

Work each of the following problems. SHOW ALL WORK.

- Light traveling through air ($n = 1.000293$) strikes an ice cube ($n = 1.309$) at a 30° angle.
 - Diagram and label the path of the light.

 - Determine the angle at which the light refracts when it moves from air into the ice cube.

- An underwater scuba diver shines a laser toward the surface at an angle of 37° to the vertical. The index of refraction of water is 1.333, and the index of refraction of air is 1.000293.
 - Diagram and label the path of the light.

 - Determine the angle at which the light refracts when it moves from water into air.

Work each of the following problems. SHOW ALL WORK.

3. Light moving through air ($n = 1.000293$) strikes the surface of crown glass ($n = 1.52$) at a 25° angle with respect to the normal, passes through the glass, and returns to air.

a. Diagram and label the path of the light.

b. Determine the angle at which the light refracts when it moves from air into the crown glass.

c. Determine the angle at which the light refracts when it moves from the crown glass into air.

d. How does the angle at which the light strikes the glass compare to the angle at which it re-enters the air?

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4. Light moving through air strikes the glass of a saltwater aquarium at an angle of 32° with respect to the normal. The glass has an index of refraction of 1.53. The saltwater has an index of refraction of 1.33. The air has an index of refraction of 1.000293.

a. Diagram and label the path of the light.

b. Determine the angle at which the light refracts when it moves from air into the glass.

c. Determine the angle at which the light refracts when it moves from the glass into the saltwater.

d. If the light were to enter the saltwater directly from air at 32° , what would be the angle of refraction of the light? Compare your answer to the angle of refraction from part 4c.

Work each of the following problems. SHOW ALL WORK.

5. Determine the critical angle between air ($n = 1.000293$) and flint glass ($n = 1.66$). Draw a diagram to illustrate your answer.
6. Light moving through air ($n=1.000293$) strikes a surface of mineral oil at an angle of 23.1° with respect to the normal. If light moves at 2.17×10^8 m/s in mineral oil, what are the index of refraction of the mineral oil and the angle of refraction?
- a. index of refraction of mineral oil
- b. angle of refraction