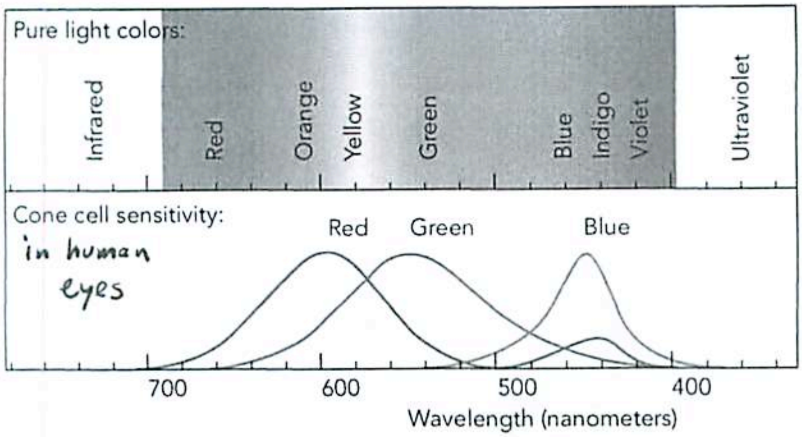


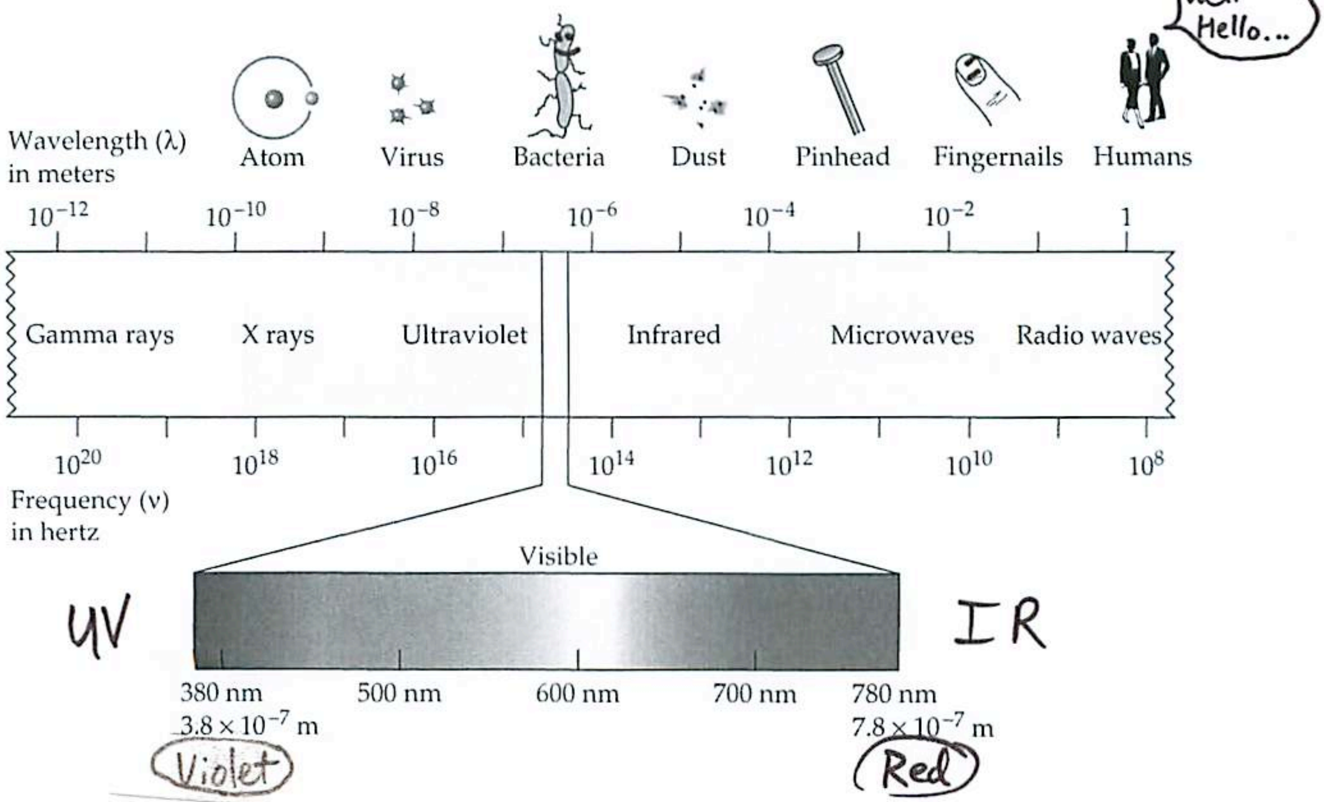
Name KEY

This is a reference HO and a worksheet! Keep this!

In book: Ch 13.3

Equations: $\Delta E = h\nu$

$c = \lambda\nu$



1. What type of electromagnetic radiation has a wavelength of: (use back of sheet for EM spectrum)

a) 5.0×10^{-4} m? IR b) 3.0×10^{-3} m Micro c) 1.0×10^{3} m radio

d) 2.4×10^{-8} m? UV e) 7.5×10^{-11} m gamma Which of the above is the most harmful to humans? gamma

2. An ultraviolet light wave is used to kill bacterial. It has a frequency of 1.2×10^{16} Hz. Find the wavelength in meters.

$c = \lambda \cdot \nu$ $\frac{c}{\nu} = \lambda$ $\frac{3.00 \times 10^{8}\ m/s}{1.2 \times 10^{16}\ 1/s} = \boxed{2.5 \times 10^{-8}\ m}$

3. An x-ray has a wavelength of 1.54×10^{-11} m. Find the frequency of this light in Hertz.

$c = \lambda \cdot \nu$ $\frac{c}{\lambda} = \nu$ $\frac{3.00 \times 10^{8}\ m/s}{1.54 \times 10^{-11}\ m} = \boxed{1.95 \times 10^{19}\ Hz}$

(+14)

4. A visible light wave has a frequency of 7.5×10^{-14} Hz. Find the wavelength in nanometers (nm) and determine the color of the light using the above chart.

$\lambda = \frac{c}{\nu} = \frac{3.00 \times 10^{8}\ m/s}{7.5 \times 10^{+14}\ 1/s} = 4.0 \times 10^{-7}\ m \left(\frac{10^{9}\ nm}{1\ m}\right) = $ **4.0×10^{2} nm violet**

5. a) The frequency of light used to heat food in a microwave oven is 2.45 GHz (2.45×10^{9} 1/s). What is the wavelength of this light in meters?

$2.45\ GHz \left(\frac{10^{9}\ Hz}{1\ GHz}\right) = 2.45 \times 10^{9}\ Hz$

$\frac{c}{\nu} = \lambda \qquad \lambda = \frac{3.00 \times 10^{8}\ m/s}{2.45 \times 10^{9}\ Hz} = $ **0.122 m**

long microwave!

b) Metal will absorb microwaves, protecting you from their harmful energy. You may have holes in the metal, as long as the holes are smaller than the wavelength of the microwave. If the metal screen in the above microwave has holes that are 0.50 mm thick, will the metal absorb the microwaves?

$0.122\ m \left(\frac{1000\ mm}{1\ m}\right) = 122\ mm$

wavelength larger than 0.50 mm so they will be blocked

6. Your favorite radio station 97.9, broadcasts at a wavelength of 3.06 meters. Find the frequency of this station in megahertz (MHz) and find out the energy in Joules of one photon from this radio station.

$\frac{c}{\lambda} = \nu \qquad \frac{3.00 \times 10^{8}\ m/s}{3.06\ m} = \nu$

$\nu = 9.80 \times 10^{7}\ Hz \left(\frac{1\ MHz}{10^{6}\ Hz}\right) = $ **98.0 MHz**

7) As you sit there, your body gives off radiation. Right now a photon with the energy of 2.4×10^{-21} Joules has left your face. Calculate the frequency and wavelength of this photon, then determine the type of radiation based on the chart.

$E = h\nu \qquad \frac{E}{h} = \nu$

$\frac{2.4 \times 10^{-21}\ J}{6.63 \times 10^{-34}\ J \cdot s} = 3.62 \times 10^{12}\ Hz$

$c = \lambda \cdot \nu \qquad \frac{c}{\nu} = \lambda$

$\frac{3.00 \times 10^{8}\ m/s}{3.62 \times 10^{12}\ Hz} = $ **8.29×10^{-5} m IR**

8) Even very high energy radiation such as gamma rays have seemingly low energy photons, since a photon is so incredibly small (massless!). Calculate the energy in joules of one photon from gamma radiation with a wavelength of 1.5 x 10^{-15} meters.

$\frac{c}{\lambda} = \nu \qquad \frac{3.0 \times 10^{8}\ m/s}{1.5 \times 10^{-15}\ m} = 2.0 \times 10^{23}\ Hz$

$E = h \cdot \nu$

$E = (6.63 \times 10^{-34}\ J \cdot s)(2.0 \times 10^{23}\ \frac{1}{s})$

$E_{photon} = 1.3 \times 10^{-10}\ J$