

# CHAPTER INVESTIGATION



## MATERIALS

- small aquarium or clear, shoebox-size container
- water
- small plastic dropping bottle or plastic spice container, with cap
- salt



## Wave Movement

**OVERVIEW AND PURPOSE** The particles in liquid water are constantly moving. Surfers, boaters, and people in inner tubes enjoy the effects of this motion—even though they never see what is happening at the particle level. How do water particles move in waves? In this investigation you will

- observe the movements of a floating object as waves pass through water
- use your observations to draw conclusions about how water particles move in waves

### ▶ Problem

Write  
It Up

What does the motion of a floating object reveal about the movement of water particles in a passing wave?

### ▶ Hypothesize

Write  
It Up

Write a hypothesis to explain what the motion of a floating object might reveal about how water particles move in a wave. Your hypothesis should take the form of an “If . . . , then . . . , because . . .” statement.

### ▶ Procedure

- 1 Fill the aquarium or clear container with cold tap water until it is three-quarters full.
- 2 Make the small bottle float with its top just below the surface of the water. You can accomplish this in several ways. First, try adding warm water to the bottle, then securely capping it without air bubbles. See if it will float. You can add salt to the bottle to move the bottle lower in the water. If the bottle is too low, you can trap a small air bubble under the cap to move the bottle higher in the water. Adjust these factors until you successfully float the bottle. The investigation will also work if the top of the bottle just touches the water's surface.
- 3 Remove the bottle from the water. Make sure the cap is tightly sealed.



**4** Push your hand back and forth in the water at one end of the aquarium for about 30 seconds, to produce waves.

**5** Gently place the small bottle back into the center of the aquarium. With your eyes level with the water surface, observe the motion of the waves and the bottle. Repeat as many times as needed until you notice the bottle behaving the same way with each passing wave.

### ▶ Observe and Analyze



**1. RECORD** Make a diagram showing the aquarium setup, including the water, the waves, and the small bottle. Use arrows to show how the bottle moved as waves passed. Or you may draw several diagrams of the aquarium, showing the bottle at different locations as waves passed. Label the various parts of the waves.

**2. ANALYZE** Did the bottle travel with the wave? Why or why not?

### ▶ Conclude



**1. INTERPRET** Compare your results with your hypothesis. Do your data support your hypothesis?

**2. INTERPRET** Answer the problem question.

**3. INFER** What do your observations tell you about particle movement in waves? Did the results surprise you? Explain.

**4. EVALUATE** Why was it necessary to float the bottle just under the surface of the water rather than letting it float right on top?

**5. IDENTIFY PROBLEMS** What problems, if any, did you encounter in carrying out the procedure?

**6. IDENTIFY LIMITS** In what ways was this experiment limited in showing particle movement? Identify possible sources of error.

**7. PREDICT** How do you think particle motion in a wave with a tall wave height might differ from that in a wave with a short wave height?

**8. SYNTHESIZE** In this lab you made waves with your hand. In the ocean, most waves are caused by wind. Earthquakes, landslides, and other events also cause waves in the ocean. What do earthquakes, landslides, wind, and your hand have in common that allows all of them to make waves?

### ▶ INVESTIGATE Further

**CHALLENGE** Redesign this experiment in a way you think will better demonstrate the particle motion in a water wave. You need not limit yourself to the materials you used in this lab. Why will your version of the experiment work better?

#### Wave Movement

**Problem** What does the motion of a floating object reveal about the movement of water particles in a passing wave?

**Hypothesize**

**Observe and Analyze**

Table 1. Diagram of Setup

no wave	before crest	at crest	after crest	in trough

**Conclude**