

Light

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What kind of energy comes from the sun?

The sun emits electromagnetic radiation of many wavelengths in all directions.

Is light a type of electromagnetic radiation?

Yes, light is the type of radiation that is visible to the human eye.

Is heat a type of electromagnetic radiation?

Complicated. Heat is the measure of kinetic energy of the molecules of a substance. Infra-red light, excites molecules increasing their energy, hence making the object hotter. While heat can't travel through a vacuum, we get no heat from the sun, infra-red light does.

Why do I feel heat when I am in the sun?

Radiation comes from the sun in the form of light. When light strikes an object, light energy is converted into heat energy.

What causes light to change into heat?

The law of **conservation of energy** tells us that energy can neither be created nor destroyed. It can only be changed into another form of energy.

What kind of energy can be derived from light?

When light strikes an object, it can be reflected, bent, or absorbed. If it is absorbed, the light energy is converted to heat energy.

If light is converted to heat when it strikes an object, why doesn't it heat up a glass window?

If you take a block of ice, it is visible because the ice crystals are arranged randomly, and light rays are absorbed when they strike the crystals. If you melt the ice, the water molecules are arranged uniformly, and the light rays will pass through unobstructed. Similarly, silica sand has molecules arranged randomly and is visible, but pure glass which is made of silica has molecules arranged uniformly, and light passes through the glass without being obstructed or absorbed.

What happens if you bend light?

If you bend light, it can be concentrated, refracted, or dispersed.

How can you concentrate light?

If you pass sunlight through a magnifying glass, you can concentrate the light onto a small focal point, and when the light is focused onto solid matter, the light energy will be converted to heat energy.

How can you refract light?

Light travels at different speeds in different mediums, and when it changes speed, it distorts what we see. For example, if you are sweeping the bottom of a swimming pool with a brush on a long pole, half the pole is below the water and half is above. Light traveling through the air will slow down a tiny bit when it goes through water, so your straight pole will appear to be bent right at the waterline.

What is dispersion of light?

When white light is passed through a glass prism, it splits the light into a spectrum of colors. The colors are: violet, indigo, blue, green, yellow, orange and red. After a rain storm, moisture in the atmosphere can disperse light into this spectrum of colors and create a beautiful rainbow.

Why are the colors of the rainbow separated into layers?

Each color has a different wavelength, the shortest is violet and the longest is red. When a beam of light enters a droplet of water, the water refracts the light into all seven colors, and each color exits the droplet at a different angle to the sun. Imagine a large triangle: you are standing on the ground, the droplet of water is in front of you, and the sun is in the sky. Every drop of water disperses the light into seven colors, and each individual color exits the droplet at a different wavelength. You perceive the rainbow arch and all the wavelengths separated into colors because of your angle to the sun. It is just the same as looking at light through a prism, and by turning the prism, you will see the colors change.

Are there colors that we can't see with our human eyes?

Yes, there are wavelengths of light outside the visible spectrum, but because they are not visible to us, we do not call them colors. Wavelengths of light below violet are called *ultraviolet light*, and wavelengths above red are called *infrared light*.

What is ultraviolet light used for?

Ultraviolet light can be very harmful to your health. It can cause sunburn, skin cancer, and cataracts. These problems can be avoided by using proper UV protection. At the same time, ultraviolet light can be very beneficial to mankind. It can be used as a powerful disinfectant, sanitizing large areas cheaply, and removing pollutants in water and air.

What is infrared light used for?

Infrared light can cause burns and damage your vision, but it is not as insidious as ultraviolet light. We use it for infrared photography, night vision devices, heating devices, and all types of remote-control devices, like garage door openers. Its applications are invaluable when used with a wide variety of laser devices, like laser pointers or laser surgery.

Who is Augustin Fresnel?

Mr. Fresnel, (*don't pronounce the "S"*), was a French physicist who was the first to study the properties of light by refracting and diffusing light rays. His greatest contribution to science is called the Fresnel lens. Diffused light rays enter the lens traveling in random patterns, and pass through a series of small, concentric lenses which will focus all the light rays into a single, powerful beam of light.

Where do we see Fresnel lenses used today?

Fresnel lenses are used wherever you want to focus your light source to a narrow focal point, like the spotlight in a theater. Antique lighthouses use them to project the light of a kerosene lantern a distance of ten miles or more. Traffic lights use them so one lane can see a green light, and the lane next to it sees a red light. Aircraft carriers use them for their optical landing system. A pilot will see a horizontal line of lights indicating the flight deck landing runway, and a vertical column of lights with Fresnel lenses which indicate the pilot's approach angle. He can make a safe landing if his glide-path light matches the runway lights.