

# 19-3 How do light waves travel?

## Objective

Describe how light travels as transverse waves.

## Key Term

**transverse** (trans-VURS) **wave**: wave in which the particles of the medium move up and down at right angles to the direction of the wave motion

**Light Waves** Light is made up of streams of photons. However, light also behaves like a wave. Light is a type of electromagnetic wave. Electromagnetic waves are different from sound waves. Sound is a longitudinal wave. A sound wave needs a medium in which to travel. Sound cannot be heard in a vacuum, or empty space.

Light waves are different from sound waves in two ways. Light travels in transverse waves. In transverse waves, the particles move up and down at right angles to the direction of wave motions. Also, light waves do not need a medium in which to travel. Light can travel through a vacuum.

**1** **CONTRAST:** How do light waves differ from sound waves?

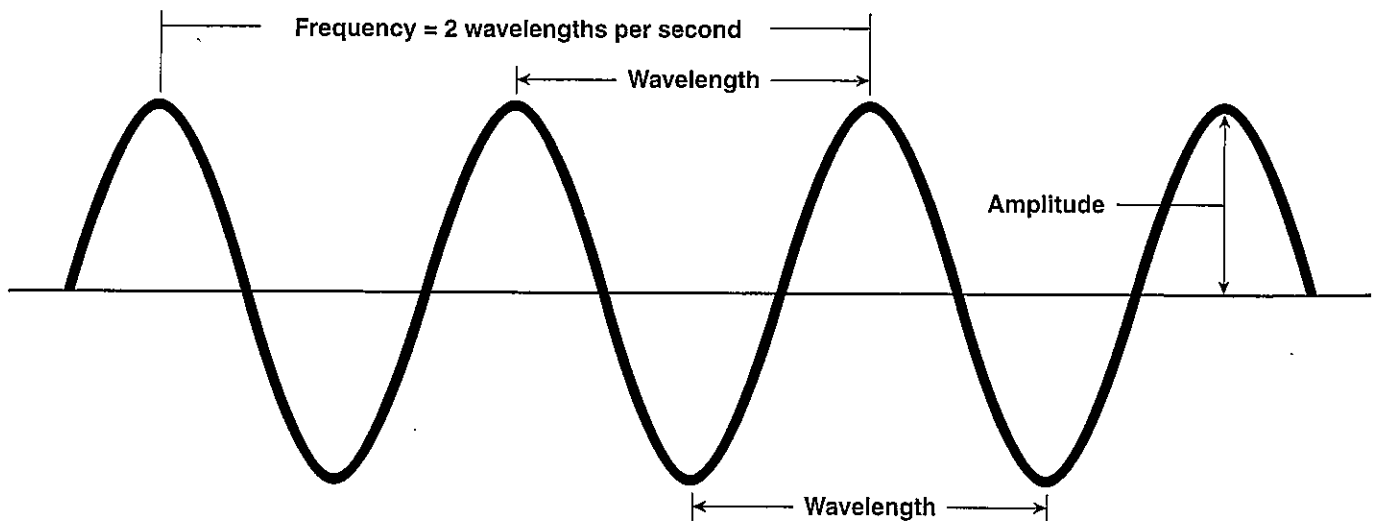
**Photons and Light Waves** Some experiments with light show that it is made up of photons. Other experiments show that light acts as a wave. Scientists have learned that some waves act as if they are made up of particles.

**2** **DESCRIBE:** How do light waves act?

**Properties of Light Waves** Like all waves, light waves have four properties. They are speed, wavelength, frequency, and amplitude.

- The speed of light is 300,000 km/s in a vacuum. Light and all other electromagnetic waves travel at this speed. The speed of light in a vacuum is the fastest possible speed.
- The wavelength of light is the distance from the crest or trough of one wave to the crest or trough of the next wave.
- The number of light waves that pass by a point each second is the frequency.
- The amplitude is the height of a wave. A bright light has a greater amplitude than a dim light does.

**3** **LIST:** What are the four properties of a light wave?



▲ Figure 19-7 Parts of a transverse wave

## ✓ CHECKING CONCEPTS

1. In a \_\_\_\_\_ wave, the particles of the medium move at right angles to the direction of the wave motion.
2. A light wave is a moving stream of \_\_\_\_\_.
3. The properties of light waves include speed, \_\_\_\_\_, frequency, and amplitude.
4. Light waves travel fastest in a \_\_\_\_\_.
5. Light waves do not need a \_\_\_\_\_ in which to travel.

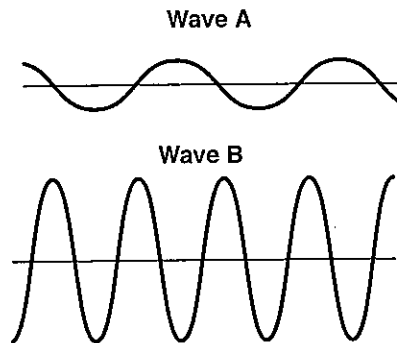
## 💡 THINKING CRITICALLY

6. **CLASSIFY:** Identify each of the following as a sound wave or a light wave.
  - a. longitudinal wave
  - b. does not travel through a vacuum
  - c. waves seem to be made up of particles
  - d. transverse waves
  - e. can travel in a vacuum

7. **RELATE:** Light waves with very high frequencies are called ultraviolet light. Ultraviolet light cannot be seen by the human eye. How is ultraviolet light similar to ultrasonic sound?

## INTERPRETING VISUALS

Look at Figure 19-8. Compare the two waves by discussing wavelength, frequency, amplitude, and speed.



▲ Figure 19-8 Compare the waves.



## Real-Life Science

### PHOTOGRAPHY

Photography is a popular activity that can teach you a lot about light. The word *photography* means "writing with light." To take a photograph, you need a camera, film, and a good source of light.

A camera has a lens and an opening for light to enter. This opening is called an aperture. When you take a picture, the aperture is open for only a short period of time. The light goes through the lens and onto the film. Film is very sensitive to light. Too much light will cause the photograph to be too bright, or overexposed. If there is not enough light, the photograph will be too dark, or underexposed. This is because the chemical on the film changes whenever a photon hits it.

Many schools have amateur photography clubs. Joining a photography club is a good way to learn more about taking photographs.

**Thinking Critically** How is film underexposed or overexposed?



▲ Figure 19-9 The varied light made parts of this photo brighter and darker.