PꜦYZLᴀʙ Sᴘʀɪɴɢʙᴏᴀʀᴅ: Usɪɴɢ Sɴᴇʟʟ's Lᴀw

• Apparatus •
___PASCO Basic Optics System:
  __light source (out of bracket)
  __power supply (plug)
  __prism (trapezoidal, semicircular, etc.)
  __Snell's Law Sheet (one per group)
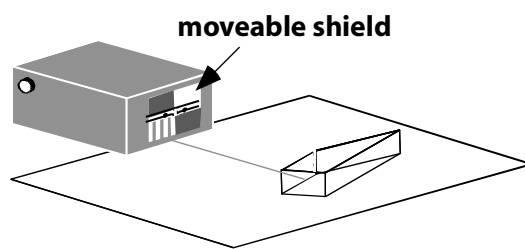
moveable shield

• Set-Up •
1. Attach the power supply to the light source and plug it in.

2. Arrange the light source to be a ray box and adjust the moveable plastic shield so that a single beam is emitted.

3. Place the prism—**dull side down**—on Configuration 1 of the Snell's Law Sheet as shown in the diagram to the right .

trapezoidal prism
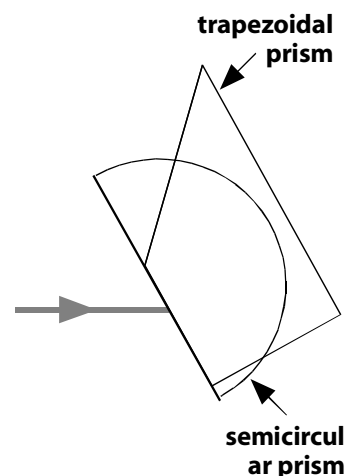
• Procedure •
1. Aim the single beam of light along the gray line in Configuration 1 toward the prism as shown to the right.

2. Mark the **point** on the paper where the beam emerges from the prism. **If you are not using a semicircular prism, do not trace the path of the beam that emerges from the prism. If using a rectangular or trapezoidal prism, the exit beam must be parallel to the entrance beam in all configurations.**

semicircular prism

3. Repeat this process on Configurations 2 and 3.

4. Take down apparatus and store it appropriately.

• Analysis •
1. The diagram to the right shows a ray of light passing from air to acrylic. Label the **incident ray**, **refracted ray**, **surface**, **normal**, **angle of incidence** θ_1, and **angle of refraction** θ_2.

2. For each configuration on the Snell's Law Sheet, complete the diagram by drawing and labeling

    a. **the refracted ray:** connect the point at which the incident ray strikes the front surface of the prism to the point at which the refracted ray emerges from the back surface of the prism. Extend the ray several centimeters.

    b. **the normal.** Extend it several centimeters on both sides of the surface line.
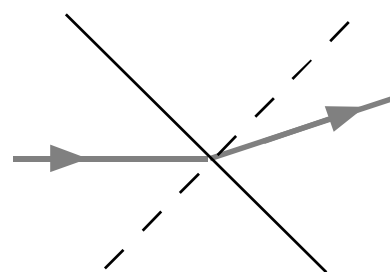
3. Describe how the following angles are measured:
   a. angle of incidence.

   b. angle of refraction.

4. Label, measure, and record the angles of incidence and refraction for each configuration.

	Configuration 1	Configuration 2	Configuration 3
Angle of incidence θ_1			
Angle of refraction θ_2			

5. Write Snell's Law for the index of refraction n in terms of the angle of incidence θ_1 and the angle of refraction θ_2.

6. If the angle of incidence had been 57° and the angle of refraction had been 23°, what would the corresponding index of refraction have been? Show the Snell's Law calculation.

7. Use Snell's Law (and good analysis technique) to determine the most accurate value you can for the index of refraction for the trapezoidal prism (made of acrylic). Show calculations for each configuration. Record your final value below and describe how it was determined.

8. Use the index of refraction you found above to complete the calculations below.
   a. What would the angle of refraction be if the angle of incidence were 75°?

   b. What would the angle of incidence be if the angle of refraction were 30°? (If you think this is what you measured in configuration 1, reread the last sentence carefully.)

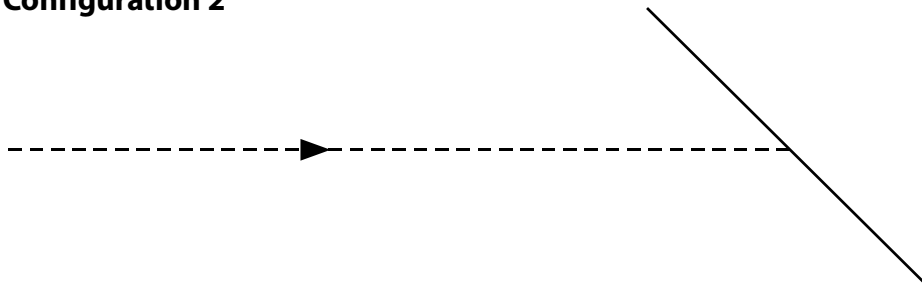   c. What would the angle of incidence be if the angle of refraction were 75°?

4/28/08 **db**
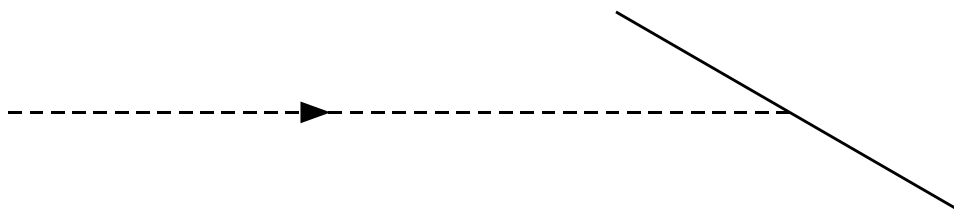
Snell's Law Sheet

Configuration 1

front surface
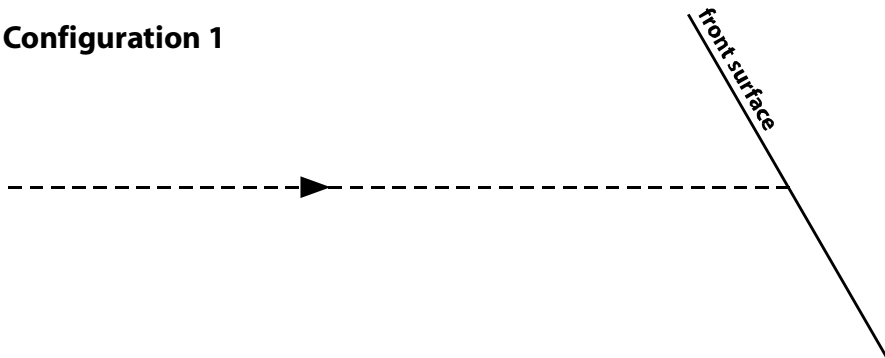
Configuration 2

Configuration 3

IMPORTANT: Make sure the beam passes all the way through the prism as it did in Configurations 1 and 2. If using a rectangular or trapezoidal prism, the exit beam must be parallel to the entrance beam.