

What Is a Wave? Lesson 1

London Bridge Is Falling Down

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Grade Level	9th – 10th Grade	**Time Frame**	130 minutes
Subject	Science	**Duration**	3 class periods
Course	Physical Science, Physics		

Essential Question

What are waves? How do waves behave differently from particles?

Summary

This is the first lesson in the "What Is a Wave?" unit. Students will begin by recalling information they already know about waves. They will explore movement with springs to learn about and identify types of waves. In groups, students will create anchor charts with key concepts and examples of waves. Finally, students will use the POMS: Point of Most Significance strategy to assess their understanding of the lesson.

Snapshot

Engage, Part 1 (Entire Unit)

Students watch a video and complete an I Notice, I Wonder chart.

Engage, Part 2 (Lesson 1)

Students participate in an Always, Sometimes, or Never True activity about waves.

Explore

In pairs, students conduct experiments with springs.

Explain

In groups, students create anchor charts and add information about waves.

Extend

Students learn academic vocabulary to describe waves and their characteristics.

Evaluate

Students use the POMS: Point of Most Significance strategy to assess their understanding.

Standards

Oklahoma Academic Standards (Physics)

PH.PS3.3 : Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.*
PH.PS3.3.DCI.1: At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy.
PH.PS3.3.DCI.2: Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them.
PH.PS3.3.DCI.3: Modern civilization depends on major technological systems. Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks.
PH.PS4.1 : Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
PH.PS4.1.DCI.1: The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing.

Attachments

- Always, Sometimes, or Never True Teacher Guide—London Bridge Is Falling Down.docx
- Always, Sometimes, or Never True Teacher Guide—London Bridge Is Falling Down.pdf
- Always, Sometimes, or Never True—London Bridge Is Falling Down - Spanish.docx
- Always, Sometimes, or Never True—London Bridge Is Falling Down - Spanish.pdf
- Always, Sometimes, or Never True—London Bridge Is Falling Down.docx
- Always, Sometimes, or Never True—London Bridge Is Falling Down.pdf
- Exploring Waves Teacher Guide—London Bridge Is Falling Down.docx
- Exploring Waves Teacher Guide—London Bridge Is Falling Down.pdf
- Exploring Waves—London Bridge Is Falling Down - Spanish.docx
- Exploring Waves—London Bridge Is Falling Down - Spanish.pdf
- Exploring Waves—London Bridge Is Falling Down.docx
- Exploring Waves—London Bridge Is Falling Down.pdf
- I Notice, I Wonder—London Bridge Is Falling Down - Spanish.docx
- I Notice, I Wonder—London Bridge Is Falling Down - Spanish.pdf
- I Notice, I Wonder—London Bridge Is Falling Down.docx
- I Notice, I Wonder—London Bridge Is Falling Down.pdf
- Lesson Slides—London Bridge Is Falling Down.pptx

Materials

- Lesson Slides (attached)
- I Notice, I Wonder handout (attached, one per student)
- Always, Sometimes, or Never True handout (attached, one per student)
- Always, Sometimes, or Never True (Teacher's Guide) (attached)
- Exploring Waves handout (attached, one per pair of students)
- Exploring Waves (Teacher's Guide) (attached)
- Poster paper (one per group)
- Slinky® toys or large springs (included in classroom supply kit available through the K20 Center, one per pair of students)

30 minutes

Engage, Parts 1 and 2

As students enter the classroom, introduce the lesson using the attached **Lesson Slides**.

Engage, Part 1 (Entire Unit)

Display **slide 3** and introduce students to the I Notice, I Wonder strategy. Pass out the attached **I Notice, I Wonder** handout to each student or have students use notebook paper. Inform students they are going to watch a video and should use their handouts to record anything they notice (observe) or wonder (have questions about).

Go to **slide 4** to play the video, titled "CYMATICS: Science vs. Music."

Embedded video
https://youtube.com/watch?v=Q3oItpVa9fs

After the video, display **slide 5**. Have students share their observations and questions with an Elbow Partner. Then, have a whole-class discussion about the video and ask for volunteers to each share one of their observations or questions.

Teacher's Note: Listening for Prior Knowledge

Listen carefully to students' questions and observations to understand whether some of them have prior knowledge and experience with this subject matter.

Go to **slide 6** and introduce students to the Driving Question Board strategy. Ask each pair of students to come up with one question about waves. Post students' questions in one area of the classroom. Inform students this area is going to be the Driving Question Board for the class to refer back to throughout the unit.

Engage, Part 2 (Lesson 1)

Display **slide 7** and introduce students to the Always, Sometimes, or Never True strategy. Pass out the attached **Always, Sometimes, or Never True** handout to each student or have students use notebook paper to complete the activity.

Ask students to read each statement about waves on the following slides and decide if the statement is always true, sometimes true, or never true. Remind students to explain their reasoning for each choice in the space provided on the handout.

Once students understand the task, transition through **slides 8–16** one at a time. For each slide, allow ample time for students to read the statement, make a selection, and write their reasoning.

Possible Student Responses

See the attached **Always, Sometimes, or Never True (Teacher's Guide)** document for possible student responses.

After showing all the statements, ask for volunteers to share their thoughts about each statement and have a class discussion. This is a good time to address any misconceptions students might have about waves.

After discussing as a class, show **slides 17–18** to share the unit's essential questions and the lesson's learning objectives with students.

20 minutes

Explore

Display **slide 19** and read aloud the questions on the slide: "What are mechanical waves? How are they made?"

Go to **slide 20** and inform students they are going to work in pairs to examine how springs create waves. Pass out a Slinky® or another type of large spring and the attached **Exploring Waves** handout to each pair of students. You may want to have students answer the first two questions on the handout before you go to the next slide.

Go to **slide 21** to provide students with instructions for the activity. Have each student pair find a place on the floor or on a tabletop to stretch out their spring 3–4 meters. As they move their spring to create different types of waves, ask students to record their observations on the Exploring Waves handout.

After students have had plenty of time to experiment with the spring and record their observations, have a class discussion about the different waves that students made and their observations of each.

Possible Student Responses

See the attached **Exploring Waves (Teacher's Guide)** document for possible student responses.

20 minutes

Explain

After allowing time (if needed) to complete the Exploring Waves activity or discussion from Day 1, inform students they are going to work in groups of four for the next activity.

Display **slide 22** and provide students with one piece of poster paper per group. Ask students to create an Anchor Chart by writing their observations and information learned from the Exploring Waves activity on the poster paper. Look for students' charts to show some level of understanding of the following possible concepts:

- They had to put energy into the spring in order to make a wave.
- They could make two kinds of waves, either by squeezing/stretching the spring or by wiggling the spring side to side.
- They could control the height of the waves and the number of waves pulsing through at one time based on how widely or how quickly they manipulated the spring.
- They could make either a single wave pulse or a continuous wave, depending on how they manipulated the spring.
- The spring moved as it carried the wave, but when the energy input (either a continuous shake or a single pulse) ended, the spring returned to its original position.

Monitor students as they complete their anchor charts.

30 minutes

Extend

Display **slide 23**. Inform students they are going to associate academic vocabulary about waves with the content on their anchor charts. As you present the new vocabulary on the following slides, ask groups to look at their anchor charts and label where/when each one occurred during the Exploring Waves activity. For each definition, students should add an example from the Exploring Waves activity if they don't already have one on their group's chart.

Go to **slide 24** and explain the vocabulary word to students. To show students a real-world example of oscillation, go to **slide 25** and play the following video, titled "Millennium Bridge."

Embedded video
https://youtube.com/watch?v=eAXVa__XWZ8

After the video, transition through **slides 26–31** one at a time and explain the rest of the vocabulary words to students. Remind students to label their own group's chart with each definition and where/when they observed the vocabulary word in practice during the Exploring Waves activity. If students do not have a particular concept on their anchor charts, pause on the slide in question and provide ample time for students to add it.

Once students have added the vocabulary words to their anchor charts, go to **slide 32**. Revisit the questions that students wrote on the Driving Question Board at the beginning of this lesson. Ask students if there are any questions they can answer at this time. If so, ask for a volunteer to write a response to the question and add it next to the question on the board.

10 minutes

Evaluate

Display **slide 33** and use the POMS: Point of Most Significance strategy to assess students' understanding of the lesson.

Ask students to imagine what they would say if their best friend had been absent for this lesson. Ask students, "What is the most important thing you learned during this lesson that you would want to share with your friend when they return?"

Have students write their responses to the question on notebook paper. Collect students' responses as an assessment of their learning. You may choose to collect students' Exploring Waves handouts and/or use their anchor charts as additional assessments.

Optional Homework Assignment

To assign homework in preparation for the next lesson, display **slide 34** and introduce students to the What Do You Meme? strategy. Each student should create a meme that demonstrates what they learned during the lesson, and they should be ready to share and explain their meme the next time class meets. Students can draw their memes by hand or use an online meme generator, such as ImgFlip or Make a Meme.

Teacher's Note: Preparing for the Next Lesson

In the next lesson that is part of this "What Is a Wave?" unit, students receive a vocabulary packet that includes some of the words introduced in this lesson. Keep this in mind when you begin the next lesson, as you might want to remind students to use their anchor charts to help them fill out their vocabulary packets.

Resources

Kamenícek, J. (2014, March 31). London Millennium Bridge from Saint Paul's [Image]. Wikimedia Commons. https://commons.wikimedia.org/wiki/File:London_Millennium_Bridge_from_Saint_Paul%27s.jpg

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