Atmospheric Interactions with Light Waves

Essential Standard 2.1

Understand the structure of and processes within our atmosphere.

Learning Objective 2.5.1

Summarize the structure and composition of our atmosphere, along with its interaction with radiant energy.

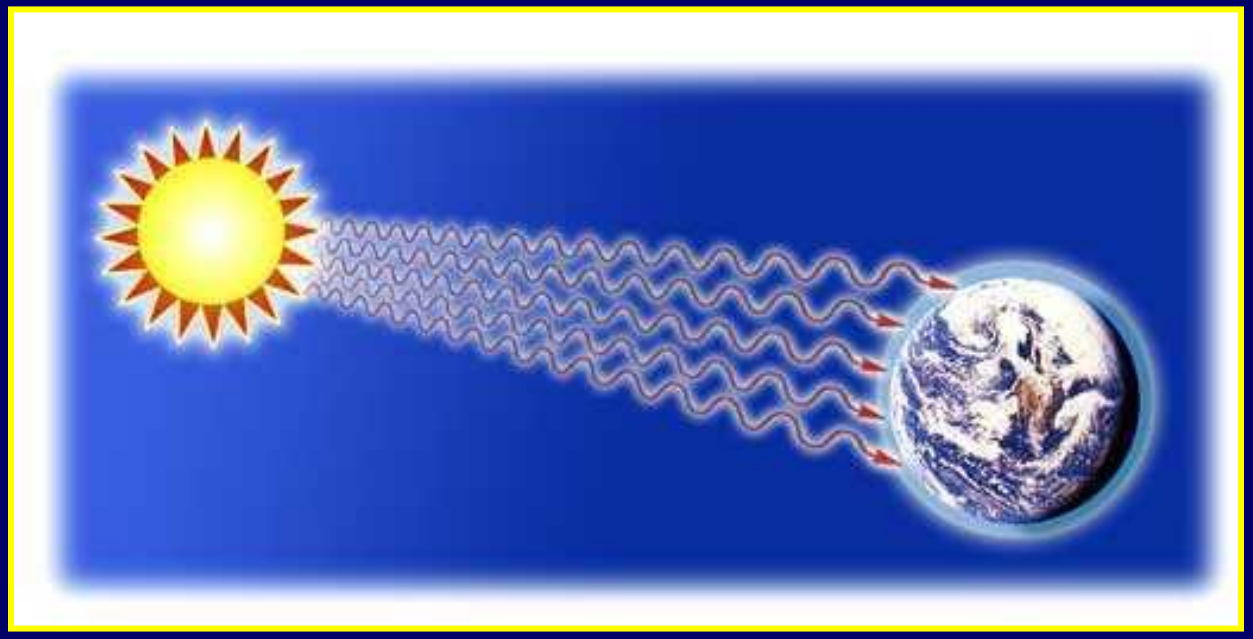
I Can Statements

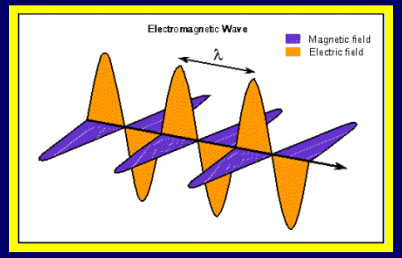
At the end of this lesson, you should be able to say, with confidence:

- I can explain how radiant energy from the Sun interacts with molecules in Earth's atmosphere.
- I can explain how rainbows are formed.
- I can explain why sky is blue and sunrises and sunsets are reddish orange.

Radiation

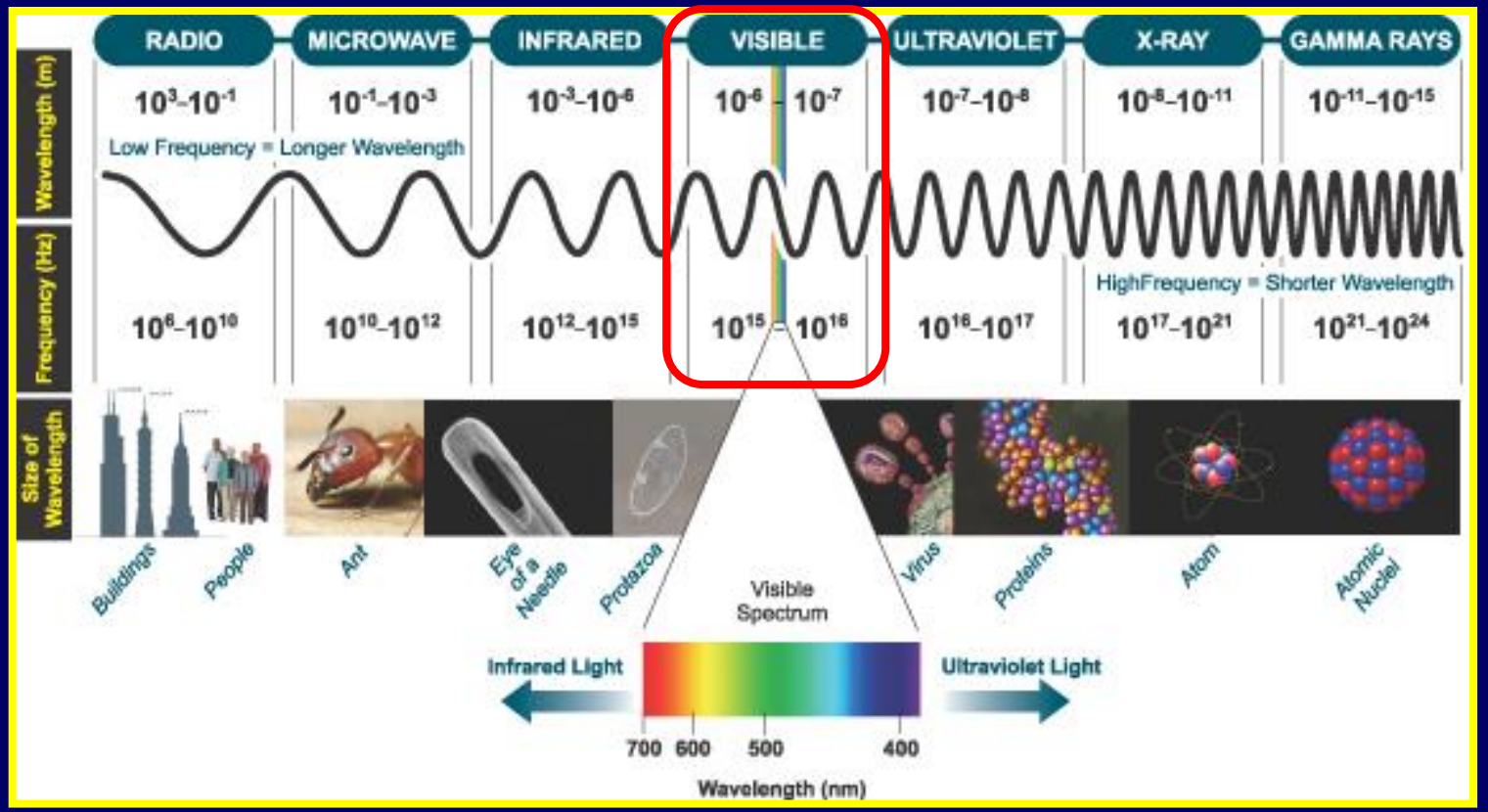
Energy from the Sun is transferred to Earth through the process of radiation which uses electromagnetic waves.





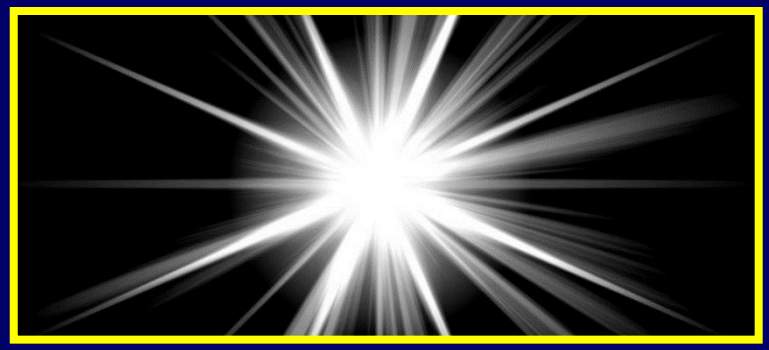
Visible Light

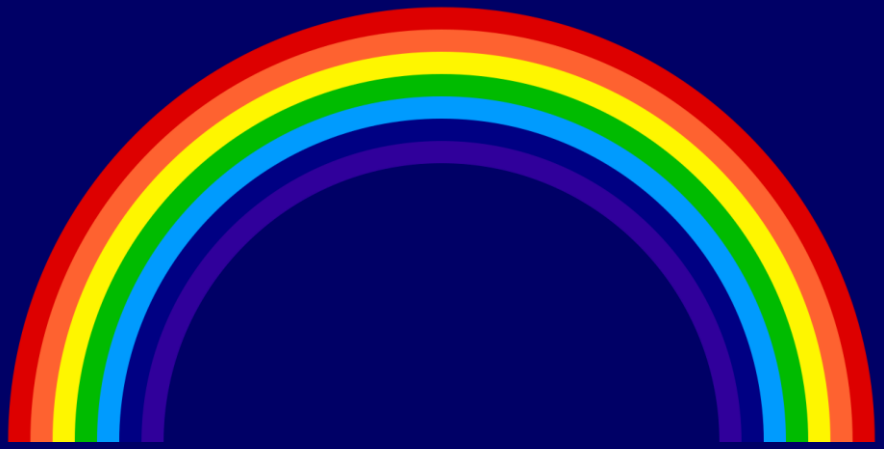
Visible light is the part of the spectrum that we are able to see with our eyes.



White Light

Our eyes see light as white, but it is actually made up of different colors.



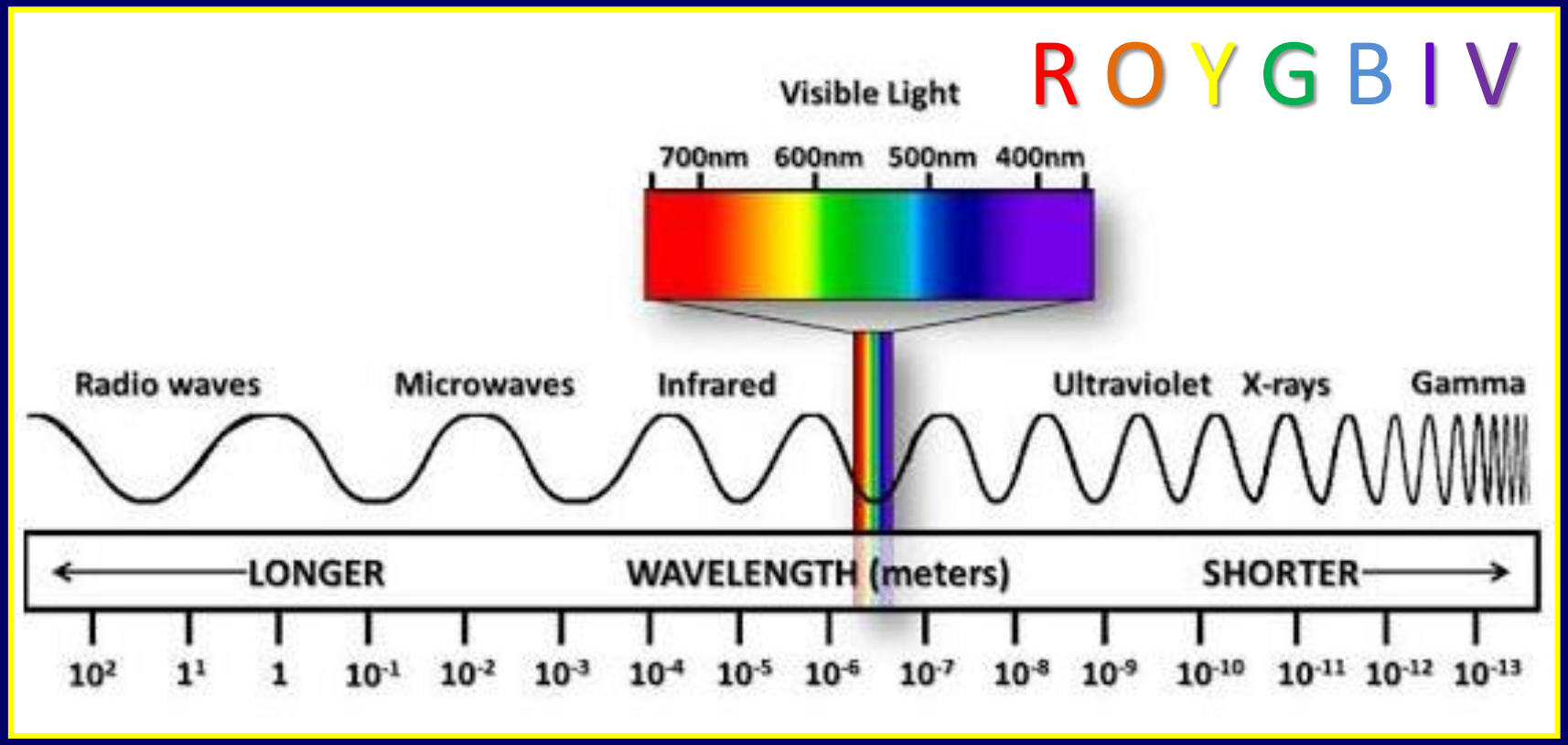


R O Y G B I V

White light contains all the colors one can see in a rainbow: red, orange, yellow, green, blue, indigo, and violet.

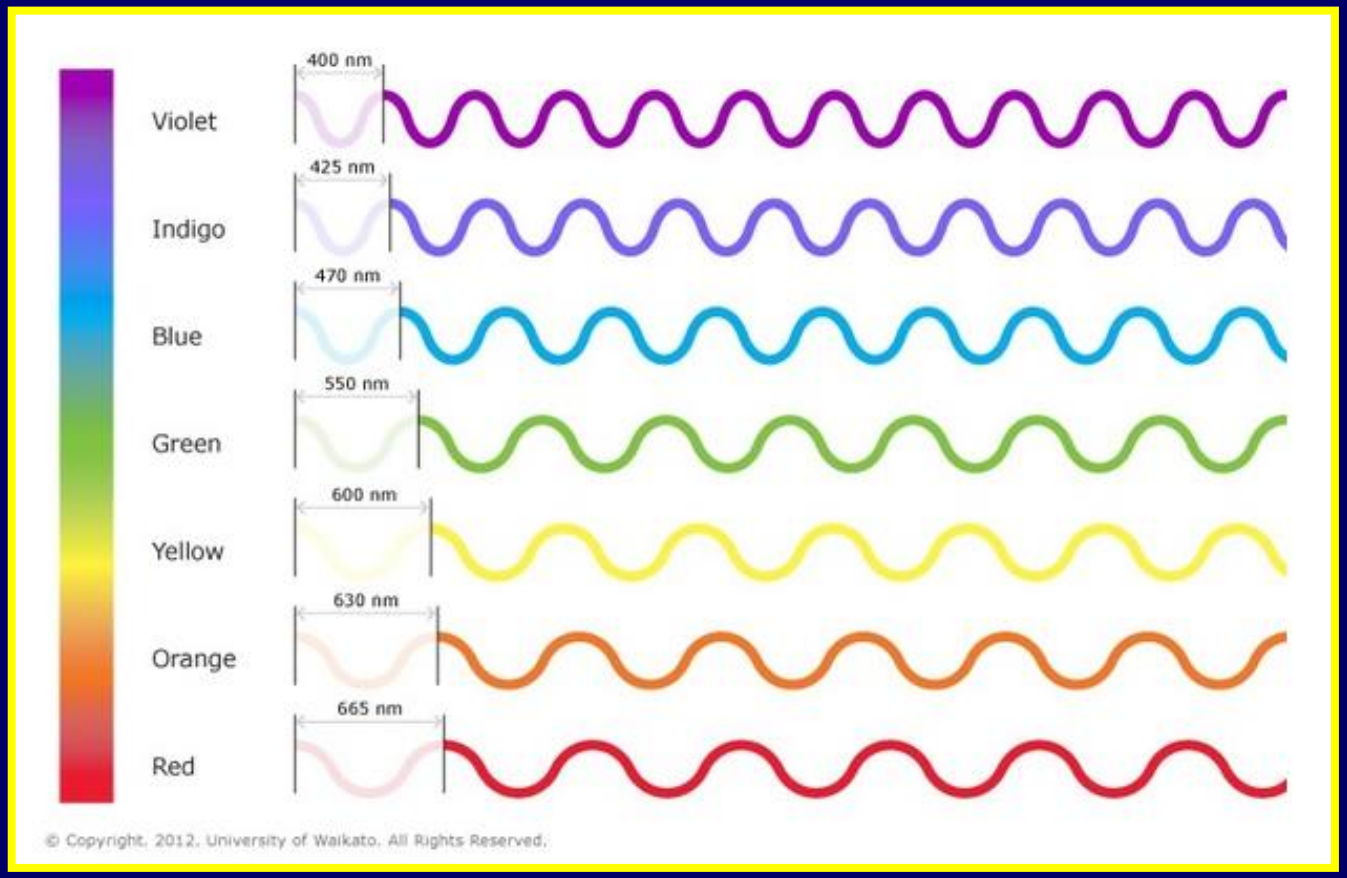
Colored Lights

The different colors of light are due to the different wavelengths of each light color.



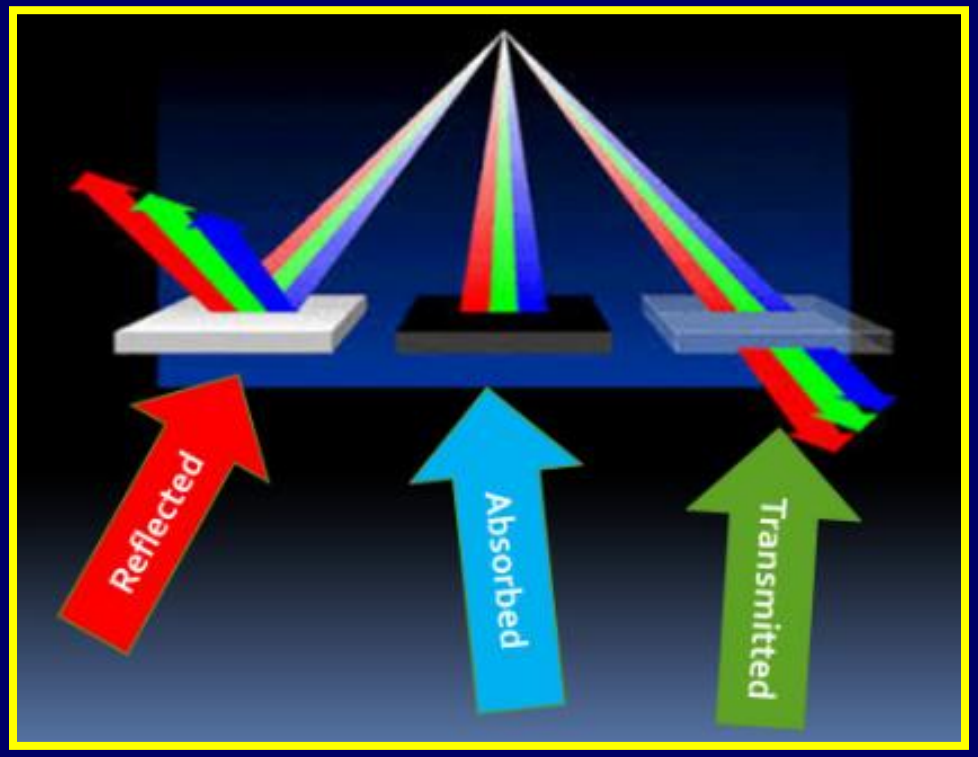
Wavelengths and Colors

Red light has the longest wavelength and violet light has the shortest wavelength.



Wave Behavior

When light waves strike an object, they can be reflected, absorbed, or transmitted completely through the material.



Reflected Waves

When Light waves strike an object, such as a mirror, and bounce back, it is said to be reflected.

Transmitted Waves

Light waves that travel through an object is said to be transmitted.

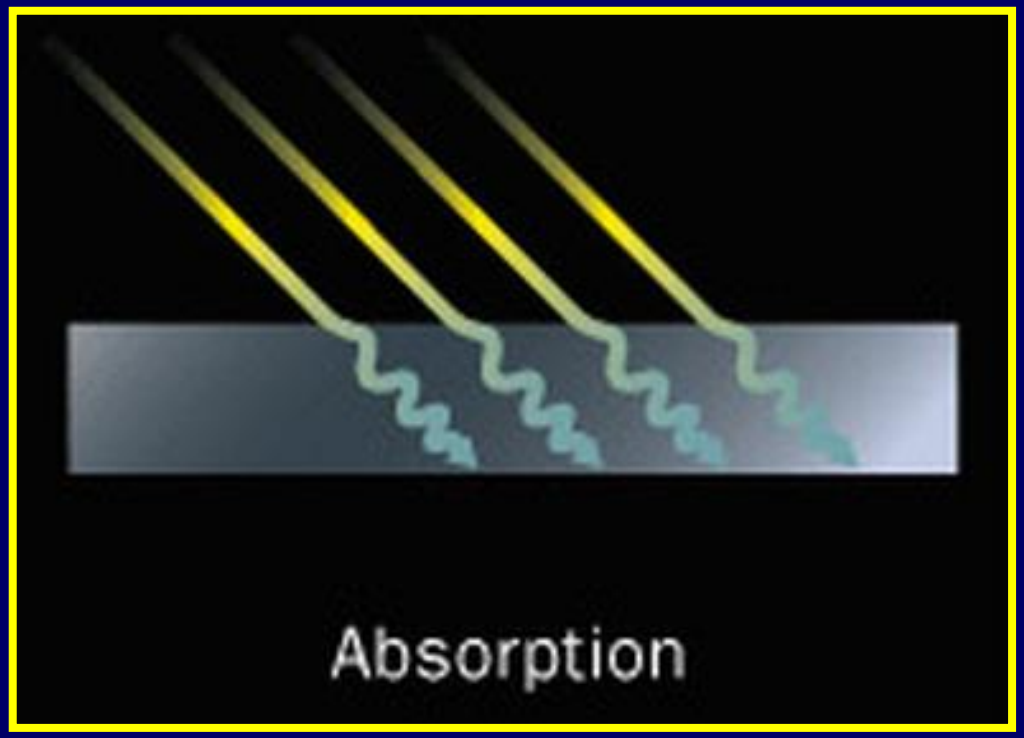
Transmitted Waves

Transparent objects allow light waves to be transmitted easily and objects are seen clearly.

Translucent objects allow some light to be transmitted but also scatter some of the light, so objects are not clearly seen.

Absorbed Waves

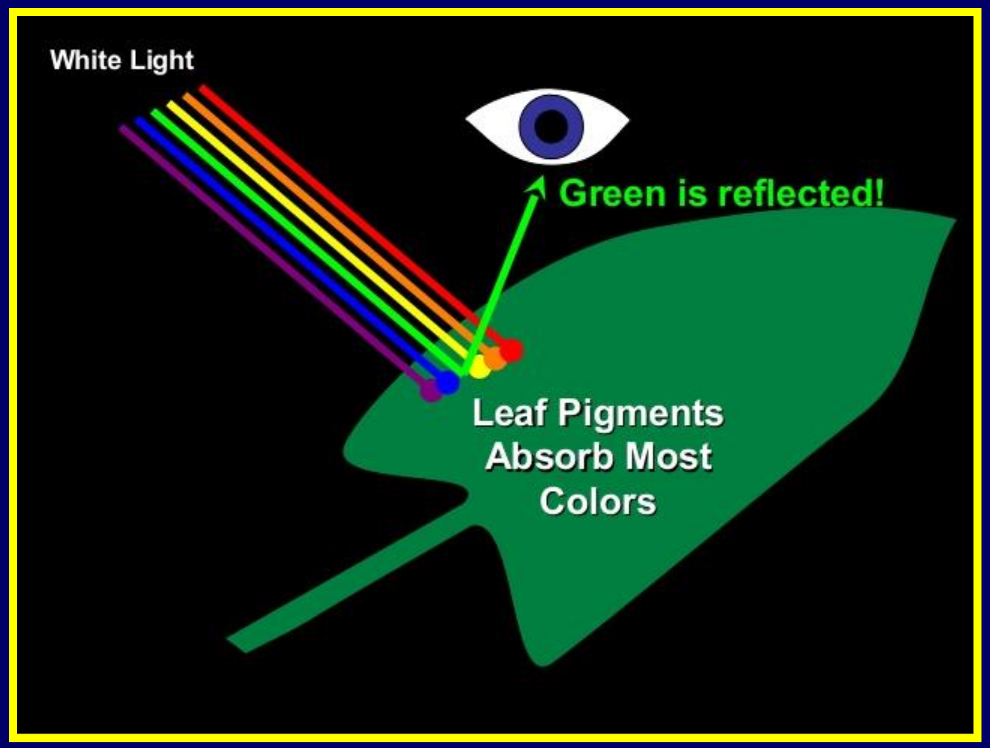
When light waves strike an object and are not reflected nor transmitted through the object, they are said to be absorbed.



Objects that absorb all light, so no light passes through, are called opaque.

Pigments

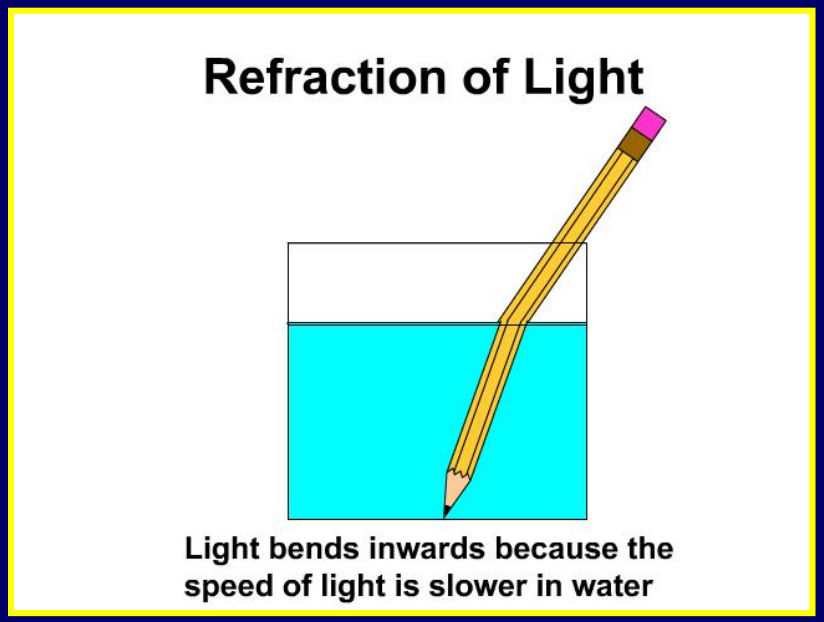
Pigments are chemical compounds in substances that absorb some wavelengths of light but reflect others.



We see the reflected colors of light.

Light Refraction

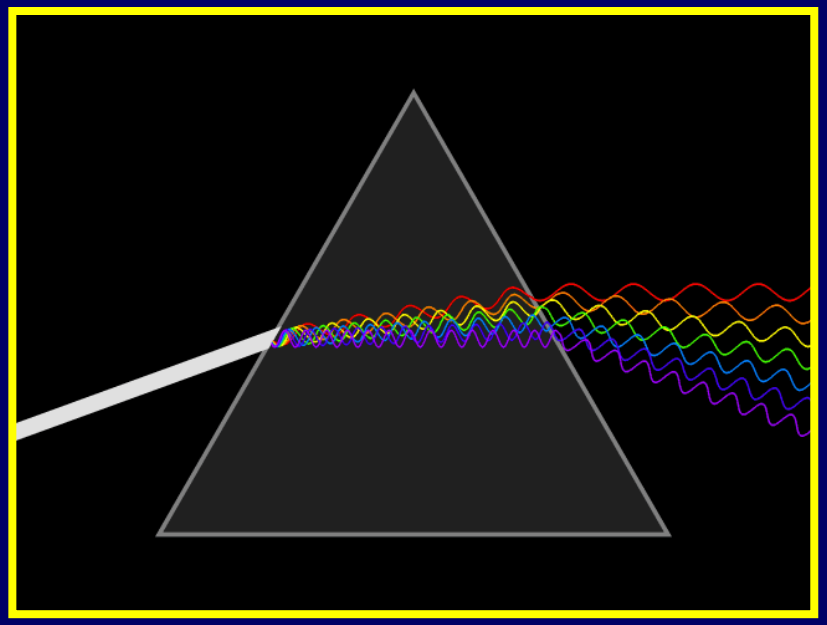
Light refraction is the bending of light as it changes mediums causing the light waves to change speed.



The pencil appears to be bent because the light reflected off the pencil is arriving at our eyes at different rates.

Prism

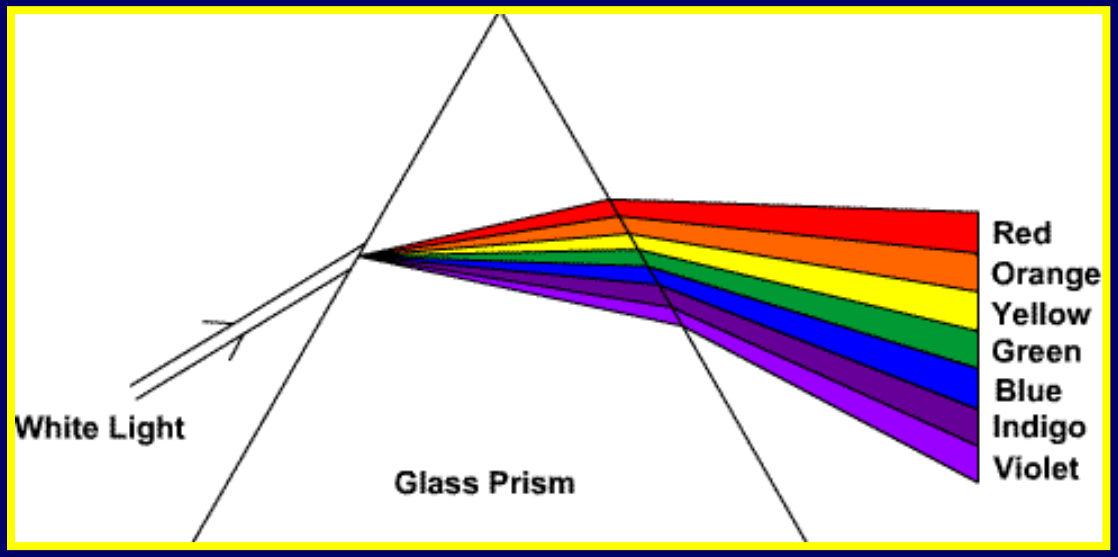
When white light enters some mediums, such as a prism, the different wavelengths of light change speed at different rates.



As the different wavelengths of light change speed, they separate out and are said to bend or refract.

Light Refraction

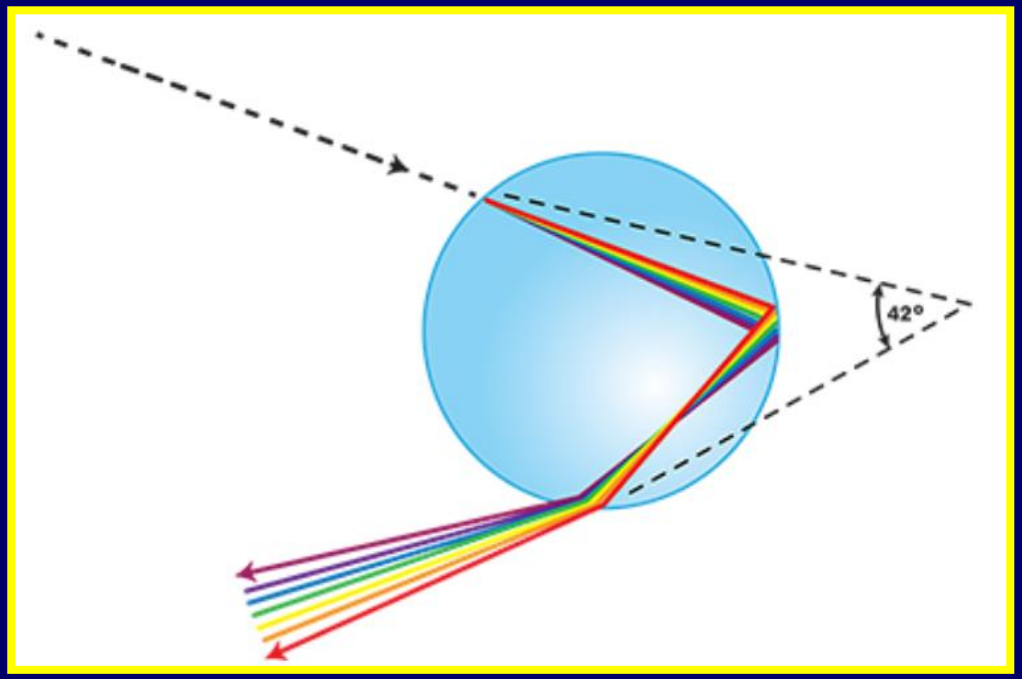
The longer red and orange light waves are refracted or bent the least.



The shorter violet and blue light waves are refracted or bent the most.

Rainbows

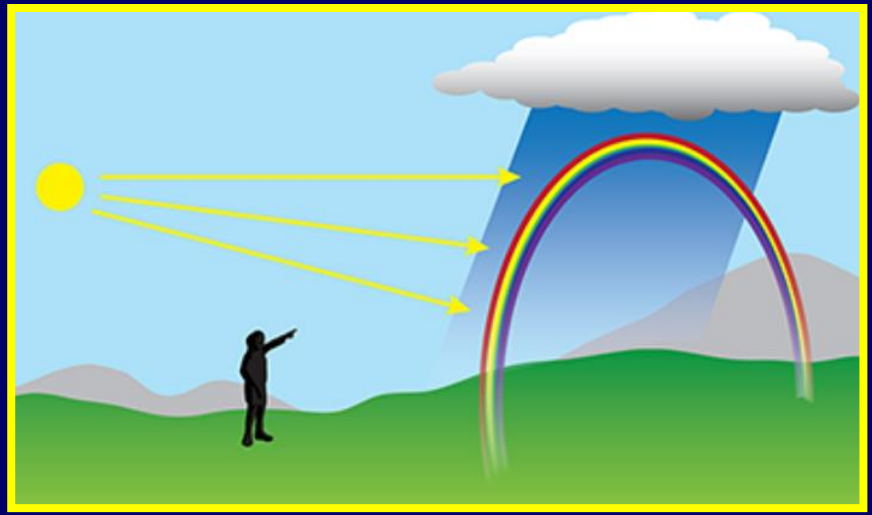
When sunlight enters a water droplet, the light waves are bent or refracted into the various colors of light.



R O Y G B I V

Rainbows

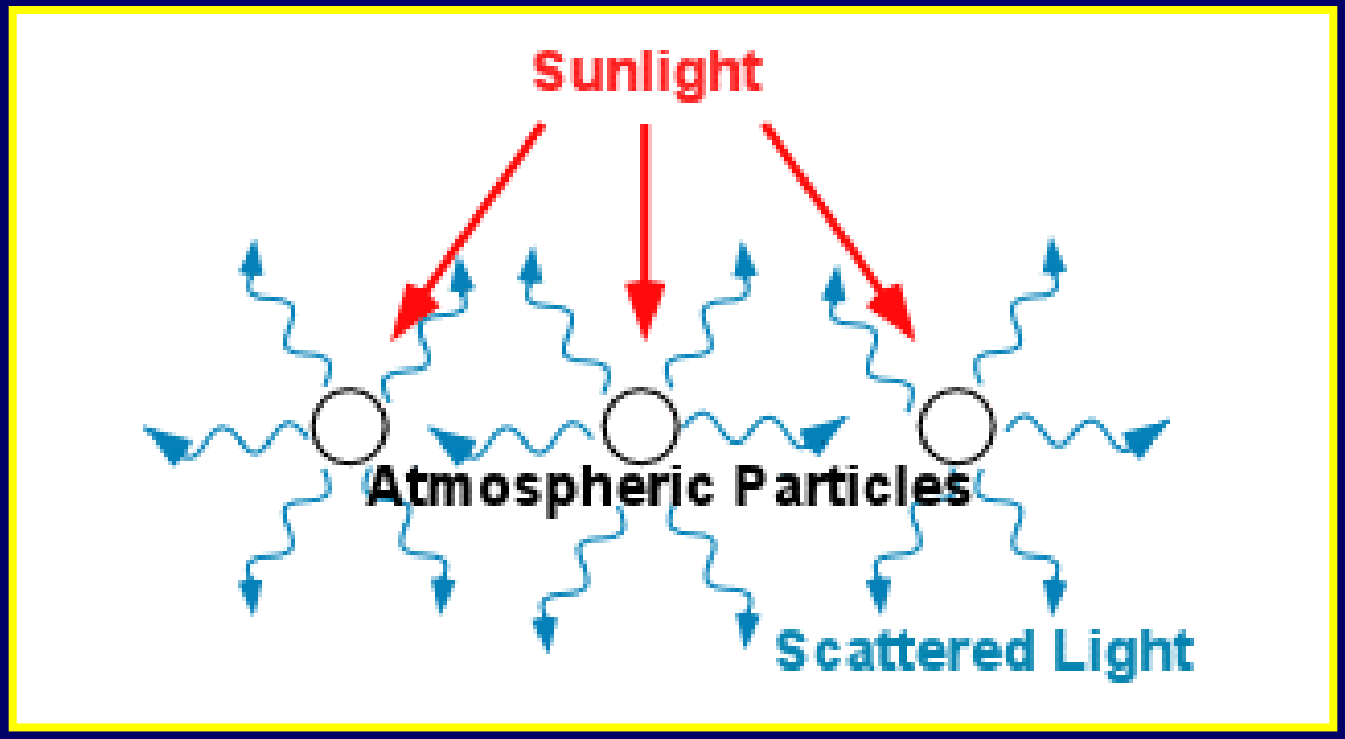
1. Rain drops floating in the air
2. Observer has back to the Sun
3. Clouds cleared away



A rainbow is actually a complete circle.

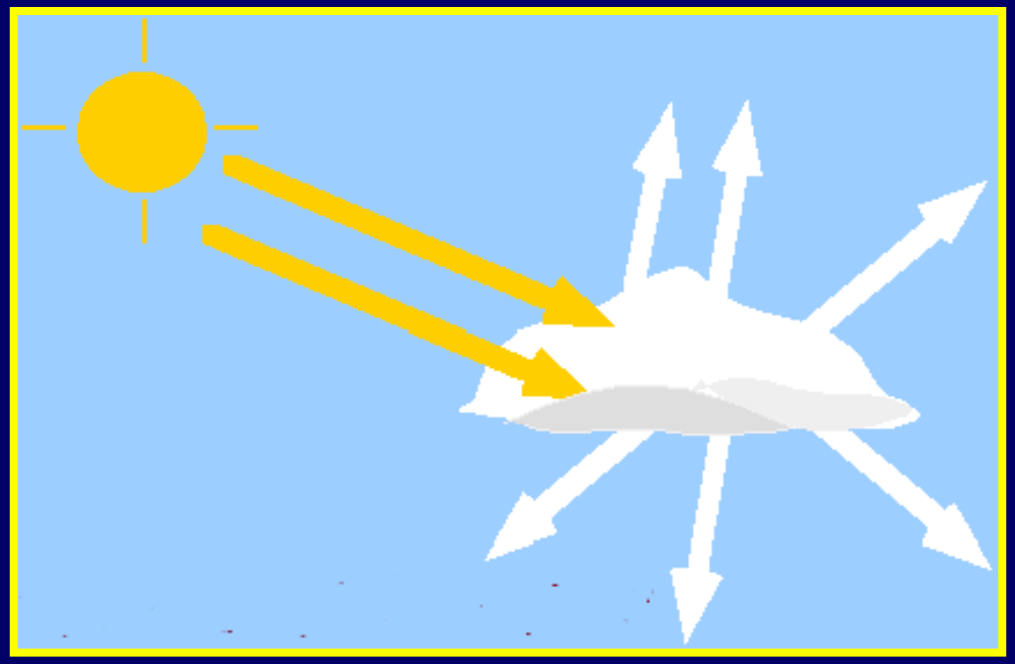
Scattering of Light

The scattering of light occurs when light strikes an atom or a molecule and is reflected in all different directions.



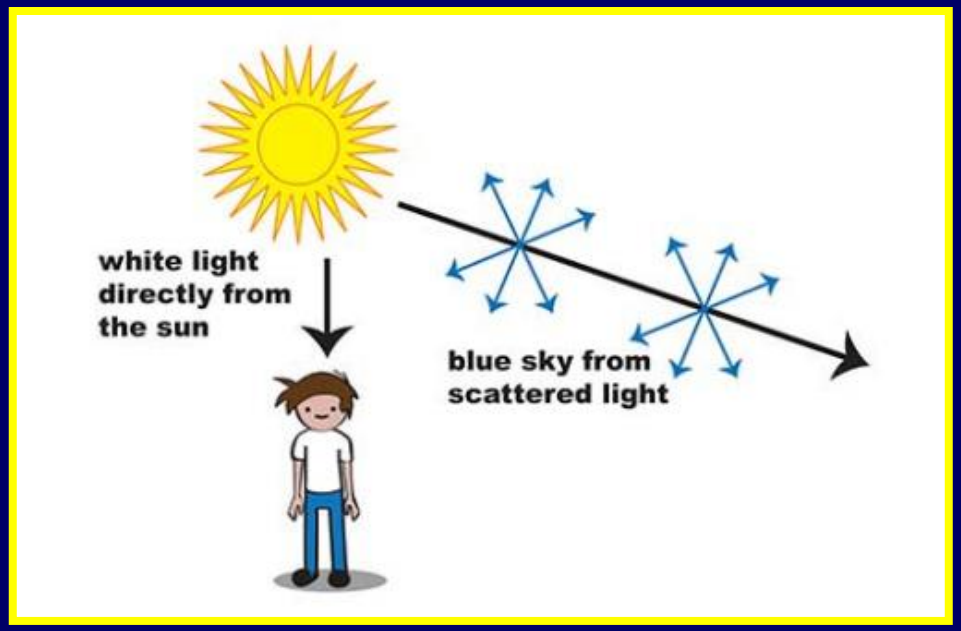
White Clouds

The water droplets in clouds are relatively large and scatter all the different colored light waves equally, making clouds appear white.



Blue Skies

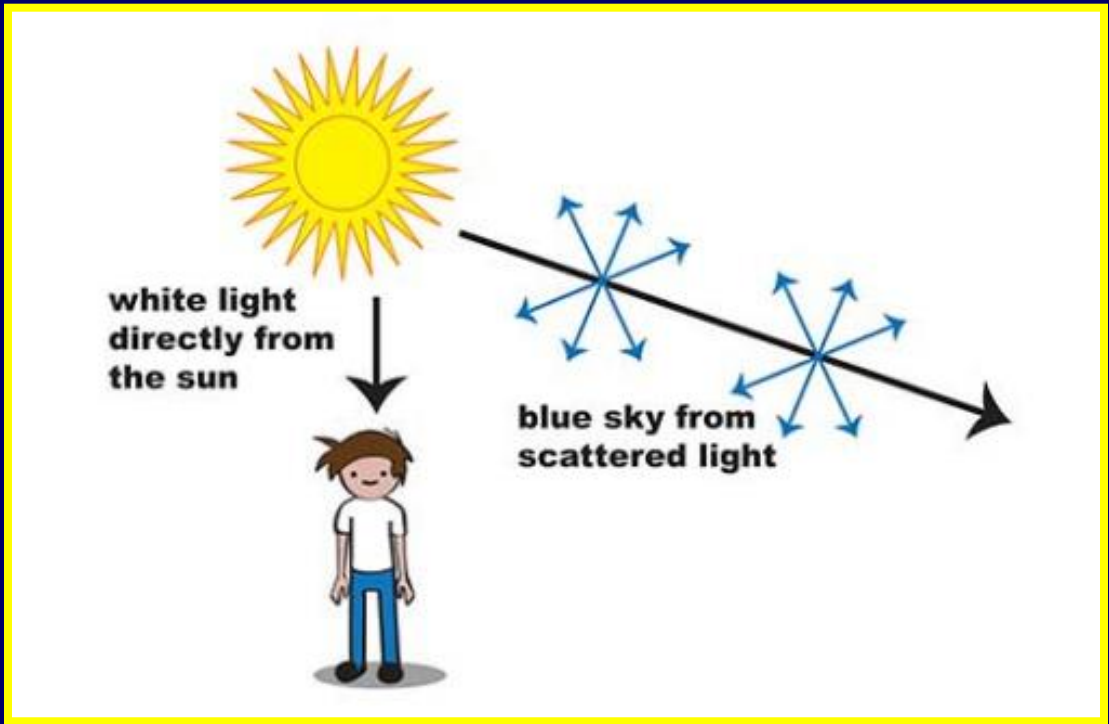
Air molecules, like nitrogen and oxygen, are very small in size and are most successful at scattering the smaller wavelengths of blue light.



The scattered blue light waves dominate the skies, making the sky appear blue.

Yellow Sun

The red, orange, and yellow light remains together, making the Sun appear yellow.



Sunrise and Sunset

As the Sun gets closer to the horizon, the sunlight travels through more air molecules, as well as larger water vapor and dust particles.

This allows us to see the scattering of red, orange, and yellow light.

The End