6.2

a) 2450 MHz radiation has a frequency of 2450 million hertz (2450×10^6) or 2.450×10^9 Hz. This frequency corresponds with a wavelength of about 10^{-1} meters or 10 cm.

b) This radiation falls outside the visible spectrum and is not visible.

c)These longer wavelength photons have less energy than visible light

d) Given that 10^{-1} m radiation falls in the microwave region, it is probably a microwave oven.

6.3

a) For electromagnetic waves, energy is inversely proportion to wavelength. Since (a) has a shorter wavelength, it represents a higher energy wave. Notice that amplitude does not represent energy.

6.11 a) meters b) s^{-1} c) m/s

6.14

a) For radiant energy, frequency and wavelength are inversely related.
b) Radiation in the 210-230 nm range is ultraviolet.

6.15

a) True
b) False, ultraviolet light is shorter wavelength than visible light
c) False, as electromagnetic radiation, X-rays and microwaves both travel at the speed of light.
d) False, electromagnetic waves travel significantly faster than sound waves. This is my you always see lightning before you hear thunder.

6.16

a) False, the frequency of radiation decreases as the wavelength increases
b) True
c) False, infrared light has a lower frequency that visible light
d) False, a fog horn blast is not electromagnetic radiation. It is sound.

6.19a) $c = \lambda\nu$

3.0×10^{8} m/s = 10×10^{-6} m x ν

$\nu = 3 \times 10^{13}$ s^{-1}

b) $c = \lambda\nu$

3.0×10^{8} m/s = $\lambda \times 5.50 \times 10^{14}$ s^{-1}

$\lambda = 5.45 \times 10^{-7}$ m (545 nm)

c) 10μm radiation is not in the visible region. However, 5.50×10^{14} hertz radiation is visible.

d)

50.0μs	1 second	3×10^{8} meters
	1×10^{6} μs	1 second

1.50×10^{4} meters

6.21 $c = \lambda\nu$

3.0×10^{8} m/s = 650×10^{-9} m x ν

$\nu = 4.6 \times 10^{14}\ s^{-1}$

The color is red

6.23

If human height we quantized in 1 foot increments a growing child would instantaneously grow in 1 foot increments. As such, children would only be 1, 2, 3, 4, etc feet tall with no heights in between.

6.27a)

$c = \lambda\nu$

3.0×10^{8} m/s = 3.3×10^{-6} m x ν

$\nu = 9.1 \times 10^{13}\ s^{-1}$

$E = h\nu$

$E = 6.626 \times 10^{-34}$ j·s · $9.1 \times 10^{13}\ s^{-1}$

$E = 6.03 \times 10^{-20}$ joules

b) Infrared region

$c = \lambda\nu$

3.0×10^{8} m/s = 0.154×10^{-9} m x ν

$\nu = 1.95 \times 10^{18}\ s^{-1}$

$E = h\nu$

$E = 6.626 \times 10^{-34}$ j·s · $1.95 \times 10^{18}\ s^{-1}$

$E = 1.29 \times 10^{-15}$ joules

b) X-ray region

6.33a) $E = h\nu$

$E = 6.626 \times 10^{-34}\ j\cdot s \cdot 1.09 \times 10^{15}\ s^{-1}$

$E = 7.22 \times 10^{-19}$ joules

b) $c = \lambda\nu$

$3.0 \times 10^{8}\ m/s = \lambda \times 1.09 \times 10^{15}\ s^{-1}$

$\lambda = 2.75 \times 10^{-7}\ m\ (275\ nm)$

c) The energy of the 120 nm light is....

$c = \lambda\nu$

$3.0 \times 10^{8}\ m/s = 120 \times 10^{-9}\ m \times \nu$

$\nu = 2.50 \times 10^{15}\ s^{-1}$

$E = h\nu$

$E = 6.626 \times 10^{-34}\ j\cdot s \cdot 2.50 \times 10^{15}\ s^{-1}$

$E = 1.66 \times 10^{-18}$ joules

We established that 7.22×10^{-19} joules is necessary to excite this electron. Any additional energy added to the electron is converted to kinetic energy. As such, we can calculate the added kinetic energy.

$E_k = E_{120} - E_{min}$

$E_k = 1.66 \times 10^{-18}\ J - 7.22 \times 10^{-19}\ J$

$E_k = 9.38 \times 10^{-19}\ J$