KIPP Nashville	AmplifyScience

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KIPP/2024/____________________

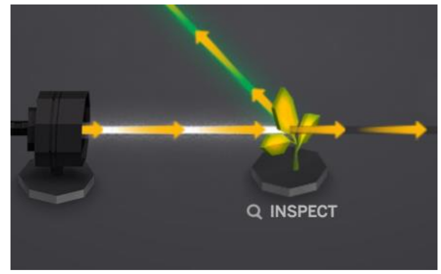
Remote Learning Packet
Assignment #4

Review of Light Waves

Directions: Try the first 3 problems to help you remember the concepts from our third unit.

____Green light____________

The following picture shows a plant and a light source. Using the words reflect and absorb, describe what you think the graphic is showing.



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Ms. Synder was working on a craft outside. She spilled a bottle of liquid glue on the pavement in the sun. Over time, the glue dried. This is because:

a. The glue reflected the energy from the light
b. The glue absorbed the energy from the light
c. The light was too strong for the glue
d. The sun removed energy from the glue

I chose ________ because

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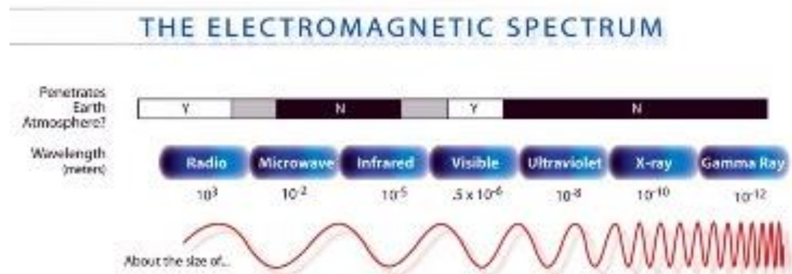
Mr. Rayner leaves a shirt outside in the sun. A few hours later, he notices that the shirt changed- the color got lighter! Why did the shirt change color?

Directions: Read and **Annotate** the following text to help you to review Light Waves.

Light Waves

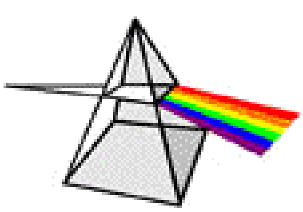


Electromagnetic waves are all light waves that are capable of traveling through a vacuum where there is no matter. Unlike sound waves that require a medium (matter) in order to transport their energy (a type of mechanical wave), electromagnetic waves are capable of transporting energy through the vacuum of space! Electromagnetic waves are produced by a vibrating electric charge and as such, they consist of both an electric and a magnetic component.

Electromagnetic waves exist with an enormous range of frequencies. This continuous range of frequencies is known as the electromagnetic spectrum. The frequency of a wave is directly related to the amount of energy the wave is carrying because the more crests that pass by a given point, the more energy that wave is going to be able to transmit. The entire range of the spectrum is often broken into specific regions. The longer wavelength, lower frequency regions are located on the far left of the spectrum, and carry the least amount of energy. The shorter wavelength, higher frequency regions are on the far right, and carry the most amount of energy.

Visible Light Spectrum

Today we will focus on the visible light region - the very narrow band of wavelengths located to the right of the infrared region and to the left of the ultraviolet region. Though electromagnetic waves exist in a vast range of wavelengths, our eyes are sensitive to only a very narrow band. Since this narrow band of wavelengths is the means by which humans see, we refer to it as the visible light spectrum. Normally when we use the term "light," we are referring to a type of electromagnetic wave that stimulates the retina of our eyes. This visible light region consists of a spectrum of wavelengths that range from approximately 700 nanometers (abbreviated nm) to approximately 400 nm and is affectionately known as ROYGBIV.



Each individual wavelength within the spectrum of visible light wavelengths is representative of a particular color. That is, when light of that particular wavelength strikes the retina of our eye, we perceive that specific color sensation. Isaac Newton showed that light shining through a prism will be separated into its different wavelengths and will thus show the various colors that visible light is made of. Each color is characteristic of a distinct wavelength; and different wavelengths of light waves will bend varying amounts upon passage through a prism.

The separation of visible light produces the colors red (R), orange (O), yellow (Y), green (G), blue (B), and violet (V). The red wavelengths of light are the longer wavelengths and the violet wavelengths of light are the shorter wavelengths. Between red and violet, there is a continuous range or spectrum of wavelengths. The visible light spectrum is shown in the diagram to the right.

When all the wavelengths of the visible light spectrum strike your eye at the same time, the color white is perceived. The sensation of white is not the result of a single color of light but rather a mixture of all the wavelengths of light. Thus, visible light - the mix of ROYGBIV - is sometimes referred to as white light.

What is happening then when we only see black? For instance if you are deep inside a cave and you turn out your flashlight. Well, if all the wavelengths of the visible light spectrum give the appearance of white, then none of the wavelengths would lead to the appearance of black. Black is the absence of the wavelengths of the visible light spectrum. So when you are in a room with no lights and everything around you appears black, it means that there are no wavelengths of visible light striking your eye as you sight at the surroundings.

Post Reading Questions:

1. A light wave is an electromagnetic wave that has both an electric and magnetic component associated with it. Electromagnetic waves are often compared and contrasted to mechanical waves, like sound. The difference is that electromagnetic waves ______.

   a. can travel through materials and mechanical waves cannot
   b. come in a range of frequencies and mechanical waves exist with only certain frequencies
   c. can travel through a region void of matter and mechanical waves cannot
   d. electromagnetic waves cannot transport energy and mechanical waves can transport energy
   e. electromagnetic waves have an infinite speed and mechanical waves have a finite speed

2. As you move from radio waves to gamma rays, what happens to the size of the wavelengths?

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3. As you move from radio waves to gamma rays on the spectrum, what happens to the frequency of the waves? What does this tell us about the amount of energy that the light is carrying?

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4. What is "light"?

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5. What is white light? What color or wavelength is your eye seeing?

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6. What wavelengths of color are you actually seeing when you see black?

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Independent Practice Problems

1. If a new substance absorbs UV light and gamma rays, can that substance change? If so, how?
    a. Yes, the substance can become warm.
    b. Yes, the substance can change color.
    c. No, the substance cannot be changed by the light
    d. Both a and b.

Explain your answer.

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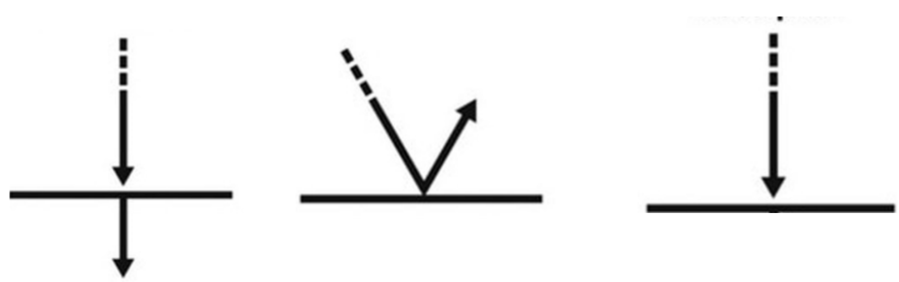
2. Label each image below as reflection, absorption, or transmission.



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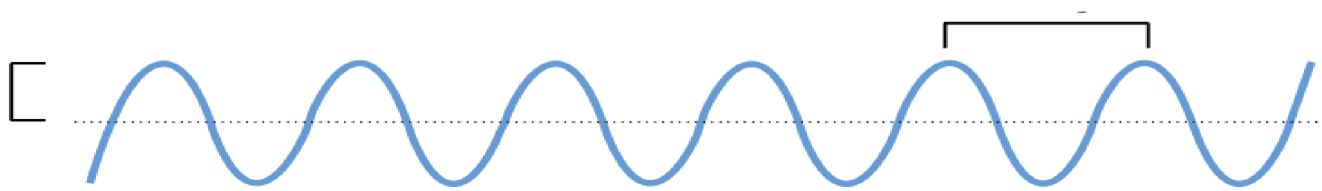
3. Mario experimented with two different light sources. One source caused glass to heat up while the other source did not cause any change to the glass. Which statement is true about the two light sources?

    a. The light sources have different amplitudes

b. The light sources have different wavelengths
c. The light sources are the same type of light
d. One light source was stronger than the other

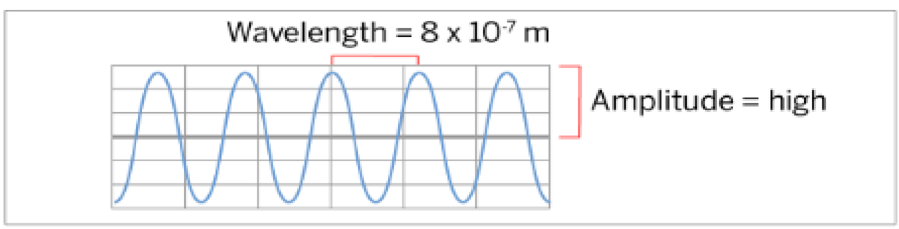
4. Label the parts of the wave below.

Crest	Trough	Amplitude	Wavelength

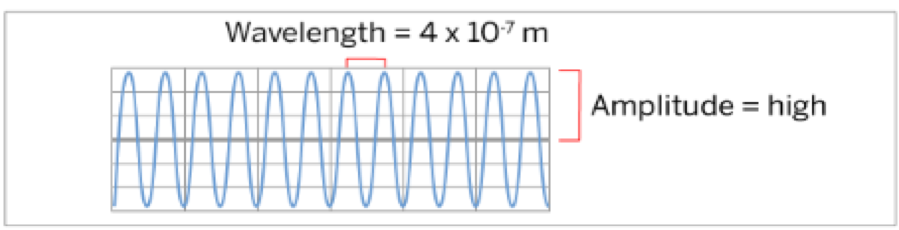


5. Ellie looks at 3 different readings for 3 lasers. Based on your observations of the properties of the waves, are any of the waves the same type of light? Are any of the waves a different type of light?

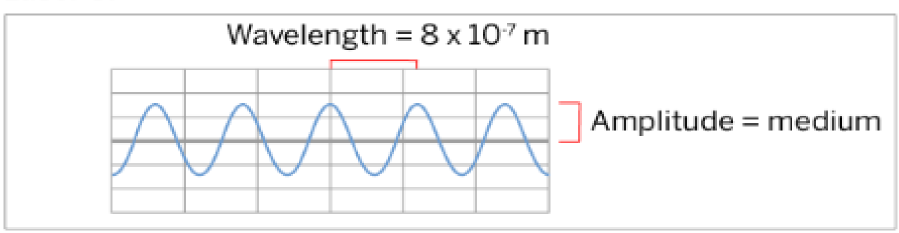
Laser 1:



Laser 2:

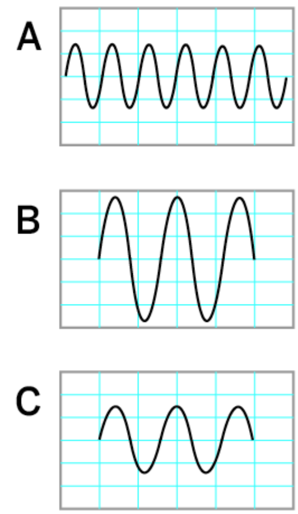


Laser 3:



a. Yes. Laser 2 could be giving off a different type of light because Laser 2 has a different wavelength than Lasers 1 and 3.
b. Yes. Laser 3 could be giving off a different type of light because Laser 3 has a different amplitude than Lasers 1 and 2.
c. Yes. All three lasers must be giving off different types of light because every light source gives off its own type of light.
d. No. All three lasers must be giving off the same type of light because all three are lasers, and the same kind of light source gives off the same type of light.

6. Which wave has the highest amount of energy (A, B, or C)? Explain how you know.



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