LESSON 114

ACTIVITY

Now You See Light Waves

Name _____

Date _____ Period _____

Purpose

To explore the wave model of light.

Materials

- piece of rope
- colored pencils (red, orange, yellow, green, blue, violet/purple)

Part I: Creating Waves

Stretch a rope out on the ground between two students. One student should hold each end of the rope. Have one student hold one end of the rope still while the other student moves the other end of the rope from side to side on the floor.

1. Have one student make a quick, single, back-and-forth motion while the other holds the end of the rope still. Sketch what you observe.

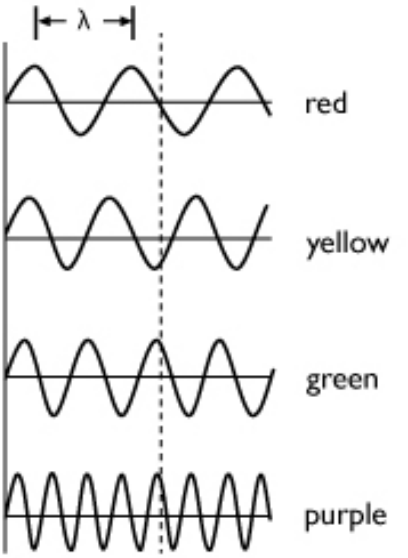
2. Have one student move the end of the rope back and forth continuously but slowly while the other holds the end of the rope still. Sketch what you observe.

3. Have one student move the end of the rope back and forth continuously with rapid motion. Sketch what you observe.

4. Describe how the motion of the rope depends on the speed of your hand motion.

Part 2: Light Waves

The diagram 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*.



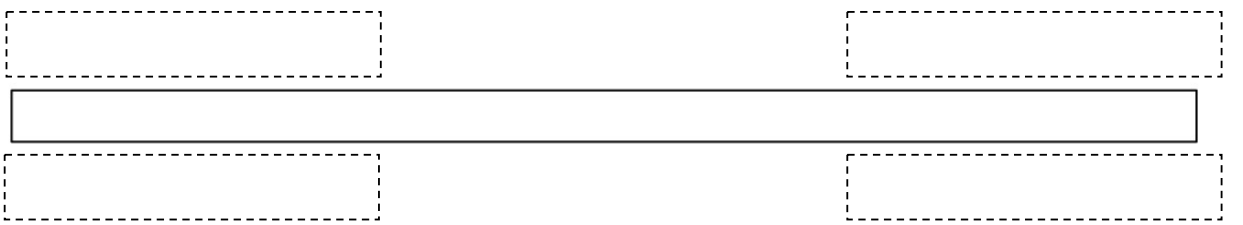
1. The wavelength for red light is labeled. Label the wavelength for the yellow, green, and purple waves.

2. What happens to the wavelength as the color of the light changes from red to yellow to green to purple?

3. Imagine that you observe the waves traveling past the dashed line. If the waves are all traveling at the same speed, for which color do you observe the most waves per second?

4. What happens to the frequency as the color of the light changes from red to yellow to green to purple?

5. The colors in rainbows are always in the same color sequence: red, orange, yellow, green, blue, violet (ROYGBV). Starting with red on the left, use colored pencils to color in this sequence of colors in the middle bar. Try to blend the colors in between the six that you have.



6. Which color has the higher frequency: orange light or blue light?

7. In the boxes above the rainbow, indicate which region of the rainbow has light with the lowest frequency and highest frequency.

8. In the boxes below the rainbow, indicate which region of the rainbow has light with the longest wavelength and shortest wavelength.

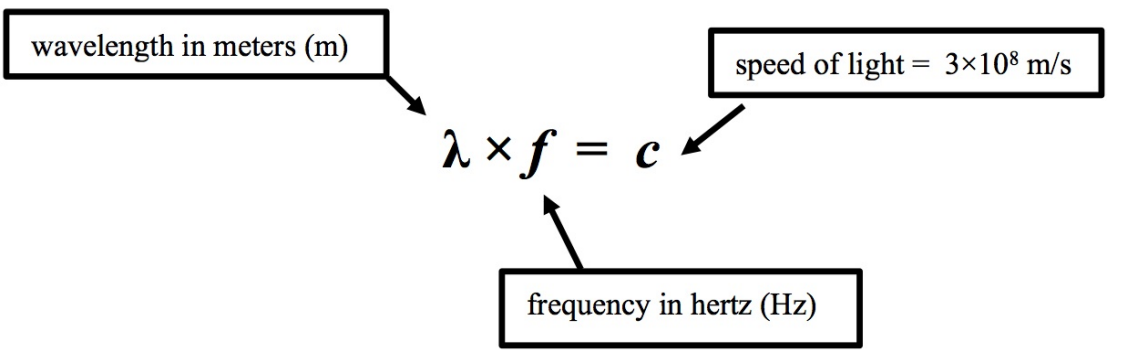
9. What happens to the wavelength as the frequency increases?

10. What happens to the wavelength as the frequency decreases?

11. The relationship between variables of wavelength and frequency that describe light are inversely proportional. Explain what that means in your own words.

Part 3: Wavelength, Frequency, and Speed of Light Waves

The relationship between the wavelength, λ and the frequency, f of light is shown here.



1. Fill in the missing blanks in the table.

Color of light	Wavelength, λ (m)	Frequency, f (Hz)	Speed, c (m/s)
red	7.2×10^{-7} m	4.2×10^{14} Hz	3×10^{8} m/s
orange		5.0×10^{14} Hz	3×10^{8} m/s
yellow	5.8×10^{-7} m	5.2×10^{14} Hz	
green	5.3×10^{-7} m	5.7×10^{14} Hz	
blue	4.7×10^{-7} m		3×10^{8} m/s
violet	4.2×10^{-7} m		3×10^{8} m/s

2. Based on the data and the equation, what can you conclude about the speed of different colors of visible light?

3. **Making Sense** Describe the differences between red and green light in terms of wavelength, frequency, and speed.