Scientific literacy has become an important foundation to the framework of science education. By understanding the basic concepts of science and technology, students are able to develop the skills, strategies, and abilities required for scientific inquiry and problem-solving. *Light and Sound Waves Close-Up* supports current science education initiatives by introducing readers to essential light and sound wave concepts and allowing them to build their understanding through hands-on experiments and real-world applications.

The Light and Sound Waves Close-Up Teacher’s Guide includes inquiry-based lessons that promote student interaction with light and sound as energy forms. Students will develop their critical thinking skills and challenge their understanding by participating in investigative and observational processes. This guide will be sure to capture the attention of students while supporting learning initiatives.

The lesson plans in this guide are tailored for grades K to 3 and focus on developing knowledge of the fundamental concepts of energy and matter. Students will learn about the properties and characteristics of light and sound and use their investigative skills to explore their impact on our everyday lives, as well as how they interact with various objects in the environment. Lessons that promote critical thinking skills through design challenges and hands-on experiments will reinforce the properties associated with each energy form and allow students the freedom to construct their own understanding of the material at hand.

In order to scaffold student understanding, it is recommended that the lessons be taught in sequential order. Reproducible worksheets and assessment tools accompany each lesson plan. The titles in *Light and Sound Waves Close-Up* include:

- What are Light Waves?
- What are Sound Waves?
- What are Shadows and Reflections?
- How Does Sound Change?
## Pacing Chart and Vocabulary

<table>
<thead>
<tr>
<th>Lesson Plan Title</th>
<th>Pacing</th>
<th>Vocabulary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exploring Properties of Light</td>
<td>2 Class Periods*</td>
<td>artificial light source</td>
</tr>
<tr>
<td></td>
<td></td>
<td>bright</td>
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<td></td>
<td></td>
<td>darkness</td>
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<td></td>
<td></td>
<td>illuminate</td>
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<td></td>
<td></td>
<td>light</td>
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<tr>
<td></td>
<td></td>
<td>natural light source</td>
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<tr>
<td>Just Passing Through</td>
<td>1 Class Period</td>
<td>absorb</td>
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<td>light waves</td>
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<td></td>
<td></td>
<td>opaque</td>
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<td>translucent</td>
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<td></td>
<td></td>
<td>transparent</td>
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<tr>
<td>Making Shadows</td>
<td>2 Class Periods</td>
<td>shadows</td>
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<td></td>
<td></td>
<td>Sun</td>
</tr>
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<td></td>
<td></td>
<td>travel</td>
</tr>
<tr>
<td>What is Sound?</td>
<td>2 Class Periods</td>
<td>sound</td>
</tr>
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<td></td>
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<td>sound wave</td>
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<td>vibrate</td>
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<td></td>
<td></td>
<td>vibration</td>
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<tr>
<td>“Good Vibrations”</td>
<td>1-2 Class Periods</td>
<td>brain</td>
</tr>
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<td></td>
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<td>ear canal</td>
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<td>eardrum</td>
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<td>loud</td>
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<td></td>
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<td>voice box</td>
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<tr>
<td>Communication is Key</td>
<td>3-4 Class Periods</td>
<td>build</td>
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<td></td>
<td></td>
<td>code</td>
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<td>communicate</td>
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<td>design</td>
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<td>device</td>
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<td>emergency</td>
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<td></td>
<td></td>
<td>model</td>
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<td></td>
<td></td>
<td>signal</td>
</tr>
</tbody>
</table>

* 1 class period = 40-60 minutes
ACCOMMODATION STRATEGIES

Accommodations provide equal access to learning and equal opportunity to demonstrate what is learned. Accommodations allow a student access to the subject or course without any changes to the knowledge and skills the student is expected to demonstrate.

Educators are encouraged to adapt the instructional approach, activities, and assessments included in this guide to best meet the diverse interests, needs, and abilities of their students. Possible accommodations may include:

### Instructional Strategies
- Break tasks into parts with accompanying time lines
- Provide extra time for processing of oral information.
- Pair oral instructions with visual ones (writing or symbols)
- Pre-teach new vocabulary and regularly review previously taught vocabulary
- Provided model of completed work
- Frequently check with the student to get him/her started
- Provide oral and visual instructions and examples
- Provide a checklist of tasks for the student

### Environmental Strategies
- Proximity to teacher
- Strategic seating
- Flexible or mixed-ability grouping
- Provide an alternative setting for learning that is free from visual and auditory distractions.

### Assessment Strategies
- Build in extra time to allow student to process questions asked and answers given
- Provide written instructions and rubrics for assignments
- Offer a choice of assessment activities so that the student can choose one suited to their strengths
- Space out or extend assignments to prevent student feeling overwhelmed
- Reduce the number of tasks used to assess skill or concept
- Allow students to use assistive devices or technology
LESSON 1
Exploring Properties of Light

Curriculum Correlations

Ontario Science and Technology Standards
Grade 4. Understanding Matter and Energy: Light and Sound 2, 2.2, 3, 3.1, 3.2

Next Generation Science Standards
Grade 1. Physical Science 1-PS4-2, 1-PS4-4

Materials

- What are Light Waves? – pages 20-21 (Light and Sound Waves Close-Up)
- Chart Paper
- Colored Markers
- Whiteboard or Chalkboard
- Whiteboard Markers or Chalk
- Computer (Video)
- Shoe Boxes
- Scissors
- Erasers
- Pencil Crayons
- Toy Cars
- Flashlights
- Getting to Know Light Worksheet
- Eye Spy Worksheet
- Eye Spy Checklist

Objectives

Students will:
- Differentiate between artificial and natural light sources.
- Describe the various properties of light.
- Explain how objects in darkness can only be seen when illuminated.

Setting the Stage

Facilitate class discussion on light by posing the question, “what is light?” Have students participate in a “Think, Pair, Share” activity where students provide answers to the following:
- What is light?
- What is an example of light?
- Why is light important?

Students will share the answers they came up with and the teacher will record the responses on the board.

Create class definition of light and write it on an anchor chart. An example definition of light is:
- Light is the brightness that lets you see the world around you

Turn off all the lights in the classroom and close the curtains to ensure that the room is completely dark. Ask the students:
- Is the room dark?
- Is it harder to see now than it was before?
- Why?
- What are some things you could use in the classroom to be able to see one another?

Show video on light properties https://www.youtube.com/watch?v=uDBracHkcUU
Engage the students in a class discussion on what makes a light source artificial and what makes a light source natural. Write the definitions for artificial and natural light on the anchor chart. Example definitions are as follows:

- **Artificial light is created by humans. These light sources need electricity or batteries to produce light**
- **Natural light cannot be controlled by humans**

Divide the students in groups and give each group chart paper, markers, and Getting to Know Light Worksheet. Students will separate the items listed on the worksheet into two categories: artificial light and natural light.

The categories will contain the following:

- **Artificial Light**
  - Sneakers
  - Headlights
  - Computer
  - iPhone
  - Toys
  - Flashlight

- **Natural Light**
  - Stars
  - Match
  - Candle
  - Sun
  - Lightning
  - Fireplace

Review worksheet as a class. Encourage students to reflect on their answers and discuss why they may have placed an object in a specific category.

Students will work in pairs to create a pinhole box. Each student pairing will be provided with a small box, scissors, flashlight, eraser, pencil crayon, and a small object, such as a toy car. Students will be provided with the *What are Light Waves?* book and an Eye Spy Worksheet that will guide them through the process of creating their pinhole box. Students should complete their worksheet individually.

- **Extensions**
  - Invite students to provide additional examples of artificial and natural light sources and record these on their Getting to Know Light Worksheets
  - Students may choose to add additional objects to their pinhole boxes to make their task of illuminating objects more difficult

Review the worksheets. Offer an open discussion about any questions students may have in regards to the activities they participated in. Ask students to hand in both worksheets.

**Assessment**

Assess Getting to Know Light Worksheet for understanding of artificial and natural light sources. Use Eye Spy Checklist to assess Eye Spy Worksheet for understanding of how objects in darkness can only be seen when illuminated by a light source. Assess student understanding during lesson by using observational notes.
Getting to Know Light Worksheet

Sort each of the items below as an **Artificial Light Source** or a **Natural Light Source**. /12

<table>
<thead>
<tr>
<th>Artificial Light Source</th>
<th>Natural Light Source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. What do you think makes light **artificial**? /2
2. What do you think makes light natural? /2

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

3. Do you think artificial light or natural light is better? Why? ____________________________________________________________ /2

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

4. What type of light do you use the most? Where do you use this light most? /2

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
Eye Spy Worksheet

Follow the activity on page 20 and 21 of *What are Light Waves?* Draw what you see in the spaces below.

This is a picture of what I see when:

______________________________________
______________________________________
______________________________________
______________________________________

This is a picture of what I see when:

______________________________________
______________________________________
______________________________________
______________________________________
What do you think would happen if you made a bigger hole in the box? How would it change what you could see inside?

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

What questions do you still have about light?

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
## Eye Spy Checklist

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student clearly drew and used scientific terminology to describe what they saw when different objects were illuminated in their pinhole box.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student used scientific vocabulary to predict what would happen if the hole in the box was made bigger. Student’s prediction fits with the properties of light discussed in this lesson.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student identifies at least one question they have about light.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes about student participation in activity:**

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__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
LESSON 2
Just Passing Through

Curriculum Correlations

Ontario Science and Technology Standards
Grade 4. Understanding Matter and Energy: Light and Sound 2, 2.2, 3, 3.3, 3.6

Next Generation Science Standards
Grade 1. Physical Science 1-PS4-3

Materials

• What are Shadows and Reflections? (Light and Sound Waves Close-Up)
• Lamp
• Orange
• Apple
• Colored Markers
• Flashlights
• Anchor Chart Paper
• Pencils
• Light Bulb
• Paper Towel
• Glasses
• Notebook
• Does the Light Shine Through Worksheet
• Just Passing Through Worksheet

Objectives

Students will:
• Explain the differences between transparent, translucent, and opaque materials.
• Explain how light travels.

Setting the Stage

Shine the light from a lamp down on an orange and an apple. Engage students in a discussion on how all light sources make light waves. Explain that light waves are rays of energy that travel quickly in a straight line until they meet up with an object, such as the orange and the apple. Discuss how light rays can pass through, reflect off, or be absorbed by an object. Ask the students:

• Do you think that the orange and apple are absorbing the light, reflecting the light, or letting the light pass through? Why?

Introduce the concepts of transparent, translucent, and opaque material and write definitions on an anchor chart. Example definitions include:

• If an object is transparent, light passes through it. You can see light clearly.
• If an object is translucent, some light passes through. The light may look a little blurry.
• If an object is opaque, it does not let any light through. It blocks the light.
Activity #1
Hand out Does the Light Shine Through Worksheet. Students will predict whether the object listed will allow the light to shine through or not. Once the students have made their predictions, demonstrate each example to the entire class and have them record the correct answer on the designated space on their worksheet.

Extensions
- Students can share their predictions with others and compare their answers.
- Students can meet with the same peers after the activity and discuss whether their predictions were correct or if the results were different than expected. Students will explore why this may be the case.

Activity #2
Students will participate in a “Passing Through” activity. Students will gather different objects around the classroom and predict if the object is opaque, transparent, or translucent. On the Just Passing Through Worksheet, students will document every item they use in their observations as well as mark their predictions. Students may choose a variety of objects such as wooden blocks, tissue paper, toys, etc. Students will test their predictions by placing their objects between a flashlight and a piece of paper to see if light is able to pass through.

Extensions
- Students can share their predictions with others and compare their answers.
- Students can meet with the same peers after the activity and discuss whether their predictions were correct or if the results were different than expected. Students will explore why this may be the case.

Wrap-Up
Review the Just Passing Through worksheet with the class. Ask students to share some examples they found for each of the categories.

Assessment
Ask students to hand in both the Does Light Shine Through and Just Passing Through Worksheets. Assess Does Light Shine Through Worksheet for completion. Assess Just Passing Through Worksheet with Just Passing Through Checklist. Assess student understanding during lesson by using observational notes. Review definitions to clarify misunderstandings as required.
Name: _______________________________ Date: __________________________

### Does Light Shine Through?

Predict whether the items listed below will let light shine through or not by circling **Yes** or **No**. Record what happened on the space provided!

<table>
<thead>
<tr>
<th>ITEM</th>
<th>LIGHT WILL SHINE THROUGH</th>
<th>DID IT?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><img src="image" alt="Light Bulb" /></td>
<td>YES / NO</td>
</tr>
<tr>
<td>2.</td>
<td><img src="image" alt="Paper Towel" /></td>
<td>YES / NO</td>
</tr>
<tr>
<td>3.</td>
<td><img src="image" alt="Notebook" /></td>
<td>YES / NO</td>
</tr>
<tr>
<td>4.</td>
<td><img src="image" alt="Glasses" /></td>
<td>YES / NO</td>
</tr>
</tbody>
</table>
**Just Passing Through**

Find objects around the classroom and guess whether they will let ALL the light in, SOME light in, or NO light in. Test your predictions by placing your objects between a flashlight and a piece of paper. What do you see?

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>WHAT DO YOU THINK WILL HAPPEN?</th>
<th>WHAT DID HAPPEN?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I will see light clearly</td>
<td>I can see light clearly</td>
</tr>
<tr>
<td></td>
<td>Light will look blurry</td>
<td>The light is blurry</td>
</tr>
<tr>
<td></td>
<td>I won’t see any light</td>
<td>I can’t see any light</td>
</tr>
</tbody>
</table>
Just Passing Through Checklist

<table>
<thead>
<tr>
<th>Did the student...</th>
<th>Level 1</th>
<th>Level 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Find and write in chart 7 different classroom objects?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mark in the chart a prediction about whether each object was transparent, translucent, or opaque?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mark in the chart a conclusion about whether each object was transparent, translucent, or opaque?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes about student participation in activity:

____________________________________________________________________________
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Objectives

Students will:

• Understand that when opaque and translucent items block a light source, a shadow is created.

• Understand that light can travel.

Setting the Stage

Engage the students by asking, “What is a shadow?” and “what do you need to make a shadow?” Students will brainstorm and share their responses. Write down student responses on the board.

• Assess student understanding of the previous lesson’s concepts by asking, “Is a translucent, transparent, or opaque object needed to make a shadow?”

• Take away concepts:
  - Opaque and translucent objects make shadows because they block the light and create a dark space behind the object the light was shone at.
  - A shadow is made when an object blocks the light

Activity #1

Pose the question, “What type of light source makes shadows on Earth?”

• Take away concept:
  - Without the Sun, we would not have shadows.
  - Your body blocks the Sun and creates shadows all around you.

Pose the problem: **What happens to shadows when the light around them moves?**

Students will explore an answer to this problem by making shadow puppets. Students will create a character out of black construction paper and glue/tape them to Popsicle sticks. Students will complete *My Shadow Story Booklet*. Using a flashlight in place of the Sun, students will explore what happens when the beam of light hits their shadow puppet at different angles. Students will draw what they see as well as fill out the blank spaces provided.
Extensions

- Students may choose to write their own narrative and introduce multiple characters to illustrate their understanding.
- Encourage students to perform this experiment outside using their bodies and the light from the Sun. Have them record or draw their shadows when the Sun is hitting them from different directions.

Wrap-Up

Invite students to share some of their My Shadow Story Booklets to the class. As a class discuss the answers to the following questions:

- Where do our shadows go if the Sun is shining in front of us?
- What happens to our shadows when the Sun shines on top of us?
- What happens to our shadows when the Sun shines behind us?

Assessment

Collect My Shadow Story Booklets and assess using Shadow Story Rubric.
This is the Story of ___________ and the Sun

Written By: ___________
Illustrated By: ___________

One morning ___________ was outside playing in the ___________.

The sun was shining ___________ them and when ___________ there was a big shadow in front of them!

At first ___________ was scared! But soon ___________ realized that the shadow was friendly and they became friends.
When lunchtime came and the Sun was beaming on top of ________’s head, ___________ realized that their shadow had become _____________.

All of a sudden clouds came by and blocked the sunshine and the shadow ______________! ______________ was really sad.

Soon the clouds went away and the Sun came back out. This made ___________ happy.

This time the Sun was shining in front of ___________ and now the shadow was ___________ them.
___________ wasn’t sad when the Sun went down for the night because they knew when the Sun came back out tomorrow they would see their ________________ again.

The End!
<table>
<thead>
<tr>
<th></th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Knowledge/Understanding</strong></td>
<td>Student demonstrates limited knowledge of content. There are more than 3 errors made on the subject matter.</td>
<td>Student demonstrates some knowledge of content. There are 2 errors made on the subject matter.</td>
<td>Student demonstrates considerable knowledge of the content. There is 1 error made on the subject matter.</td>
<td>Student demonstrated thorough knowledge of content. There are no errors made on the subject matter.</td>
</tr>
<tr>
<td><strong>Thinking and Investigating</strong></td>
<td>Student uses critical/creative thinking processes, skills, and strategies with little effectiveness.</td>
<td>Student uses critical/creative thinking processes, skills, and strategies with minimal effectiveness.</td>
<td>Student uses critical/creative thinking processes, skills, and strategies with a great deal of effectiveness.</td>
<td>Student uses critical/creative thinking processes, skills, and strategies with a high degree of effectiveness.</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td>The conventions, terminology, and vocabulary used does not relate to the story. The student expresses and organizes ideas inadequately.</td>
<td>The conventions, terminology, and vocabulary used somewhat relate to the story. The student expresses and organizes ideas with some effectiveness.</td>
<td>The conventions, terminology, and vocabulary used relate to the story considerably. The student expresses and organizes ideas with moderate effectiveness.</td>
<td>The conventions, terminology, and vocabulary used relate to the story considerably. The student expresses and organizes ideas with exceptional effectiveness.</td>
</tr>
<tr>
<td><strong>Application</strong></td>
<td>Student transfers knowledge and skills to unfamiliar contexts with limited effectiveness.</td>
<td>Student transfers knowledge and skills to unfamiliar contexts with some effectiveness.</td>
<td>Student transfers knowledge and skills to unfamiliar texts with considerable effectiveness.</td>
<td>Student transfers knowledge and skills to unfamiliar texts with a high degree of effectiveness.</td>
</tr>
</tbody>
</table>
LESSON 4
What is Sound?

**Curriculum Correlations**

**Ontario Science and Technology Standards**
Grade 4. Understanding Matter and Energy: Light and Sound 2, 2.3, 3., 3.4, 3.5

**Next Generation Science Standards**
Grade 1. Physical Science 1-PS4-1

**Objectives**

- Understand that sounds are created by vibrations.

**Setting the Stage**

Engage students by playing *The Listening Walk* on YouTube. Or, read the story out loud to the class. [https://www.youtube.com/watch?v=uc66HaouFU](https://www.youtube.com/watch?v=uc66HaouFU)

Open the classroom windows and door and ask the students to remain silent. Ask them to listen to any sounds that they hear (i.e. coughing, shuffling of feet, tapping of a pencil, sniffling, the sound of a teacher’s voice, etc.). After a couple of minutes of silence, ask the students what sounds they heard and record the answers on the board.

Create class definition of sound, and add it to an anchor chart. A definition could be:
- **Sound is all the noises that you hear each day.**

**Activity #1**

Pose the problem, “how is sound created?” In pairs, have students explore the answer to this problem by having one student stretch elastic bands between their fingers and having the other student pluck them with their finger.

Guide the investigation by asking the following questions and discussing the answers as a class:
- What happens to the elastics when you pluck them with your finger?
- Do you hear anything?
- Do you feel anything?
- What is it that you are feeling?

Take away concepts:
- The elastics will **vibrate** when you move your finger along them.
- The **vibration** of the elastics is making the sound.
- All sounds are made by **vibrations**.

Add definition for vibration on the definition anchor chart
- **Vibrations are quick movements back and forth**

**Materials**

- *How Does Sound Change?* – pages 20-21 (*Light and Sound Waves Close-Up*)
- Computer (Video) or *The Listening Walk* by Paul Showers
- Whiteboard or Chalkboard
- Whiteboard Markers or Chalk
- Elastics
- Anchor Chart
- Modeling Clay
- Rulers
- Straws
- Tape
- Scissors
- 3-2-1 Exit Card
Extensions

- Have students explore the classroom to find other items that visibly vibrate to make sound.
- Have students explore different volumes of sound by strumming lighter or softer on the elastics. Ask students to record their findings.

Wrap-Up

Have a discussion with the class on how their panpipes use different vibrations to make different sounds. The sounds in the shorter straws are higher because the sound waves move more quickly and lower in the longer straws because they move more slowly. Hand out 3-2-1 Exit Card and have students complete them to hand in.

Activity #2

Let the class know that they will be making an instrument that anyone can play and that demonstrates how different vibrations make different sounds.

Tell the class that vibrations create sound waves that travel through the air.

To explain sound waves, tell the class to think about tossing a pebble or stone into a lake or a pool. Ask the class, “what happened to the water when you tossed the stone/pebble in?”

- Take away concepts:
  - The ripples created in the water are like the sound waves that travel in the air.
  - Sound waves can carry vibrations from place to place.
  - Your ears catch the sound waves and send them to your brain.

Students will be provided with the book, How Does Sound Change? Students will follow the directions for making a panpipe on pages 20-21.

Assessment

Teacher will collect 3-2-1 Exit Card and assess for understanding. Observational notes should be taken throughout the lesson.
3-2-1 Exit Card

3 Things that I Learned Today

2 More Things I Want to Know

1 Question I Have

Color the face that shows how you feel most about our lesson on sound.
LESSON 5
Good Vibrations

Curriculum Correlations

Ontario Science and Technology Standards
Grade 4. Understanding Matter and Energy: Light and Sound
2, 2.3, 3., 3.4, 3.6

Next Generation Science Standards
Grade 1. Physical Science 1-PS4-1, 1-PS4-4

Materials

• What are Sound Waves? – pages 16, 20, 21 (Light and Sound Waves Close-Up)
• Whiteboard or Chalkboard
• Whiteboard Markers or Chalk
• Paper Cups
• Cotton String/Yarn
• Scissors
• Reflecting on Sound Sheet
• Sound Performance Assessment

Objectives

Students will:
• Explain that sounds cause vibrations and vibrations cause sound.
• Understand that sound waves travel.
• Build a device that uses sound to solve the problem of communicating over distance.

Setting the Stage

Have the students sit in a circle. Ask students to place two fingers on their throat and to make a low humming noise. Ask the students what they felt when they made the sound.

• Take away concept:
  ▶ You can feel the vibrations from your voice box when you make noise.

Class discussion:

• The louder the sound, the stronger the vibrations.
• Strong vibrations from loud sounds can rattle windows and move objects. They can even make the ground shake!

Review page 16 of What are Sound Waves? Explain to the students that:

• When you make a sound, sound waves cross through the air and enter the outer part of the ear.
• The waves then travel down a tube called the ear canal until they hit the eardrum.
• The eardrum vibrates and sends these signals to your brain.
• Your brain tells you what sounds you are hearing.
**Activity #1**

Pose the question, "does sound just travel through air, or can it travel through other materials?"

Decide on a buzz word with the class. Have one student stand outside the classroom, just on the other side of the door. Have a conversation with the class and drop the buzz word into the conversation.

When the student hears the buzz word, they should return to the room and join the class discussion.

Brainstorm with the class all the materials that sound waves can travel through. Write the answers on the whiteboard.

- **Take away concept:**
  - Sound can travel through air, water, and through solid materials such as wood (that is why you can hear you parents shouting your name from another room!)

**Extensions**

- In pairs, have students research how sound waves travel differently through one type of material over another. Students will find two facts to share with another partner pairing and discuss their findings.

**Activity #2**

Students will receive the book *What are Sound Waves?* Following the directions outlined on pages 20-21, students will make paper-cup telephones and explore how their phones work.

After students have had a chance to explore their paper-cup telephones, engage the class in a discussion on how they believe it was possible to hear each other.

- **Take away concept:**
  - Sound waves from your voice make the bottom of the cup vibrate.
  - The vibrations travel along the string and your ears pick up the vibrations.

**Extensions**

- Have students use different materials to build a telephone in order to see how the sound changes with different materials

**Wrap-Up**

Have students complete Reflecting on Sound Sheet to hand in.

**Assessment**

Assess Reflecting on Sound Sheet for student understanding on sounds and vibrations. Use the Sound Performance Checklist to assess level of understanding.
Reflecting On Sound

Draw a picture of the paper-cup telephone you made:

Explain in your own words how your phone worked:
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

Circle the type of material that your sound waves moved through:

Air  Water  Cup

Explain in your own words how your phone worked:
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

Name a fact you have learned about sound: ________________________________
Sound Performance Assessment

1. Picture of paper-cup telephone /1

2. Explanation of how device worked /2

3. CUP is circled /1

4. Explanation of sound and vibrations /1

5. Fact /1

Total: /6
Lesson 6
Communication is Key

Curriculum Correlations
Grade 4. Understanding Matter and Energy: Light and Sound
2, 2.3, 3., 3.4, 3.6

Next Generation Science Standards
Grade 1. Physical Science 1-PS4-4

Materials
- Whiteboard or Chalkboard
- Whiteboard Markers or Chalk
- Anchor Chart
- Colored Markers
- Computer (Video)
- Flashlights
- Lasers
- Elastic Bands
- Panpipes
- Mirrors
- Paper Cups
- String
- Bells
- Adventure in the Forest Scenario Sheet
- My Communication Device Planning Sheet
- Peer/Self-Assessment
- Communication is Key Rubric

Objectives
Students will:
- Understand the importance light and sound play in day-to-day communications.
- Build a device using light or sound to solve the problem of communicating over a distance.

Setting the Stage
Write the word “communication” in the middle of the board. Discuss what communication means. Create class definition and add to anchor chart. An example definition could be:

- To communicate is to share ideas and information.

Ask students to name ways people can communicate with one another. Examples could include: calling on the phone, texting, e-mail, eye contact, school bells, light signals, etc.

Write down the examples on the board in a web-like fashion.

Play about a minute or so of a video showing fire trucks responding to an emergency. https://bit.ly/2HWGFhj

Engage the class in a discussion:
- How do firefighters use light and sound to communicate to people and drivers around them?
- Do you think that communicating with both lights and sound can make us even safer in an emergency? Why?
- Is there anything else that you can think of that uses sound or lights or both to warn people in an emergency?
  - Examples could include: Fire alarms, police cars, ambulances, etc.

Explain to the class that they have been communicating with light and sound throughout all their lessons!
Hand out *Adventure in the Forest Scenario Sheet*. Engage the class in the activity by painting the following scenario:

You and a friend have just gone on an exciting adventure in the middle of the forest! You set up camp as the Sun starts to set, and it becomes dark. One of you goes to fetch some water from the stream nearby. But as you return, you see a huge bear blocking your path to the tent! Thankfully, you and your partner have prepared 3 codes using light and sound to communicate in a dangerous situation. Use your codes to help your partner pass the bear and return to the safety of the tent. Good luck adventurers!

Working in pairs, students will come up with and test a way to communicate three codes using light, sound, or both: “Emergency!” “Stop, don’t move” and “Coast is Clear.” They can use any material in the class, but they cannot use words to communicate their codes (speaking out-loud will spook the bear).

Share rubric with students so that they have a clear understanding of the expectations.

Students will first complete *My Communication Device Planning Sheet* and then build their devices. The teacher will encourage pairs to test and practice the codes for each command.

Use *Communication is Key Rubric* to assess students’ projects. Teacher will also take into consideration the Peer/Self-Assessments. Teacher will take observational notes throughout the project.
You and a friend have just gone on an exciting adventure in the middle of the forest! You set up camp as the Sun starts to set, and it becomes dark. One of you goes to fetch some water from the stream nearby. But as you return, you see a huge bear blocking your path to the tent! Thankfully, you and your partner have prepared 3 codes using light and sound to communicate in a dangerous situation. Use your codes to help your partner pass the bear and return to the safety of the tent. Good luck adventurers!

Design and build a different device to communicate signals for the following words. Each signal must be different and use light, sound, or both.

**Emergency**

**Stop, Don’t Move!**

**Coast is Clear**

Remember, you can use any materials in the class you would like, but you can’t use words to communicate. (This will cause the bear to become angry!) One partner will communicate the signal using the device and the other partner will respond by modelling the cue.

**DESIGN:** Wording should be in a more visually appealing format for children. Ideally, pictures would re-create the scene mentioned above. Font should be larger and more engaging. A border should be placed around the page. Could be spread out over two pages.
My Communication Device Planning Sheet

Draw a picture of what your device looks like AND the signal for communicating the code Emergency:

To build it you need: __________________________
__________________________________________

My device uses: ____________________________
____ Sound
____ Light
____ Both

Draw a picture of what your device looks like AND the signal for communicating the code Emergency:

To build it you need: __________________________
__________________________________________

My device uses: ____________________________
____ Sound
____ Light
____ Both

Draw a picture of what your device looks like AND the signal for communicating the code Emergency:

To build it you need: __________________________
__________________________________________

My device uses: ____________________________
____ Sound
____ Light
____ Both
Peer/Self-Assessment

Name: ________________________________________

Partner’s Name: ________________________________________

Date: ________________________________________

My Partner ...  I ...

- Listened to what I had to say
- Shared their ideas
- Was helpful
- Listened to my partner
- Shared my ideas
- Was helpful

We worked well together because . . . .

How do you feel about your partner’s work?

Perfect  Great  Good Effort  OK  Better Next Time

How do you feel about your work?

Perfect  Great  Good Effort  OK  Better Next Time
**Name:** ____________________________________________  **Name of Partner:** ________________________________

## Communication is Key Rubric

<table>
<thead>
<tr>
<th></th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Light/Sound</strong></td>
<td>Light and sound is not incorporated in any of the devices chosen for the signal words.</td>
<td>Light or sound is incorporated in one of the devices chosen for the signal words.</td>
<td>Light or sound is incorporated in two of the devices chosen for the signal words.</td>
<td>Light or sound is incorporated in all three of the devices chosen for the signal words.</td>
</tr>
<tr>
<td><strong>Communication Devices</strong></td>
<td>Student is unable to use any of the communication devices in their demonstration. Devices are incomplete and/or unfinished.</td>
<td>Student uses the same device for all three of the signal words. There are very small differences among the communication signals chosen.</td>
<td>Audience has a difficult time differentiating between the signal used and its corresponding cue.</td>
<td>Student uses completely different devices for all three of the signal words. Each communication signal is unique. Audience can identify which signal corresponds with which cue immediately.</td>
</tr>
<tr>
<td><strong>Modeling the Devices</strong></td>
<td>Student is unable to respond to the signal modeled by their partner or utilize the device to cue a response.</td>
<td>Student can respond to one of the signals modeled by their partner or utilize the device to cue one response.</td>
<td>Student can respond to two of the signals modeled by their partner or utilize the device to cue two responses.</td>
<td>Student can respond to all the signals modeled by their partner or utilize the device to cue all the responses.</td>
</tr>
<tr>
<td><strong>Planning Sheet</strong></td>
<td>Planning sheet is vague or unclear. Student does not provide any information about the planning process.</td>
<td>Planning sheet provides some information about the planning process. The sheet is incomplete and is missing information.</td>
<td>Planning sheet outlines the communication devices and presents ideas in a clear and concise manner.</td>
<td>Student provides thorough detail about the thought process behind their communication devices. The planner is complete and organized.</td>
</tr>
</tbody>
</table>