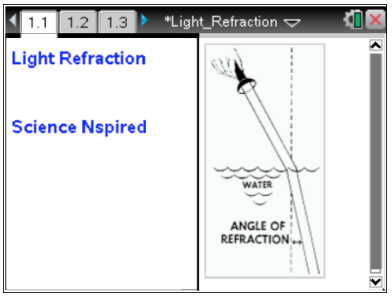
Light Refraction
Student Activity

Name _____
Class _____

Open the TI-Nspire document *Light_Refraction.tns.*

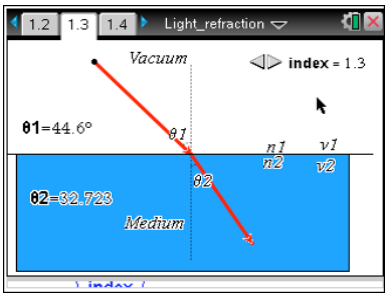
Have you ever put the end of a pole under water and observed that it looks like it is no longer straight? Instead, it appears to be bent as you view it from above. In this lab we are going to explore this phenomena that occurs when an object is placed in a liquid.



Move to pages 1.2–1.4.

When light moves from air into a liquid, light is refracted. The angle of incidence (θ_1) is the angle between the incident light ray and a line perpendicular to the surface. The angle of refraction (θ_2) is the angle between the normal and the path of the refracted light ray.

The index of refraction for a given medium is the ratio of the speed of light traveling through a vacuum to the speed of light traveling through the medium.



1. Play with the index of refraction on page 1.3 and observe how it affects the paths of the light ray.

Move to pages 1.5–1.8. Answer the following questions here or in the .tns file.

Q1. When the refractive index of the liquid medium increases, _____.

A. $\theta_1 = \theta_2$
B. $\theta_1 > \theta_2$
C. $\theta_1 < \theta_2$
D. the angles cannot be predicted

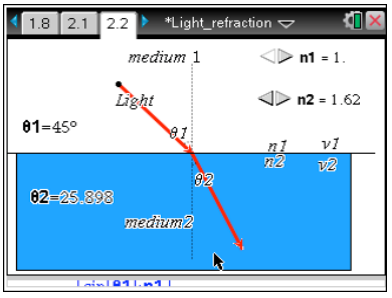
Q2. Calculate the sine of θ_1 and the sine of θ_2.

Q3. What is the ratio of $\sin(\theta_1)$ to $\sin(\theta_2)$?

Q4. What is the relationship between the angle of incidence, the angle of refraction, and the medium's index of refraction?

Move to pages 2.1–2.3.

In the last problem light was refracted as it traveled from a vacuum into a medium. In Problem 2 you will examine what happens as light travels from one medium into another.



2. n_1 is the index of refraction for medium 1 and n_2 is the index of refraction for medium 2. Explore the simulation by changing n_1 and n_2, observing what occurs as you vary these values.

Move to pages 2.4–2.10. Answer the following questions here or in the .tns file.

Q5. If $n_1 > n_2$, then _____.

A. $\theta_1 = \theta_2$

B. $\theta_1 > \theta_2$

C. $\theta_1 < \theta_2$

D. Cannot be determined

Q6. Calculate the ratio of n_1/n_2.

Q7. Calculate the ratio of the $\sin(\theta_1)/\sin(\theta_2)$.

Q8. How does the ratio of n_1/n_2 compare to $\sin(\theta_1)/\sin(\theta_2)$?

Q9. The correct relationship between the angles and refractive indexes is/are _____.
(More than one response may be correct.)

A. $\frac{\sin\theta_1}{\sin\theta_2} = \frac{n_1}{n_2}$

B. $\frac{\sin\theta_1}{\sin\theta_2} = \frac{n_2}{n_1}$

C. $n_1 \sin\theta_1 = n_2 \sin\theta_2$

D. $n_2 \sin\theta_1 = n_1 \sin\theta_2$

Q10. Air has a refractive index of 1.0003 and water has a refractive index of 1.3330. If a light ray in air strikes water at an angle of 15.0°, what will the angle of refraction be in water?

Q11. A beam of light passes through a layer of benzene at a 20.0° angle to the normal. When it enters the layer of water, the angle of refraction is 30.88°. If the refractive index for water is 1.0003, what is the refractive index for benzene?