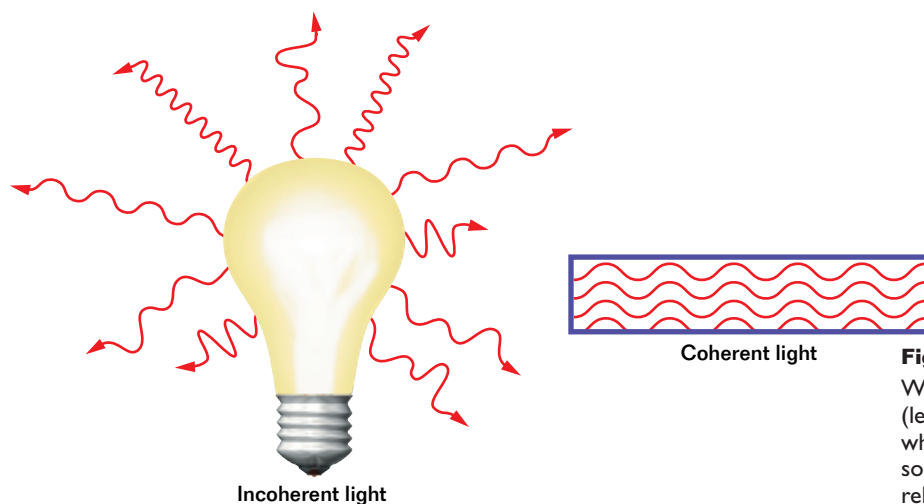


### LASERS AND COHERENCE

At this point, you are familiar with electromagnetic radiation that is produced by glowing, or *incandescent*, light sources. This includes light from light bulbs, candle flames, or the sun. You may have seen another form of light that is very different from the light produced by incandescent sources. The light produced by a **laser** has unique properties that make it very useful for many applications.

To understand how laser light is different from conventional light, consider the light produced by an incandescent light bulb, as shown in **Figure 23**. When electric charges move through the filament, electromagnetic waves are emitted in the form of visible light. In a typical light bulb, there are variations in the structure of the filament and in the way charges move through it. As a result, electromagnetic waves are emitted at different times from different parts of the filament. These waves have different intensities and move in different directions. The light also covers a wide range of the electromagnetic spectrum because it includes light of different wavelengths. Because so many different wavelengths exist, and because the light is changing almost constantly, the light produced is incoherent. That is, the component waves do not maintain a constant phase difference at all times. The wave fronts of incoherent light are like the wave fronts that result when rain falls on the surface of a pond. No two wave fronts are caused by the same event, and they therefore do not produce a stable interference pattern.



### SECTION OBJECTIVES

- Describe the properties of laser light.
- Explain how laser light has particular advantages in certain applications.

#### laser

*a device that produces coherent light at a single wavelength*

### Did you know?

The light from an ordinary electric lamp undergoes about 100 million ( $10^8$ ) random changes every second.

**Figure 23**

Waves from an incoherent light source (left) have changing phase relationships, while waves from a coherent light source (right) have constant phase relationships.