

✓ CHECK YOUR LEARNING

Suggested Answers

- (a) The index of refraction for a medium is the ratio of the speed of light in a vacuum to the speed of light in that medium.

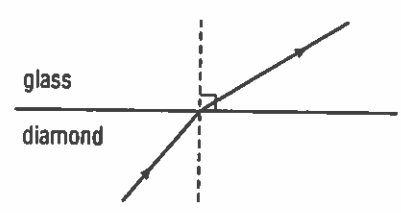
(b) The index of refraction is a dimensionless quantity because it is the ratio of two speeds, which both have the same units. The common units in the numerator and denominator of the ratio cancel, leaving no units for the index of refraction.
- $$n_{\text{vinegar}} = \frac{3.00 \times 10^8 \text{ m/s}}{2.30 \times 10^8 \text{ m/s}} \doteq 1.30$$
- $$n_{\text{sapphire}} = \frac{3.00 \times 10^8 \text{ m/s}}{1.69 \times 10^8 \text{ m/s}} \doteq 1.78$$
- (a) $v_{\text{quartz}} = \frac{3.00 \times 10^8 \text{ m/s}}{1.46} \doteq 2.05 \times 10^8 \text{ m/s}$

(b) $v_{\text{diamond}} = \frac{3.00 \times 10^8 \text{ m/s}}{2.42} \doteq 1.24 \times 10^8 \text{ m/s}$
- $$v_{\text{solution}} = \frac{3.00 \times 10^8 \text{ m/s}}{1.49} = 2.01 \times 10^8 \text{ m/s}$$
- $$v_{\text{acetone}} = \frac{3.00 \times 10^8 \text{ m/s}}{1.36} = 2.21 \times 10^8 \text{ m/s}$$
- (a) $n_{\text{unknown}} = \frac{3.00 \times 10^8 \text{ m/s}}{2.20 \times 10^8 \text{ m/s}} = 1.36$

(b) ethyl alcohol or acetone
- An answer of $4.0 \times 10^8 \text{ m/s}$ is impossible because it exceeds the speed of light in a vacuum ($3.00 \times 10^8 \text{ m/s}$), which is the fastest possible speed for light.

- (a) The angle of refraction will become smaller.

(b) When the medium in which the refracted light ray travels is changed to glass, the speed of the light is still greater than in the diamond, but not as great as in air. The refracted ray still bends away from the normal in the glass, but to a lesser degree than in air.



- The speed of light is different from medium to medium, which gives each medium a unique index of refraction. But the speed of light through a medium is the same regardless of which medium the light passes through first.