Wavelength, Frequency, Energy
Practice Problems

Key

$\mathbf{c = \lambda\nu}$ $c = 3.00 \times 10^{8}$ m/sec

$\mathbf{E = h\nu}$ $h = 6.63 \times 10^{-34}$ J•sec

1. What is the wavelength of electromagnetic radiation if its frequencyis 3.2×10^{-2} Hz?

9.4×10^{9} m

2. A particular green color of visible light has a wavelength of 465 nm. (a) What is the wavelength in meters? (b) What is the frequency of the wave?

(a) 465×10^{-7} m (b) 6.45×10^{14} Hz

3. The numbers used to identify radio stations are the *frequencies* of the radio signal carrier waves. Two Kansas City radio stations are FM station Mix 93, with a carrier wave of 93.3 MHz and AM station 610 Sports Radio, with a carrier wave of 610 KHz. (a) What are the frequencies in Hz? (b) What are the wavelengths of these carrier waves?

(a) 93,300,000 Hz or 9.33×10^{7} (b) 3.21 m
610,000 Hz or 6.10×10^{5} 492 m

4. Gamma radiation produced in certain nuclear decay processes has a frequency of 2.50×10^{19} Hz. What is the energy carried by a photon of this radiation?

1.66×10^{-14} joule (J)

5. What the is frequency of a radio wave whose photons have an energy of 1.55×10^{-24} J?

2.34×10^{9} Hz

6. The MRI imagers used in medical diagnosis operate at a frequency of 400.0 MHz. (a) What is the wavelength of the waves? (b) What is the energy carried by a photon of the wave?

400.0 MHz = 4.000×10^{8} Hz

(a) 0.7500 m (b) 2.652×10^{-25} J

7. Barcode scanners use a red light with a wavelength of 633 nm. Determine the energy of a photon of this light.

633 nm = 6.33×10^{-7} m

Find frequency $\nu = 4.74 \times 10^{14}$ Hz $E = 3.14 \times 10^{-19}$ J

8. As we will learn, the electrons in atoms emit energy in the form of photons when they move from higher energy levels down to lower energy levels. In a certain atom, an electron releases a photon with an energy of 6.24×10^{-19} J. (a) Determine the wavelength of this light in nm. (b) In what region of the electromagnetic spectrum would this radiation be found?

(a) 319 nm (b) UV (ultraviolet)