



LESSON PLAN

WAVE PROPERTIES GRADES 3-5

SUMMARY

Students will understand how energy travels through transverse and longitudinal waves.



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.

Science & Engineering Practices	Connections to Classroom Activity
<p>Developing and Using Models Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence</p>	<ul style="list-style-type: none"> • Students model energy transfer by creating a human wave. • Students create a wave model using candy, skewers, and tape. • Students interpret diagrams of transverse and longitudinal waves.
Disciplinary Core Ideas	Connections to Classroom Activity
<p>PS4.A: Wave Properties Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water</p>	<ul style="list-style-type: none"> • Students address their misconceptions about water waves through observation, modeling, and exploration. • Students explore how changes in energy influence amplitude and wavelength.

meets a beach. (Note: This grade band endpoint was moved from K-2.)

Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks).

Crosscutting Concepts

Patterns

Connections to Classroom Activity

- Students observe and compare wave patterns for transverse and longitudinal waves.
- Students explore how changes in energy influence wave patterns.

DURATION

One to two 45-minute classroom periods

PRE-ASSESSMENT QUESTIONS

Please see discussion questions located under the video. These can be discussed as a group or answered individually in student science notebooks.

MATERIALS

- Science notebooks
- Pencils
- Transparent containers (such as large plastic boxes) or water table if available
- Water
- Towels for clean up



ENGAGE

Ask students what they think of when they think about waves. Steer the conversation towards waves in the ocean or at a lake, specifically wave motion in open water, not waves breaking on a shore. Show a video of waves in open water or make waves inside a container filled with water. Ask students what is happening here. What are waves? Do waves move water? What causes waves? What causes waves to get taller? What causes waves to happen closer together? Further apart?



EXPLORE

Allow students to explore waves using simple containers with water. Have them focus on the questions from above. Through their observations of waves in a container, they can attempt to answer the questions. This could be a wet and messy activity that may be best completed outdoors.



EXPLAIN

After students have had time to explore water waves, gather the group to discuss possible answers to the above questions. There may still be misconceptions and disagreement. Explain that the class will create a model together to better understand what is going on with waves and to look for evidence to answer the questions. Create a line with all students standing shoulder to shoulder facing the same direction. Ask the students whether they have ever participated in “the wave” at a sporting event? Explain to students that they represent water and they are going to be modeling a water wave. Instruct the students to create a human wave by having the student at one end of the line raise and immediately lower his or her arms. The second student should raise his or her arms as soon as he/she sees the first start, and so on down the line. You may want to record a video of the students as a group so that they can see the overall affect.

Now address each question from above:

What is going on here?

- Arms are (water is) moving up and down.

What are waves?

- Waves are the up and down motion of water. They are how energy is transferred through water from place to place.

Do waves move water?

- Waves move water up and down, but not sideways as it appear to be moving.

What causes waves?

- Waves are caused by energy (in the case of the human wave the energy comes from the students, in the case of the water waves, the energy comes from some sort of disturbance—from a hand, the wind, etc.).

What causes waves to get taller?

- To answer this question, have students make a small human wave (lift hands slightly above head) and then a large wave (hands high and jump). Which took more energy? More energy makes waves taller (higher amplitude).

What causes waves to happen closer together? Further apart?

- Have students experiment with their human wave. They should eventually determine that for waves to be close together, they must happen faster, which takes more energy. For waves to happen further apart, they must happen slower, which takes less energy.

Students now have a decent understanding of transverse waves in water.



AS A GROUP, WATCH THE GENERATION GENIUS WAVE PROPERTIES VIDEO TO FURTHER EXPAND THIS UNDERSTANDING AND INTRODUCE LONGITUDINAL WAVES.

Then facilitate a conversation using the Discussion Questions.



ELABORATE

In small groups, students can work together to complete Zoe’s DIY Activity and make a wave model. Be sure that each group spaces their skewers consistently along the duct tape. You should then be able to connect all groups’ models end to end (using additional duct tape) to create a longer wave model. Students can then experiment with amplitude and wavelength using this model.

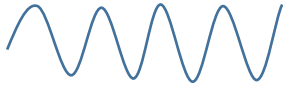
Challenge students to create a model of longitudinal waves. This could be similar to the model that Dr. Jeff, Zoe, and Izzy made using the spring toy.





EVALUATE

Provide students with drawings representing (modeling) transverse and longitudinal waves.



Instruct them to label each type of wave (transverse and longitudinal).

Instruct them to label amplitude and wavelength on the appropriate wave.

Which of these wave models represents water waves? Which represents sound waves?

