

Consider This 2.11**Analyzing a Rainbow**

Water droplets in a rainbow act as prisms to separate visible light into its colors.

- In Figure 2.6, which color has the longest wavelength? The highest frequency?
- Green light has a wavelength of 500 nm. Express this value in meters.

Answer

- 500×10^{-9} m. In scientific notation, this is 5×10^{-7} m.

The **electromagnetic spectrum** is a continuum of waves that ranges from short, high-energy X-rays and gamma rays to long, low-energy radio waves. Visible light is only a narrow band in this spectrum. The term **radiant energy** refers to the entire collection of different wavelengths, each with its own energy. Figure 2.7 shows the electromagnetic spectrum, the relative wavelengths (not drawn to scale), and some examples to help you develop perspective on the range of wavelengths represented.

In this chapter, we consider the **ultraviolet (UV)** region that lies adjacent to the violet end of the visible region of the electromagnetic spectrum, but at shorter wavelengths. At still shorter wavelengths are the X-rays used in medical diagnosis and the determination of crystal structures, and gamma rays that are given off in processes of nuclear decay. At wavelengths longer than those of red visible light lies the **infrared (IR)** region. We cannot see these wavelengths, but can feel their heating effect. The microwaves used in radar and to cook food quickly have wavelengths on the order of centimeters. At still longer wavelengths are the regions of the spectrum used to transmit your favorite AM and FM radio and television programs.

**Figure 2.6**

A rainbow of color.

We will consider the IR region of the spectrum in Chapter 3.

Your Turn 2.12**Relative Wavelengths**

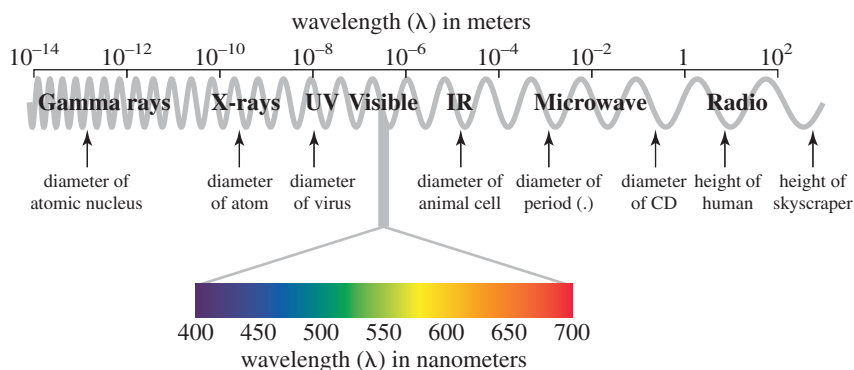
Consider these four types of radiant energy from the electromagnetic spectrum: infrared, microwave, ultraviolet, visible.

- Arrange them in order of *increasing* wavelength.
- Approximately how many times longer is a wavelength associated with a radio wave than one associated with an X-ray?

Hint: See Figure 2.7.

Answer

- ultraviolet < visible < infrared < microwave

**Figure 2.7**

The electromagnetic spectrum. The wavelength variation from gamma rays to radio waves is not drawn to scale.



Figures Alive! Visit the textbook's website to learn more about relationships in the electromagnetic spectrum.