

Light

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CONCEPT 1

Light

- Identify electromagnetic waves that are commonly called light.
- Describe infrared light and its sources.
- Distinguish visible light from other wavelengths of light.
- Describe ultraviolet light, and explain why it is dangerous.



Slip! Slop! Slap! Did you ever hear this slogan? It stands for *slipslop* on some sunscreen, and *slap* on a hat. The slogan originated in Australia in the 1980s, but it has since been adopted in many other places around the globe. It sums up simple steps you can take to protect your skin from sunlight. Sunlight consists of a wide range of electromagnetic waves, some of which are harmful.

The Waves in Sunlight

Electromagnetic waves are waves that carry energy through matter or space as vibrating electric and magnetic fields. Electromagnetic waves have a wide range of wavelengths and frequencies. Sunlight contains the complete range of wavelengths of electromagnetic waves, which is called the electromagnetic spectrum. The **Figure 1.1** shows all the waves in the spectrum.

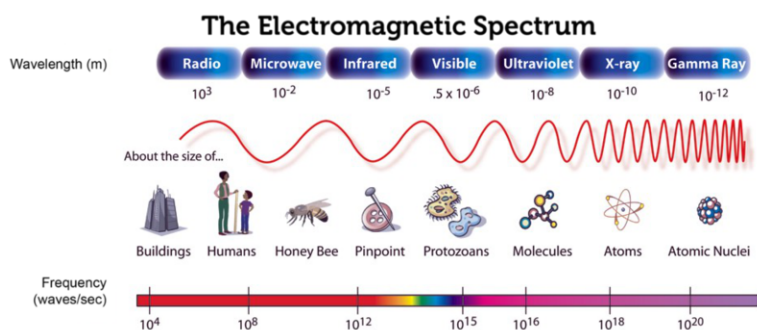


FIGURE 1.1

Let There Be Light

Light includes infrared light, visible light, and ultraviolet light. As you can see from the diagram above, light falls roughly in the middle of the electromagnetic spectrum. It has shorter wavelengths and higher frequencies than microwaves, but not as short and high as X rays.

Q: Which type of light do you think is harmful to the skin?

A: Waves of light with the highest frequencies have the most energy and are harmful to the skin. Use the electromagnetic spectrum above to find out which of the three types of light have the highest frequencies.

Infrared Light

Light with the longest wavelengths is called **infrared light**. The term *infrared* means “below red.” Infrared light is the range of light waves that have longer wavelengths and lower frequencies than red light in the visible range of light waves. The sun gives off infrared light as do flames and living things. You can’t see infrared light waves, but you can feel them as heat. But infrared cameras and night vision goggles can detect infrared light waves and convert them to visible images. For a deeper understanding of infrared light, watch the video at this URL: <http://www.youtube.com/watch?v=2-0q0XIQJ0>

Visible Light

The only light that people can see is called **visible light**. This light consists of a very narrow range of wavelengths that falls between infrared light and ultraviolet light (See **Figure 1.2**). Within the visible range, we see light of different wavelengths as different colors of light, from red light, which has the longest wavelength, to violet light, which has the shortest wavelength (see the spectrum below). When all of the wavelengths of visible light are combined, as they are in sunlight, visible light appears white. You can learn more about visible light at this URL: <http://www.youtube.com/watch?v=PMtC34pzKGc>

Ultraviolet Light

Light with wavelengths shorter than visible light is called **ultraviolet light**. The term ultraviolet means “above violet.” *Ultraviolet* light is the range of light waves that have shorter wavelengths and higher frequencies than violet light in the visible range of light. With higher frequencies than visible light, ultraviolet light has more energy. It can be used to kill bacteria in food and to sterilize surgical instruments. The human skin also makes vitamin D when it is exposed to ultraviolet light. Vitamin D, in turn, is needed for strong bones and teeth. You can learn more about ultraviolet light and its discovery at this URL: <http://www.youtube.com/watch?v=QW5zeVy8aE0&feature=related>

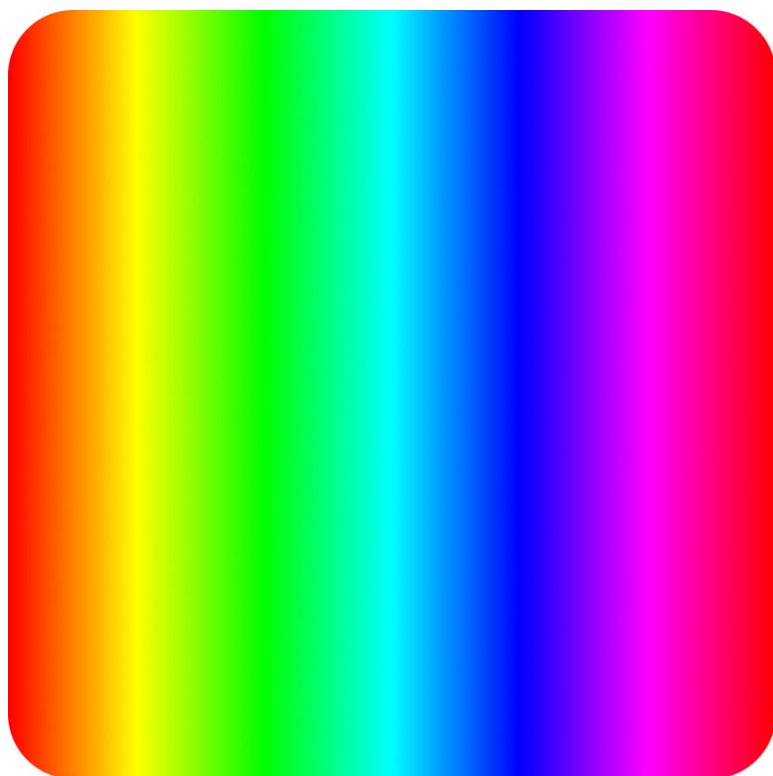


FIGURE 1.2

Too much exposure to ultraviolet light can cause sunburn and skin cancer. As the “slip, slop, slap” slogan suggests, you can protect your skin from ultraviolet light by wearing clothing that covers your skin, applying sunscreen to any exposed areas, and wearing a hat to protect your head from exposure. The SPF, or sun-protection factor, of sunscreen gives a rough idea of how long it protects the skin from sunburn (see **Figure 1.3**). A sunscreen with a higher SPF value protects the skin longer. Sunscreen must be applied liberally and often to be effective, and no sunscreen is completely waterproof. You can learn more about the dangers of ultraviolet light at this URL: <http://www.youtube.com/watch?v=np-BBJyl-go>

Q: You should apply sunscreen even on cloudy days. Can you explain why?

A: Ultraviolet light can travel through clouds, so it can harm unprotected skin even on cloudy days.

Summary

- Sunlight contains the complete range of wavelengths of electromagnetic waves. The entire range is called the electromagnetic spectrum.
- Electromagnetic waves that are commonly called light fall roughly in the middle of the electromagnetic spectrum. Light includes infrared light, visible light, and ultraviolet light.
- Infrared light is light with the longest wavelengths and lowest frequencies. You can't see infrared light, but you can feel it as heat. Besides the sun, flames and living things give off infrared light.
- Visible light consists of a very narrow range of wavelengths that falls between infrared light and ultraviolet light. It is the only light that people can see. Different wavelengths of visible light appear as different colors.
- Ultraviolet light has shorter wavelengths and higher frequencies than visible light. Ultraviolet light also has more energy, which makes it useful for killing germs. Too much exposure to ultraviolet light can damage the skin.



FIGURE 1.3

Vocabulary

- **infrared light:** Part of the electromagnetic spectrum in which waves have a wavelength between those of radio waves and visible light.
- **ultraviolet light:** Electromagnetic radiation with a wavelength falling between the wavelengths of visible light and X rays.
- **visible light:** Range of wavelengths of electromagnetic waves that the human eye can detect.

Practice

At the first URL below, find the UV index for your zip code. Then, at the second URL, learn what this value of the index means and what steps you should take to protect yourself from this level of UV radiation. <http://www.epa.gov/sunwise/uvindex.html> http://www.epa.gov/sunwise/kids/kids_uvindex.html

Review

1. Relate sunlight to the electromagnetic spectrum. Where do the waves that are commonly called light fall on the spectrum?
2. Define infrared light. How can infrared light be detected?
3. What is visible light? What determines the color of visible light?
4. Describe ultraviolet light. How and why should you protect your skin from ultraviolet light?