PhyzLab Springboard:
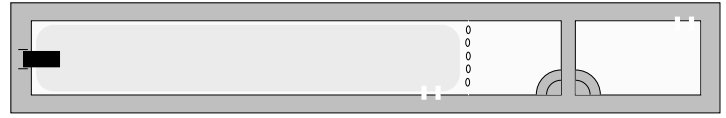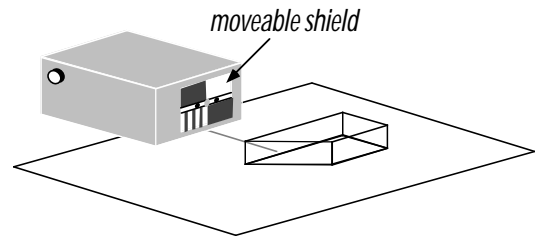# Using TIR to Determine n

## • Apparatus •

___PASCO Basic Optics System:

___light source (out of bracket)

___power supply (plug)

___prism (trapezoidal, semicircular, etc.)

___blank sheet of paper

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 a blank sheet of paper.
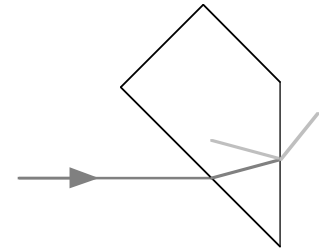
• Procedure •

1. Aim the single beam of light toward the prism as shown to the right. The beam should reflect from the midpoint of the flat/angled surface of the prism.

2. Rotate the prism back and forth (while maintaining the same point of reflection on the back surface) until you find the critical angle. By the way, what **is** the critical angle?
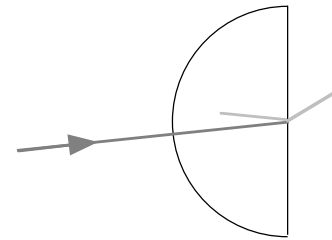
3. Once you've found the critical angle, mark
   • the point on the paper where the beam enters,
   • rthe point on the paper where the beam eflects, and
   • the point on the paper where the beam emerges from the prism.
   • Also trace out the angled (reflecting) surface.

• Analysis •

1. Complete your diagram by drawing

   a. the internal **incident ray** (traveling through the acrylic toward the reflecting surface). Extend this ray several centimeters and label it.

   b. the internal **reflected ray.** Extend this ray several centimeters and label it.

2. Make a sketch of your completed diagram to the right.

3. According to the law of reflection, which is greater: the angle of incidence or the angle of reflection?

4. Compared to the angle of incidence, how large is the angle between the incident ray and the reflected ray?

5. Describe a method by which the critical angle can be determined **without using the normal line or the surface line.**

6. Write the equation describing the index of refraction n in terms of the critical angle θ_c for a material.

7. If the critical angle had been 27°, what would the corresponding index of refraction of the prism be? Show your calculation.

8. For the critical angle you found for the prism, what is the corresponding index of refraction?