

Overview:

In this lesson, students differentiate tsunami waves from wind waves.

Targeted Alaska Grade Level Expectations:

Science

- [3] SA1.2 The student demonstrates an understanding of the processes of science by observing and describing the student's own world to answer simple questions.
- [4] SA1.2 The student demonstrates an understanding of the processes of science by observing, measuring, and collecting data from explorations and using this information to classify, predict, and communicate.

Objectives:

The student will:

- observe the pattern of water particle movement of wind waves and tsunami waves within the water column; and
- classify waves as wind waves and tsunami waves.

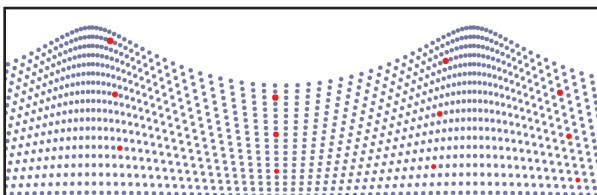
Materials:

- Tissue paper or butcher paper
- Tape
- VISUAL AID: "Wind Waves"
- VISUAL AID: "Tsunami Waves and Their Generators"
- VIDEO FILE: "Water Particles"
- STUDENT WORKSHEET: "Wave Sort"

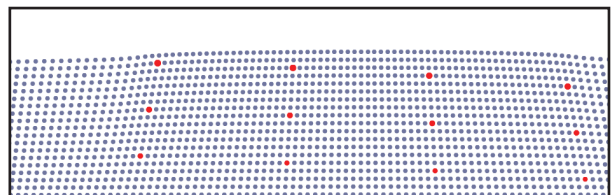
Whole Picture:

Most ocean waves are generated by wind. Wind waves cause water particles to move in circular motion. The diameter of each circle decreases with depth. The depth of influence in the deep ocean is $\frac{1}{2}$ the wavelength. Because of circular motion, wave particles return to the approximate same position, therefore an object on a wave would not move with the wave energy but return to the same general area. In a tsunami wave, the water particles move differently. Their enormous wavelength causes them to act like shallow water waves and the water particles to move in an oval shape.

Wind Wave



Tsunami Wave



Wind can create waves of different sizes. The smallest are capillary waves. Increasing winds and storms can produce chops and swells. Tsunami waves are always called by the same name. They may cause runups that are barely noticeable in size to those that are enormous and life-threatening. Tsunamis are caused by displacement associated with earthquakes, landslides, or volcanic activity.

In the Deep Ocean

| Type of Wave | Period | Wavelength | Depth of influence | Source |
|---------------------|---------------|--------------------------|---------------------------|---|
| Capillary or ripple | < .1 second | < 2 cm | Very shallow | Light wind, insects |
| Chop | 1-10 seconds | 1-10 m | Shallow | Strong wind |
| Swell | 10-30 seconds | Up to hundreds of meters | ½ of the wavelength | Storms |
| Tsunami | 5-60 minutes | 20 km to 300+ km | To the bottom | Earthquakes, Landslides, Volcanic eruptions |

Activity Preparation:

The activity of tracing water particles may be carried out in two ways. If the video is projected onto a wall, a large piece of butcher paper may be taped to the wall for tracing. If the video is viewed on individual computer monitors, tissue paper may be tape to the screen for student tracing.

Activity Procedure:

1. Explain students will learn how wind waves are different from tsunami waves.
2. Show VISUAL AID: "Wind Waves" and explain that the wind can make different sizes of waves on the ocean. Point out and describe each type of wave on the overhead.
3. Show VISUAL AID: "Tsunami Waves and Their Generators" and explain tsunami waves are all very large but may not be noticed by a boat out on the deep ocean. Tsunamis are started by earthquakes, landslides, or volcanic eruptions. Point out and describe each tsunami wave generator.
4. Display VIDEO FILE: "Water Particles" and explain there is another way to see how tsunami and wind waves are different. Select wind waves. Explain that each dot represents a water particle, a very small piece of water. Tape paper over the display and trace the movement of each particle. Ask students to describe how the particles move. Select tsunami wave. Repeat the process of tracing the water particles and describing. Students should realize the depth of influence of the wind waves does not go to the bottom and the tsunami wave does.
5. Distribute STUDENT WORKSHEET: "Wave Sort" for student completion.

Extension Ideas:

Take a fieldtrip to different areas of water and observe the waves. Bring a camera to take pictures. Make a collage of the photographs.

Name: _____

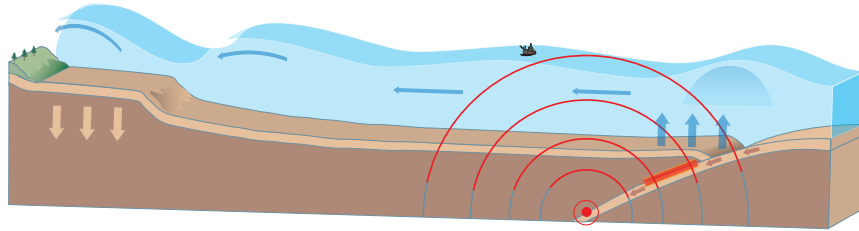
Wave Sort

Student Worksheet

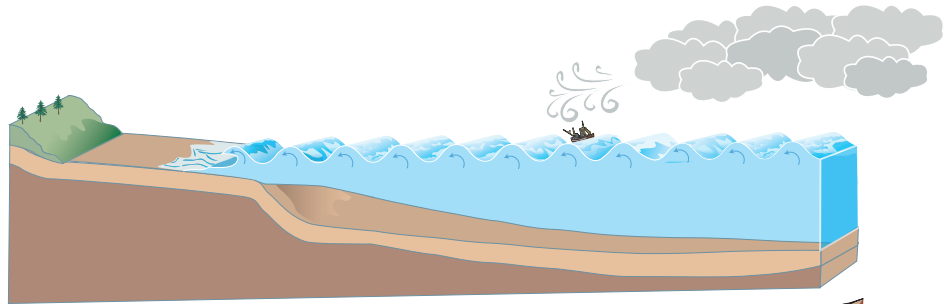


Directions: Circle the correct wave type next to each picture.

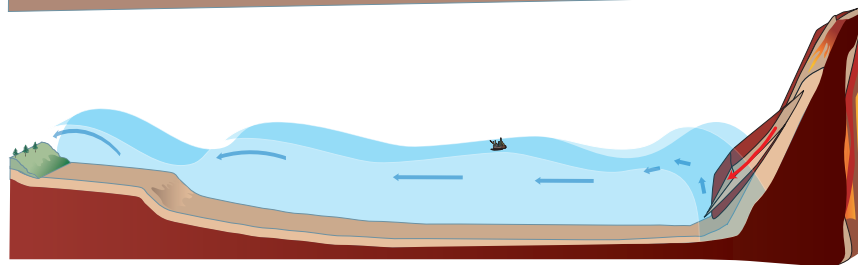
- a. tsunami
- wind wave



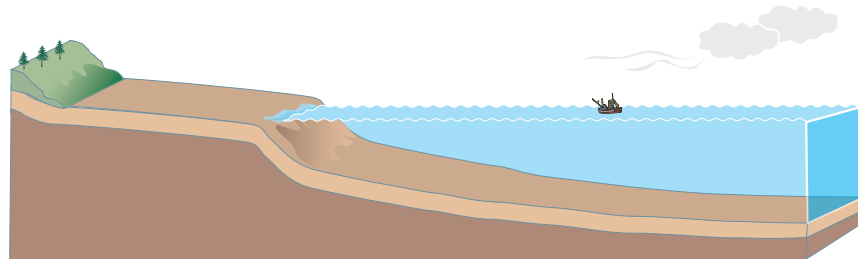
- b. tsunami
- wind wave



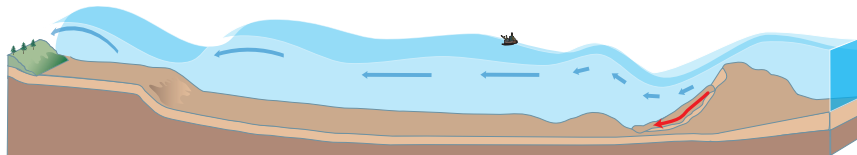
- c. tsunami
- wind wave



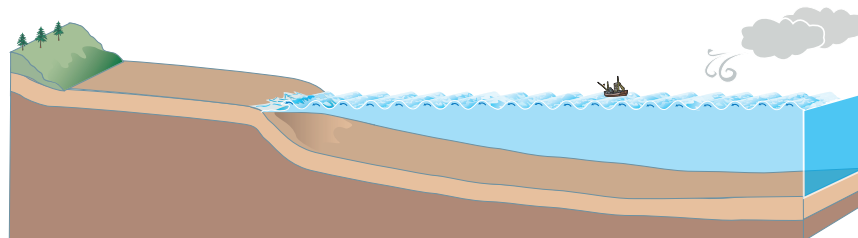
- d. tsunami
- wind wave



- e. tsunami
- wind wave



- f. tsunami
- wind wave



Wave depictions based on information provided by the Ocean Institute with support from the National Science Foundation, and the National Oceanic & Atmospheric Administration West Coast/Alaska Tsunami Warning Center, in addition to input from Geophysical Institute scientists.