

HW 8.3 Refraction and Critical Angle

Per _____ Name _____

$$n_{\text{air}} = 1 \quad n_{\text{water}} = 1.33 \quad n_{\text{glass}} = 1.55$$

1. The index of refraction of ordinary glass for red light is 1.51 and for violet light is 1.53. A beam of white light falls on a cube of such glass at an incident angle of 40 degrees. What is the difference between the angle of refraction of the red and violet light?

2. The critical angle for total internal reflection in lucite is 41 degrees. Find lucite's index of refraction.

3. What is the angle of refraction of a beam of light that enters the surface of a lake at an angle of incidence of 50 degrees?
($n_{\text{water}} = 1.33$)

4. Light enters a piece of glass from water at a 38 degree angle. After passing through the glass, the light travels into air. Find the angle the light makes when traveling into the air.

5. The speed of light in a certain type of glass is $1.91 \times 10^8 \text{ m/s}$. What is the index of refraction of the glass?

6. What is the critical angle for light passing from a diamond ($n = 2.42$) to air?

7. What is the critical angle for light passing from glass into water?

8. The critical angle for light passing from rock salt into air is 40.5 degrees. Calculate the index of refraction of rock salt.

9. A beam of light enters a liquid of unknown composition from air at an angle of incidence of 30 degrees and is deflected by 5 degrees from its original path. Find the index of refraction.

10. Paxton has a brilliant idea and decides to spear a fish using a laser sight. Using her considerable knowledge of physics she calculates her aim. If she hits the fish did she aim above, below or directly at the fish?

11. How long does it take a pulse of light to pass through a glass plate that is 6 cm thick?

12. A flashlight beam is directed into water with an incidence angle of 56 degrees. Find the angle the beam makes in the water.

13. A layer of oil ($n = 1.45$) floats on water. A ray of light shines onto the oil from air and makes an angle of 40 degrees. Find the angle that the ray makes in the water.

14. Extra dense flint glass has one of the highest indices of refraction of any type of glass. Suppose a beam of light passes from air into a block of extra dense flint glass. If the light has an angle of incidence of 72° and an angle of refraction of 34° , what is the index of refraction of the glass?

15. Someone on a glass-bottom boat shines a light through the glass into the water below. A scuba diver beneath the boat sees the light at an angle of 17° with respect to the normal. If the glass's index of refraction is 1.5 and the water's index of refraction is 1.33, what is the angle of incidence with which the light passes from the air into the glass?

16. When light in air enters an opal mounted on a ring, it travels at a speed of 2.07×10^8 m/s. What is opal's index of refraction?

17. A British company makes optical fibers that are 13.6 km in length. If the critical angle for the fibers in air is 42.1° , what is the index of refraction of the fiber material?

18. Find the critical angle for light traveling from blue topaz ($n = 1.61$) into air.