Course and Section____________ Names___________________________________

Date_________ ____

REFLECTION AND REFRACTION

Short description:

Use the ray optics kit to study how light reflects off a shiny surface, and how it refracts when entering a transparent material. You'll use a light source that uses slits to create 5 or 6 rays of light. You will place a mirror or plastic trapezoid in front of the rays and observe the reflected rays and the refracted ones.

Equipment:

- Plastic trapezoid
- Plastic mirror
- Light source
- Paper
- Protractor

Procedure:

Part I. Reflection.
Take the triangular shaped shiny piece that looks like metal but must be plastic because it's so light. This piece has two curved and one plane mirror side. Today we'll just use the plane mirror.

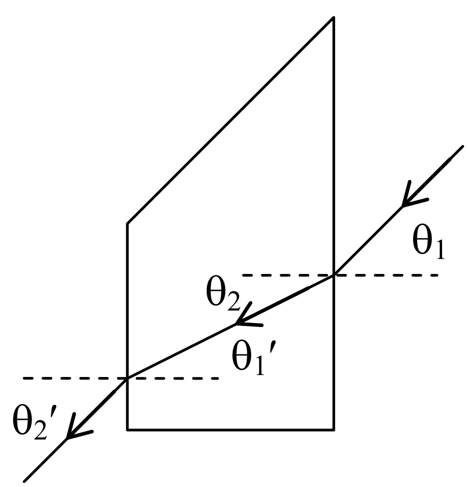
Place the mirror in front of the rays and observe the reflection. What you are to investigate is whether the angle of reflection equals the angle of incidence. This is a very simple law, and is easily verified. Figure out what to do and describe your technique in the space below. Use words and a figure in your description.

Verify at least 5 different angles of incidence. Enter the results of your measurements in the table below.

Measurement	Angle of incidence	Angle of reflection
1		
2		
3		
4		
5		
6		
7		

Part II. Refraction

Take a trapezoidal piece of plastic and let the light ray shine through it as shown in the figure below.



Now trace the lines. Place a piece of white paper under the apparatus, and use a pencil to indicate points on the path of the ray. For instance, make a dot where the ray leaves the light source, where it hits the plastic, where it leaves the plastic, and where it is about an inch away from the plastic. You'll also need to trace the right surface of the trapezoid. Then connect the dots to show the lines followed by the light ray.

Now measure the angles, using a protractor, and use Snell's Law to find the index of refraction for this plastic material. Note that you have refraction both when the light enters the plastic, and when it leaves…so you can **apply Snell's Law twice**. Ideally, you should get the same result in each case.

Measurement	Angle of incidence	Angle of refraction	n
Entry point			
Exit point			

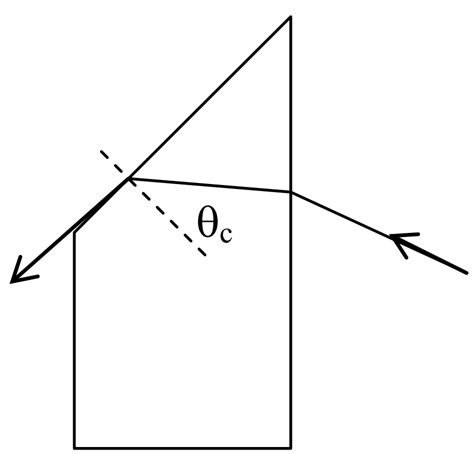
You may find that the two values that you got for n are somewhat different because of the uncertainty in accurately measuring the angles. This will be especially true if your angles are small. To get a better value of n, make measurements at the entry point of the angle of incidence, θ_1, and the angle of refraction, θ_2, over a range of angles between 0° and 90°. (Don't bother to make measurements at the exit.) Plot $\sin\theta_1$ versus $\sin\theta_2$ and determine n from the slope.

Measurement	θ_1	θ_2	$\sin\theta_1$	$\sin\theta_2$
1				
2				
3				
4				
5				
6				
7				
8				

n = ________ (slope)

Part III. Total Internal Reflection

Rotate the trapezoid slowly and watch as the refracted rays get closer and closer to the outer surface of the trapezoid. At the angle where the refracted rays disappear, and only reflection takes place at the inner face, stop rotating the trapezoid. Measure the light rays as you did in the previous section and see if you can calculate the index of refraction from this information.



critical angle = ________

n = ________