Snell’s Law and Refraction Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Background:** Willebrord Snell conducted experiments in 1621 where he passed light from air into other substances. He found a pattern to the way light behaved as it bent. We call the relationship he found Snell’s Law. Each substance has an index of refraction. He found this by passing light from air into the substance and found the ratio of the sine of the angle of incidence divided by the sine of the angle of refraction. This value says how optically dense a medium is for light (how fast or slow light travels in it). Given these values, he came up with Snell’s Law:

nisinθi = nrsinθr

**Activity:** Go to Edline physics page and open BENDING LIGHT PhET in the link section.

**Procedure:**

**Part 1**

1) Set the top medium to AIR. Set the second medium to CUSTOM. Move the slider for the index of refraction to 1.41.

2) Use Snell’s Law to find the following (show your work): If θi = 45°, what is the value of θr?

Using Snell’s Law, θr = \_\_\_\_\_\_\_\_\_\_\_\_\_

3) Now take your protractor out and place it at the intersection of the two media. Turn ON your laser (the red button). Move it around until the angle of incidence in air =45°. Look at the custom material to and find the angle of refraction from the protractor.

From the protractor θr =\_\_\_\_\_\_\_\_\_\_\_\_

Hit **reset all.**

**Part 2**

1) Set your top medium to water. Set your bottom medium to MYSTERY A. Using the laser, make your angle of incidence 35° in the water. Use your protractor to find the angle of refraction in the Mystery A substance.

θr= \_\_\_\_\_\_\_\_\_\_\_\_\_

2) Using Snell’s Law, find the value of the index of refraction of the medium Mystery A. Show work.

nr = \_\_\_\_\_\_\_\_\_\_\_\_ (mystery A)

Hit **reset all**

**Part 3**

1) Set your top medium as Mystery B. Set your bottom medium to custom and the index of refraction to 1.15. Bring the protractor out. Turn on the laser and put the angle of incidence at 40.0°. Use your protractor to find the angle of refraction and record it below.

θr = \_\_\_\_\_\_\_

2) Using Snell’s Law, calculate the index of refraction of the INCIDENT medium (Mystery B). Record it below. Show your work.

ni = \_\_\_\_\_\_\_\_ (mystery B)

hit Reset All

**Part 4.**

1) Set your top (incident) medium as glass. Set your bottom (refracted) medium as air. Using the values for n, find at what angle light will be refracted in air if it is incident at an angle of 55° in glass. Show your work.

What did you get for your angle of refraction?

2) Turn on the Laser and put it at 55°.

**What happens? Does this explain what is going on with your solution to Snell’s Law?**

3) The greatest angle that a substance can refract is 90°.

a) Move your slider around until you can get light to refract at 90°. What was your incident angle? An angle that makes light refract at 90 degrees is called the **critical angle of incidence.**

θi critical= \_\_\_\_\_\_ to make light refract at 90.

b) Using Snell’s Law, see if you can come up with this value. Using the two indices of refraction and your angle of refraction of 90°, solve for the angle of incidence.

Show your work:

θi critical= \_\_\_\_\_\_\_\_

**Part 5**

Flip the media around. Set the incident (top) medium as air and the refracted (bottom) medium as glass.

1) Move your laser around to see what incident angle gives you a refracted angle of 90 degrees.

**What did you find out? What does this tell you about critical angles and indices of refraction?**