Name:_____Date:_____Class:_____

Student Worksheet

Refraction Tank: Guided Inquiry

Safety
Never shine a laser into anyone's eyes. It can cause permanent blindness.

Introduction

To further investigate the bending of light through different mediums, we will be using a new scientific measurement tool called the refraction tank. Using this tool, you will be able to measure the *angle of incidence* and the *angle of refraction* of a beam of light as it travels through two mediums. Your goal will be to establish a general rule describing the bending of light as it travels from water to air and as the light travels from air into water.

Materials
- refraction tank
- water

Question

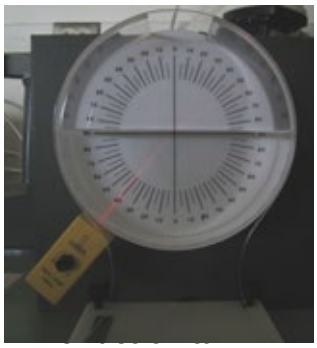
What happens to a beam of light as it crosses from one medium to another?

Make a Prediction

Light will bend towards the normal as it enters water from air because light travels slower in water.

Procedure: Part I

1. Make sure the water level reaches horizontal line (90°) on the refraction tank and turn on the laser.
2. Adjust the laser so that the beam enters the tank at 20° below the surface of the water. This is your *angle of incidence*.
3. Record the corresponding *angle of refraction* on the table below.
4. Increase your angle of incidence by 10° and continue to measure angles of refraction until you have reached and angle of incidence of 90°.
5. Does your light beam ever obtain *total internal reflection*? If so, at which angle does it start? ___40°–50°_____



Developed by Marilyn Garza
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Observations

Data Table: Angles of incidence and refraction as light travels from water into air

Angle of Incidence	Angle of Refraction
20°	*35°*
30°	*45°*
40°	*55°*

Analyze the Results

1. Does the beam behave consistently at all angles of incidence? If not, explain.

   Between incidence angles of 40° and 50° the beam appears to bounce off the bottom of the water/air interface and instead of leaving the water, it reflects back into the water. This is called total internal reflection.

2. Develop a general rule describing the relationship between the angle of incidence and the angle of refraction as the beam travels from water into air.

   The angle of refraction is always larger than the angle of incidence until the angle of refraction reaches 90°, at which point total internal reflection occurs.

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Procedure: Part II

Light traveling from air into water: Now investigate the bending properties of light as it travels from air into water. Set up a data table similar to the one you just completed and write a simple procedure to accompany your measurements.

Procedure:	**Data Table:**
Include an example procedure.	

Analyze the Results

1. Does the beam behave consistently at all angles of incidence? Develop a general rule describing the relationship between the angle of incidence and the angle of refraction as the beam travels from air into water.

   Yes, in each case the angle of refraction is less than the angle of incidence.

2. Does total internal reflection occur in this situation? Why or why not?

   Since the angle of refraction is always less than the angle of incidence, it never reaches 90° and is therefore not reflected.

3. How would the critical angle of total internal reflection change if a liquid other than water were used?

   If we used a liquid that slowed down light even more than the water, then critical angle of total internal reflection would be less.

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