

71

Ripple While You Work**Purpose**

To observe wave phenomena in a ripple tank

Required Equipment/Supplies

ripple tank with light source and bottom screen
 3/4-inch dowel
 paraffin blocks
 medicine dropper
 length of large-diameter rubber hose
 wave generator
 large glass plate
 cut rubber stoppers

Discussion

Water waves have simple properties when they have small amplitude, and they are familiar to everyone. Observing the behavior of water waves in a ripple tank will introduce you to the analysis of wave motion.

Procedure

Step 1: The ripple tank is set up for you. Turn on its light. Observe the screen at the base of the tank as you produce a pulse by touching your finger or pencil tip once to the water surface.

Observe pulse.

1. What is the shape of the pulse?

2. Does the speed of the pulse seem to be the same in all directions?

Step 2: Place the dowel in the water. Produce a straight wave front by rolling the dowel forward 1 cm, with the flat of your hand.

Generate straight wave front.

3. What is the shape of the pulse?

Observe reflections.

Step 3: Place a paraffin block in the tank. With the dowel generate a pulse that strikes the barrier straight on.

4. What does the pulse do when it reaches the barrier?

5. After the pulse strikes the barrier, what is the new direction of the pulse?

Step 4: Move the paraffin block to change the angle at which the pulse strikes it.

6. What is the shape of the reflected pulse?

Generate circular wave pulses.

Step 5: Produce circular wave pulses with water drops from the medicine dropper.

7. How do the pulses reflect from the paraffin block?

8. From what point do the reflected pulses appear to be originating?

Observe wave pulses reflected by a parabola.

Step 6: Bend a length of large-diameter rubber hose into the approximate shape of a parabola. Place it in the tank.

9. What do you observe when you use this tubing as a reflector for straight pulses?

Step 7: Find the *point* at which the straight pulses reflected by the hose meet and mark it on the screen with your finger. This is the *focus* of the parabola. Generate a circular pulse with the dropper held straight above the focus of the parabola.

Observe wave pulses originating at the focus.

10. What is the shape of the reflected pulse?

11. Do any other points give the same pulse shape?

Step 8: Start the wave generator to produce a straight wave. The distance between bright bars in the wave is the wavelength. Adjust the frequency of the wave generator.

Observe frequency change.

12. What effect does increasing the frequency have on the wavelength?

Step 9: Place a paraffin barrier halfway across the middle of the tank. Observe the part of the straight wave that strikes the barrier as well as the part that passes by it. Adjust the frequency of the wave generator so that the combination of the incoming and reflected wave appears to stand still. The combination then forms a standing wave.

Observe standing wave.

13. How does the wavelength of the standing wave compare with the wavelength of the wave traveling past the barrier?

Step 10: Support a piece of rectangular slab of glass with rubber stoppers so that it is 1.5 cm from the bottom of the tank and its top is *just* covered with water. Arrange the glass so that incoming wave fronts are parallel to one edge of the glass.

14. What happens as waves pass from deep to shallow water?

Compare wave speeds.

Step 11: Now turn the glass so that its edge is no longer parallel to the incoming wave fronts.

15. Are the wave fronts straight both outside and over the glass?

16. How do the speeds of the waves compare?

Observe wave spreading.

Step 12: Place paraffin blocks across the tank until they reach from side to side with a small opening in the middle. Generate straight waves with the wave generator.

17. How does the straight wave pattern change as it passes through the opening?

Step 13: Using a piece of paraffin about 4 cm long, modify your paraffin barrier so that it has two openings about 4 cm apart near the center. Generate a straight wave and allow it to pass through the pair of openings.

18. What wave pattern do you observe?

Step 14: Put two point sources about 4 cm apart on the bar of the wave generator. Turn on the wave generator to produce overlapping circular waves.

19. What pattern do you now observe?
