

Making Waves

Adapted from "Making and Using a Wave Machine", Visit to an Ocean Planet, NASA
<http://sealevel.jpl.nasa.gov/education/activities.html>

Materials (per group of 4-5 students)

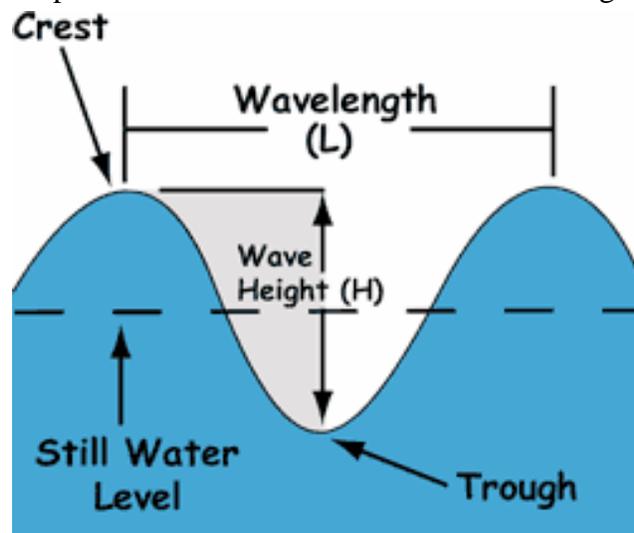
- 2 small aluminum baking pans or one large one
- Duct tape*
- Heavy scissors or tin snips*
- Silicon caulking*
- Water
- Sand and/or small gravel
- Stiff piece of plastic or wood to fit across short end of pan
- Small Styrofoam balls
- Ruler or meter stick
- Paper and pencil
- Small Styrofoam balls
- Computer with Internet (optional)

* Needed only if using two pans that will be glued together

Characteristics of Ocean Waves

Waves in the ocean are caused primarily by wind blowing across the surface. The wind transfers some of its energy to the water through friction between the air molecules and the water molecules. Some important terms to know when studying waves are:

- **Crest** - The highest part of a wave
- **Trough** - The lowest part of a wave
- **Wave Height** - Vertical distance between a wave's trough and crest.
- **Wavelength** - The distance between two successive wave crests or troughs
- **Period** - The time taken for two successive wave crests to pass the same point
- **Frequency** - The number of wave crests that pass a point in a given amount of time divided by the amount of time (#/second).
- **Fetch** - The length of open sea surface across which the wind can generate waves



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Virtual Waves (optional)

National Geographic has a great wave simulator on the web. It allows you to see the effect of changing wave characteristics. Check it out:

<http://www.nationalgeographic.com/volvoceanrace/interactives/waves/index.html>

Making a Wave Tank (if using 2 pans)

- Cut one end off each pan so that the two ends fit together.
- Connect pans using duct tape and caulking or silicon seal to make them water tight.

Making and Measuring Waves

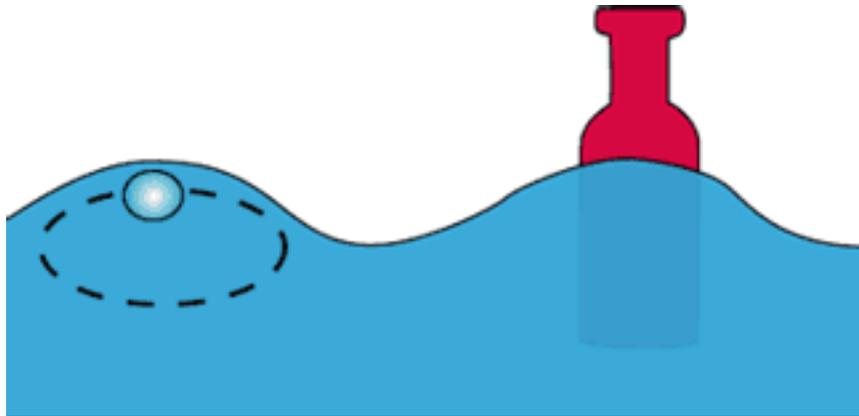
- Add about 2 inches of water to the bottom of your wave tank
- Use the wood piece to generate waves by sweeping it along the surface of the water at the non-beach end of the pan. Try different methods of generating waves to see which works best. Try to generate even waves with a slow and consistent rhythm.
- When a consistent set of waves are being generated, use a ruler to estimate the *wavelength* and *wave height* of the waves, use a watch to estimate the *wave frequency*. Record your observations in the table below next to "Wave Set #1".
- Increase the frequency of your waves and repeat your measurements of frequency, height and wavelength. Record your measurements in the table next to "Wave Set #2"
- Increase the frequency of your waves and repeat the measurements. Record your results in the table next to "Wave Set #3".

	Frequency (#/sec)	Wave Height (cm)	Wavelength (cm)	Period (sec)	Speed (cm/sec)
Wave Set #1					
Wave Set #2					
Wave Set #3					

- The speed of a wave is equal to the wavelength/period. Calculate the wave speed for each of your sets of waves.
- What, if any, relationships do you notice between frequency and the other wave properties you measured?

Investigating Wave Energy

- Scatter a few Styrofoam balls in the water in the middle of the pan.
- Generate waves in your wave tank. What do you notice about the Styrofoam? Does it move forward with the waves or stay in one place? What do you think explains your observations?
- Generate waves that break on the beach and place a few Styrofoam balls in the area where the waves are breaking. What happens to the Styrofoam where the waves are breaking? Why do you think this happens?
- Explain why surfers can surf near-shore but not in the middle of the ocean.



Explanation: Waves are not moving water, they are *energy moving through the water*. In the open ocean, objects travel in a circular motion as waves pass underneath them, as shown by the path of the ball in the Figure above. When waves break on shore, the energy is dissipated and the water rushes forward, moving the objects in its way.

Activity Group Discussion

- What are some results of waves?
- Why are waves important to people and to marine plants and animals?
- Why do scientists want to study waves?

Engineers and Scientists Studying Waves: The Wave Research Lab at Oregon State University

The Wave Research Lab at Oregon State University is a facility used by scientists and engineers to study waves. Like the wave basins you made, but on a much bigger scale, these are used to simulate conditions in the real ocean so that scientists can study the effects of waves on the beach and on man-made structures. You can keep track of what is happening

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in the Tsunami Basin and the Wave Flume at The Wave Research Center by checking out their webcams:

http://wave.oregonstate.edu/About_Us/webcam/



The Flume Tank at the OSU Wave Research Lab



The Tsunami Basin at the OSU Wave Research Lab