



Wikipedia: Sunset

Color 02

Light Scattering

Why is the daytime sky blue and the evening sky red?



Materials

1. A basin, either transparent or translucent
2. Water
3. Milk
4. Flashlight

Why does the daytime sky look blue and the evening horizon looks red?

The sun shines white light. White light is made up of light of all colors: red, orange, yellow, green, blue, and violet. We know that because the sun's white light shining through rain droplets forms a rainbow – all the colors of the sun's white light. The rain droplets, act as a **prism, refracting** (separating) the white light into its separate colors. You can do this by shining a flashlight on a CD and looking at refracted colors that **reflect** from the CD onto the wall

Light is a wave, and each of these colors corresponds a different wavelength of light.

The colors in the rainbow spectrum are arranged according to their wavelengths: Violet and blue light have shorter wavelengths than yellow, orange, and red light (whose wavelength is the longest, in a rainbow).

When the white light from the sun shines through the earth's atmosphere, it collides with air gas molecules. These molecules scatter the light.

The shorter the wavelength of the light, the more it is scattered by the air in the atmosphere. Because its wavelength is so much shorter, blue light is scattered approximately ten times more than red light.

The distance between your eyes and the edge of the atmosphere depends upon where you are looking. The distance between the edge of the atmosphere and your eyes as you look up is less than the distance between the edge of the atmosphere and your eyes as you look towards the horizon.

Any red light that is not scattered continues on in its original direction. When you look up in the sky, the scattered blue light is the light that you see because it is scattered throughout the atmosphere much more than any other color

Why does the setting sun look reddish orange? When the sun is on the horizon, its light takes a longer path through the atmosphere to your eyes than when the sun is directly overhead. By the time the light of the setting sun reaches your eyes, most of the colors of light have been scattered out. The light you finally see is reddish orange, the light that was not scattered.

The same thing happens when you shine line through a container of milky water. The blue scatters first through the water. Any unscattered red is seen through the other side of the container.

This last paragraph is for older students:

In addition, the frequency of blue light, compared to red light, is closer to the resonant frequency of the atoms and molecules that make up the air. That is, if the electrons bound to molecules in the air are pushed, they will oscillate with a natural frequency that is even higher than the frequency of blue light. Blue light pushes on the electrons with a frequency that is close to their natural resonant frequency, which causes the blue light to be re-radiated out in all directions in a process called scattering.



Image from Wikipedia Commons



Blue light is scattered more than other wavelengths by the gases in the atmosphere, surrounding Earth in a visibly blue layer when seen from space onboard the ISS at an altitude of 335 km (208 mi) Wikipedia

Terms

Reflection

The change in direction of a wavefront at an interface between two different media so that the wavefront returns into the medium from which it originated. Common examples include the reflection of light, sound and water waves.

Refraction

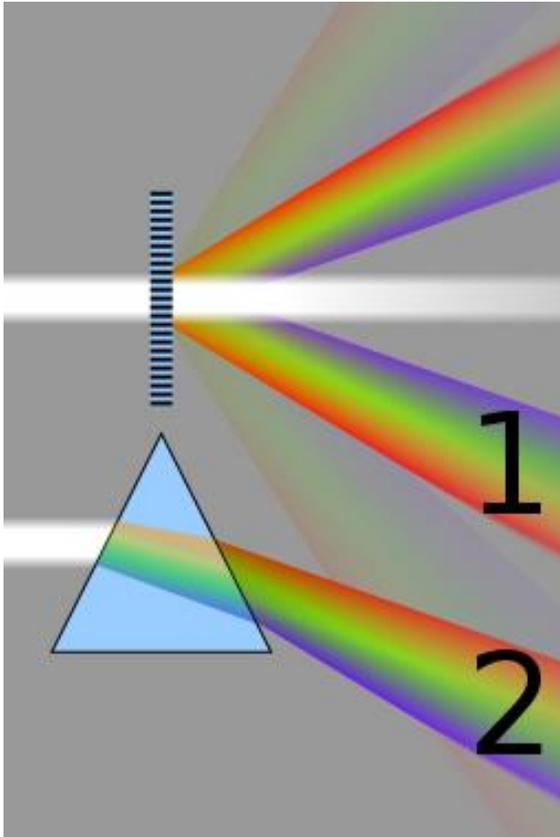
The change in direction of a wave passing from one medium to another. Refraction of light is the most commonly observed phenomenon.

Prism

An optical prism is a transparent optical element with flat, polished surfaces that refract light. At least one surface must be angled.

Atmosphere

An atmosphere is a layer or a set of layers of gases surrounding a planet.





Questions

1. What color is the horizon at sunrise?
2. What color is the atmosphere when looking at it from the space shuttle?
3. Which has a longer wavelength, green or orange?
4. If you could hear light, which would have a higher pitch (frequency), red or blue?



Rabbi Meir said, "In what way is Techelet (a bluish color used to dye one of the Tzitzit threads - Bamidbar 15:38) different from all other colors?"

Because Techelet is similar to the sea; the sea is similar to the sky; and the sky is similar to the Throne of Glory, as it says (Shemot 24:10), 'They saw the G-d of Israel, and under His feet was something like a sapphire stone, bright as the color of the sky.' "(Sotah 17a, Menachot 23b, Chullin 89a)

