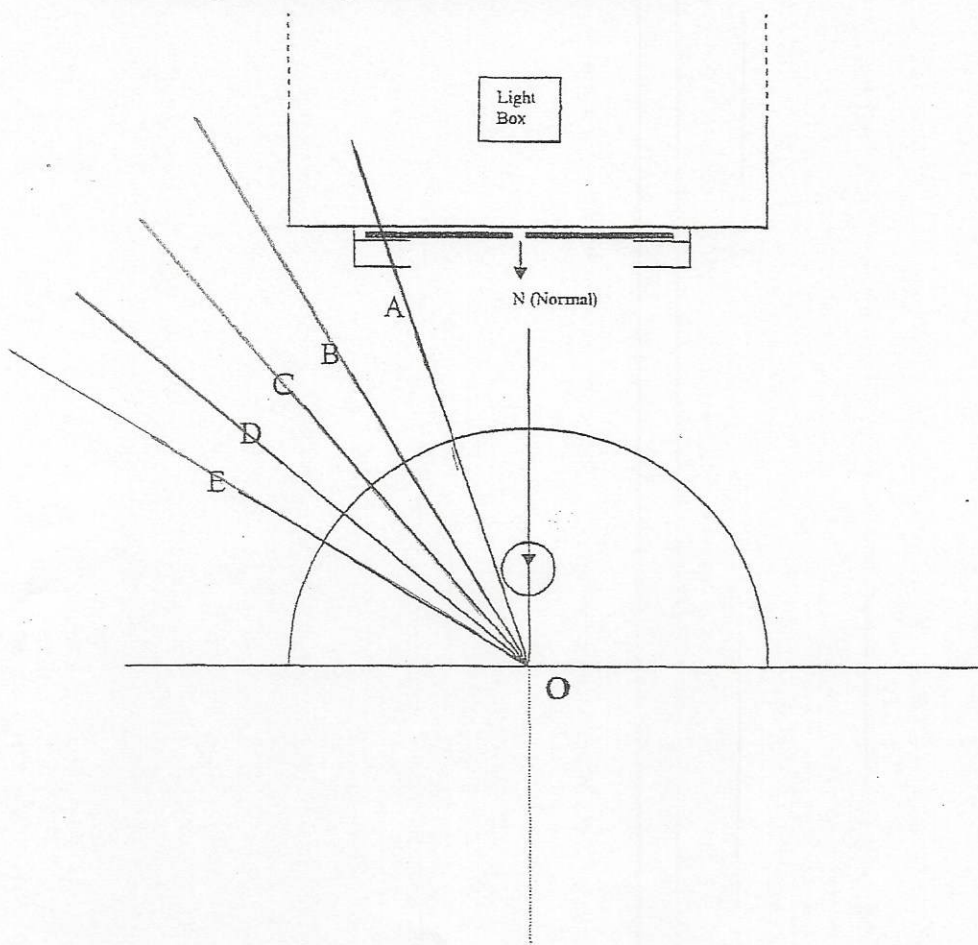


## Discovery Station (15 pts)

### Procedure

1. Use a single-slit mask on the light box. Position the semi-circular Plexiglas block on this sheet.
2. Aim the ray at the center point on the semi-circular block of plastic.
3. Start at the normal. The light should pass through the semi-circular block of plastic with no change in its direction.
4. Move the light box so the ray is along line AO. Use your pencil to mark the path of light that comes out of the Plexiglas.
5. Adjust the light box so that the light ray enters the block along the indicated lines. Mark the path each ray takes as it leaves the block.



When is Light Reflected Internally?  
Student Worksheets

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1 point for each  
refracted ray

6. Remove the plastic block. Draw a line from point O for each refracted ray.
7. Where does the bending of the light ray take place?

- 
8. For which ray (A, B, C, D, E) does the refracted ray disappear? \_\_\_\_\_
  9. Measure each angle of incidence and the corresponding angle of refraction for each ray. Record your measurements in the data table below. Remember to measure angles from the normal line.

Ray	Angle of Incidence $\theta_i$	Angle of Refraction $\theta_r$
AO		
BO		
CO		
DO		
EO		

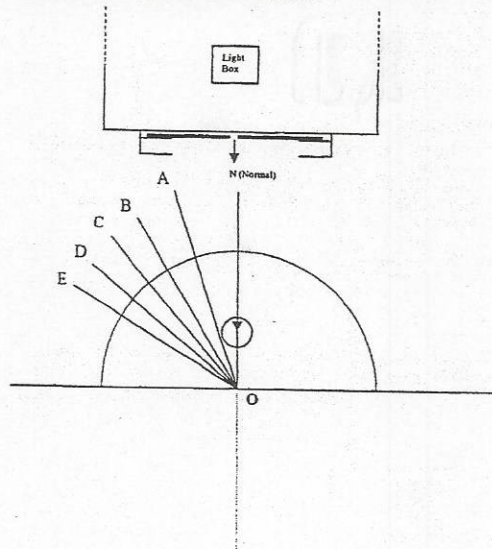
10. Use the data above to make a general statement about refraction of light as it moves from Plexiglas to air.

- 
11. As you moved the light box, you observed that the angle of the refracted ray (light leaving flat side of Plexiglas) was greater than the incident ray. For what incident angle did the refracted angle equal  $90^\circ$ ? Incident angle = \_\_\_\_\_. What happened to the light ray when the incident angle exceeded this angle?
-



### Procedure

1. Use a single-slit mask on the light box. Position the semi-circular Plexiglas block on this sheet.
2. Aim the ray at the center point on the semi-circular block of plastic.
3. Start at the normal. The light should pass through the semi-circular block of plastic with no change in its direction.
4. Move the light box so the ray is along line AO. Use your pencil to mark the path of light that comes out of the Plexiglas.
5. Adjust the light box so that the light ray enters the block along the indicated lines. Mark the path each ray takes as it leaves the block.



20 pts  
total

5 pts  
1 for  
each  
refracted  
ray

6. Remove the plastic slab. Draw a line from point O for each refracted ray.
7. Where does the bending of the light ray take place?  
The bending occurs at the boundary between Plexiglas and air. There is no bending for the light entering the Plexiglas since it is moving on a radius which is a normal line. (1)
8. For which ray (A, B, C, D, E) does the refracted ray disappear?  
The light along line D or E do not exit the Plexiglas through refraction. It is reflected at the Plexiglas - air boundary. None escapes through refraction. (1)
9. Measure each angle of incidence and the corresponding angle of refraction for each ray. Record your measurements in the data table below.

Ray	Angle of Incidence $\theta_i$	Angle of Refraction $\theta_r$
AO	18.0	28.2
BO	31.0	50.0
CO	40.0	78.3
DO	50.1	Reflected
EO	58.8	Reflected

10 pts

- within  
1° for  
all angles

10. Use the data above to make a general statement about refraction of light as it moves from Plexiglas to air.  
The refracted angle is greater than the incident angle when air travels from Plexiglas to air. If the incident angle is too large, the light is no longer refracted. (1)
11. As you moved the light box, you observed that the angle of the refracted ray (light leaving flat side of Plexiglas) was greater than the incident ray. For what incident angle did the refracted angle equal  $90^\circ$ ? Incident angle = 41°. What happened when the incident angle exceeds this angle?  
When this angle is exceeded, no light is refracted. It is reflected at the plexiglas - air boundary. (1)