

2C Wave Speed

What is the relationship between water depth and wave speed?

In the ocean, most waves are driven by the wind. As long as the wave is in deep water, the water depth does not influence the wave very much. When a wave approaches the shore, however, the speed of the wave changes.

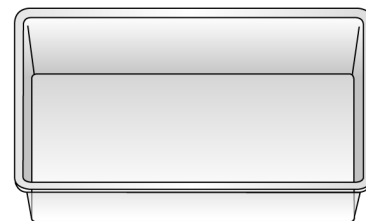
In this investigation, you will collect data to observe how water depth affects wave speed.

Materials

- GeoBox
- 1,000 mL beaker
- Masking tape
- Data Collector
- Ruler or measuring tape
- Graph paper
- Wooden block

1 Setting up

Gather your materials including the GeoBox. Fill the 1,000-mL beaker with water.



GeoBox

2 Stop and think

Predict the relationship between wave speed and water depth. Does the wave speed increase or decrease as the water depth increases? Why?

3 Doing the experiment

1. Place water in the GeoBox to a depth of one centimeter.
2. Place the wooden block under one end of the tray. One student will use the Data Collector in Stopwatch mode and be the “timer,” while the other student will watch the waves.
3. First practice the following, then measure when you are ready. Pull the wooden block out. This will create a wave as the tray falls to the table. The water will “slosh” lengthwise in the tray.
4. As soon as you begin to move the block, start the stopwatch. The person watching the wave will watch it make four round trips. That means back and forth four times. As soon as it completes the four round trips, stop the stopwatch. Record your data (time) in Table 1. Repeat for the same depth for two more trials.
5. Once you have made three time measurements for the one-centimeter depth, add water up to the two-centimeter mark.

6. Follow the same procedure and continue increasing water depth until you get as high as you can go (probably around six centimeters).
7. Find the average time for each depth. Then calculate wave speed using the formula below.

$$\text{wave speed} = \frac{\text{total distance traveled (cm)}}{\text{average time (s)}}$$

Hint: Be careful when you measure for the total distance traveled—think about how many times the wave goes back and forth.

Table 1: Wave speed at different depths

Depth (cm)	Trial 1 (s)	Trial 2 (s)	Trial 3 (s)	Average (s)	Wave speed (cm/s)
1					
2					
3					
4					
5					
6					

8. Make a graph with depth on the x -axis and wave speed on the y -axis.

Title: _____



x-axis: _____

4 Thinking about what you observed

- a. Describe the pattern of the graph.

- b. Why should there be any change in wave speed?

5 Exploring on your own

- a. What happens when waves reach the shoreline?

- b. What is the difference between swells and whitecaps?

- c. Would waves approach the shore in the same manner if the shoreline was gradual or very steep? Explain.
