

# PreAP Light and Optics 7

You will need your "Critical Angle" notes.

- \* Light is traveling at an angle of  $42^\circ$  in water. What is its angle in air?
- Light is traveling at an angle of  $55^\circ$  in water. What is its angle in air?

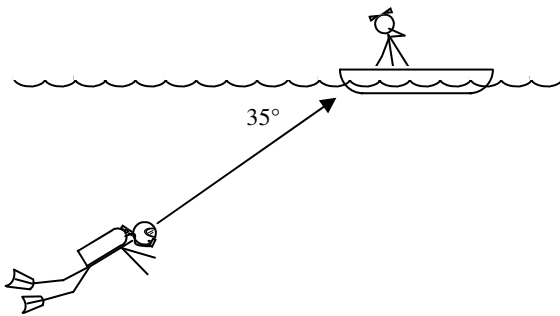
*Why did you get an error? Because sin can never be bigger than 1. So,  $55^\circ$  is beyond the critical angle for water.*

- Now let's say that light is travelling  $85^\circ$  in water. What is its angle in glass?

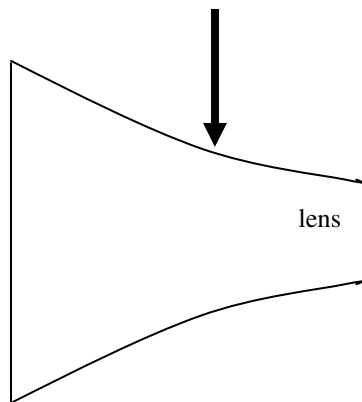
*Notice that even at a VERY large angle the light ray bent toward the normal. This is why there is no critical angle when light passes from a fast medium (water,  $n = 1.33$ ) into a slower medium (glass,  $n = 1.52$ ).*

- Substance 1 has an index of refraction of 1.68. Substance 2 has an index of refraction of 2.4.
  - In which substance does light travel faster?
  - In which case would there be a critical angle: from substance 1 OR from substance 2?
- \* Calculate the critical angle from light as it passes from a diamond to water.

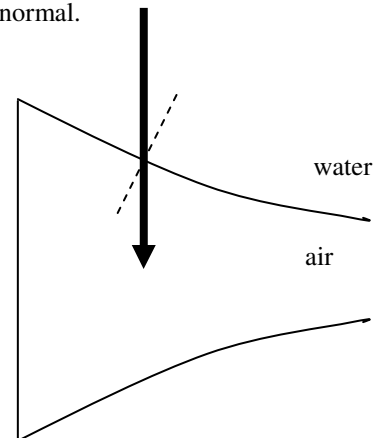
*This very small critical angle is why diamonds shine so brilliantly: once the light gets into the diamond, it has a hard time getting out. It bounces around several times, making the diamond "sparkle".*



- Slim Jim is also a diver. Jim finds a treasure chest and wants to signal Slim Kim in the boat above. He can see the bottom of the boat poking thru the surface of the sea water (use  $n = 1.35$ ), but he can't see Kim. Why? (And give numbers to prove it.)



- A ray of light is passing from air into a lens. Draw the path of the light ray as it passes into and out of the glass lens. To make this easier at each of the boundaries draw dotted lines for the normal and the straight path. Then decide if the light ray will bend toward or away from the normal.



- But what if the indexes of refraction were reversed? In this example an empty concave tray is placed in water. Using the same procedure as before, determine the path the light ray follows into and out of the tray. Hint: it will be different than in the previous example.