Laboratory Investigation Name _____

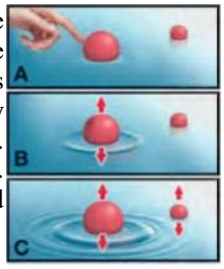
Physics@Frisch: Form L7.3A Date _____ Period _____

Motion and Interaction of Waves

PROBLEM

How do waves move and interact with things?

INTRODUCTION



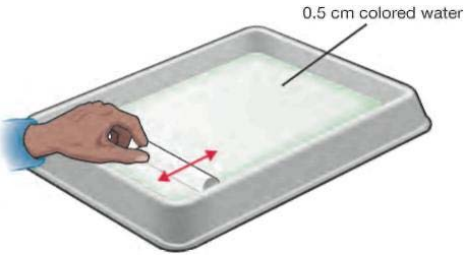
Waves are oscillations that spread out from where they start. A ball floating on water is a good example of the difference between a wave and ordinary harmonic motion. If you poke the ball, it moves up and down (A). The oscillating ball creates a wave on the surface of the water that spreads outward, carrying the oscillation to other places (B). A second ball floating farther away also starts oscillating as soon as the wave reaches it (C). The wave is only carrying the energy from place to place, however. The water is not spreading out. It is moving up and down in place. The wave started by an earthquake can travel all around the world and reach places far away from where it began. In this investigation, you will: Create and study waves in water; observe how waves can pass through openings and bend around corners; and observe how waves reflect from boundaries.

MATERIALS (*per group*)

Aluminum blocks (2); Food coloring; PVC tube; Wave tray.

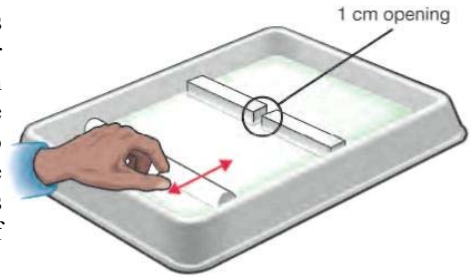
PROCEDURE

1. Fill your wave tray with about 0.5 cm of colored water. The color helps you see the waves. Make a single, gentle back-and-forth motion with the PVC tube as shown in the diagram to the right to launch a wave that goes across the tray. The PVC tube makes nearly straight plane waves. On the next page, draw a sketch that shows the wave front of your plane wave. Also on your sketch, draw an arrow that shows the direction the wave moves. Note whether the wave front is parallel or perpendicular to the direction the wave moves.



2. Next, poke the surface of the water with your fingertip. Disturbing a single point on the surface of the water makes a circular wave that moves outward from where you touched the water. On the next page, draw another sketch that shows the circular wave fronts and include at least four arrows that show the direction in which each part of the wave moves. Note whether the wave fronts are more parallel or perpendicular to the direction in which the wave moves.

3. Diffraction is a process that reshapes waves as they move through and around openings or corners. Because of diffraction, waves spread out after passing through openings or around corners. Put the aluminum blocks in your tray so they block the whole width except for a 1 cm opening near the center as shown in the diagram to the right. Make a plane wave that moves toward the center as you did in step 1. Note what happens to the part of the wave that goes through the opening. On the next page sketch the shape of the wave fronts before and after the opening. Note whether or not the wave changes shape when it passes through the opening. If you see any change, note what kind of shape the wave changes into.



4. Reflection is the process of waves bouncing off obstacles like the side of the tray. When a wave reflects it can change direction and may also change in shape. Use the PVC tube to make a plane wave that moves at an angle toward the edge of the tray. Observe what happens to the wave as it hits the edge. Draw a sketch that shows what happens to the wave front when it hits the side of the tray. Draw an arrow showing the direction of the wave approaching the side. Draw another arrow showing the direction of the wave after it reflects from the side. Note the relationship between the incoming and outgoing arrows.

OBSERVATIONS

Plane Wave

Circular Wave

Diffraction

Reflection

CONCLUSIONS

1. Is the wave front of a plane water wave parallel or perpendicular to the direction the wave moves? _____

2. Is a water wave a transverse wave or a longitudinal wave? _____

3. Are the wave fronts of a circular wave more parallel or perpendicular to the direction in which the wave moves? _____

_____

4. What happens to the water wave when it passes through the opening in step 3? _____

5. What is the relationship between the incoming and outgoing arrows showing the movement of the reflected wave? _____

_____

_____

6. You can easily hear a person talking through a crack in the door although you cannot see them. Which of your observations provide a clue to how sound can get through tiny cracks? _____

7. Ocean waves can get many meters high. Big waves on the ocean tend to occur on very windy days. Explain how wind might contribute to making big waves. Use a sketch in your explanation. _____

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