**Contributors**

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**Intended Audience**

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>K-4</td>
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<tr>
<td>5-8</td>
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<tr>
<td>9-12</td>
<td>X</td>
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</tbody>
</table>

**Activity Characteristics**

<table>
<thead>
<tr>
<th>Classroom Setting</th>
<th>Requires special equipment</th>
</tr>
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<tbody>
<tr>
<td></td>
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<tr>
<td>Uses hands-on manipulatives</td>
<td>X</td>
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<tr>
<td>Requires mathematical skills</td>
<td>X</td>
</tr>
<tr>
<td>Can be performed individually</td>
<td></td>
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<tr>
<td>Requires group work</td>
<td>X</td>
</tr>
<tr>
<td>Requires more than one (45 min class) period</td>
<td></td>
</tr>
<tr>
<td>Appropriate for special needs student</td>
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Introduction

Description
Students will learn about the differences between light waves and sound waves.

Abstract
Students will participate in a stations lab that will demonstrate various characteristics of light waves and sound waves. Students will observe and highlight differences between the two forms of waves.

Core Themes Addressed

<table>
<thead>
<tr>
<th>Core Themes Addressed</th>
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<tbody>
<tr>
<td>Microbial Cell Biology</td>
</tr>
<tr>
<td>Microbial Genetics</td>
</tr>
<tr>
<td>Microorganisms and Humans</td>
</tr>
<tr>
<td>Microorganisms and the Environment</td>
</tr>
<tr>
<td>Microbial Evolution and Diversity</td>
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<tr>
<td>Other –Physical Science</td>
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</tbody>
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Keywords
Waves, Transverse, Longitudinal, Compression, Amplitude

Learning Objectives
At completion of this activity, learner will:

1. Differentiate between transverse and longitudinal waves
2. Explain how waves travel
3. Explain how amplitude affects other wave characteristics

National Science Education Standards Addressed

Standard A: Science as Inquiry

- Abilities necessary to do scientific inquiry

Standard B: Physical Science

- Interactions of energy and matter
Teacher Handout

Light vs. Sound

Student Prior Knowledge

Students should have an understanding of the parts of a wave and how waves transfer energy.

Teacher Background Information

There are two types of waves: mechanical waves and electromagnetic waves. Mechanical waves are described as the previously discussed characteristics: longitudinal and transverse. Mechanical waves require a medium to travel through. Electromagnetic waves, like light, do not require a medium to travel through.

Electromagnetic waves make up the electromagnetic spectrum. The part of the spectrum that humans can see is known as the visible light spectrum. The visible light spectrum is simply the colors of the rainbow or ROY G. BIV, for easy reference.

Four phenomena that can be observed with waves are reflection, refraction, diffraction and interference. Reflection is a change in direction of a wave so that it returns to where it came from. Refraction is the bending of light. Diffraction is the bending of a wave around an obstacle. Interference is when two or more waves pass the same point.

Class Time

This activity will require a minimum of one 90 minute class period.

1. Give a lecture detailing the characteristics of waves and differentiating between light and sound waves: 15 minutes.
2. Students should move to their lab stations and begin the lab: 60 minutes.

Teacher Preparation Time

This lesson will require approximately 40 minutes of preparation time.

1. Print out instructions and handouts necessary for each station: 10 minutes. These items can be found in the Light vs. Sound Stations Instructions document.
2. Set up various stations: 30 minutes.
   a. To produce the Phone Cups for Station 3, poke a hole in the bottom of the plastic cups and draw the piece of string through. Tie the ends onto the paper clips to keep the string from falling out of the cups.
Safety Precautions

Be cautious around the open flame. Students will be using glassware and should be cautious of possible broken glass.

Materials and Equipment

<table>
<thead>
<tr>
<th>Item</th>
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</thead>
<tbody>
<tr>
<td>Diffraction Squares (4)</td>
</tr>
<tr>
<td>Two Plastic Cups</td>
</tr>
<tr>
<td>20 ft. Piece of String</td>
</tr>
<tr>
<td>Paper Clips</td>
</tr>
<tr>
<td>200 mL Vegetable Oil in a Beaker</td>
</tr>
<tr>
<td>200 mL Water in a Beaker</td>
</tr>
<tr>
<td>Pencil</td>
</tr>
<tr>
<td>Votive Candle</td>
</tr>
<tr>
<td>Bucket</td>
</tr>
<tr>
<td>Lighter</td>
</tr>
<tr>
<td>6 – 200 mL Beakers</td>
</tr>
<tr>
<td>600 mL Beaker of Water</td>
</tr>
<tr>
<td>Glass Stirring Rod</td>
</tr>
<tr>
<td>Pan with Water</td>
</tr>
<tr>
<td>Tuning Forks</td>
</tr>
<tr>
<td>Wooden Box</td>
</tr>
<tr>
<td>Printed Items for Lab Stations</td>
</tr>
</tbody>
</table>

Methods

A. Station 1 – Wave Definitions

1. Select the correct definition for each of the terms and place them in the definition boxes.
2. After you are finished, have your answers checked and signed off by your teacher.

B. Station 2 – Rainbow Glasses

1. Take one of the diffraction squares, hold it up and look at the classroom light.
2. Describe what you see on the answer sheet and answer any questions for this station.
C. Station 3 – Phone Cups

1. Have one partner take a cup and walk to the end of the room and the other partner walk with the other cup to the other end of the room.
2. Pull the strings tight but not too tight to break them.
3. Whisper to each other through the cups, then whisper through the air.
4. Answer any questions for this station on your answer sheet.

D. Station 4 – Pencil in Oil

1. Place the pencil in the glass of water and observe it closely from the side of the beaker.
2. Place the pencil in the glass of oil and observe it closely from the side of the beaker.
3. Answer the questions on your answer sheet.

E. Station 5 – Candle and Bucket

1. Put the bucket on the table next to the candle with the open end facing the candle.
2. Hit the bottom of the bucket and see what happens to the candle.
3. Answer the questions on your answer sheet.

F. Station 6 – Symphony Beakers

1. Pour different amounts of water into each beaker.
2. Using a stirring rod, gently tap each beaker and listen for the sound.
3. Can you change the amount of water in each beaker so you can play a song?
4. Pour the water back into the original beaker.
5. Answer the questions on your answer sheet.

G. Station 7 – Tune Me Out

1. Hit a tuning fork using the rubber wedge. Listen.
2. Hit a tuning fork using the rubber wedge and put it into the water. Listen.
3. Hit a tuning fork using the rubber wedge and place it on the wooden block. Listen.
H. **Station 8 – Light vs. Sound**
1. Place the terms in the Venn diagram.
2. Terms that fit only light waves will go on the left
3. Terms that fit only sound waves will go on the right
4. Terms that fit both light and sound waves will go in the middle
5. After you have finished, have your answers checked and signed off by your teacher.

I. **Station 9 – Electromagnetic Waves**
1. Use the pictures of the electromagnetic spectrum and the visible spectrum to decide which word or words answer(s) each question.
2. After you have finished, have your answers checked and signed off by your teacher.

**Tips/Suggestions**
1. If your class period is less than 90 minutes, cut back on the number of stations by selecting those suitable for your classroom and time constraints.
2. Have plenty of paper towels for the stations that require water.
3. Laminate the instruction sheets at each station if they will be used for multiple classes.

**Answers to Student Handouts**

**Station 2 – Rainbow Glasses**

3. What did you see when you held the glass up to the classroom light?
   The rainbow

4. What part of the electromagnetic spectrum are you seeing?
   The visible light spectrum

**Station 3 – Phone Cups**

5. How do you think you are able to hear the other person through a string?
   The string serves as a medium to transport the sound waves.

6. What is the difference in the sound when you whisper through the air vs the cups and why?
Sound travels faster through solids and the string serves as a medium to transport the sound waves

Station 4 – Pencil in Oil

4. What do you think happens to the speed of the light waves when they hit water or oil?

   It slows down.

Station 5 – Candle and Bucket

4. Explain what happened.

   The flame moved.

5. What does this station tell us about the relationship of sound waves and energy?

   Sound waves require a medium for the energy to travel and air, though not visible, is still a medium.

Station 6 – Symphony Beakers

6. What does adding water to the beakers do to the sound waves?

   It makes the pitch higher.

Station 7 – Tune Me Out

4. Which do sound waves pass through the fastest: solid, liquid, or gas (air)?

   Solid
Introduction

Waves can be observed in everyday life, be it the waving of a flag or the mighty waves of the ocean. What you are seeing in these instances are not the waves themselves, but their movement of the medium they are flowing through. Waves are simply energy that can be carried through matter or space.

Student Background Knowledge

There are two types of waves: mechanical waves and electromagnetic waves. Mechanical waves are described as the previously discussed characteristics: longitudinal and transverse. Mechanical waves require a medium to travel through. Electromagnetic waves, like light, do not require a medium to travel through. Electromagnetic waves make up the electromagnetic spectrum. The part of the spectrum that humans can see is known as the visible light spectrum. The visible light spectrum is simply the colors of the rainbow or ROY G. BIV, for easy reference.

Four phenomena that can be observed with waves are reflection, refraction, diffraction and interference. Reflection is a change in direction of a wave so that it returns to where it came from. Refraction is the bending of light. Diffraction is the bending of a wave around an obstacle. Interference is when two or more waves pass the same point.

Vocabulary

Electromagnetic Wave: Wave produced by the vibration of electric charges.

Mechanical Wave: Wave produced by the movement of matter.

Safety Considerations

Be cautious around the open flame. Students will be using glassware and should be cautious of possible broken glass.
Student Worksheet

Light vs. Sound

Name: ___________________________________        Block: _________

Sound and Light Waves Stations Lab

Station 1:
1. Have your teacher sign off when he/she has checked your answers _____________

Station 2:
1. What did you see when you held the glass up to the classroom light?
2. What part of the electromagnetic spectrum are you seeing?

Station 3:
1. How do you think you are able to hear the other person through a string?
2. What is the difference in the sound when you whisper through the air vs the cups and why?

Station 4:
1. Draw what the pencil looks like in the glass of water:
2. Draw what the pencil looks like in the glass of oil:
3. What do you think happens to the speed of the light waves when they hit water or oil?
Station 5:
1. Explain what happened:

2. What does this station tell us about the relationship of sound waves and energy?

Station 6:
1. What does adding water to the beakers do to the sound waves?

Station 7:
1. Which do sound waves pass through the fastest, solid, liquid, or gas (air)?

2. Draw what you think a sound wave that passes through a solid would look like and one that passes through air. Don’t forget, in order to increase speed we must increase frequency.
   Air drawing:

   Solid drawing:

Station 8:
1. Have your teacher sign off when he/she has checked your answers ______________

Station 9:
1. Have your teacher sign off when he/she has checked your answers ______________