

# Introduction to Reflection and Refraction Worksheet

## Activity A. Reflections from a Plane Mirror

### Data Table A

Cork Position		Eye Position		Position of Cork with Pin		Observations
Quadrant	Angle	Quadrant	Angle	Quadrant	Angle	
4	40°					
4						
3						

## Post-Lab Questions

- Based on your observations, compare the size of a virtual image seen in a plane mirror, and its distance from the mirror, compared to the size and distance of the actual object.
- What does the angle of the line of sight represent when looking at an image in a mirror?
- Review the hypothesis from *Pre-Lab Question 2*. The relationship between the angle of incidence and the angle of reflection is known as the Law of Reflection. Based on your observations, write the Law of Reflection below.
- Five students are seated at their desks, which are spaced equally apart, in the front row of a classroom (see diagram below). The instructor places a large plane mirror on the board directly in front of the middle student. When student 1 looks at the center of the mirror, which student's image will be seen? Explain.



## Activity B. Refraction of Transmitted Light

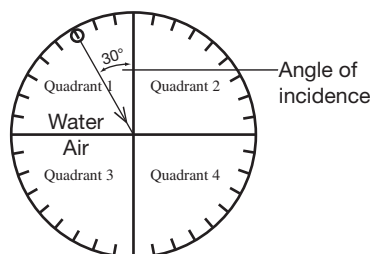
**Data Table B**

Light Transmission	Observations	Pin Position		Toothpick Position	
		Quadrant	Angle	Quadrant	Angle
Air to Water		4	50°		
Air to Water		4	30°		
Air to Water		4	70°		
Water to Air		1	45°		
Water to Air		1	30°		
Water to Air		1	10°		

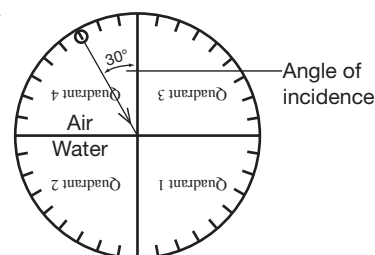
### Post-Lab Questions

- The index of refraction of water at 20° C is 1.33. Would you expect the speed of light in water to be less than, greater than, or the same as the speed of light in air? Explain.
- In the diagrams below, the letter O at 30° (second trial for each setup) represents the placement of the object, the actual cork and pin. The line and arrow represent the path of incoming light through air or water, respectively, to the center line of the dish. Use the data from Table B to label each diagram as described below.
  - Write the letter T (for toothpick) at the angle that represents each placement of the toothpick when the object was at 30°.
  - Draw a line with an arrow to show the path of light as it traveled from the center line of the dish to your eye.
  - Label the angle of refraction.

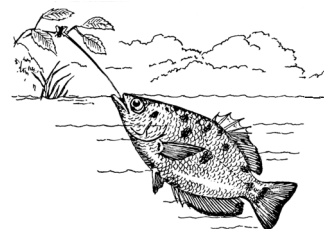
Part 1. Air to Water



Part 2. Water to Air



- As the light travelled from air into water, which way did it bend with respect to the normal line? Did the light speed increase or decrease?
- As the light travelled from water into air, which way did it bend with respect to the normal line? Did the light speed increase or decrease?
- The archer fish captures its prey by knocking insects off a branch with a stream of water from its mouth. To compensate for the refraction of light as it is transmitted from air into water, would the fish aim above or below the image of the insect it sees? Explain or draw a diagram.



## Activity C. Multiple Images

### Data Table C

Angle Formed by Mirrors	Whole Images
90°	
72°	
60°	
40°	
120°	

### Post-Lab Questions

10. What happens to the number of images as the angle between the mirrors decreases?
  
  
  
  
  
11. A circle is divided into 360 degrees. *a.* How many 90°-sections are in a circle? *b.* 72°-sections? *c.* 60°-sections? *d.* 40°-sections? *e.* 120°-sections?
  
  
  
  
  
12. Compare the number of images from the data table with the answers to question 11. What is the relationship between the angle formed by the mirrors and the number of images seen in the mirror?
  
  
  
  
  
13. Predict how many images would be seen if the angle formed by the mirrors was 20°.
  
  
  
  
  
14. Write the relationship between the angle formed by the mirrors and the number of images seen in the mirrors as a mathematical equation. Use *n* to represent the number of images.