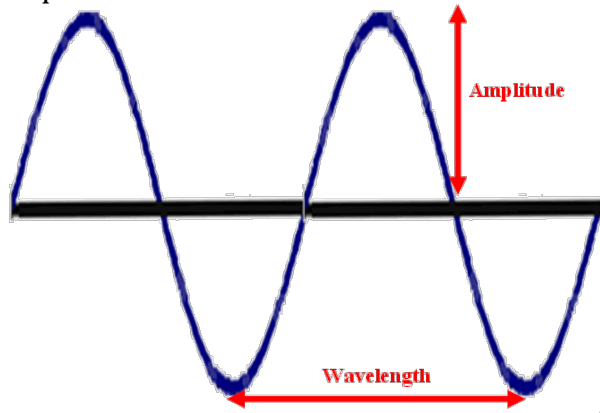


**Part A: Definitions and Concepts**

4 quantities that matter in a wave:

**Wavelength**

The distance between two crests of a wave.

**Amplitude**

The distance between the middle of a wave and the top of the wave

**Frequency**

How many times a light wave oscillates in a second.

**Energy**

The amount of energy in one tiny piece of light (called a photon).

**Speed**

How fast a wave moves

(distance / time)

For light = 300,000,000 m/s

**Important Parts of a Light Wave****The intensity (brightness) of light**

-amplitude

**The color of light:**

- frequency

-wavelength

**Always the same in light:**

- speed

**A.1** What part of a light wave creates the *brightness* of the light?

**A.2** What two parts of a light wave creates the *color* of the light?

**A.3** What part of a light wave is always the same?

**Electromagnetic vs. Mechanical**

Two different types of waves are *electromagnetic* and *mechanical*

An electromagnetic wave is made of electric and magnetic energy.

A mechanical wave is made of oscillating particles.

A light wave is always *electromagnetic*.

**Transverse vs. Longitudinal**

Two different types of waves are *transverse* and *longitudinal*.

A transverse wave involves oscillation perpendicular to the direction of the wave.

A longitudinal wave involves oscillation parallel to the direction of the wave.

A light wave is always *transverse*.

**Photons**

Light waves come in tiny pieces called *photons*.

**A.4** Is a light wave electromagnetic or mechanical?

**A.5** Is a light wave transverse or longitudinal?

**A.6** A light wave is:

- A. electromagnetic and transverse
- B. electromagnetic and longitudinal
- C. mechanical and transverse
- D. mechanical and longitudinal

**A.7** What is a tiny piece of a light wave called?

**Part B: Wavelength, Frequency, and Energy in Color****Frequency and Wavelength:**

Whenever frequency is HIGHER wavelength is SHORTER.

Whenever frequency is LOWER wavelength is LONGER.

What happens to wavelength when frequency becomes HIGHER?

What happens to wavelength when frequency becomes LOWER?

What happens to frequency when wavelength becomes LONGER?

What happens to frequency when wavelength becomes SHORTER?

**Frequency, Wavelength, and Energy**

Whenever frequency is HIGHER, energy is also HIGHER, but wavelength is SHORTER.

Whenever frequency is LOWER, energy is also LOWER, but wavelength is LONGER.

What happens to energy when frequency becomes HIGHER?

What happens to energy when frequency becomes LOWER?

What happens to energy when wavelength becomes LONGER?

What happens to energy when wavelength becomes SHORTER?

We focus on 6 colors in physics class.

We remember the six colors, in order, with the device "ROY G. BV"

The six colors are Red Orange Yellow Green Blue Violet

We need to remember them *in that order*.

Color			
Red	Lowest Energy	Lowest Frequency	Longest Wavelength
Orange			
Yellow			
Green			
Blue			
Violet	Highest Energy	Highest Frequency	Shortest Wavelength

A couple notes:

- we don't mention indigo because it is so similar to blue and violet
- it's important to say 'violet' and not purple, because that's what the light wave of that frequency is called.

Which has a <i>higher frequency</i> : Red or Green	Which has a <i>lower frequency</i> : Blue or Green
Which has a <i>shorter wavelength</i> : Orange or Blue	Which has a <i>longer wavelength</i> : Green or Violet
Which has a <i>higher energy</i> : Green or Blue	Which has a <i>lower energy</i> : Red or Orange

Write a sentence comparing violet and red.

Violet has a \_\_\_\_\_ frequency and a \_\_\_\_\_ energy than red, but violet has a \_\_\_\_\_ wavelength than red.

Write a sentence comparing blue and yellow.

Blue has a \_\_\_\_\_ frequency and a \_\_\_\_\_ energy than yellow, but blue has a \_\_\_\_\_ wavelength than yellow.

Write a sentence comparing violet and blue.

Violet has a \_\_\_\_\_ frequency and a \_\_\_\_\_ energy than blue, but violet has a \_\_\_\_\_ wavelength than blue.

Using the model above, write a sentence comparing green and orange.

Write a sentence comparing red and blue.

Write a sentence comparing orange and yellow.

## Part 3: Wavelength and Frequency in Other Electromagnetic Waves

Type of Wave			
Radio waves	Lowest Energy	Lowest Frequency	Longest Wavelength
Microwave			
Infrared			
Visible Light			
Ultraviolet			
X-Ray	Highest Energy	Highest Frequency	Shortest Wavelength
Gamma Ray			

Which has a <i>higher frequency</i> : Radio or X-Ray	Which has a <i>lower frequency</i> : Ultraviolet or Radio
Which has a <i>shorter wavelength</i> : Microwave or Visible Light	Which has a <i>longer wavelength</i> : Infrared or Gamma Ray
Which has a <i>higher energy</i> : Visible Light or Infrared	Which has a <i>lower energy</i> : Visible Light or Gamma Ray

Write a sentence comparing microwave and visible light.

Microwave has a \_\_\_\_\_ frequency and a \_\_\_\_\_ energy than visible light, but microwave has a \_\_\_\_\_ wavelength than visible light.

Write a sentence comparing radio and ultraviolet.

Radio waves have a \_\_\_\_\_ frequency and a \_\_\_\_\_ energy than ultraviolet, but radio has a \_\_\_\_\_ wavelength than ultraviolet.

Write a sentence comparing X-Ray and gamma ray.

X-rays have a \_\_\_\_\_ frequency and a \_\_\_\_\_ energy than gamma rays, but X-rays have a \_\_\_\_\_ wavelength than gamma rays.

Using the model above, write a sentence comparing microwaves and radio waves.

Write a sentence comparing visible light and ultraviolet.

Write a sentence comparing infrared and X-rays.

## Part 4: The Full Electromagnetic Spectrum

The Electromagnetic Spectrum

	<b>Type of Wave</b>			
	Radio	Lowest Energy	Lowest Frequency	Longest Wavelength
	Microwave			
	Infrared			
VISIBLE LIGHT	Red			
	Orange			
	Yellow			
	Green			
	Blue			
	Violet			
	Ultraviolet	Highest Energy	Highest Frequency	Shortest Wavelength
	X-Ray			
	Gamma Ray			

“The electromagnetic spectrum” includes the six types of electromagnetic waves you cannot see, plus all of the six colors, which are located in the section entitled “visible light.” Red, orange, yellow, green, blue, and violet are the ‘visible light’ waves. Radio, microwave, infrared, ultraviolet, X-ray, and gamma ray are the ‘invisible light’ waves.

Write a sentence comparing green light with infrared light. Compare the *frequency*, *wavelength*, and *energy* of these types of light.

Write a sentence comparing X-rays with blue light.

Write a sentence comparing radio waves and orange light

Despite all the differences in wavelength, frequency, and energy, what is the same for all types of electromagnetic wave?