

## Electromagnetic Radiation

What are we looking at when we look at objects? When you look at a basketball, what are you seeing? You're seeing a collection of colors, lines, textures, and shapes. There are many ways to think about how we perceive the information our eyes take in from the outside world. Science tells us that light is the reason we are able to see objects. Without light, we wouldn't be able to process the visible world. And the light that allows us to see isn't just the stuff that comes from light bulbs in our homes and schools.

Light is a form of electromagnetic radiation made of electromagnetic waves. Electromagnetic radiation is a stream of photons that travels in a wave-like pattern, carrying energy, and moving at the speed of light. The electromagnetic spectrum is the range of all types of electromagnetic radiation, including visible light, infrared light, ultraviolet light, X-rays, and gamma rays. Our eyes are capable of seeing only a small portion of the electromagnetic spectrum. So there are plenty of waves being expressed by the physical world that we simply don't get to see.

On the electromagnetic spectrum, you will see that there are all different types and intensities of waves. The electromagnetic spectrum is organized in order of wavelength. There are different types of light, each with a different length of wave. Some of these waves are scrunched together, like a closed slinky. Other waves are stretched far apart, like a slinky that is stretched between opposite ends of a room.

The portion of the spectrum that our eyes are sensitive to—called visible light—is smack dab in the middle of the spectrum. The spectrum's far ends include electromagnetic radiation with scrunched together waves—gamma rays and X-rays—and stretched out waves, such as radio waves and microwaves. If our eyes were capable of seeing every type of wave on the electromagnetic spectrum, a commonplace sight like your school cafeteria would look completely chaotic! You would see microwaves, radio waves—different types of electromagnetic energy—bouncing off practically every surface. And that's just within the known spectrum. Scientists imagine that the spectrum goes on forever, with infinite types of waves. There even may be some waves we cannot sense at all.

The waves emitted by our physical world make it possible for us to communicate over vast distances, see objects in the dark that are deep beneath the surface of the earth and sea, and even look deep into outer space. By studying electromagnetic waves and creating tools that help us gain access to a wider portion of the electromagnetic spectrum, humankind has given itself unique powers for collecting information about our world. We can think of the waves as a kind of ongoing message being sent out by the universe, one to which we have only limited natural access.

Many of the tools mankind has invented over time to harness the information contained within electromagnetic radiation are present in your home or school every day, including televisions and radios. Other tools like night-vision goggles are also examples of technology that gives us superhuman access to wave frequencies further toward the ends of the known spectrum.

Even without special tools and machines, however, our eyes' sensitivity to light makes it possible for us to see beautiful things—that bouncing basketball; a tall, vivid rainbow after a storm; the faces of our friends and families. If it weren't for the way our eyes and brain are able to create comprehensible images from waves of visible light, it would be very difficult for us to understand the messages emitted by our physical universe.

1. What allows people to see objects?

- A radio waves
- B glass
- C x-rays
- D light

**2.** We can think of electromagnetic waves as a kind of ongoing message being sent out by the universe. Humans are able to naturally access only a portion of this message. What information from the passage best supports this statement?

- A** Mankind has invented tools to harness the information contained within electromagnetic radiation.
- B** The waves emitted by our physical world make it possible for us to communicate over vast distances.
- C** Without light, we wouldn't be able to process the visible world.
- D** The human eye is only sensitive to a portion of the electromagnetic spectrum.

**3.** Based on the passage, what can be concluded about the ability of humans to see X-rays and gamma rays?

- A** Humans cannot see X-rays and gamma rays.
- B** Humans can see X-rays and gamma rays.
- C** Humans can see X-rays but not gamma rays.
- D** Humans can see gamma rays but not X-rays.

**4.** What is the passage mainly about?

- A** why waves have different wavelengths
- B** electromagnetic waves and how humans utilize them
- C** different tools humans have invented to harness information
- D** gamma rays and x-rays

**5.** Read the following sentence: "When you look at a basketball, what are you seeing?" Why

might the author have started the passage with this question?

- A** because the main idea of the passage is about basketball
- B** to show how important the color orange is to electromagnetic waves
- C** because the author wants to use the example of basketball to explain electromagnetic radiation
- D** to give the reader an object to visualize before examining the role of light

**6.** What is electromagnetic radiation?

**7.** According to the passage, what are televisions, radios, and night-vision goggles all examples of?

**8.** Why might humans want to gain access to a wider portion of the electromagnetic spectrum? Use information from the passage to support your answer.

**9.** What would happen if someone were to have an accident of some sort and gain the ability to see the entire spectrum? Create a superhero or villain who has these powers, and briefly discuss their origin story (how did they get the power, how did they train themselves to use their power, what were some challenges in using their power, what is their purpose now that they have the power, tell of one story in which they were able to use their power to defeat another person)