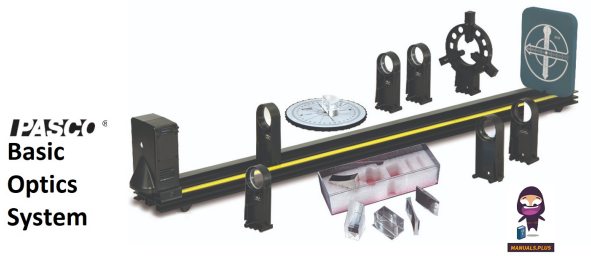
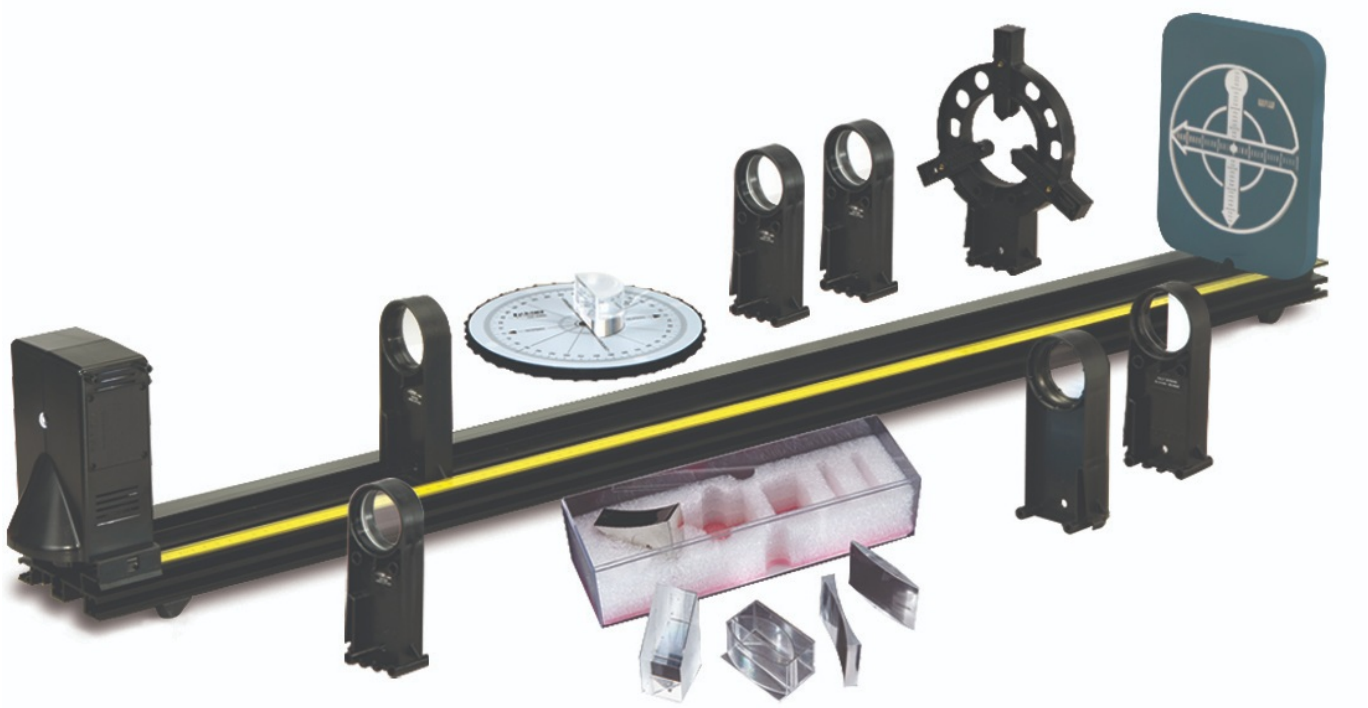


PASCO Basic Optics System Instructions

Contents

PASCO Basic Optics System



Specifications

- **Product Name**: Basic Optics System Ray Table D-shaped Lens Light Source
- **Components:** Ray Table, D-shaped Lens, Light Source
- **Purpose:** Determine the relationship between the angle of incidence and the angle of refraction

Reversibility

Required Equipment from Basic Optics System

- Ray Table
- D-shaped Lens
- Light Source

Purpose

In Trial 1 of this experiment, you will determine the relationship between the angle of incidence and the angle of refraction for light passing from air into a more optically dense medium (the acrylic of the D-shaped lens).
In Trial 2, you will determine whether the same relationship holds between the angles of incidence and refraction for light passing out of a more optically dense medium back into air. That is to say, if the light is traveling in the opposite direction through the lens, is the law of refraction the same or different? By comparing the results of both trials, you will find the answer to this question.

In Figure 1, notice that refraction occurs only at the flat surface of the D-shaped lens, not at the curved surface.

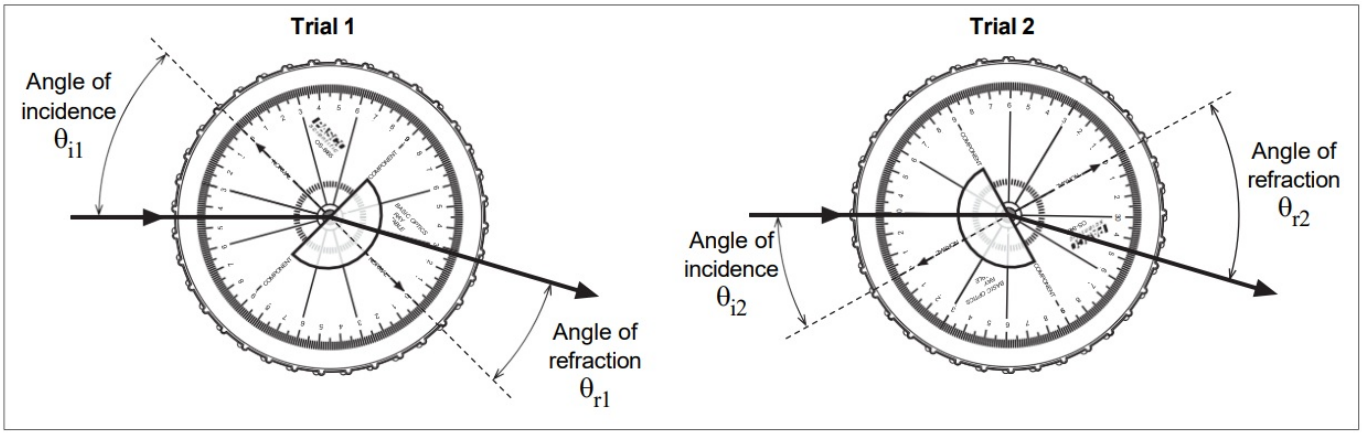


Figure 1: Refraction of light passing into the lens (Trial 1) and out of the lens (Trial 2)

Setup

1. Place the light source in ray-box mode on a flat tabletop. Turn the wheel to select a single ray.
2. Put the ray table in front of the light source so the ray from the light source crosses the exact center of the ray table.
3. Put the D-shaped lens on the ray table exactly centered in the marked outline.o

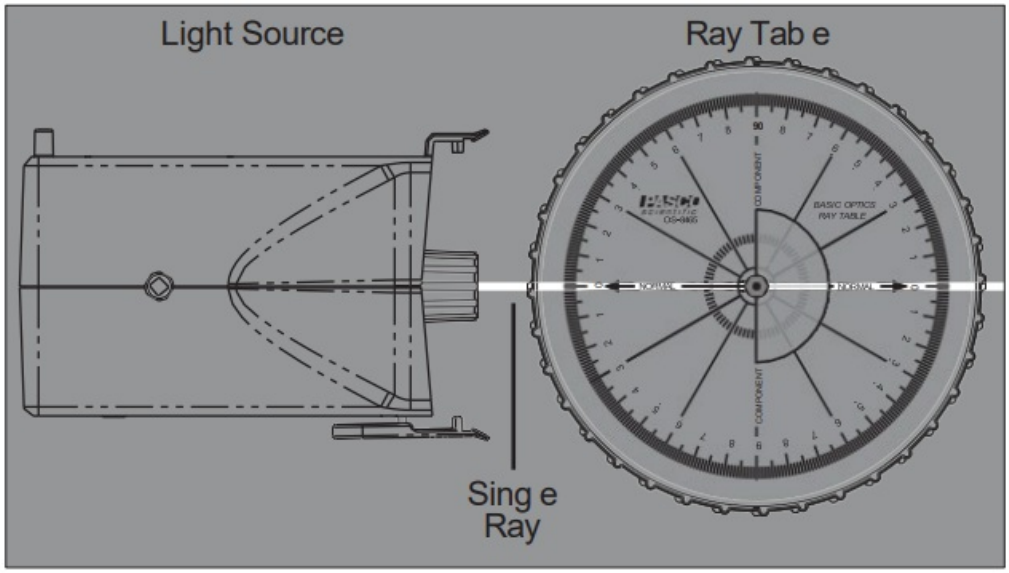


Figure 2: Initial setup for Trial 1

Record Data

Trial 1

1. Turn the ray table so the incoming ray enters the lens through the flat surface (see Figure 2).
2. Rotate the ray table to set the angle of incidence to each of the values listed in the first column of Table 1. For each angle of incidence (θi1), observe the corresponding angle of refraction (θr1) and record it in the second column of the tab

Trial 2

1. Copy all of the values in the second column to the third column of the table. (In other words, the angles of refraction that you observe in Trial 1 will be the angles of incidence that you use in Trial 2.)

2. Turn the ray table so the incoming ray enters the lens through the curved surface.
3. For the angles of incidence (θi2) that you wrote in the third column of the table, observe the corresponding angles of refraction (θr2) and record them in the fourth column.

Table 1: Data

Trial 1 **Ray Incident on Flat Surface**		**Trial 2** **Ray Incident on Curved Surface**	
Angle of Incidence θ_{i1}	**Angle of Refraction** θ_{r1}	**Angle of Incidence** θ_{i2}	**Angle of Refraction** θ_{r2}
0°			
10°			
20°			
30°			
40°			
50°			
60°			
70°			
80°			

Analysis

1. Using your values for θi1 and θr1 and Snell's Law (Equation 10.1), determine the index of refraction of acrylic (nacrylic). Assume the index of refraction of air (nair) is 1.0.

$$n_{air}\sin(\theta_{i1}) = n_{acrylic}\sin(\theta_{r1}) \qquad (1)$$

$n_{acrylic}$ = _____ (from θ_{i1} and θ_{r1})

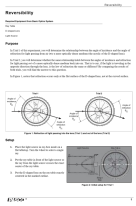
2. Determine nacrylic again, this time using your values of θi2 and θr2.

$n_{acrylic}$ = _____ (from θ_{i2} and θ_{r2})

Questions

1. Is the law of refraction the same for light rays going in either direction between the two media?
2. Does the principle of optical reversibility hold for reflection as well as refraction? Explain.

Documents / Resources

	PASCO Basic Optics System [pdf] Instructions 012-09900B, 012-09900B Basic Optics System, 012-09900B, Basic Optics System, Optics System

References

- User Manual