

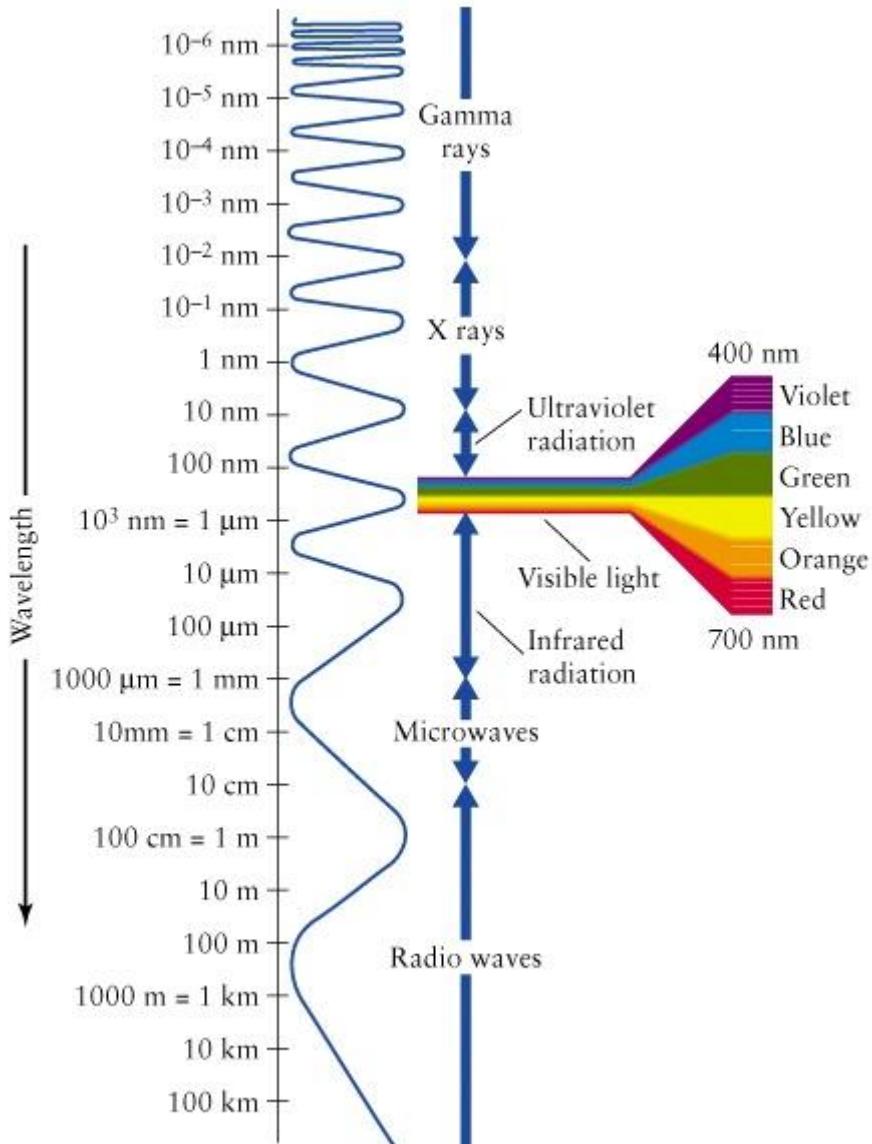
What Wavelength Goes With a Color?



Our eyes are sensitive to light which lies in a very small region of the electromagnetic spectrum labeled "visible light". This "visible light" corresponds to a wavelength range of 400 - 700 nanometers (nm) and a color range of violet through red. The human eye is not capable of "seeing" radiation with wavelengths outside the visible spectrum. The visible colors from shortest to longest wavelength are: violet, blue, green, yellow, orange, and red.

Ultraviolet radiation has a shorter wavelength than the visible violet light. Infrared radiation has a longer wavelength than visible red light. The white light is a mixture of the colors of the visible spectrum. Black is a total absence of light.

Earth's most important energy source is the Sun. Sunlight consists of the entire electromagnetic spectrum.



(Wavelength image from *Universe* by Freedman and Kaufmann.)

What is Color?

The color of a star is related to the color of light that it gives off. Light is a wave - a cycling motion that travels through empty space. When a star emits a light wave, the wave can travel across empty space to the Earth, where we see the star's light.

Light waves, like waves in water, can be described by the distance between two successive peaks of the wave - a length known as the wavelength. Different wavelengths of light appear to our eyes as different colors. Shorter wavelengths appear blue or violet, and longer wavelengths appear red.

Violet Light

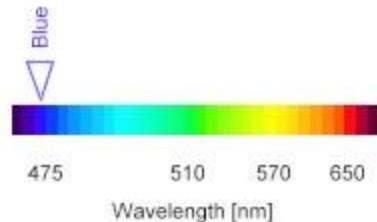
The visible violet light has a wavelength of about 400 nm. Within the visible wavelength spectrum, violet and blue wavelengths are scattered more efficiently than other wavelengths. The sky looks blue, not violet, because our eyes are more sensitive to blue light (the sun also emits more energy as blue light than as violet).

Indigo Light

The visible indigo light has a wavelength of about 445 nm.

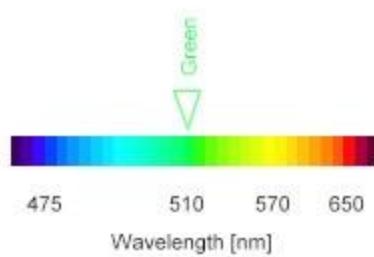
Blue Light

The visible blue light has a wavelength of about 475 nm. Because the blue wavelengths are shorter in the visible spectrum, they are scattered more efficiently by the molecules in the atmosphere. This causes the sky to appear blue.



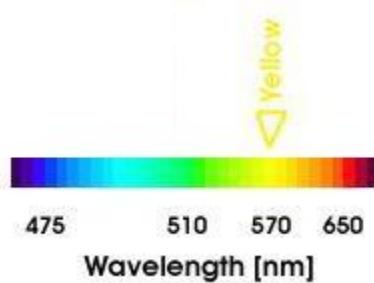
Green Light

The visible green light has a wavelength of about 510 nm. Grass, for example, appears green because all of the colors in the visible part of the spectrum are absorbed into the leaves of the grass except green. Green is reflected, therefore grass appears green.



Yellow Light

The visible yellow light has a wavelength of about 570 nm. Low-pressure sodium lamps, like those used in some parking lots, emit a yellow (wavelength 589 nm) light.

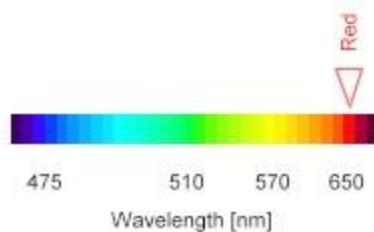


Orange Light

The visible orange light has a wavelength of about 590 nm.

Red Light

The visible red light has a wavelength of about 650 nm. At sunrise and sunset, red or orange colors are present because the wavelengths associated with these colors are less efficiently scattered by the atmosphere than the shorter wavelength colors (e.g., blue and purple). A large amount of blue and violet light has been removed as a result of scattering and the longwave colors, such as red and orange, are more readily seen.



Colors We Can't See

There are many wavelengths in the electromagnetic spectrum the human eye cannot detect.

Energy with wavelengths too short for humans to see

Energy with wavelengths too short to see is "bluer than blue". Light with such short wavelengths is called "Ultraviolet" light.

How do we know this light exists? One way is that this kind of light causes sunburns. Our skin is sensitive to this kind of light. If we stay out in this light without sunblock protection, our skin absorbs this energy. After the energy is absorbed, it can make our skin change color ("tan") or it can break down the cells and cause other damage.

Energy with wavelengths too long for humans to see

Energy whose wavelength is too long to see is "redder than red". Light with such long wavelengths is called "Infrared" light. The term "Infra-" means "lower than".

How do we know this kind of light exists? One way is that we can feel energy with these wavelengths such as when we sit in front of a campfire or when we get close to a stove burner.

Scientists like Samuel Pierpont Langley passed light through a prism and discovered that the infrared light the scientists could not see beyond red could make other things hot.

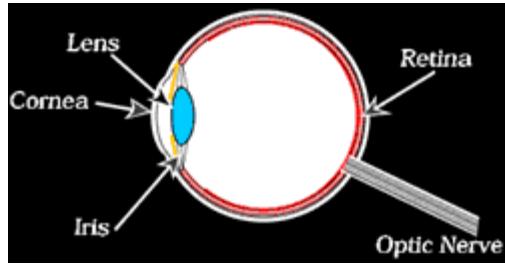
Very long wavelengths of infrared light radiate heat to outer space. This radiation is important to the Earth's energy budget. If this energy did not escape to space, the solar energy that the Earth absorbs would continue to heat the Earth.

Inside Your Eyeball



This is your eye. It's a ball with a hole in front. The hole is called your **pupil**.

Light comes through the pupil and splashes inside your eye on the **retina**. **Optic nerves** carry information about the light to your brain.

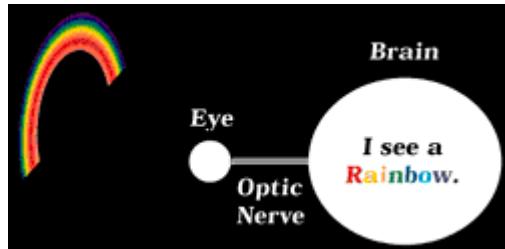


Next, find out what happens to light when it hits your retina.

How We See



Light goes through your pupil and splashes on the rods and cones of your retina. There, the light causes a chemical reaction.



The **optic nerve** connects your eyes to your brain. It understands the chemical reaction. It carries a message to your brain.

THE ELECTROMAGNETIC SPECTRUM

