Curiosity Guide #609
Waves

Accompanies Curious Crew, Season 6, Episode 9 (#609)

Bobbing Waves

Investigation #8

Description

Rubber Ducky, you're the one. You make wave science so much fun!

Materials

- Pan of water
- Dish soap
- Stirring stick
- Marble
- Rubber duck
- Dowel, $\frac{1}{2}$-inch thick
- Dowel, $\frac{1}{4}$-inch thick
- Wood glue
- Saw
- Drill
- $\frac{1}{4}$-inch drill bit

Procedure

1) Cut the large dowel so that the dowel is just narrower than the width of the pan.
2) Drill a small hole in the center of the length of the dowel.
3) Cut a 6-inch length of the small, $\frac{1}{4}$-inch dowel.
4) Glue the small dowel into the larger one. This will serve as a handle.
5) Fill the pan with water so that the water is a couple of inches deep.

6) Add a few drops of soap. Spread the soap with your hand or a stirring stick, being careful not to make bubbles.
7) Drop a single marble into the pan. What do you notice?
8) Gently lay the large dowel on the surface of the water.
9) What do you notice when the dowel is pressed down once? What do you notice when you press the dowel down repeatedly?
10) Place the rubber duck in the center of the pan when the water is calm.
11) Press gentle repeated pulses on the rubber duck up and down into the water.
12) What happens?

My Results

Explanation

These are examples of transverse waves traveling through the medium of water. In each case, the disturbance was perpendicular to the way the wave traveled. The added soap minimizes the surface tension on the water and makes the wave result easier to see. The dropped marble showed the circular ripple that moves outward from the disturbance. The dowel is useful to show a flat or linear wave that will travel across the tank, collide with the pan, and partially reflect. Placing the rubber duck in the pan and pulsing it gently illustrates that the water itself is not moving, but the energy is. That is why the duck will bob up and down in place, but the wave travels on. Each of the particles in the water bangs into the next and transfers the energy from molecule to molecule without moving along itself.

Extend your thinking. Waves in water are fairly easy to see, even when the disturbance that produces the waves is gentle. Imagine if we could see light waves! We could see the particles, called photons, that transfer energy! Light waves can be arranged in seven different patterns that make up the electromagnetic spectrum. The spectrum starts with long radio waves, which are perfect for transmitting radio and cell phone signals. The next longest are microwaves, which we use as heat for cooking. As the wave vibration frequency increases, the spectrum then includes infrared, visible, ultraviolet, x-ray, and gamma rays, which are the shortest light wave. Although we can only see visible light, there sure are a lot of waves out there!

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