

# Waves and Water

By ReadWorks



When a big boat, like a cruise ship, goes through the ocean, it often creates waves. This happens when the large engines on the back of the cruise ship churn up water on the ocean's surface. These waves move out from the boat in both directions. If you are captaining a smaller boat, it's often best to steer clear of a cruise ship's wake, so that your boat is not buffeted by the waves, causing it to capsize. However, unless your boat is standing still, it is also creating some waves, because it, too, is disturbing the ocean's surface.

A wave is a pattern of motion. When you look at a wave, it may appear as simply water moving across the surface of the ocean. In fact, this is false. The water is actually not moving in the same direction as the wave. While the wave itself—the pattern of motion—is moving across the surface of the ocean, the water is actually moving in a circular motion, which brings the water molecules back to their original position. The water merely gives the appearance of moving forward.

If this is confusing, think of the kind of wave you do at a baseball stadium. Viewed from a distance, the wave is clearly moving across the stadium. But the thing that makes up the wave—the people—are not moving across the stadium—they're just moving up and down in their seats. This is just like the water in an ocean wave. A lot of water is moving up and down, which gives water the appearance of moving along with the wave.

When the water hits the beach, it is actually moving sideways. At this point, there is no more water to push up and down. When a wave splashes onto a beach, the water in the wave is being forced onto dry land.

Surfers pay a lot of attention to waves. If you're not in an area where the waves are suitable for surfing, then you can't surf. Usually, surfers gather in areas known for big waves—waves that rise high off the ocean's surface. If the wave is bigger, then the surfer is often able to surf for longer distances and perform more tricks. The height of a wave is known as its amplitude. If you could make a wave freeze, then you could measure the wave's amplitude by running a tape measure from the ocean's surface to the very peak of the wave.

Another thing surfers look for is how often the waves arrive. While surfers may enjoy an area in which there are waves with consistently high amplitude, the area should also have waves that come relatively frequently. If a surfer has to wait too long for a suitable wave, he may get bored. The distance between the two peaks of a wave is known as the wavelength. If a surfer knows the wavelength of a particular kind of wave and the speed the wave travels, then he'll be able to estimate how often that particular kind of wave will arrive.

A boat is just one thing that can create waves. Waves can be caused by many things, both natural and manmade. Tides can be caused by the moon, which has an influence on the ocean's motion. Waves are also frequently caused by weather. For example, winds generated by a hurricane can create waves. Similarly, underwater earthquakes can cause water to draw back into a giant wave, called a tsunami. When this wave finally reaches shore, it is so powerful it can cause lots of damage to buildings on land.

All waves can be measured using amplitude and wavelength. While the waves created by a boat have very small amplitude—sometimes as small as a few centimeters—the wavelength can be very short, as lots of waves are being generated. By contrast, a tsunami has very high amplitude—sometimes more than 100 feet—but a relatively long wavelength, as it's one high wave.

Waves generated in the same way can have great differences in amplitude and wavelength. For example, think back to the cruise ship. While each ship creates waves caused by the movement of the boat, the properties of each of the waves may be very different. For example, a larger cruise ship, with powerful engines, may create a wave that has high amplitude and a short wavelength. However, if the ship's engines slow down, they may then start creating less powerful waves at a slower rate. This would cause the waves' amplitude to decrease, but its wavelength to increase.

Name: \_\_\_\_\_ Date: \_\_\_\_\_

1. What is a wave, as defined in the passage?

- A a pattern of sound
- B a pattern of light
- C a pattern of motion
- D a pattern of water

2. The cause of a wave is water molecules moving in a circular motion. What is the effect of this motion?

- A Water has the appearance of moving forward.
- B Water has the appearance of moving backward.
- C Water has the appearance of moving in a circle.
- D Water molecules move across the surface of the ocean.

3. Waves can be dangerous, depending on their size. What evidence from the passage best supports this conclusion?

- A When a wave hits the beach, the water in the wave is forced onto dry land.
- B Tsunamis are large, powerful waves that can cause lots of damage to buildings.
- C Surfers prefer waves with large amplitudes, so they have more time for tricks.
- D Waves generated in the same way can have different amplitudes and wavelengths.

4. Read the following sentences from the passage: "A larger cruise ship, with powerful engines, may create a wave that has high amplitude and a short wavelength. However, if the ship's engines slow down, they may then start creating less powerful waves at a slower rate."

Based on this information, what conclusion can be made?

- A Waves are always caused by boats and ships.
- B The faster the boat, the less frequent the wave.
- C There is a connection between wavelength and amplitude.
- D Waves differ depending on the way they are created.

5. What is this passage mostly about?

- A how waves are created and measured
- B the best kind of waves for surfing
- C the cause and effects of tsunamis
- D wave amplitude and wavelength

6. Why does the author give an example of people in a baseball stadium doing the wave?
- A to confuse the reader with an unrelated side note
  - B to explain a familiar idea with a challenging example
  - C to explain a challenging idea using a familiar example
  - D because the author really likes baseball

7. Choose the answer that best completes the sentence below.

\_\_\_\_\_ a wave appears as water moving across the surface of the ocean, water is not actually moving in the same direction as the wave.

- A Therefore
- B Although
- C Particularly
- D Meanwhile

8. What is the wavelength of a wave?

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9. What is the amplitude of a wave, and how is it measured?

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10. Compare waves created by a cruise ship engine and an underwater earthquake, using the amplitude and wavelength. Which wave is more frequent? Which wave is taller?

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## Teacher Guide &amp; Answers

Passage Reading Level: Lexile 1030

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8. What is the wavelength of a wave?

**Suggested answer:** The wavelength is the distance between two peaks of a wave.

9. What is the amplitude of a wave, and how is it measured?

**Suggested answer:** The amplitude of a wave is the height of the wave, measured from the ocean surface to the peak of the wave.

10. Compare waves created by a cruise ship engine and an underwater earthquake, using the amplitude and wavelength. Which wave is more frequent? Which wave is taller?

**Suggested answer:** Students should indicate that a wave caused by an underwater earthquake has a larger amplitude and wavelength than a wave caused by a cruise ship. The waves of the cruise ship are more frequent, because they have a shorter wavelength. The wave created by the underwater earthquake is taller, because it has a larger amplitude.