

## Student Exploration: Refraction

**Directions:** Follow the instructions to go through the simulation. Respond to the questions and prompts in the orange boxes.

**Vocabulary:** angle of incidence, angle of refraction, frequency, index of refraction, medium, refraction, Snell's law, total internal reflection, wave front, wavelength, wave speed

**Prior Knowledge Questions** (Do these BEFORE using the Gizmo.)

Two runners ran side by side, each holding one end of a horizontal pole.

1. What would most likely happen if one of the runners began jogging in knee-deep water?

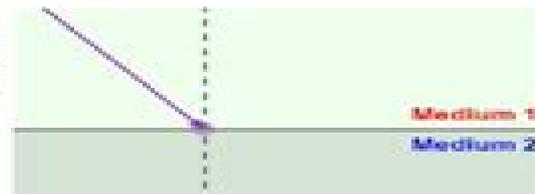
If one of the runners began jogging in knee-deep water, the runner would slow down.

2. How would this affect the direction of the runners? Explain.

This would affect the direction of the runners because the runner on the dry ground would outpace the runner in the water.

### Gizmo Warm-up

Light can travel through many materials, or **media**. As with a runner on pavement or sand, the speed of light can change when it moves into a different medium. The *Refraction* Gizmo allows you to observe what happens to a beam of light as it travels from one medium to another.



Turn off **View wave fronts**. Set **Index of refraction 2** to 3.0.

1. Click **Play** (▶). Observe the ray of light as it passes from **Medium 1** to **Medium 2**.

- A. What happens to the speed of the light wave?

The speed of the light wave got significantly slower as it passed from Medium 1 to Medium 2.

- B. What happens to the direction of the light wave?

The direction of the light waves changes. The wavelength decreases as the light enters the medium and the light wave changes direction.

The bending of the light ray you see is called **refraction**.

2. Click **Reset** (↺) and turn on **View wave fronts**. A **wave front** is an imaginary line that connects the crests or troughs of a wave. The **wavelength** of a wave is the distance between wave fronts.

# Refraction Gizmo Answer Key

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**Refraction Gizmo Answer Key:**

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