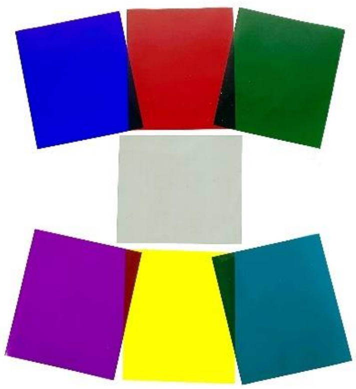
Color Filter Set of 7, 175 mm x 200 mm

33-0195

INSTRUCTIONAL GUIDE

Contents

Your kit includes six color filters and one neutral density filter cut into 175 x 200 mm sheets.



Filters Include:

- Blue
- Magenta
- Red
- Yellow
- Green
- Cyan
- Neutral Density (50% transmission)

Background

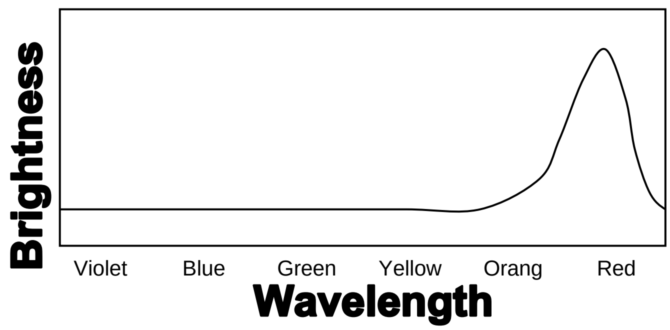
> *"To the physicist, the colors of things are not in the substances of the things themselves. Color is in the eye of the beholder and is provoked by the frequencies of light emitted or reflected by things. We see red in a rose when light of certain frequencies reaches our eyes. Other frequencies will provoke the sensation of other colors. Whether or not these frequencies of light are actually perceived as colors depends on the eye-brain system."* (Hewitt, 411)

The above quote illustrates two points: (1) color is a subjective excitement in the eye that tells the brain what frequency of light is hitting it. The eye is only sensitive to a narrow band of frequencies known as visible light. And, if the eye or brain receives more than one frequency at a time, they will often interpret this as only one color. (2) We perceive an object's color to be our eye/brain response to the light that is either created or reflected. Reflected light can have its spectrum changed by the object it reflects off of because most materials absorb some frequencies and reflect the rest. If an object absorbs most visible frequencies and reflects red, for example, the material appears red. If a material reflects all of the light shined on it, it will have the same color as the initial light source. If it absorbs all light, it will appear black.

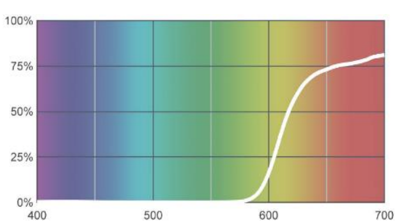
Introduction

The color of a transparent object depends on the color of the light it transmits. A red piece of glass appears red because it absorbs all the colors that compose white light, except red, which it transmits. The material in the glass that selectively absorbs colored light is known as a pigment. (Hewitt, 414) The transmittance of an object can be shown with a wavelength spectrum graph.

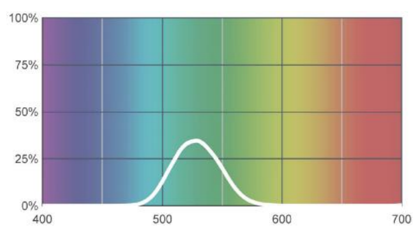
Such a graph shows the amplitude, or brightness, of the light of each wavelength that is transmitted. So, the wavelength spectrum of a red plate of glass might look something like below…



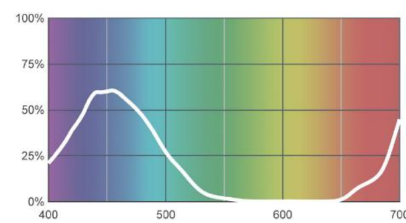
Notice that the transmitted light is brightest near the red part of the spectrum. The rest of the wavelengths have low brightness. Here are the transmittance spectrums of the 6 color filters included in the kit. They refer to wavelength in nanometers along the x-axis. Rather than using brightness or amplitude, the graphs refer to the transmission, or the percentage of the original brightness that was allowed to pass through, along the y-axis.



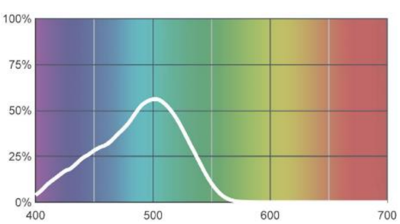
Red



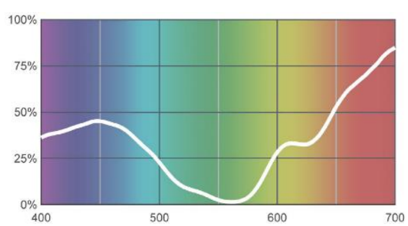
Green



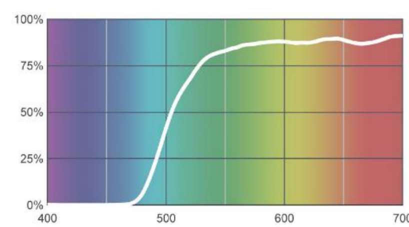
Blue



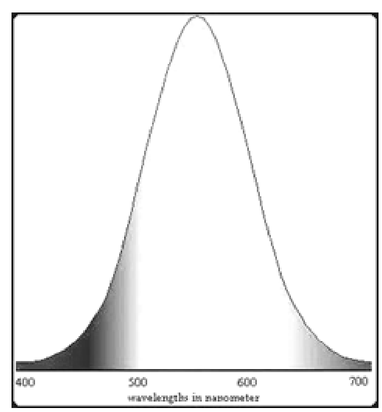
Cyan



Magenta

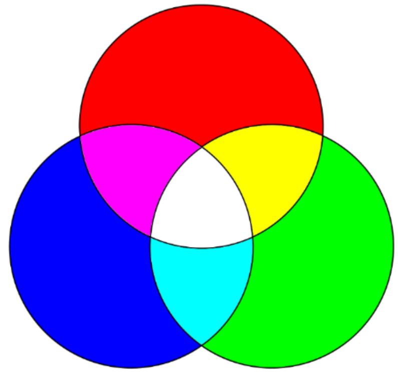


Yellow



Notice that there aren't pure peaks at red, blue, green, etc. Rather, what our eyes perceive as color is often made up of several different frequencies. All of the filters let in high wavelength light, but our eyes are only sensitive to up to about 700 nm. The graph to the right shows the relative eye sensitivity of a *standard observer.* Notice that humans are more sensitive to green and yellow light than any other. A conjecture can be made by pointing out that humans evolved in a natural setting of green foliage. Sensitivity to green was much more important than sensitivity to red or blue. This relative sensitivity plays a big part in how we perceive colors. So not only does our eye-brain mechanism assign single colors to light made up of multiple wavelengths, but it is more sensitive to some of those wavelengths than it is others. All of this adds up to a very confusing time for scientists and artists.

Activities



1. Use several projectors as light sources to shine colored light onto a screen or white wall. Arrange the projectors to overlap each other and create complementary colors by adding a primary with its complement. Can your students explain this with the help of the chart? (yellow = red + green, so blue + yellow = blue + red + green = white)
2. Subtract color from the projector light source by placing one, then two, and then three filters in front of the source. Use three secondary colors first.
3. Try shining colored light onto colored objects, like sheets of construction paper or student art. Very powerful demonstrations consist of images with definitive colors that everyone is familiar with (i.e., red hearts with piercing black arrows, green money.) Keep the real color of the image or paper secret by only showing it in the colored light. Have your students try to figure out what color it really is. Or, by knowing what color the sheet is, have them try to guess what color light is shining on it. If you really want to freak them out, try eating food like fruit and vegetables bathed in colored light. Does it have an effect on the taste!
4. Have your students put on diffraction grating glasses (see Rainbow Glasses below). View a light bulb with them on (lower wattage, diffuse bulbs work best so that students don't focus on the very bright center of the light.) While they are analyzing the spectrum given off by the bulb, hold a color filter in front of it. They should see sections of the spectrum simply disappear. Compare the colors left over to the transmission charts.

Related Products

Light Box & Optical Set 2.0 (P2-9580) This affordable Light Box and Optical Set makes it easy to perform experiments involving the optics of lenses, mirrors, and prisms, as well as providing a versatile way to display primary and secondary colors, and both additive and subtractive color mixing.

Color Mixing Projector (P2-9555) Now you can demonstrate color addition and colored shadows like the museums do! Our color mixing projector gives you three distinct circles of colored light which can be overlapped in any combination, show color addition, complementary colors, color fatigue and colored shadows. Size: 6" x 4.25" x 3.25".

Subtractive Color Theory Demonstration (P2-9565) The Subtractive Color Theory Demonstration provides students with a hands-on experience as they learn subtractive color mixing and explore color theory in a whole new way.

Bibliography

Conceptual Physics: The High School Physics Program. Paul G. Hewitt. Pearson Education, Inc.