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## Color Magic

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One of the most pleasing properties of light is color. People see red shirts, yellow pencils, blue sky, and green grass. In this article we will explain to you what color is and how you can detect it.

Light from the sun, white light, passes through a prism. The latter is a clear piece of glass or plastic shaped like a wedge. White light enters the prism and colored light comes out. Does a prism change white light into different colors or is white light a mixture of colors? When light from the first prism enters the second, the colors spread out more. These results show that white light is a mixture of many colors.

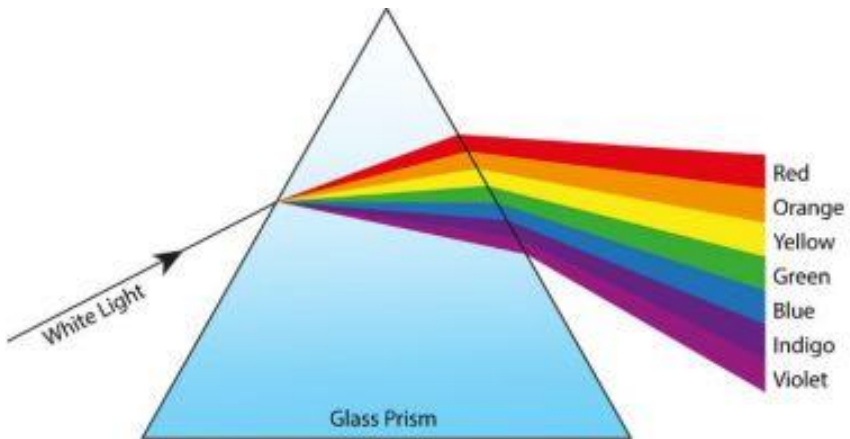


Figure1: Separation of White Light into a Spectrum

Colors of light are similar to musical notes because they have different wavelengths. Colors are different wavelengths of visible light. The longest wavelengths of visible light are red. The shortest visible wavelengths are violet.

How does a prism separate light into colors? Light waves are refracted as they enter another medium. When white light enters a prism, it is refracted. The amount of refraction depends on the wavelength of the light. Shorter wavelengths bend more than longer wavelengths. So blue light bends more than red one. As a result, each color leaves a prism at an angle slightly different from the other colors. This is why we see colored light leaving the prism. People see the same colors in a prism as they do in a rainbow.



Rainbow

The colors from the prism in Figure 1 and from a rainbow are examples of a spectrum that is a band of colors produced when wavelengths of white light are separated [1].

The next questions we want to discuss is: Why is a leaf green or a sweater red? The color of an object depends on what happens as light hits the object?

Different materials absorb some colors and reflect others. The colors we see are the colors reflected by the object. For

example, a green leaf absorbs all colors except green. It reflects green, so green is the color you see. A black material absorbs all colors and reflects none. That is why people do not see any colors. A white material absorbs very little light and reflects all colors. As you have seen, all the colors blending together produce white light. Materials that absorb light without transmitting it are said to be opaque materials. We cannot see through an opaque object.

Some materials, like glass or water, are transparent. Materials that you can see through are said to be transparent ones. Sometimes a transparent material transmits only one color of light. Such materials are called filters. A filter is a material that transmits one color of light and absorbs others.

Suppose you shine a flashlight on a tomato. You see its red color. Now place a red filter in front of the flashlight. The red filter allows red light to go through and absorb all other colors. Red light now hits the tomato and it is still red. Now replace the red filter with a green one. This time, green light is passed through and all other colors are absorbed. Since the red tomato reflects only red light, it appears black [2].

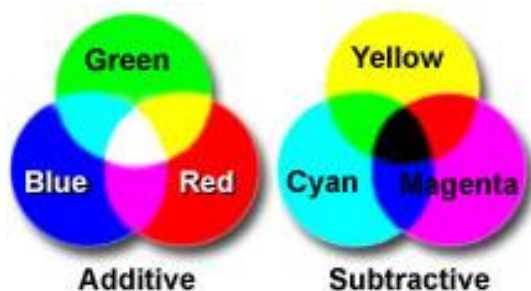


Figure 2: Primary Colors

As Figure 2 shows, you can use filters to produce colored light. Notice that only three colors of light are needed. These

colors are called the primary colors. The three main primary colors are red, green, and blue. Adding the proper amounts of these three colors produces any color including white. For example, red and green light add together and produce yellow light. Blue and red add and make magenta [3].

The color picture on a television screen is produced by adding the primary colors together. A screen contains groups of red, blue, and green dots that act like filters. A group of these dots makes a color by transmitting different amounts of red, green, and blue. These groups of colored dots blend together and produce the color picture.

Making or blending paints is different from the way your eye blends colored light. Paints are made from three primary pigments, which are different from the primary colors. The primary pigments are magenta, yellow, and cyan. Each pigment absorbs some colors and reflects others. You see the colors that are reflected. By mixing the primary pigments, you pick the colors that are absorbed and those that are reflected.

Figure 2 shows how the primary pigments absorb and reflect light. When white light hits cyan pigment, blue light and some green are reflected. Red, orange, and yellow light are absorbed. Yellow pigment reflects red and some green, but absorbs blue. When cyan and yellow pigments are mixed, all colors are absorbed except green. So, the pigment is green.

#### References:

1. Introduction to Light, Color and Color Space [Electronic resource]. – Mode of access: <https://www.scratchapixel.com>. – Date of access: 01.04.2020.
2. The Colorful World of Tomatoes and Lasers: Why is Tomato Red? [Electronic resource]. – Mode of access: <https://www.barco.com>. – Date of access: 13.03.2020.
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