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Dispersion

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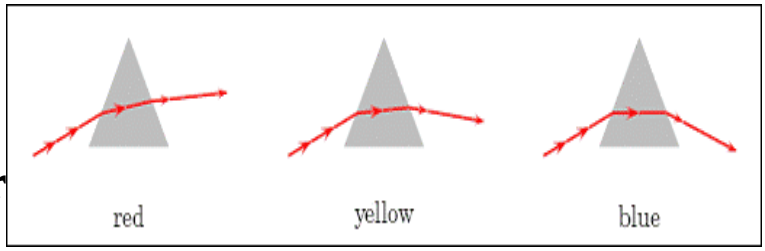
Introduction to Dispersion

What is Dispersion?

Dispersion is a property of waves that describes the frequency dependence of wave speeds through media. Suppose that two waves enter the same dispersive medium and have different frequencies. They will have different speeds in that medium even if they both enter with the same speed.

It turns out that the index of refraction of most materials depends on the wavelength of light. Hence, different wavelengths are bent by different amounts.

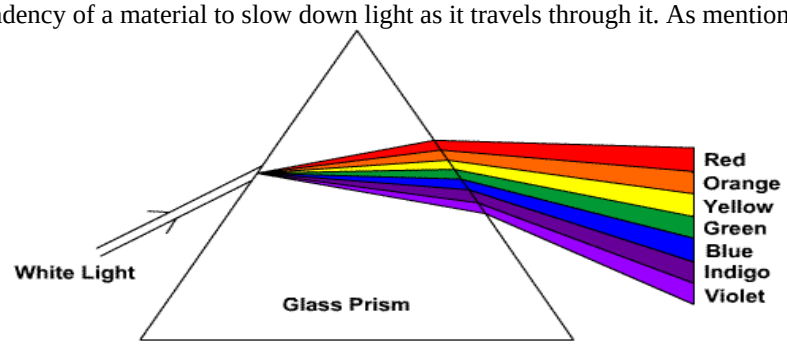
The splitting of white light into its different components (VIBGOUR) is called the dispersion of light. When a beam of light traveling from a material enters a new material which is perpendicular to a common surface, it goes straight into the new material without bending. When the beam enters at an angle it bends. The amount of bending relates to the relative indices ofrefraction . The light is made up of different colors that are going through different indices of refraction; they are being refracted at different angles. Therefore, the colors of light split into the colors of the rainbow -- an effect that is called dispersion.



Dispersion of Light by a Prism

When white light enters a glass prism, the different colors in the white light are refracted at different angles. Each color is characteristic of a distinct wave frequency, and different frequencies of light waves bend to different degrees as they pass through a prism.

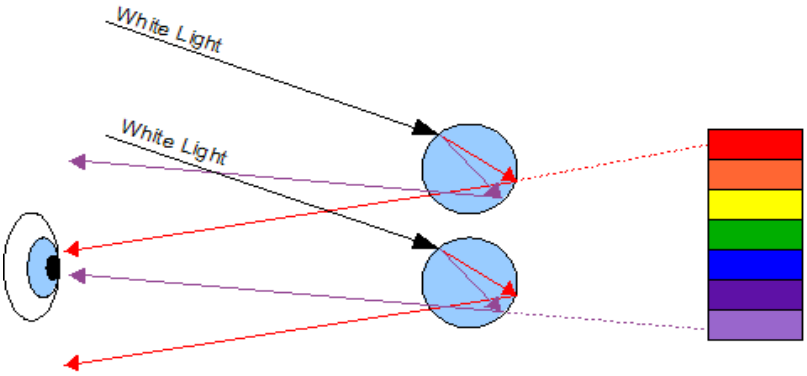
Different materials are distinguished from each other by their different optical densities. Optical density is simply a measure of the tendency of a material to slow down light as it travels through it. As mentioned earlier, a



light wave traveling through a transparent material interacts with the atoms of that material. When a light wave impinges on an atom of the material, the atom absorbs it. The absorbed energy causes the electrons in the atom to vibrate. If the frequency of the light wave does not match the resonance frequency of the vibrating electrons, then the light will be reemitted by the atom at the same frequency at which it impinged on it. The light wave then travels through the interatomic vacuum towards the next atom of the material. Once it impinges on the next

atom, the process of absorption and reemission is repeated.

Casting white light through a triangular prism at different angles allows an observer to see the distinct component colors of visible light.



Dispersion and Rainbows

As the sun appears after a rainstorm, droplets of water still remain in the atmosphere. These act as tiny prisms that split the sun's light into its component colors, and thus rainbows appear.

Light entering a raindrop is first split into all the colors of the rainbow due to dispersion. Inside the raindrop, the red is refracted least and violet is refracted the most. When the colors of light hit the back of the raindrop, they reflect due to total internal reflection. When they exit on the other side, only certain colors will be at an angle suitable to appear to a person's eye; drops near the top appear red, ranging through the other colors, to violet at the bottom. And therefore a rainbow is formed.

Want to know more about dispersion?Click here to schedule a live session with an eAge eTutor!

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Reference Links:

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- http://www.unmuseum.org/speed.htm
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