

## Lab 7: Lenses and Optics Pre-Lab

Start by reading the entire lab and prelab.

When a light ray strikes a smooth interface separating two transparent materials (like air, glass, or water), the wave is partly reflected and partly refracted (or transmitted) into the second material.

Start by downloading and opening the PhET **Bending Light** sim we will be using:  
<http://phet.colorado.edu/en/simulation/bending-light>

### Analysis:

- 1) What do you notice about the angle of the reflected light in comparison with the angle of the incident light? (Note that there is a protractor on the PhET sim that you can use to measure angles!)
- 2) Now let's look at the refracted light. In general, the relationship between the angles of refracted light and a property of the media is given by:

$$\frac{\sin\theta_1}{\sin\theta_2} = \frac{n_2}{n_1}$$

Here  $\theta_1$  corresponds to the angle in the top media and  $\theta_2$  corresponds to the angle in the bottom media. Both of these angles are measured from the z-axis down to the light (or up to the light in the media below). Similarly,  $n_1$  and  $n_2$  are the indices of refraction of the top and bottom material, respectively. (These numbers are shown on the PhET sim.)

Now find a way to verify the relation given above on the PhET sim. You will want to take at least three data points at either different angles or different indices of refraction (you get to choose which!). Here is a table to help you organize your work:

$n_1$	$\theta_1$	$n_2$	$\theta_2$	$\frac{\sin\theta_1}{\sin\theta_2}$	$\frac{n_2}{n_1}$

Show all of your work in doing this and give a brief (2-3 sentences) description of the method you used to complete this problem.

Does this make sense? Describe what the equation/ relation means in words.

### Part 2: Prism Break (EXTRA CREDIT)

Now switch to the tab on the top of the PhET sim titled "Prism Break." For these

Try playing around with the various sorts of prisms and answer the following (a couple of sentences per answer is sufficient):

- 1) Are the reflection and refraction of light color-dependent? How can you tell?
- 2) Which shapes split the white light into different colors the best? Is there a particular set-up that you found demonstrates this well?
- 3) Given that white light can be split, try to make a situation where light forms a rainbow. What shape did you use to do this? Can you make a double rainbow in any way?