

Name: Meghan Rudquist

Standard

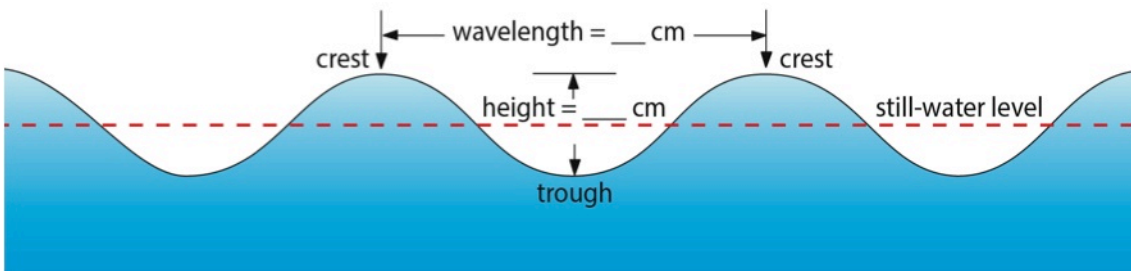
4-PS4-1 Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

- **Learning Center Objective:** In this lesson, students will explore different types of objects that create waves and describe the patterns seen by recording their observation in a notebook.

Clarification Statement: Examples of models could include diagrams, analogies, and physical models to illustrate wavelength and amplitude of waves (e.g. waves could be modeled using rope, wire, slinky, fabric, water).

Engage

- **Phenomena:** Ask students if they have ever seen the wave done in a big crowd. Show this video of the longest wave done at a sports game.
https://www.youtube.com/watch?v=-SNCE_3QVxc
- **Background Knowledge:** The teacher will explain to the students that today will be science centers with three activities to complete. Students will use their notebooks throughout each center and will document all of their findings. Next, ask the students what is a wave? “a disturbance that transfers energy through matter or space, with little or no associated mass transport. Waves consist of oscillations or vibrations of a physical medium or a field, around relatively fixed locations.” What is a, trough, crest, wavelength, amplitude and wave height? Trough is the bottom of a wave, crest in the top of the wave, the wavelength is one complete wave cycle, amplitude is the distance from the rest to the crest, and the wave height is the height from the bottom to the top of the wave. There are three types of waves transverse wave, longitudinal wave, and electromagnetic wave. The centers will focus on the transverse and longitudinal wave. A transverse wave is “a wave vibrating at right angles to the direction of its propagation.” A longitudinal wave is “a wave vibrating in the direction of propagation.” The teacher will show this or a similar picture to the students.



Center 1

- **Challenge:** Jump rope and different kinds/sizes of rope. Students will predict what type of wave they are making.
- **Materials Needed:**
 - Jump Rope
 - Different sizes of rope
 - Camera

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- Science notebooks
- **Learning Documents:** Science notebook,
 - Other materials located in appendix A- **students will glue this worksheet in their journal to record and observe their findings.**
- **Special Directions:** Students will have partners and will create waves with their rope and observe their findings. They will record their data in their science notebooks. Before they move the rope they are to predict what type of wave they will create and then test their hypothesis. Write down what you think will happen and then what actually happened. Where you right on your hypothesis? Students can then use a camera to video tape their rope moving like a wave and then watch the video to get a closer look at what is happening.

Center 2

- **Challenge:** Observe water in a bottle by one person moving it back and forth and another video taping. Watch the video to see what kinds of waves are being made.
- **Materials Needed:**
 - Plastic Bottles
 - Water
 - Food coloring
 - Camera
- **Learning Documents:** Science notebook
 - Other materials located in appendix B- students will glue this worksheet into their notebook to record and observe their findings.
- **Special Directions:** Students will be learning about trough, crest, wavelength, and wave height in this section. Students should first glue their worksheet into their notebook. Then students can grab a plastic bottle that will be filled with water and food coloring already for them so they do not have as much work to do. The teacher should prepare this before hand to avoid food coloring getting all over clothing and the floor. Students will then move the bottle back and forth to create waves inside the bottle. Their partner will be taking a video of this so they can watch it afterwards and even in slow motion to see what kind of waves are being created. Students are to first predict what is going to happen and then observe and record what actually happens.

Center 3

- **Challenge:** Observe and record what kind of waves a slinky makes.
- **Materials Needed:**
 - Slinky
 - Meter stick or broomstick
 - Science notebook
 - Camera
- **Learning Documents:** Science notebook
 - Other materials located in appendix C- students will glue the worksheet into their notebook to record and observe their findings.
- **Special Directions:** Students will load a slinky onto a meter stick or a broom stick (which ever is available) and then stretch it out. Then hold the stick at waist level or secure onto a flat surface, such as a desk, table, or stool. One student will hold one end

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of the slinky still while the other shakes the other end back and forth as quickly as they can. Students are to predict what type of wave this motion will make and then record this in their notebook. Make sure then end is being held very tightly, but do not interfere with the other coils on the slinky.

Wrap-Up Session

- **Challenge:** Students will create a large model of a wave as a class. This can be done inside or outside depending on the weather.



- **Materials Needed:**
 - Stool
 - Heavy object
 - Duck tape
 - Scissors
 - Wooden skewers
 - Gumdrops
- **Learning Documents:** Science notebooks
 - Other materials located in appendix D- students will glue this worksheet into their notebooks.
- **Special Directions:** Students will be in groups of four to five and each group will be able to create a model of a wave with the materials provided. Place two stools about six feet apart. Place the heavy object on each one. Place a piece of duck tape on both stools with the sticky side up by taping underneath the stool. Leave about one foot of tape open on each end and then place the skewers along the sticky side up tape about 1 ½ in apart from one another. Place the gumdrops on each end of the skewers. Tap the skewer on one end and wait to observe what happens. What kind of wave is this making?

Big Idea

- **Science Content:** The science content that the students will be learning is about three different types of waves and what they look like in objects from the classroom. They will learn how to predict what type of wave will be created by looking at the type of materials being used. Then they will learn how to test their hypothesis by creating different waves. Finally, they will be able to create a larger model of what they have

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been learning. Before doing the above centers, students will learn necessary vocab words to be able to classify what type of wave they are observing.

- **Learning Supports:**
 - **Below Proficiency:** Students will be grouped with someone who can help them stay on task. Some Materials will be ready before they start the activity.
 - **Emergent Proficiency:** Students will complete the task as guided in the instructions and will prepare their materials.
 - **Above Proficiency:** Students will be grouped with someone who may need more organization or guidance on a task. Students can look into sound waves as an extra activity if they finish early.

Assessment Plan:

- **Formative:**
 - I will observe the students as they work with the hands-on materials throughout each center.
 - Students will keep their finding in their science notebook that I will look through during the center to make sure they are recording all their data collected.
 - Students will be observed on how they participate during the activates.
- **Summative:**
 - Students will be assessed on their final science notebook that will be turned in at the end of the lesson.
 - Students will take a review test on what was done during the activity.

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Appendix A

Jump Rope

What kind of rope am I using? Circle one.

- Jump Rope
- Medium Length
- Short Length

Write a hypothesis _____

What type of wave did you create? Describe what you saw.

Draw a picture on the next page on what you observed during your experiment.

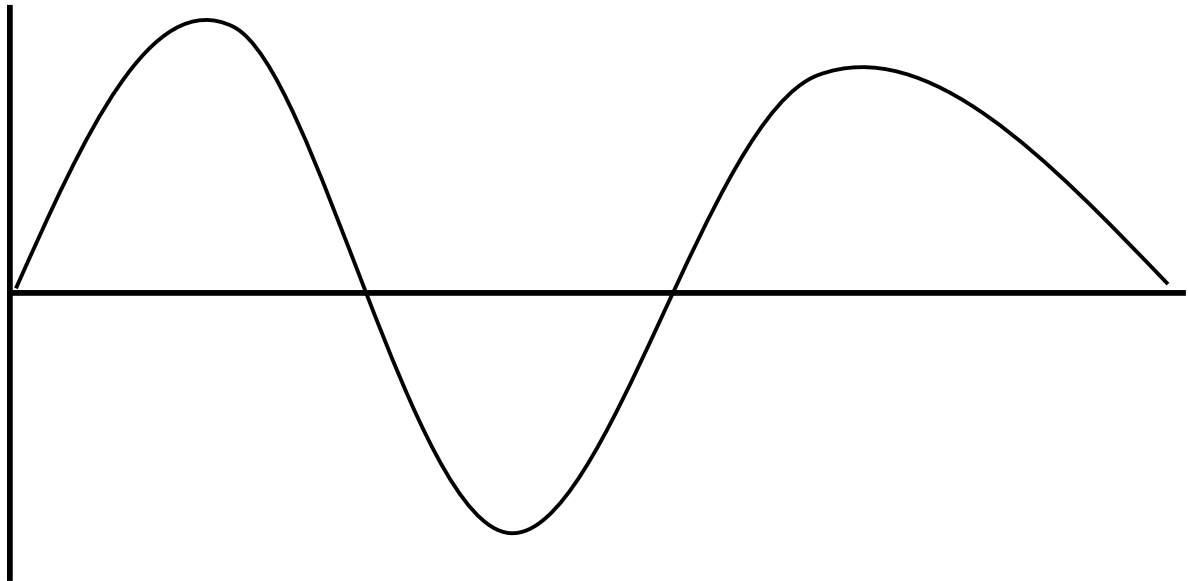
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Appendix B

Plastic Bottle

Write a hypothesis _____

Label the parts of the wave, including **trough**, **crest**, **wavelength**, **amplitude** and **wave height**.



Draw a picture on the next page on what you observed during your experiment.

What type of wave did you create?

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Appendix C

Prediction

What is your hypothesis on what will happen with the slinky?

Observation

What did you observe?

Claim

What data did you collect?

Evidence

Was your hypothesis correct and what evidence do you have to prove it?

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Reasoning

How is the evidence and your claim connected?

Draw a picture of before and during the experiment.

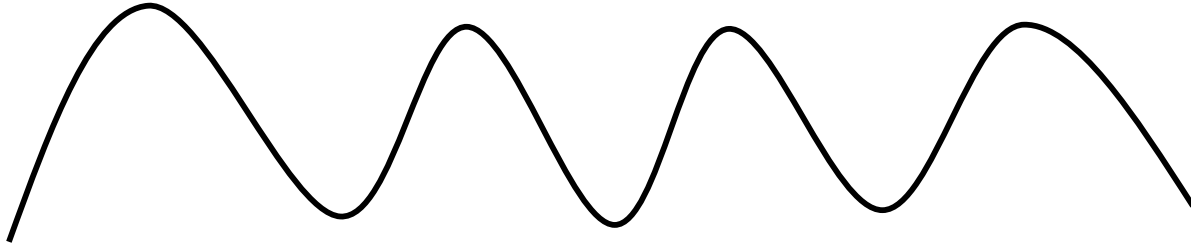
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Appendix D

Review

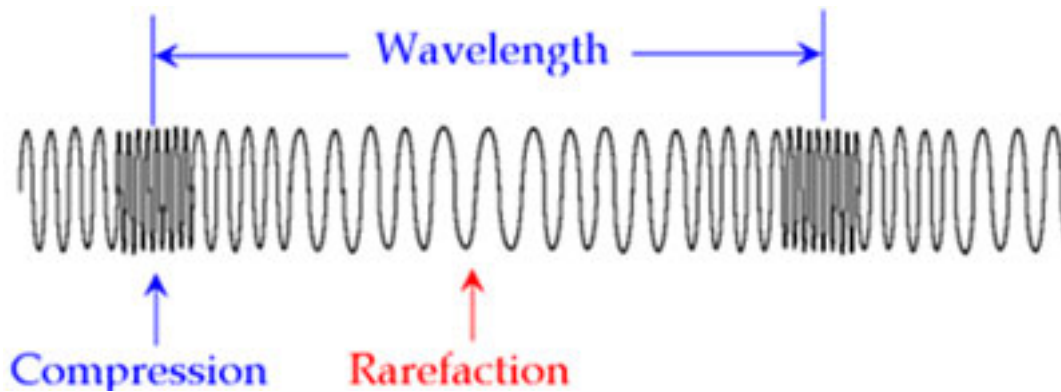
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1) What type of wave is this?



- a) Longitudinal Wave
- b) Transverse Wave
- c) Electromagnetic Wave

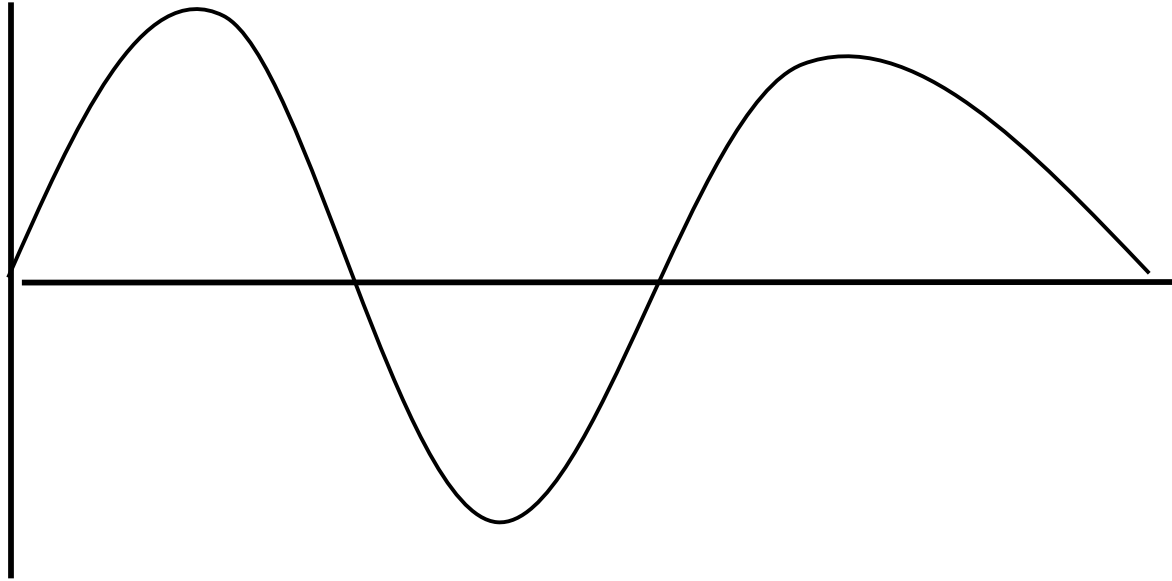
2) What type of wave is this?



- a) Longitudinal Wave
- b) Transverse Wave
- c) Electromagnetic Wave

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3) Label the wave with *trough*, *crest*, *wavelength*, *amplitude* and *wave height*.



4) Write an example of a hypothesis.

5) What is one thing you learned/enjoyed during these activities?
