

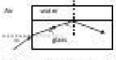
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**Brainpop Online**  
**Physics Worksheets**  
**Reflection and Refraction of Light**

Questions:

1.   
 A beam of light is incident on the hypotenuse of a right-angled glass prism in the air. What is the largest angle of incidence alpha before the ray that is reflected undergoes total reflection from the back of the prism (the hypotenuse)? (n\_glass = 1.50)

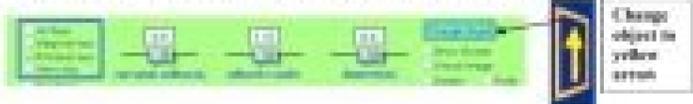
2.   
 What is the angle theta\_r if the light also strikes the glass-water interface at an angle just barely exceeds the critical angle? (n\_glass = 1.50, n\_water = 1.33)

**Lenses Virtual Lab using PhET Geometric Optics**

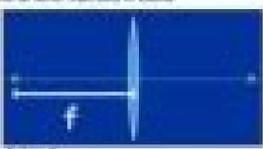
- Materials:** Computer, internet connection, simulator  
**Goal:** \_\_\_\_\_
- Objectives:**
- to demonstrate the formation of images from convex and concave lenses.
  - to identify the type of image formed by convex and concave lenses.
  - to establish the lens equations.

**Procedure: Convex lens**

- Go to **PhET Simulations** to **Play with Disks** to **Physics** to **Light** and **Simulation** to **Geometric Optics** to **Run Now!**
- Take some time to play with the simulation to get familiar with how it works.
- Maximize your screen. **Warning:** For the measurements listed in this lab, the ruler in the PhET program will not work. Therefore, we will use a standard ruler appearing from the computer monitor. The scale used to make these measurements will change from computer to computer so once you start, you must finish.
- In this lab, you will be moving the object to explore how images are formed. When you are ready to get started be sure that your settings are as follows:



- Bring the ruler vertically the distance from the center line of lens. Record in Data Table 1 as f. Double this value and record as 2f.
- Measure the height of object (h\_o) and record.
- Place the yellow arrow beyond 2f.
- In Data Table 2, record (h\_o, h\_i) and your observations of the image.
- Move the yellow arrow to 2f. Record in Data Table 2. Four measurements for (h\_o, h\_i) and your observations of the image.
- Move the yellow arrow to between 2f and f. Record in Data Table 2. Four measurements for (h\_o, h\_i) and your observations of the image.
- Place the yellow arrow at f. Record your observations, showing trouble locating image. Check your ray diagram. Record your observations in Table 2.
- Move the yellow arrow to a position that is halfway between f and the lens. If you can't locate the image, check the distance to the object. Record your observations in Table 2.



**Table 1**

focal length, f	
2f	
Height of object, h_o	

**Wave Calculations Worksheet**

- Velocity = Wavelength x Frequency**  
**Wavelength = Velocity / Frequency**  
**Frequency = Velocity / Wavelength**
1. Wavelength = 1.5m, Frequency = 150 Hz
2. Velocity = 400 m/s, Wavelength = 1.5m, Frequency = \_\_\_\_\_
3. Velocity = 330 m/s, Wavelength = 0.8m, Frequency = \_\_\_\_\_
4. Velocity = \_\_\_\_\_, Wavelength = 1.2m, Frequency = 250 Hz
5. Velocity = \_\_\_\_\_, Wavelength = 1.5m, Frequency = 120 Hz
6. Velocity = 12 m/s, Wavelength = 60 Hz
7. Velocity = 100 m/s, Wavelength = 1.075 m, Frequency = \_\_\_\_\_
8. Velocity = 150 m/s, Wavelength = 30 Hz
9. Velocity = \_\_\_\_\_, Wavelength = 2.2 m, Frequency = 70 Hz
10. Velocity = 65 m/s, Wavelength = 6.5 m, Frequency = \_\_\_\_\_

**Measuring Angles**

Use your protractor to extend the lines and measure each angle.

(1)  This angle is 55 degrees.

(6)  This angle is 120 degrees.

(2)  This angle is 30 degrees.

(7)  This angle is 90 degrees.

(3)  This angle is 45 degrees.

(8)  This angle is 135 degrees.

(4)  This angle is 60 degrees.

(9)  This angle is 90 degrees.

(5)  This angle is 75 degrees.

(10)  This angle is 150 degrees.

## Quiz & Worksheet - Reflection & Refraction Facts for Kids

1. The picture of this frog is an example of reflection because...



- The light is bending around the frog so you see underneath it.
- The light is being absorbed by the frog.
- The light is scattering all around the frog.
- The light is bouncing back so the frog's image is reflected underneath it.

2. Choose the BEST answer to explain how a flashlight, with a tiny light bulb, allows you to see when you walk outside in the dark.

- The light from the bulb is reflected off of the shiny silver material around it, which makes the light beam cover a larger area.
- The flashlight has batteries that give energy to the light bulb, which creates light that allows us to see when it is dark.
- The flashlight has a silver material which refracts the light from the bulb, and creates more light.
- The tiny light bulb is very strong, and uses the energy from the batteries to produce a large amount of light.

3. This picture shows a white beam of light entering a prism from the left. On the right side, the light has been divided into beams of different colors. Why is this an example of refraction?



- the white beam of light is bouncing off of the prism.
- the colored beams of light are reflecting off of the prism.
- light is being absorbed when it travels into the prism.
- the white beam of light is being bent when it travels through the prism, which creates the colored beams of light.

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