

## Physics Lab #9: Refraction and Lenses

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Objective: Examine the properties of rays when passing through lenses.

Theory: Light can be described as a wave. When light encounters a transition from one medium to another, part of its energy passes into the other medium and part of the energy reflects and remains in the first medium. Going from one medium to another is called refraction. Refraction and reflection angles are measured with respect to the normal line. The index of refraction is defined as the speed of light in a vacuum over the speed of light in the material, represented as  $n$ . The change in direction of the light is defined as

$n_1 \sin(\theta_1) = n_2 \sin(\theta_2)$ . Curved lenses produce real and virtual images of the object whose light is passing through. Whether the image is real or virtual depends on the positioning of the lense and its curvature. Lenses also affect the size of the image produced.

Procedure:

Part one:

Setup, start at incident of 0 degrees and increase by 10 each time. Record the incident and the refracted angle of the ray.

Part two:

Place target arrows over the light source. Place the lens in front of the light source at a distance greater than the focal point. Measure the distance from the lense, the distance between the lens and the screen, and the size of the image and object.

Part three:

Construct a telescope using two lenses at separation equal to the sum of their focal lengths. Find the magnification factor.

Part four:

Construct a microscope by moving the telescope lenses apart. Place an object just beyond the focal point of the smaller lense and look at the magnified image.