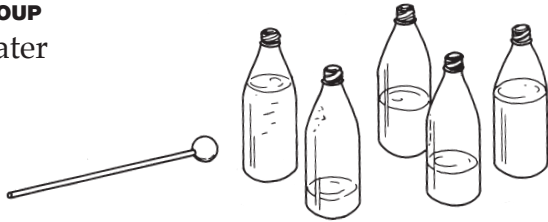
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## THE WATERPHONE

### MATERIALS FOR A GROUP

- 5 Bottles with water
- 1 Mallet

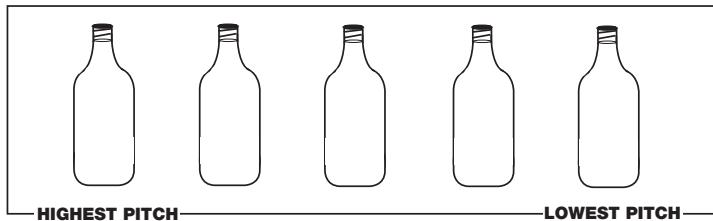


### INVESTIGATION

1. Choose two bottles. Tap the bottles below the water line. Ask your group to listen with eyes closed and with eyes open. Vote on which bottle has the higher pitch.
2. Take turns. Each player chooses two bottles. Everyone listens. Everyone votes on which bottle has the higher pitch.
3. Arrange the bottles from the highest to the lowest pitch.

### RECORD

Draw the water level in the bottles to show how you arranged them.



Describe what you observed about pitch and the waterphone.

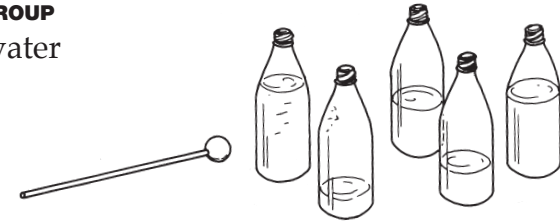
### GO FURTHER

- Try playing a tune your group will recognize.
- Put your ear to the table and have someone else tap the bottles.

## THE WATERPHONE

### MATERIALS FOR A GROUP

- 5 Bottles with water
- 1 Mallet

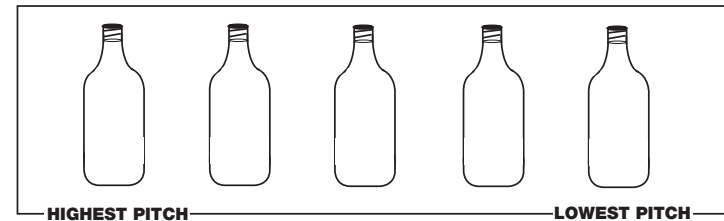


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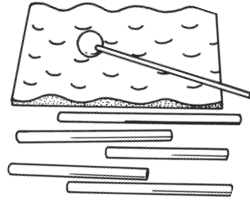
### GO FURTHER

- Try playing a tune your group will recognize.
- Put your ear to the table and have someone else tap the bottles.

## THE XYLOPHONE

### MATERIALS FOR A GROUP

- 5 Xylophone tubes
- 1 Foam piece
- 1 Mallet



### REMEMBER

Always place the xylophone tubes on the piece of foam so that they do not touch each other.

### INVESTIGATION

1. Choose two xylophone tubes. Hit each tube with the mallet. Ask your group to listen with eyes closed and with eyes open. Vote on which tube has the higher pitch.
2. Take turns. Each player chooses two tubes. Everyone listens. Everyone votes on which tube has the higher pitch.
3. Arrange the tubes from the highest to the lowest pitch.

### RECORD

Draw the tubes to show how you arranged them. Describe what you observed about the pitch of the tubes. Compare a long tube to a short tube.



HIGHEST PITCH

LOWEST PITCH

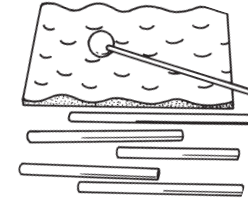
### GO FURTHER

- Challenge your group to identify a tune you play on the xylophone.

## THE XYLOPHONE

### MATERIALS FOR A GROUP

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- 1 Foam piece
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### REMEMBER

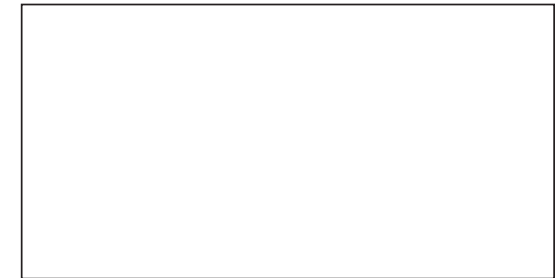
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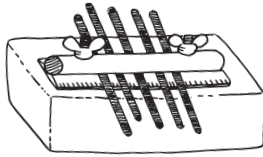
### GO FURTHER

- Challenge your group to identify a tune you play on the xylophone.

## THE KALIMBA

### MATERIALS FOR A GROUP

- 5 Steel springs
- 1 Kalimba base
- 2 Craft sticks



### REMEMBER

To place a bar in the kalimba, loosen the wing nuts, slide the bar under the dowel, and tighten the wing nuts.

### INVESTIGATION

1. Place the five bars in the kalimba base so they are all different lengths. Choose two of the kalimba bars. Pluck them while everyone listens. Ask your group to listen with eyes closed and with eyes open. Vote on which bar makes the higher pitch.
2. Take turns. Each player chooses two bars to pluck. Everyone votes on which bar makes the higher pitch.
3. Arrange the bars from the highest to the lowest pitch.

### RECORD

Draw the kalimba with the bars in position to play sounds from highest to lowest pitch.

Describe what you observed about the pitch of the bars. Compare a long bar to a short bar.



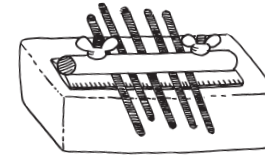
### GO FURTHER

- Press your ear to the table while someone else plays the kalimba on the table.
- Two people play a duet on the kalimba *at the same time*. One person plays the bars on one side, and the second person plays the bars on the other side.

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### GO FURTHER

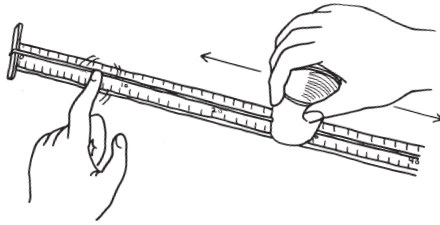
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## THE STRING BEAM

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### MATERIALS FOR A GROUP

- 1 String beam



### INVESTIGATION

1. Pluck the string. Move the cup and pluck the string again. Ask your group to listen with eyes closed and with eyes open. Vote on which sound has the higher pitch.
2. Take turns. Each player plays two notes. Everyone listens. Everyone votes on which has the higher pitch.

### RECORD

How does the length of the string change the pitch of the sound?

### GO FURTHER

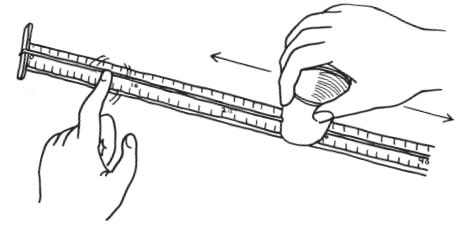
- Do the investigation again with each player playing *three notes* instead of just two. Vote on the order from highest to lowest pitch.
- Gently hold the back of the string beam across your ear while someone else plays some notes.
- Play a tune on the string beam.

## THE STRING BEAM

---

### MATERIALS FOR A GROUP

- 1 String beam



### INVESTIGATION

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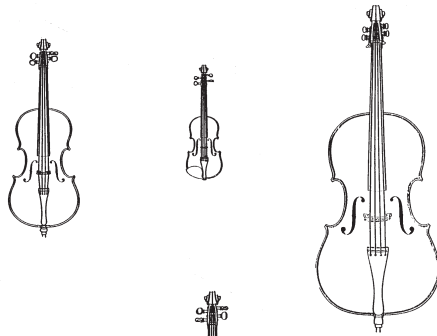
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## RESPONSE SHEET—GOOD VIBRATIONS

Look at the pictures of the stringed instruments to the right.

- Put an *H* on the instrument that you think can play the highest notes.
- Put an *L* on the instrument that you think can play the lowest notes.



Then respond to the paragraph below.



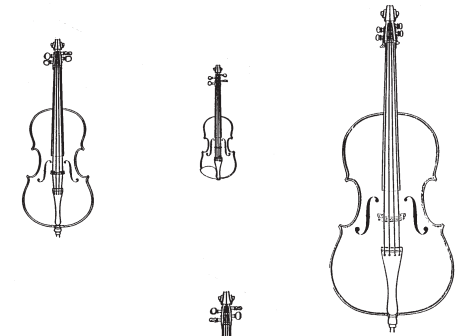
Wendell told his class, “You can make sounds with these instruments. All you have to do is stop the strings from vibrating, either by plucking them or moving a bow across them. The bigger the instrument, the higher the pitch. And if I tighten one of the strings, that string will have a higher pitch.”

Do you agree with what Wendell said? If you disagree, what would you say differently?

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Do you agree with what Wendell said? If you disagree, what would you say differently?

## THE MINIGUTBUCKET

### MATERIALS FOR A GROUP

- 2 Minigutbuckets

### INVESTIGATION

1. Pull on the cup to tighten the string.  
Put the cup up to your ear.  
Pluck the string and listen.  
What happens to the sound when you pull the string tighter?
2. Have a partner pluck the string while you listen.  
Change the tension on the string and compare the sound it makes.
3. Change roles and repeat steps 1 and 2.

### REMEMBER

Wrap the end of the string around a leg of a chair or desk. Use the paper clip to hold the string in place.



### RECORD

Describe how the pitch changes as you tighten the string.  
Describe how the pitch changes as you loosen the string.

### GO FURTHER

- Play a whole scale: do, re, mi, fa, sol, la, ti, do.
- Play a tune on the minigutbucket.
- Have a partner pinch the string while you play. Notice how the pitch changes as your partner slides a hand up and down the string.
- If there are two minigutbuckets, play a duet!

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## THE FOSS-ULELE

### MATERIALS FOR A GROUP

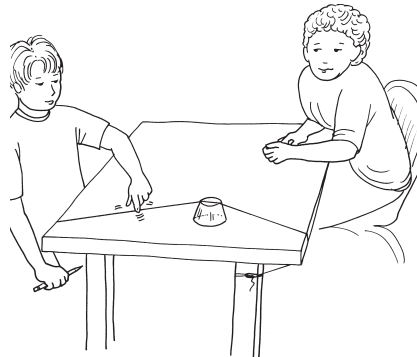
- 2 FOSS-uleles
- 2 Plastic cups

### REMEMBER

Wrap the end of the string around a leg of a table or desk. Use the paper clip to hold the string in place.

### INVESTIGATION

1. Place a cup on the table upside down. Pull the FOSS-ulele string across the bottom of a cup. Pull down on the pencil to put some tension on the string. Pluck the string and listen.
2. Release some tension on the string so that it becomes looser. Pluck the string and listen to the sound.
3. Increase the tension on the string (pull it tighter) and listen again.



### RECORD

Describe how the pitch changes as you tighten the string.  
Describe how the pitch changes as you loosen the string.

### GO FURTHER

- Play a whole scale: do, re, mi, fa, sol, la, ti, do.
- Play one of your favorite tunes.
- Keep the string tight and move the cup on the table. Describe the change in the pitch.

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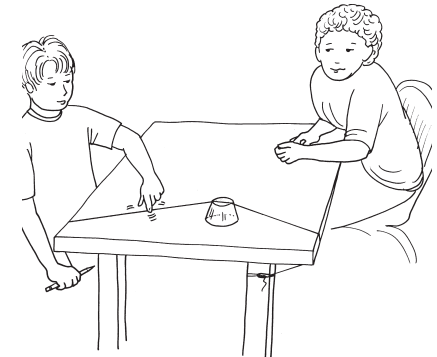
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## SOUNDS THROUGH AIR

### MATERIALS FOR A GROUP

- 1 Tuning fork
- 3 Tubes
- 1 Block

### REMEMBER

To start the tuning fork vibrating, strike it sharply on the piece of wood. Hit the edge of one tine, not the sides of both tines.



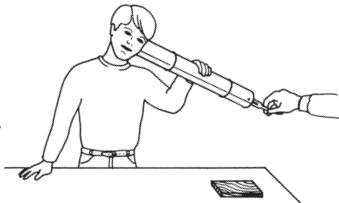
### INVESTIGATION

1. Carefully hit the tuning fork on the wood and then hold the tuning fork in the air near your ear. Listen to the sound it makes.
2. Have your partner hit the tuning fork. Ask him or her to hold the tuning fork at the end of the tube while you listen.



### RECORD

Compare the sound of a tuning fork heard in open air and through the tube. Describe what was the same and what was different.



### GO FURTHER

- Try placing the tuning fork far inside the tube. Slowly move it in and out a little bit. See if the tuning fork sounds different.
- Use a clock or a stopwatch to find out how long each group member can hear the tuning fork without the tube. Then find out how long you can hear it with the tube.
- Listen to other sounds through the tube.

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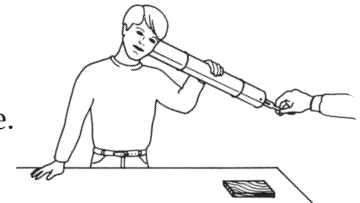
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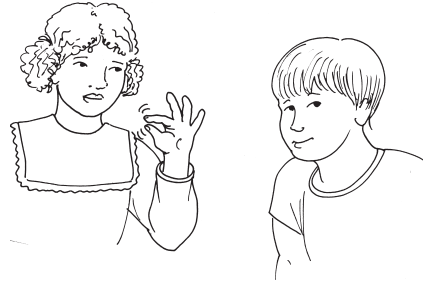
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## SOUNDS THROUGH WATER

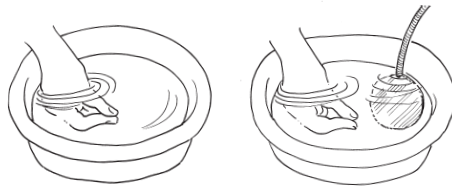
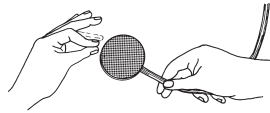
### MATERIALS FOR A GROUP

- 1 Basin of water
- 2 Stethoscopes
  - Paper towels
  - Alcohol and cotton balls



### INVESTIGATION

1. Tap your fingers together. Listen to the sound.
2. Tap your fingers again. Listen to the sound through a stethoscope.
3. Tap your fingers underwater and listen.
4. Tap your fingers underwater. Listen with the stethoscope through the water.



**Safety Note:** Remember not to strike the diaphragm of the stethoscope against hard objects.

### RECORD

Describe your observations. How was the finger tapping different when you listened to it through the water?

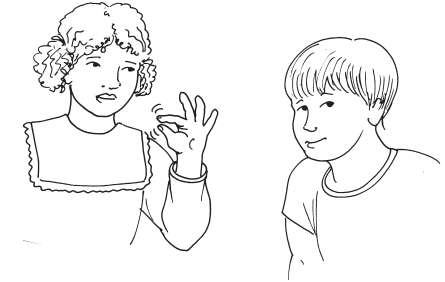
### GO FURTHER

- Take turns using the stethoscope. Listen to more sounds out of water and compare them to the same sounds underwater. Try hitting pencils together or tapping your finger against the side of the basin.

## SOUNDS THROUGH WATER

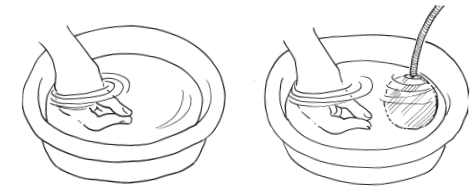
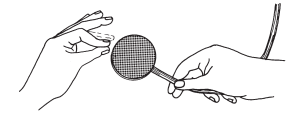
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  - Paper towels
  - Alcohol and cotton balls



### INVESTIGATION

1. Tap your fingers together. Listen to the sound.
2. Tap your fingers again. Listen to the sound through a stethoscope.
3. Tap your fingers underwater and listen.
4. Tap your fingers underwater. Listen with the stethoscope through the water.



**Safety Note:** Remember not to strike the diaphragm of the stethoscope against hard objects.

### RECORD

Describe your observations. How was the finger tapping different when you listened to it through the water?

### GO FURTHER

- Take turns using the stethoscope. Listen to more sounds out of water and compare them to the same sounds underwater. Try hitting pencils together or tapping your finger against the side of the basin.

## RESPONSE SHEET—HOW SOUND TRAVELS

---

Yiyu and Wen were having an argument. They had just seen an adventure movie about space travel. The spaceships made interesting sounds as they zipped through outer space. Yiyu said that there should have been no sound when the spaceships were flying through space. She told Wen, “Sound has to travel through something, like the air or water or something solid. Sound can’t travel in outer space because there’s nothing there.”

Wen said, “But all the movies I see about space have noise to show the spaceships are moving, just like when you hear an airplane, you know it’s going somewhere. They can’t all be wrong!”

What would you tell the girls to settle their argument?

## RESPONSE SHEET—HOW SOUND TRAVELS

---

Yiyu and Wen were having an argument. They had just seen an adventure movie about space travel. The spaceships made interesting sounds as they zipped through outer space. Yiyu said that there should have been no sound when the spaceships were flying through space. She told Wen, “Sound has to travel through something, like the air or water or something solid. Sound can’t travel in outer space because there’s nothing there.”

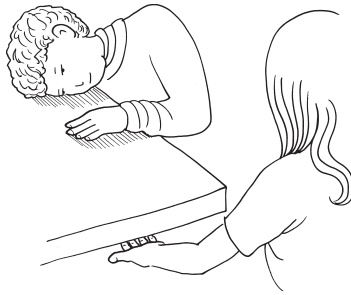
Wen said, “But all the movies I see about space have noise to show the spaceships are moving, just like when you hear an airplane, you know it’s going somewhere. They can’t all be wrong!”

What would you tell the girls to settle their argument?

## SOUNDS THROUGH SOLIDS: WOOD

### MATERIALS FOR A GROUP

- 2 Wood dowels
- Tissues
- Tape



### INVESTIGATION

1. Have someone scratch the table. Listen to the sound through air.
2. Press your ear to the tabletop and listen to the sound through the solid table.
3. Wrap a tissue around the rounded end of the stick. Tape it in place. Rub the other end of the stick and listen to the sound through the air.
4. Carefully hold the tissue end of the stick to your ear. Rub the end of the stick and listen to the sound through the solid stick.



### RECORD

What did you observe? How was the sound different when you listened through the stick?

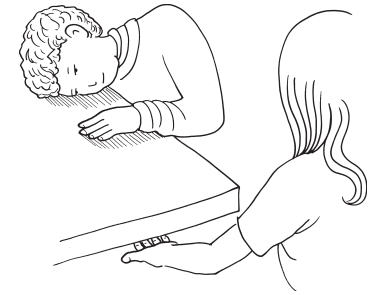
### GO FURTHER

- Listen to other sounds through the stick.
- Press the stick to the table, wall, or floor. Listen to the sounds.
- Listen to sounds through two sticks end to end.

## SOUNDS THROUGH SOLIDS: WOOD

### MATERIALS FOR A GROUP

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### INVESTIGATION

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### RECORD

What did you observe? How was the sound different when you listened through the stick?

### GO FURTHER

- Listen to other sounds through the stick.
- Press the stick to the table, wall, or floor. Listen to the sounds.
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## SOUNDS THROUGH SOLIDS: STRING

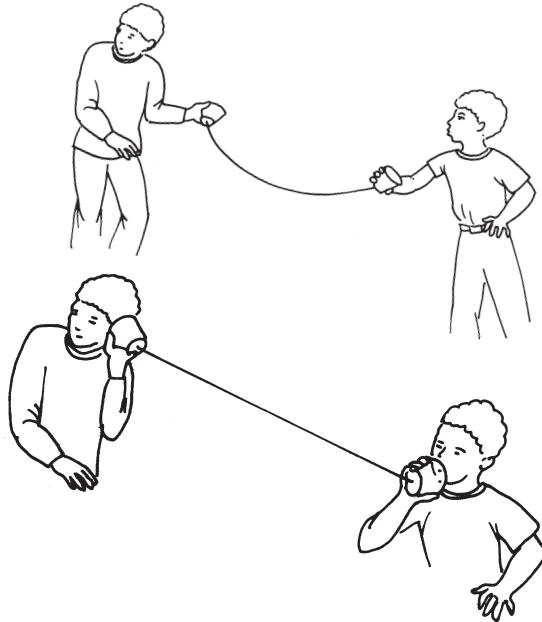
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### MATERIALS FOR A GROUP

2 String telephones

### INVESTIGATION

1. Stand apart and talk softly to your partner without using the phone.
2. Now talk softly into the cup of the string telephone. Be sure the string is pulled tight.



### RECORD

What did you find out? Compare the whisper through the air and through the string.

### GO FURTHER

- Tap the cup or scratch the string. Ask your partner to listen to the noise on the phone line.
- See how your telephone works with a very high voice and a very low voice.
- Try to send messages around a corner.

## SOUNDS THROUGH SOLIDS: STRING

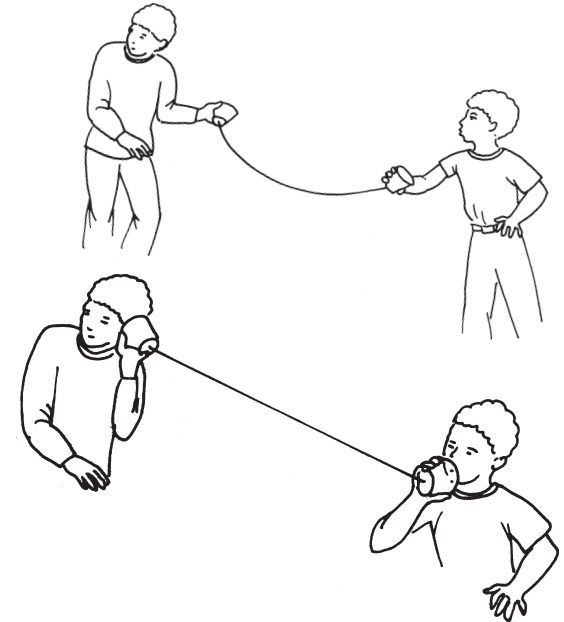
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## THE FOSS-ULELE CHALLENGE

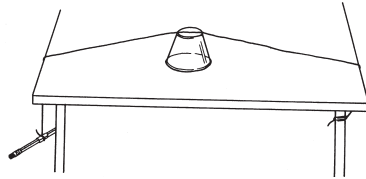
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Design a way to make the FOSS-ulele sound very loud.

### HINTS

You can...

- Add something to the FOSS-ulele.
- Change the way the sound travels.
- Add something to your ear.



### RECORD

List all the different solutions you tried.

Use pictures and words to describe your best solution.

What are all the things the sound of the FOSS-ulele traveled through on the way to your ears?

### GO FURTHER

- Design a way to hear the sound of your finger tapping as far away as possible.
- Design a musical instrument.

## THE FOSS-ULELE CHALLENGE

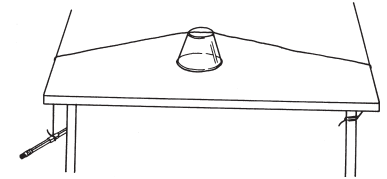
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### GO FURTHER

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- Design a musical instrument.

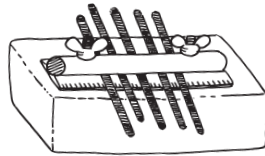
## THE KALIMBA CHALLENGE

---

Design a way to hear the sound of a kalimba as far away as possible.

### HINTS

- The sound of a kalimba can travel through the air, and it can also travel through other materials.
- Add something to your ear.



### RECORD

List all the different solutions you tried.

Use pictures and words to describe your best solution.

What are all the things the sound of the kalimba traveled through on the way to your ears?

### GO FURTHER

- Design a way to send secret messages that only your group members can hear.
- Design a musical instrument.

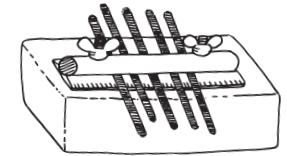
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What are all the things the sound of the kalimba traveled through on the way to your ears?

### GO FURTHER

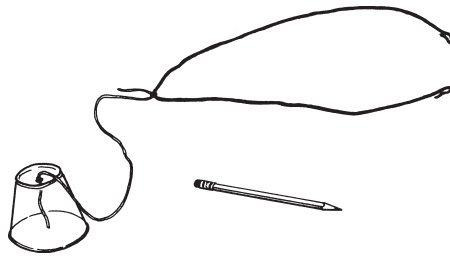
- Design a way to send secret messages that only your group members can hear.
- Design a musical instrument.

## THE LONG-GONG CHALLENGE

---

This is really two challenges in one.

- Design a way to allow more than one person to listen to the long gong.
- Make it possible for people to be far away from the long gong while they listen.



### RECORD

List all the different solutions you tried.

Describe your best solution.

What are all the things the sound of the long gong traveled through on the way to your ears?

### GO FURTHER

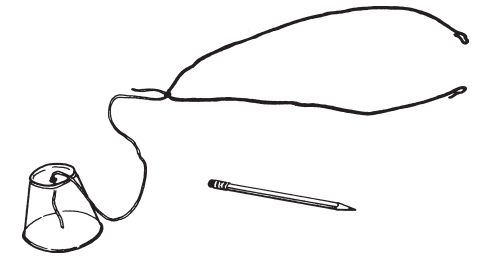
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- Make it possible for people to be far away from the long gong while they listen.



### RECORD

List all the different solutions you tried.

Describe your best solution.

What are all the things the sound of the long gong traveled through on the way to your ears?

### GO FURTHER

- Design a way to send secret messages that only your group members can hear.
- Design a musical instrument.

## THE MINIGUTBUCKET CHALLENGE

---

Make four minigutbuckets.

- Design one that makes low pitches.
- Design one that makes high pitches.
- Design two that make medium pitches.



### RECORD

What is the difference between your minigutbuckets?

Why do your minigutbuckets make different pitches?

### GO FURTHER

- Design a way to hear the sound of your finger tapping as far away as possible.
- Design a musical instrument.

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Why do your minigutbuckets make different pitches?

### GO FURTHER

- Design a way to hear the sound of your finger tapping as far away as possible.
- Design a musical instrument.

## THE STRING-BEAM CHALLENGE

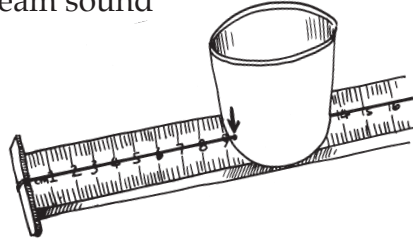
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Design a way to make the string beam sound louder.

### HINTS

You can...

- Add something to the string beam.
- Change the way the sound travels.
- Add something to your ear.



### RECORD

List all the different solutions you tried.

Use pictures and words to describe your best solution.

What are all the things the sound of the string beam traveled through on the way to your ears?

### GO FURTHER

- Play a song on the string beam. Record the centimeter used for each note in the song.
- Design a musical instrument.

## THE STRING-BEAM CHALLENGE

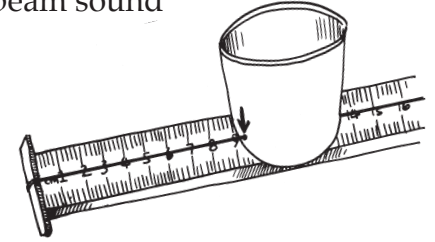
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Design a way to make the string beam sound louder.

### HINTS

You can...

- Add something to the string beam.
- Change the way the sound travels.
- Add something to your ear.



### RECORD

List all the different solutions you tried.

Use pictures and words to describe your best solution.

What are all the things the sound of the string beam traveled through on the way to your ears?

### GO FURTHER

- Play a song on the string beam. Record the centimeter used for each note in the song.
- Design a musical instrument.

## THE TUNING-FORK CHALLENGE

---

Design a way to hear the sound of a tuning fork as far away as possible.

### HINT

The sound of a tuning fork can travel through the air, and it can also travel through other materials.

### RECORD

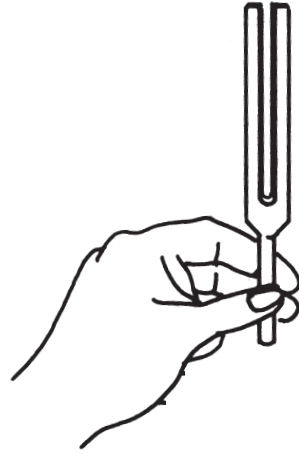
List all the different solutions you tried.

Use pictures and words to describe your best solution.

What are all the things the sound of the tuning fork traveled through on the way to your ears?

### GO FURTHER

- Design a way to make a permanent record of the vibrations of a tuning fork.
- Design a musical instrument.



## THE TUNING-FORK CHALLENGE

---

Design a way to hear the sound of a tuning fork as far away as possible.

### HINT

The sound of a tuning fork can travel through the air, and it can also travel through other materials.

### RECORD

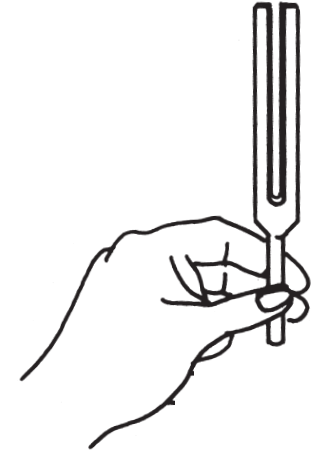
List all the different solutions you tried.

Use pictures and words to describe your best solution.

What are all the things the sound of the tuning fork traveled through on the way to your ears?

### GO FURTHER

- Design a way to make a permanent record of the vibrations of a tuning fork.
- Design a musical instrument.



## THE WATERPHONE AND XYLOPHONE CHALLENGE

Tune the bottles of the waterphone so that they have the same pitches as the tubes of the xylophone.

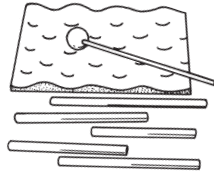
Or, if this cannot be done, tune the bottles so that they sound good with the xylophone. Play some tunes!



### RECORD

How did you change the pitch of the bottles in the waterphone?

What tunes did you play with the waterphone and the xylophone?



### GO FURTHER

- Design a musical instrument.
- Number the bottles and tubes 1–5. Use the numbers to show someone how to play a tune.

## THE WATERPHONE AND XYLOPHONE CHALLENGE

Tune the bottles of the waterphone so that they have the same pitches as the tubes of the xylophone.

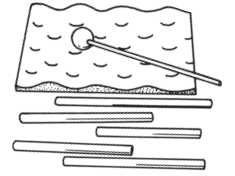
Or, if this cannot be done, tune the bottles so that they sound good with the xylophone. Play some tunes!



### RECORD

How did you change the pitch of the bottles in the waterphone?

What tunes did you play with the waterphone and the xylophone?



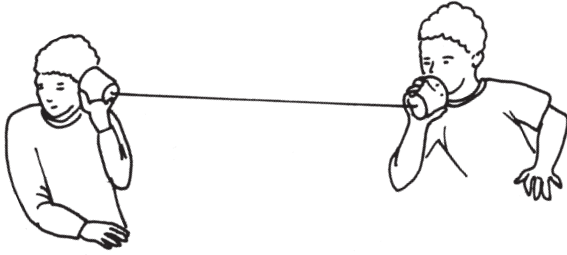
### GO FURTHER

- Design a musical instrument.
- Number the bottles and tubes 1–5. Use the numbers to show someone how to play a tune.

## THE WHISPER CHALLENGE

---

Design a way to allow your whole group to hear your voice when you speak very softly.



### RECORD

List all the different solutions you tried.

Use pictures and words to describe your best solution.

What are all the things the sound of your voice traveled through on the way to everybody's ears?

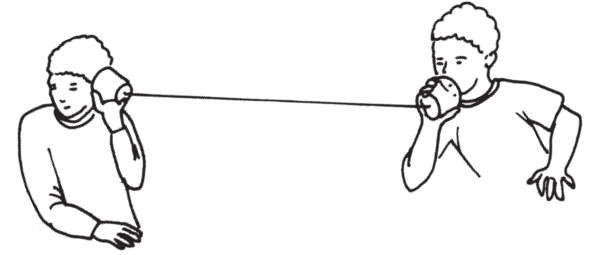
### GO FURTHER

- Design a way to make the sound of writing with a pencil seem louder.
- Design a musical instrument.

## THE WHISPER CHALLENGE

---

Design a way to allow your whole group to hear your voice when you speak very softly.



### RECORD

List all the different solutions you tried.

Use pictures and words to describe your best solution.

What are all the things the sound of your voice traveled through on the way to everybody's ears?

### GO FURTHER

- Design a way to make the sound of writing with a pencil seem louder.
- Design a musical instrument.

## PROJECT IDEAS

### INVENT A MUSICAL INSTRUMENT

Create an instrument that changes the pitch of the sound at its source. Vary the length, tension, or thickness.

Use what you have found out about how sound travels to bring the sound to the sound receivers. Direct the sound through water, air, or a solid object.

### TAKE THE MYSTERY OUT OF MUSICAL INSTRUMENTS

Research how different musical instruments vary the pitch of their sound. Prepare a slide show or poster display, or bring in real instruments to demonstrate how they work.

### MAKE A DUCK FLUTE

Flatten a plastic straw at one end and cut it to make a double reed. Blow through the straw with the reed completely in your mouth to make a duck flute. Use what you know about sound vibrations to change the pitch of this flute. How can you use a second straw of a different diameter to make a slide duck flute?

### RECORD SOUND EFFECTS

Sounds that are duplicated or altered for movies or television are called sound effects. Use a tape (or video) recorder to collect sound effects. Crumpled cellophane makes the sound of fire. Some rice grains in an inflated balloon make nice rain sounds. What other effects can you make?

### INVESTIGATE STRING TELEPHONES

Make new and improved phone systems. Try using a different kind of cup, or try using wire instead of string. Design a phone line for three or four listeners at a time. Try using a garden hose for a telephone. (Be sure that the water is drained out of the hose.)

### COMPARE SOUND MUFFLERS

Research ways to muffle sound at the source and at the receiver. Building supply stores may be able to supply samples of acoustical tile for this project.

### RESEARCH HEARING AIDS

Research the history of hearing aids. Why do people need them and how do they work?

### MAKE AN AIR CANNON

Make an air cannon from an empty 20-liter (5-gallon) plastic bucket, a piece of tough fabric (like Naugahyde), and a drum beater. Find out what it can do and how it works.

### EXPLAIN SOUND-MAKING TOYS

Many interesting devices that are sold at toy stores and science centers make sounds. Bring in a collection to class and explain how each device makes sound.

### RESEARCH HEARING IMPAIRMENTS

Research different forms of hearing impairments. Find out how people with hearing impairments learn at school and communicate. Learn some sign language to teach the class.

### RESEARCH HUMAN HEARING AND VOCAL CORDS

Research your own sound receiver and producer. Find out ways to protect your hearing.

### INVESTIGATE THE ADAM'S APPLE

What is that bump in the throat that moves as you speak? Why is it there? Research the Adam's apple to share with the class.

### RESEARCH ANIMAL SOUNDS

Research the way that different types of animals make sounds. Suggested animals: crickets, frogs, hummingbirds, whales.

### RESEARCH WHALE AND DOLPHIN COMMUNICATION

Prepare a report on how marine mammals communicate underwater. Use your understanding of sound's ability to travel through water.

### RESEARCH BAT NAVIGATION

Prepare a report on how bats use sounds to find food and to navigate. Use your understanding of sound's ability to travel through air.

### COMPARE ANIMAL EARS

Research and compare the shapes of animal ears. Why might some animals need large ear flaps while others have none? What kinds of outer ears do water dwellers have?

## PROJECT IDEAS

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Create an instrument that changes the pitch of the sound at its source. Vary the length, tension, or thickness.

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**FOSS PHYSICS OF SOUND MODULE**  
**PROJECT PROPOSAL**

1. What is the question or the project that you are proposing?

2. What materials or references will you need to complete the project?

3. What steps do you need to take to complete the project?

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1. What is the question or the project that you are proposing?

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## PRESENTATION GUIDELINES

---

You will have exactly 3 minutes to present your project to the class. In those 3 minutes you should answer these questions.

- What were you trying to find out (your question)?
- What materials or references did you need to do your project?
- What procedure did you follow to complete your project?
- What did you learn from doing your project?

When you begin speaking you will see the *green card* held up. When you see the *yellow card*, you have 30 seconds left. When you see the *red card*, it means you can finish your sentence, but you must stop within the next few seconds.

Practice your presentation so you will be sure it is at least 2 1/2 minutes long, but not more than 3 minutes long. Be sure you have included all of the information asked for above.

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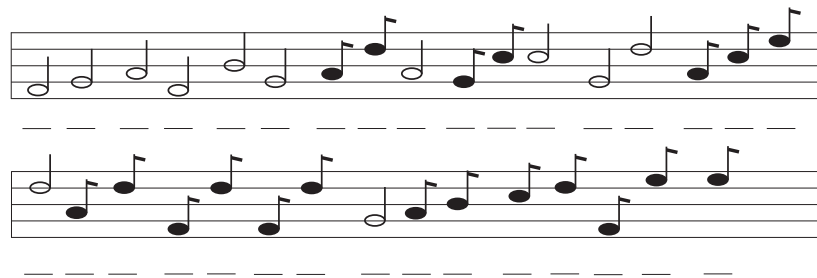
## MATH EXTENSION—PROBLEM OF THE WEEK

### INVESTIGATION 1: DROPPING IN

Shipwrecked on an island! During World War II a small passenger ship hit a reef and washed up on an island in the Pacific Ocean. After the captain made sure everyone was safe, he called for help. But how did he keep the enemy from finding out where they were? He sent the message in code! He used music code to contact the navy. Here's the code.



That night the navy communications officer received an interesting musical message. When he decoded it, he knew how many men and women were stranded on the island, and by looking on his map, he could find the island they were on. Can you figure it out? Here is the song he received.

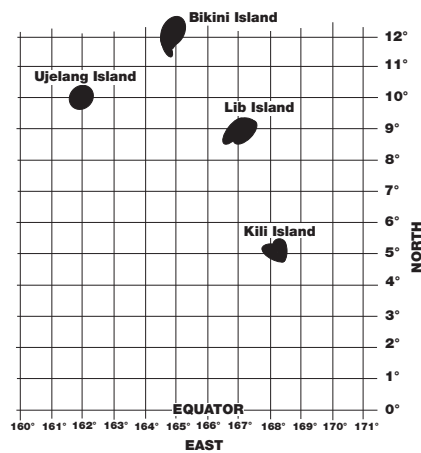


- How many people are on the island?
- How many of them are men?
- How many of them are women?
- Which island are they on?

The navy could not rescue the people right away, so they flew over and dropped enough supplies for 10 days. They planned the following:

- 1 Tent for 4 people to be shared.
- 2 Potatoes per day for each person.
- 1 Lemon for each person every other day.
- 1 Gallon of water for two people to share each day.

How much of each item was included?



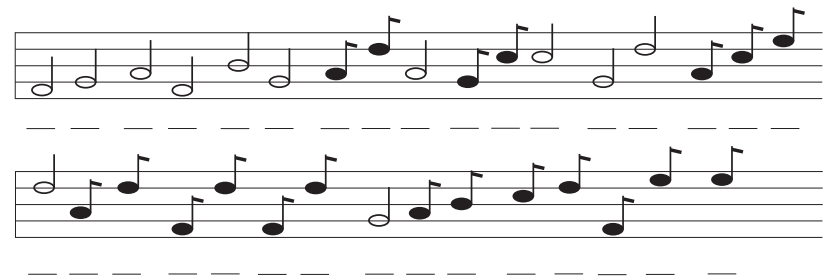
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Shipwrecked on an island! During World War II a small passenger ship hit a reef and washed up on an island in the Pacific Ocean. After the captain made sure everyone was safe, he called for help. But how did he keep the enemy from finding out where they were? He sent the message in code! He used music code to contact the navy. Here's the code.



That night the navy communications officer received an interesting musical message. When he decoded it, he knew how many men and women were stranded on the island, and by looking on his map, he could find the island they were on. Can you figure it out? Here is the song he received.

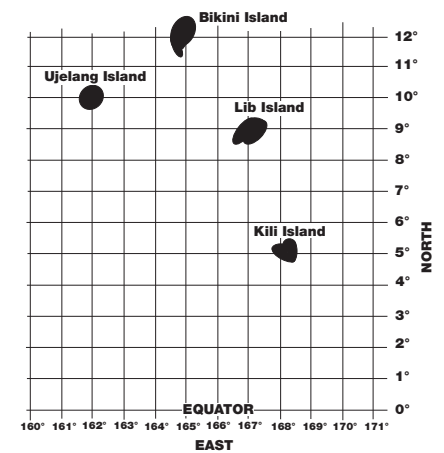


- How many people are on the island?
- How many of them are men?
- How many of them are women?
- Which island are they on?

The navy could not rescue the people right away, so they flew over and dropped enough supplies for 10 days. They planned the following:

- 1 Tent for 4 people to be shared.
- 2 Potatoes per day for each person.
- 1 Lemon for each person every other day.
- 1 Gallon of water for two people to share each day.

How much of each item was included?



**MATH EXTENSION—PROBLEM OF THE WEEK**  
**INVESTIGATION 2: GOOD VIBRATIONS**

Nancy, Andrea, and Michael are forming a musical group. They are hoping to play a piece for back-to-school night. The three students are all in different grades at school, third through fifth. From the clues below, figure out what musical instrument each student plays and what grade each is in.

1. A girl plays the guitar.
2. Nancy is in a higher grade than the violin player.
3. The flute player is not in third grade.
4. The girl in fourth grade takes private lessons.
5. Michael is not in fifth grade.
6. Andrea is in a lower grade than the flute player.

Use this chart to organize information from the clues. Put an X in the grid when you discover something that is not a possibility. For instance, the first clue tells us that a girl plays the guitar. Therefore it is not possible for Michael to play the guitar, because he is a boy. Put an X in the Michael/guitar grid cell.

Put a dot in the grid when you know something is true.

	3rd	4th	5th	Guitar	Violin	Flute
Nancy						
Andrea						
Michael				X		
Guitar						
Violin						
Flute						

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## MATH EXTENSION—PROBLEM OF THE WEEK

### INVESTIGATION 3: HOW SOUND TRAVELS

Ms. Trujillo’s class is making string telephones, minigutbuckets, and FOSS-uleles for a sound and music festival. All 24 students will be playing minigutbuckets and FOSS-uleles or listening on the string telephone at the same time. These are the instruments that Ms.

Trujillo’s students chose.

- Eight students playing FOSS-uleles. (Remember, two students work with each FOSS-ulele.)
- Eight students playing minigutbuckets. (Remember, one student works with each minigutbucket.)
- Eight students listening with string phones. (Remember, two students work with each string telephone.)

Here are the materials lists for the instruments.

FOSS-ulele	Minigutbucket	String Telephone
1 String, 2 meters long	1 String, 1.5 meters long	1 String, 4 meters long
1 Cup	1 Cup	2 Cups
1 Paper clip	1 Paper clip	2 Paper clips
1 Pencil		

1. How much string is needed to make the instruments for the festival?
2. How many cups are needed to make the instruments?
3. How many paper clips are needed to make the instruments?
4. How many pencils are needed to make the instruments?
5. Sixteen students from Mr. Olsen’s class want to join the festival. The students looked to see what materials they still had to make additional instruments. They found plenty of cups, pencils, and paper clips, but they weren’t sure if they had enough string. They had only the remains of the original ball of string, which had 52 meters when it was new. Can 16 more students join the fun? If so, what instruments should they make?

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## MATH EXTENSION—PROBLEM OF THE WEEK

### INVESTIGATION 4: SOUND CHALLENGES

Your group has just been awarded the PUBA (President's Unbelievably Brainy Award). You get to spend \$10.00. But you can't buy candy with it! Your challenge is to make and name a musical instrument. It must play *at least* three pitches. You can use only materials that you purchase from the list. The shop will drill holes or cut materials for you. But you have to pay the shop, too.

Price	Item	Quantity
\$0.50	thin wire	1 meter
\$0.60	medium wire	1 meter
\$0.70	thick wire	1 meter
\$1.45	wood	1 meter long
\$0.89	nails	10
\$0.20	hooks	each
\$2.30	glue	1 bottle
\$1.25	metal can	25 centimeters wide
\$1.50	metal can	50 centimeters wide
\$1.75	metal can	1 meter wide
\$1.00	can lid	each
\$2.75	metal pipe	1 meter long
\$1.25	paint	each color
\$0.50	each cut made	
\$0.50	each hole drilled	

How much will it all cost?

How much money will you have left over?

What will you buy?

(Remember, 1 meter = 100 centimeters.)

Draw a picture of your instrument and explain how it makes sounds.

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## HOME/SCHOOL CONNECTION

### INVESTIGATION 1: DROPPING IN

#### PART 1: THE SOUNDS OF SILENCE

Find the quietest place you can. It might be in a room at home, in your yard, or in front of your home, or someplace else. Sit back-to-back with a partner and listen. How quiet is the quietest place you can find?

#### PART 2: NAME THAT SOURCE

Find a noisy place. Get paper and pencils for each partner. Write down the sounds that you hear in 5 minutes. Compare notes. Did you both hear the same things? What was the source of each sound? Was something vibrating there? What do you think it was?

#### PART 3: MODIFIED HEARING

Does a family member or friend have to modify their hearing in some way to do their job effectively and safely? Some people work in noisy places and use protective devices to prevent damage to hearing. Other people use hearing aids or stethoscopes to make sounds louder. Can you find any examples of hearing modification among your family or friends? How do the devices they use work?

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## HOME/SCHOOL CONNECTION

### INVESTIGATION 2: GOOD VIBRATIONS

Put together a tinker’s band with family and friends. Make as many different kinds of sounds and as many pitches as you can with everyday objects around the house. Try to make a diatonic scale.

*do, re, mi, fa, sol, la, ti, do.*

Things to try out for the band might include

- Bottles, with and without water.
- Bowls, glasses, and pitchers.
- Tin cans.
- Cook pots and fry pans.
- Lids for cook pots and fry pans.
- Nails or bolts or pieces of pipe hanging from strings.
- Pieces of wood.
- Strings, wires, or ropes pulled tight.
- Rubber bands, inner tubes, or bungee cords pulled tight (be very careful).

Play some tunes, either solo or in a combo with friends and family. Turn on the radio or some recorded music and play along. Make a sound recording of your own musical efforts. Bring the recording to class and have other students analyze the different sounds they hear and record them on a chart.

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### INVESTIGATION 3: HOW SOUND TRAVELS

If you have a chance to swim in a pool, take a few minutes to find out a little more about how sound travels underwater and about underwater hearing.

**Safety Note:** Students should always swim with adult supervision.

- Above the water, close your eyes and have a friend click spoons together. Try to locate the sound source as your friend moves it around.

Now take a breath and duck under the water, eyes still closed. Have your friend click spoons together underwater, moving them from place to place. Can you locate the sound source? Which is easier to locate, a source in air or a source underwater? Why do you think so?

- Put your fingers in your ears while your friend clicks two spoons together in air. Then remove your fingers from your ears and listen to the clicking sound. How does it sound? Was it different with and without your fingers in your ears? How can you explain this observation?

Put your fingers in your ears and duck under the water while your friend clicks the two spoons together underwater. Was it different with and without your fingers in your ears? How can you explain this observation?

- With your head below water, have your friend say words that sound the same, like “top,” “pop,” “mop,” “cot,” and “pot.” How does it sound? What do you think is going on?
- Have your friend sing to you as you lie underwater. Encourage your friend to really ham it up, with lots of high and low pitches, and loud and soft sounds. Try listening with your ears open and with your fingers in your ears. Does it sound different or not?

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