

Lesson Topic: Waves and Their Properties**Objective:**

Students will be able to:

1. Describe waves as having repeating qualities.
2. Recognize that waves transport energy.
3. Define frequency, amplitude, and wavelength.
4. Predict how changes in amplitude and frequency relate to changes in energy.

Time Required: 75 minutes**Materials Needed:**

- Stopwatch
- Teacher computer with internet access
- Projector/interactive whiteboard/Smartboard
- 1 computer/laptop/iPad per student with internet access
- Waves and Their Properties Worksheet (attached)

Teacher Preparation:

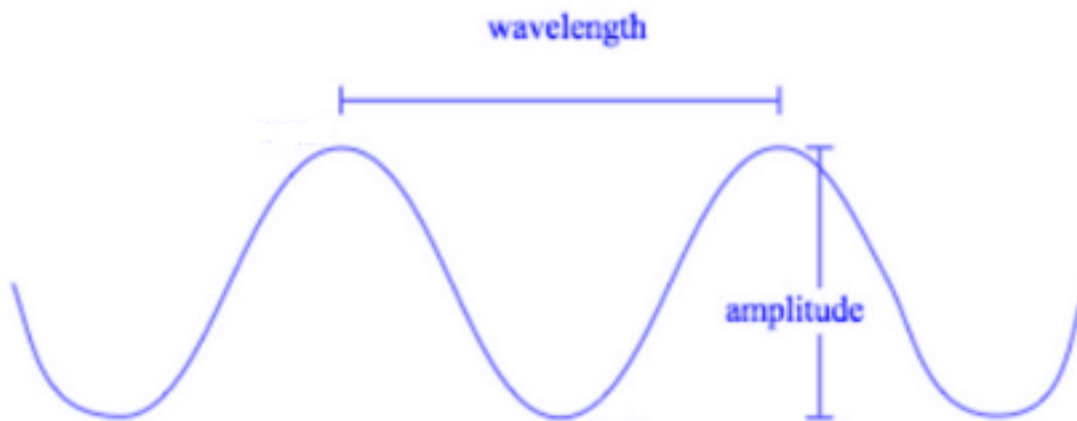
- Assign a Legends of Learning Instructional [Quick Play](#) playlist for the day(s) you will be teaching the lesson.
 - Instructional - Middle School - Waves and Their Properties
- Assign a Legends of Learning Content Review [Quick Play](#) playlist for the day(s) you will be teaching the lesson.
 - Content Review - Middle School - Waves and Their Properties
- Make copies of Waves and Their Properties Worksheet (1 per student)

Engage (10 minutes):

1. Explain to students that they will be learning about waves and their properties.
2. Ask students to give examples of types of waves that they may already know.
 - a. Answer: ocean waves, sound waves
3. Ask for four student volunteers for a demonstration using sound waves to navigate in the dark.
4. Have Student One close their eyes. (No peeking!) Explain that Student Two will stand a short distance away. Student Two will clap their hands at varying volumes to help Student One find their way. Student Three will keep a silent count of the number of claps. Student Four will record the time it takes for Student One to reach their destination. (Be sure the path is free from any obstructions. Students Three and Four should stand off to the side.)
5. Ask Student One at what point was it easier to find their way to their classmate.
 - a. Answer: When Student Two clapped loudest.
6. Explain that the students used sound waves to help in their navigation task.
7. The properties of the sound waves changed with the energy input from Student Two.
8. Write the following information on the board.
 - a. Waves – disturbances that transport energy in repeating patterns
9. Ask Student Three how many claps did they count during the activity. Record this

information on the board.

10. Ask Student Four what the total time elapsed for Student One to reach their destination was. Record this information on the board.
11. Explain to students that the number of claps over a given period can be used to determine frequency, a property of all simple waves.
12. Write the definition of frequency on the board.
 - a. Frequency – the number of times a pattern repeats over a given time
13. Explain that waves have other characteristics, including wavelength and amplitude.
14. Draw this diagram of a wave and label the parts.



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15. Explain to students that the amplitude of the wave is the height above the median, and that the louder claps were examples of higher amplitude.
16. Ask students how the amplitude changed when the volume of the claps was lower.
 - a. Answer: The amplitude was lower.
17. Explain to students that the wavelength is the distance between peaks.
18. Remind students that they have observed one type of wave, and during the lesson, they will learn about other examples, but to keep in mind that waves share three properties, a wavelength, amplitude, and frequency.

Explore (30 minutes):

1. Have your students [sign in to Legends of Learning](#). Instruct students to complete the Instructional playlist.
2. As students complete the assigned games, students will complete the Waves and Their Properties Worksheet.
3. Circulate as students work through the playlist and complete the handout. Listen for evidence of understanding and use this opportunity to correct any misconceptions.

Explain (20 minutes):

1. Review answers to Waves and Their Properties Worksheet by drawing the wave diagram on the whiteboard or using Smartboard. Have students take turns reading sentences from the paragraph, using the correct vocabulary to complete them.
2. Relate student knowledge to the demonstration at the beginning of the lesson.
 - a. What happens to the amount of energy transmitted by a wave if the frequency

- increases? (energy increases)
- b. When studying waves, what information is required to determine frequency? (the number of times a pattern repeats over a given time)
 - c. What wave property is related to frequency other than time? (wavelength)
 - d. If you turn up the volume when listening to music, how did you change the amplitude of the sound waves? (increased the amplitude)
 - e. What are three properties that all simple waves possess? (amplitude, wavelength, frequency)
 - f. Who can label wavelength and amplitude on a simple illustration of a wave?
 - i. Draw a blank wave like the one presented at the beginning of the lesson and allow a student volunteer to label the wavelength and amplitude.
 - g. Who can explain how frequency can be determined using the illustration on the board?
 - i. Have the student explain the relationship between the number of waves passing a given point over a certain amount of time.

Elaborate (5 minutes):

1. Explain to students that the properties of waves also give them unique characteristics. Some waves travel at frequencies that make them audible to humans, some waves may be visible as light, some may not be visible to humans, but all transport energy. Some animals have evolved to use waves in their daily lives.
2. Show this video of bats using sound waves for hunting moths. The bats use echolocation, which involves emitting sound waves, which bounce off their prey, allowing the bat to locate them in low-light conditions.
 - a. [Bat using echolocation](#)
3. Ask students what properties of waves they can identify from the video. Answer: They may notice volume changes as amplitude changes, the repetition of the pattern over time as frequency.

Evaluate (10 minutes):

1. Have your students [sign in to Legends of Learning](#). Instruct students to complete the Content Review playlist.
2. [Analyze student results](#) to determine what concepts need to be a focus for reteaching.

Additional Lesson Strategies:

- To use Legends for additional instruction, create a [custom playlist](#) with an [instructional game](#) and pre and post [assessment](#).
- To use Legends for a quick formative assessment, create a 5-question [assessment](#) in a [playlist](#).
- To use Legends for a student-directed experience, create a [targeted freeplay](#) playlist.
- Encourage students to play on their own at home in [Legends of Learning: Awakening](#) for a student-driven experience including avatars, battling, and quests all centered around topics they are covering in class.

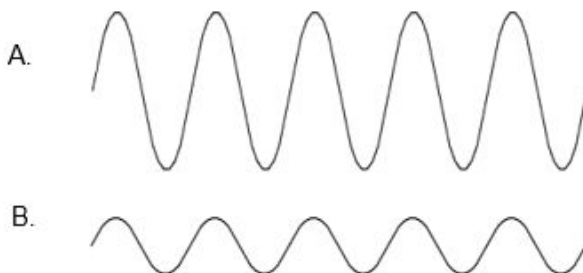
Waves and Their Properties

Name: _____

Directions: While playing the games in Legends of Learning, use what you learn to answer the questions below.

Part 1. Wave Comparison.

Circle the letter that corresponds to the wave with the highest amplitude. Write your reasoning for your choice in the box.



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Part 2. Use the word bank below to complete the paragraph about waves and their properties. Some words may be used more than one time.

Waves are disturbances that carry _____. The speed of a wave depends on the _____ it travels through. _____ waves cannot travel in a total vacuum. Two examples of mechanical waves are _____ waves and _____ waves. The distance between two wave peaks is called the _____. The number of waves that pass a point over a given time is called _____. Waves do not transmit _____.

Word Bank			
<i>sound</i>	<i>vacuum</i>	<i>wavelength</i>	<i>energy</i>
<i>material</i>	<i>surface</i>	<i>matter</i>	<i>frequency</i>

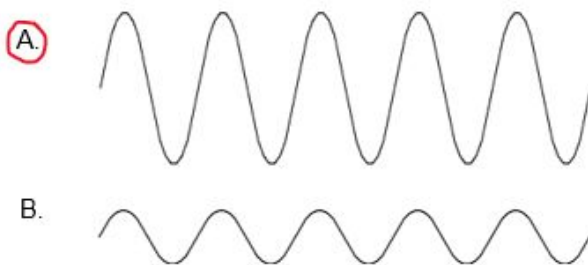
Waves and Their Properties

Name: _____ *KEY* _____

Directions: While playing the games in Legends of Learning, use what you learn to answer the questions below.

Part 1. Wave Comparison.

Circle the letter that corresponds to the wave with the highest amplitude. Write your reasoning for your choice in the box.



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The correct answer is choice A.

Amplitude is defined as the height of the wave, determined from the median (base level) to the peak.

Upon visual inspection, choice A has the highest amplitude.

Part 2. Use the word bank below to complete the paragraph about waves and their properties. Some words may be used more than one time.

Waves are disturbances that carry energy. The speed of a wave depends on the material it travels through. Sound waves cannot travel in a total vacuum. Two examples of mechanical waves are sound waves and surface waves. The distance between two wave peaks is called wavelength. The number of waves that pass a point over a given time is called frequency. Waves do not transmit matter.

Word Bank

sound

vacuum

wavelength

energy

material

surface

matter

frequency