Light absorption

Light absorption is a process by which light is absorbed and converted into energy. An example of this process is photosynthesis in plants. However, light absorption doesn’t occur exclusively in plants, but in all creatures/inorganic substances. Absorption depends on the electromagnetic frequency of the light and object’s nature of atoms. The absorption of light is therefore directly proportional to the frequency. If they are complementary, light is absorbed. If they are not complementary, then the light passes through the object or gets reflected. These processes usually occur at the same time because the light is usually transmitted at various frequencies. (For instance, sunlight also comprises lights of various frequencies; from around 400 to 800 nm). Therefore, most objects selectively absorb, transmit, or reflect the light. When light is absorbed heat is generated. So the selective absorption of light by a particular material occurs because the frequency of the light wave matches the frequency at which electrons in the atoms of that material vibrate.

Absorption depends on the state of an object‘s electron. All electrons vibrate at a specific frequency, which is known as their "natural" frequency. When light interacts with an atom of the same frequency, the electrons of the atom become excited and start vibrating. During this vibration, the electrons of the atom interact with neighboring atoms and convert this vibrational energy into thermal energy. Consequently, the light energy is not to be seen again, that is why absorption differs from reflection and transmission. And since different atoms and molecules have different natural frequencies of vibration, they selectively absorb different frequencies of visible light.

Examples

As was mentioned above, everything is capable of absorbing light. For example, organic molecules are good at absorbing light. If an organic molecule has electrons that have a high natural frequency then they absorb the light which has a high frequency as well. The longer the conjugated system(conjugated system is a system of connected pi-orbitals with delocalized electrons), the longer the wavelength of the light absorbed.

Another example. Let's imagine that we are walking around a park with a lot of grass and plenty of beautiful flowers. As you already know, all living things have their own color. We can infer from this that all living or inorganic things reflect, absorb, and transmit light at the same time. Every matter has its own specific frequency at which its electrons vibrate so if the frequencies are complementary then the light is absorbed but on the other hand, if the frequencies are not complimentary light is reflected or transmitted. Colors we can see around us are the result of transmission, absorption, and reflection of light caused by non-complementary frequencies.

Applications

By relying on this method, physicists are able to determine and identify the properties and material composition of an object by observing which frequencies of light it absorbs. While some materials are opaque to some wavelengths of light, they are transparent to others. Wood, for example, is opaque to all forms of visible light. Glass and water on the other hand are opaque to ultraviolet light, but transparent to visible light.

Light absorption and colors

Absorption of electromagnetic radiation requires an opposite-field i.e. the field which has the opposite coefficient in the same mode. A good example of this is color. If a material or matter absorbs light of certain wavelengths (or colors) of the spectrum, an observer will not see these colors in the reflected light. On the other hand, if certain wavelengths of colors are reflected from the material, these are the colors that the observer will see. For example, leaves contain the pigment chlorophyll, which absorbs the blue and red colors of the spectrum and reflects green therefore leaves appear green. To the naked eye, reflected light often appears to be refracted into several colors of the spectrum. As a result, light absorption is related to matter's frequency (and frequency of light also) and wavelength of light.

Links

Related articles

External links

Bibliography

http://en.wikipedia.org/wiki/Absorption_%28electromagnetic_radiation%29
http://navercast.naver.com/contents.nhn?contents_id=930 (Journal written by Dr. Joonwoo Park)