

## Refraction Exploration

**Purpose:**

The purpose of this activity is to explore the behavior of a ray of light at the boundary between two materials. Variables that would affect the behavior of light will be investigated.

**Background:**

This activity centers around the behavior of light when it reaches the boundary or interface that separates two materials. To begin, look up, read about, and define the following terms. (You could consider using the Search bar on The Physics Classroom.)

Reflection: \_\_\_\_\_  
\_\_\_\_\_

Refraction: \_\_\_\_\_  
\_\_\_\_\_

Transmission: \_\_\_\_\_  
\_\_\_\_\_

Angle of Incidence: \_\_\_\_\_  
\_\_\_\_\_

Angle of Refraction: \_\_\_\_\_  
\_\_\_\_\_

Index of Refraction: \_\_\_\_\_  
\_\_\_\_\_

Navigate to the Refraction Interactive in the Physics Interactives section of The Physics Classroom's website. Explore the environment - move the laser, fire the laser, manipulate the protractor to measure angles, change the top and bottom substance and observe all results. Once you're familiar with the environment, begin exploring the questions listed in the next section. Your teacher will tell you how many questions and/or which questions to explore.

As you *tackle a question*, think about what variables you will change variables and what variables you will keep constant; and think about what observations and/or measurements you must make in order to answer the question. Record your findings and then answer the question using a claim-evidence-reasoning format. The claim is the answer to the question; the evidence is a reference to collected data that have been recorded; and the reasoning is a clear and logical discussion of how the evidence supports the claim that you are making.

Your teacher will give you instructions as to how and where you will record the data and conclusions for each question that you are assigned.

**Questions:**

1. Are there conditions under which the incident light ray undergoes reflection but not transmission at the boundary? If so, then what are those conditions?
2. Are there conditions under which the incident light ray undergoes transmission across the boundary without actually bending (or refracting)? If so, then what are those conditions?
3. The amount of light that undergoes reflection or transmission is demonstrated by how bright the reflected or transmitted ray is. Under what conditions is the amount of transmission maximized and the amount of reflection minimized?
4. What affect does an increase in the angle of incidence have upon the angle of reflection?
5. What affect does an increase in the angle of incidence have upon the angle of refraction?
6. Under what conditions are the angles of incidence greater than the angles of refraction?
7. Every substance has its own unique index of refraction ( $n$ ). For light passing from air to another material, what affect does increasing the angle of incidence have upon the angle of refraction?
8. Under what conditions is the angle of incidence greater than the angle of refraction? And under what conditions is the angle of incidence less than the angle of refraction?
9. How does the index of refraction of Unknown #1 compare to the index of refraction of oil?
10. How does the index of refraction of Unknown #2 compare to the index of refraction of oil?
11. Now think of your own *testable* question. Use the simulation to answer the question.