LESSON 115

CLASSWORK

Beyond What You See
Electromagnetic Radiation

Name _____

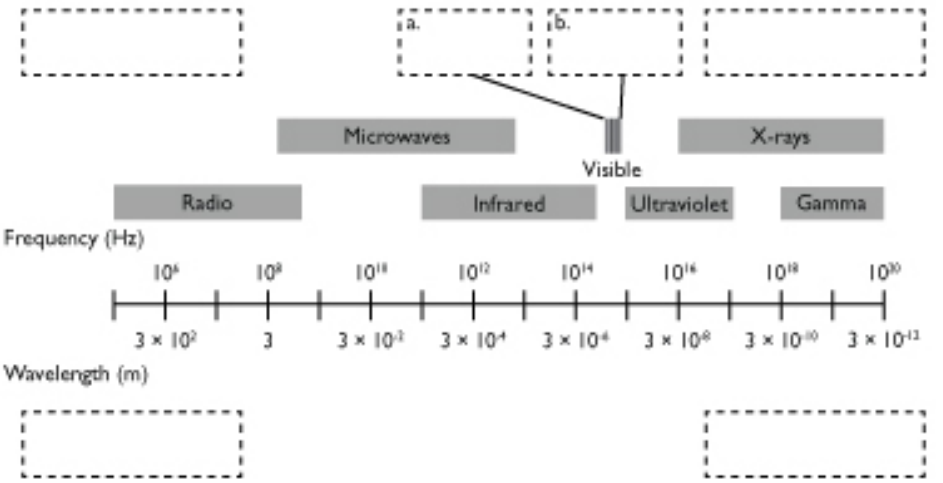
Date _____ Period _____

Purpose

To explore light of wavelengths and frequencies that humans cannot see.

Part 1: Iron Lung

The light that we see is part of a larger collection of waves called *electromagnetic radiation.* The wavelength, frequency, and energy of electromagnetic radiation vary widely, but these waves all travel with the same speed.

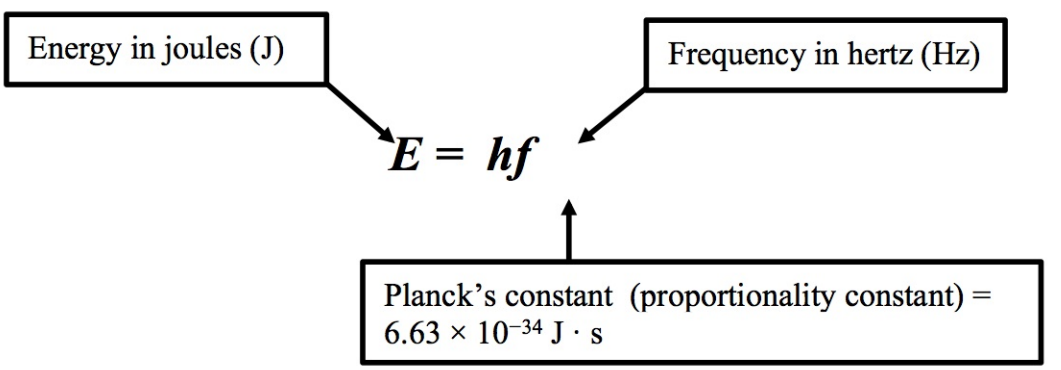


1. In the empty boxes on the left and right of the diagram above, label the radiation with the highest frequency, lowest frequency, longest wavelength, and shortest wavelength.

2. Visible radiation (the rainbow) is spread between the boxes labeled (a) and (b). In the boxes provided, indicate the color you would see nearest to (a) and nearest to (b).

Part 2: Light Energy

The diagram above shows waves that represent red, yellow, green, and purple light. The distance between peaks is called the wavelength, λ (pronounced lambda). The number of waves that pass by per second is called the frequency, *f*.



1. Fill in the missing blanks in the table.

Type of radiation	Wavelength, λ (m)	Frequency, *f* (Hz)	Planck's constant, *h* (J · s)	Energy, *E* (J)
Gamma rays	3×10^{-12} m	10^{20} Hz	6.63×10^{-34} J · s	6.63×10^{-14} J
X-rays		10^{18} Hz		6.63×10^{-16} J
Ultraviolet	3×10^{-8} m	10^{16} Hz	6.63×10^{-34} J · s	
Visible	6×10^{-7} m	5×10^{14} Hz	6.63×10^{-34} J · s	
Infrared	3×10^{-5} m		6.63×10^{-34} J · s	6.63×10^{-21} J
Microwaves		10^{10} Hz		6.63×10^{-24} J
Radio waves	3×10^{3} m		6.63×10^{-34} J · s	6.63×10^{-29} J

2. Which type of radiation is considered the most harmful because it has the highest energy?

3. Which type of radiation is considered the least harmful because it has the lowest energy?

4. There are two equations that describe electromagnetic radiation.

$$\lambda \times f = c$$

$$E = h \times f$$

Write an equation that relates the energy to the wavelength associated with that type of radiation. Hint: Determine the two variables that both equations above have in common. Solve for that variable in one equation, and substitute it into the other.

5. Describe in your own words how the frequency of an electromagnetic wave is related to the energy associated with the wave.

6. Describe in your own words how the wavelength of electromagnetic radiation is related to the energy of the wave.

7. Making Sense Describe in your own words how all types of electromagnetic radiation are similar and how they are different.