



Introduction to Waves Lesson

Grade Span	6-8th Grade
Time Span	2 (70 minute) classes
Standards	<p>MS-PS4-1 Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.</p> <p>Practice Standards: Analyzing and Interpreting Data Developing a Model Engaging in Argument from Evidence Obtaining, Evaluating, Communicating Information Using Mathematics and Computational Thinking</p>
Focus Question	What are waves and how do they work?
Overview	Students will be looking at how waves play a role in our everyday lives. Students will be looking at transverse and longitudinal waves and be able to label the parts of each.
Objectives	Students will be able to: <ul style="list-style-type: none"> • List the types of waves. • Label parts of a wave. • Explain how waves travel
Materials Needed	For each group you will need: <ol style="list-style-type: none"> 1. Container to hold water 2. Water 3. Ball 4. Sheet or towel 5. Rice 6. Oatmeal or some kind of container with a lid 7. Slinky 8. Computer
Video Material	<ul style="list-style-type: none"> • Waves: https://www.youtube.com/watch?v=L6xVw-SRks4#t=12 • Bozeman Science on Waves: https://www.youtube.com/watch?v=JppViHtLNlc • Wave Machine made with Jelly Bears (babies as he calls them) https://www.youtube.com/watch?v=VE520z_uqcU • Bill Nye the Science Guy on Waves: https://www.youtube.com/watch?v=pMldzILycTY



<p>Vocabulary</p>	<p>Wave Medium Amplitude Wavelength Mechanical Wave Matter Energy Crest Trough Transverse Compression Compressional Wave Volume, Frequency Vibrations Conductor Transmission Sound Medium Pitch Air Water Solid Amplitude</p>
<p>Teacher Prep</p>	<ul style="list-style-type: none"> • The Physics Classroom What is a Wave: https://www.physicsclassroom.com/Class/waves/U10L1b.cfm • The Physics Classroom: Anatomy of a Wave: https://www.physicsclassroom.com/Class/waves/u10l2a.cfm
<p>Background</p>	<p>The following: Waves and Wavelike Motion has background information and thinking points about waves.</p> <p>Physics Classroom Waves Background Information</p>



<h2>Procedure</h2>	<p>Engage:</p> <ol style="list-style-type: none"> 1. Students will be moving around to 3 different stations and use the <u>data sheet</u> to record their observations. <ol style="list-style-type: none"> a. Station 1 Waves in Water <ol style="list-style-type: none"> i. Have a dishpan or a bin with water. ii. Place the ball in the pan of water. iii. Students tap the water observing the motion of the waves and the movement of the ball. b. Station 2 Waves in Solids <ol style="list-style-type: none"> i. You will need a towel or a sheet. ii. Students hold the ends of the towel/sheet and move the towel/sheet up and down. iii. Make observations about the sheet/towel's movement. c. Station 3 Waves in Gases <ol style="list-style-type: none"> i. You will need an empty oatmeal container or some type of container with a lid and rice. ii. Tap on the container and observe the motion of the rice. 2. After completing, discuss as a whole class your observations. <p>Explore:</p> <ol style="list-style-type: none"> 1. Watch any of the videos above listed under Videos. 2. Have students complete the <u>Slinky Wave Lab</u> 3. Using the PhET Simulations have students answer the questions taken from the information below. <ol style="list-style-type: none"> a. <u>Waves on a String Pre/Post Lab</u> (credit: Jackie Esler) b. <u>Waves on a String Student Guide</u> (credit: Jackie Esler) c. Waves on a String Student Learning Guide (credit: Kathleen Miller) d. <u>http://www.troup.org/userfiles/929/My%20Files/Science/MS%20Science/8th%20Science/waves/wave_parts_affected_changes/wave_on_string_student_exploration_phet.doc?id=23570</u> e. Waves on a String: Properties of Waves (credit: Kristi Goodwin) f. <u>http://www.troup.org/userfiles/929/My%20Files/Science/MS%20Science/8th%20Science/waves/wave_parts_affected_changes/wave_on_string_prop_waves_phet.doc?id=23569</u> g. Taken from <u>https://phet.colorado.edu/en/contributions/view/4316</u> Using the PhET simulation: <u>https://phet.colorado.edu/en/simulation/bending-light</u> This is an interactive simulation for students to mess around with. h. As well as this PhET simulation: <u>https://phet.colorado.edu/en/simulation/wave-on-a-string</u> <u>Waves on a String Pre/Post Lab</u> (credit: Jackie Esler) <u>Waves on a String Student Guide</u> (credit: Jackie Esler) <p>Explanation:</p> <ol style="list-style-type: none"> 1. Students explain their thinking in the <ol style="list-style-type: none"> a. Slinky Wave Lab b. PhET Simulation Activities
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	<p>Extension:</p> <ol style="list-style-type: none"> 1. Extension of What are Waves: student figure out Anatomy of a Wave worksheet Anatomy of a Wave worksheet Key from this site: 8th Grade Waves Unit Information 2. Have students do a “pondering” activity. Writing activity where students think about what would happen if the water rises 10 feet. https://archive.bigelow.org/mitzi/ponder_quest.html <ol style="list-style-type: none"> a. Use Sea Level Rise Viewer from NOAA to help with visualization.
	<p>Evaluate:</p> <p>Formative Assessment: (Taken directly from: https://betterlesson.com/lesson/633219/properties-of-waves-making-waves-visible)</p> <p>Have students stand and use their hands to show the following:</p> <ol style="list-style-type: none"> 1. Longitudinal wave: students should push their hands forward. 2. Transverse wave: students should move their hands back and forth. 3. High amplitude for a longitudinal wave: students should push hard. 4. Low amplitude for a longitudinal wave: student should push soft. 5. High amplitude for a transverse wave: students should move their hands back and forth a large distance. 6. Low amplitude for a transverse wave: students should move their hands back and forth a small distance. 7. Low frequency for a longitudinal wave: students should move their hands back and forth slow. 8. High frequency for a transverse wave: students should move their hands back and forth fast. 9. Long wavelength for a longitudinal wave: students should push their hands slow. 10. Short wavelength for a transverse wave: students should move their hands back and forth fast. <p>A really important distinction to emphasize as students have misconceptions is that amplitude is independent of frequency. Students quickly confuse energy with speed. They believe that more energy means you have to move fast. However, you can have a low pitch sound with a high amplitude. Anytime you notice a student correlating frequency and amplitude, correct their misconception.</p> <p>Summative Assessment: Students will be able to complete the following: https://www.paulding.k12.ga.us/cms/lib/GA01903603/Centricity/Domain/2519/WaveIntroductionWaveTypesWaveFrequency.pdf</p>



Other Optional Activities

1. Share the Powerpoint from:
https://schoolwires.henry.k12.ga.us/cms/lib/GA01000549/Centricity/Domain/7241/intro_waves.pdf (links do not work)
 - a. Fill in the Graphic Organizer on waves from:
https://www.troup.org/userfiles/929/My%20Files/Science/MS%20Science/8th%20Science/waves/characteristics/intro_waves_graphic_organizer.pdf?id=23556
 - b. And label the wave diagrams from here:
https://www.troup.org/userfiles/929/My%20Files/Science/MS%20Science/8th%20Science/waves/characteristics/wave_diagram_label.pdf?id=23559
2. Better Lessons: Properties of Waves: Making Waves Visible:
<https://betterlesson.com/lesson/633219/properties-of-waves-making-waves-visible> Use this lesson to better understand the different types of waves and become familiar with the vocabulary.