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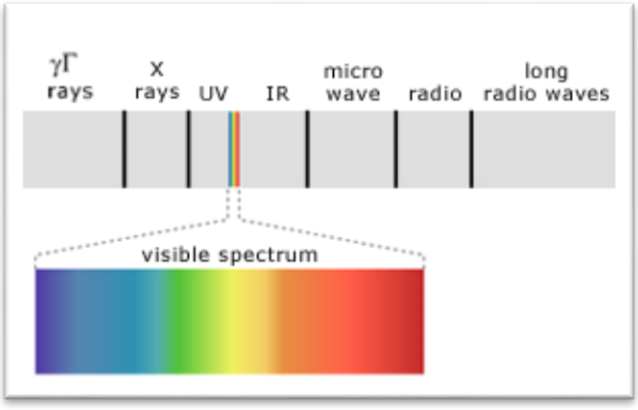
EDUCATION



What is Kelvin Color and Why Does it Matter?

An educational resource provided by HCI LED

Introduction

Light is one small portion of the electromagnetic spectrum.

As seen above, light at one end of the visible spectrum has shorter wavelengths near the 400nm range of the spectrum producing a "blue" visual sensation.

Medium wavelengths in the 500-600nm range produce a "yellow to green" sensation. Longer wavelengths produce a "reddish" sensation.

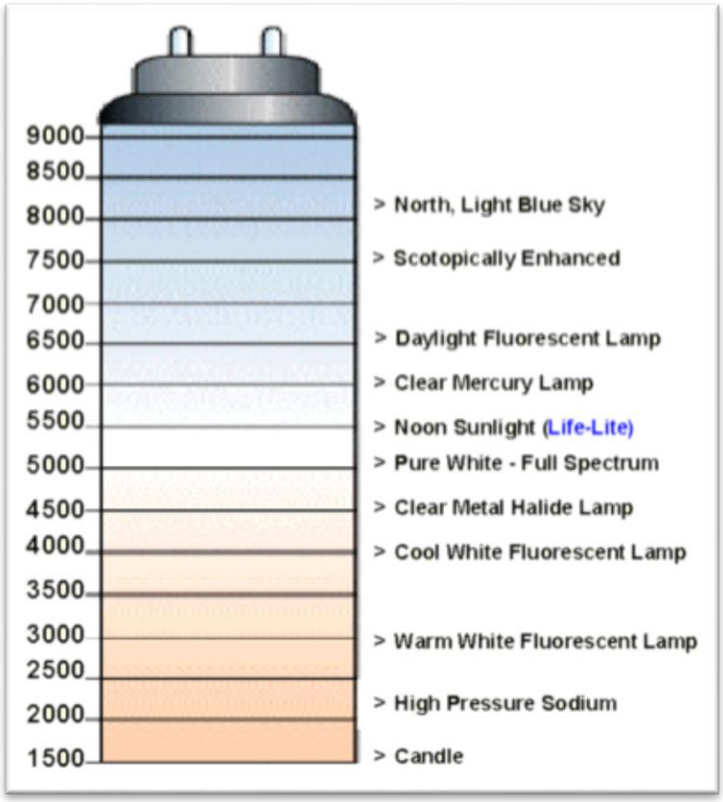
Color Metrics

COLOR TEMPERATURE

The absolute temperature of a blackbody radiator, having a chromaticity equal to that of the source.

CORRELATED COLOR TEMPERATURE (CCT)

Temperature, describes the overall color appearance of a lamp. CCT is measured in Kelvins (K). Color temperature is used to describe the overall color tone of a white light source. Common warmer light sources, similar to incandescent color, have a Kelvin temperature of 2700K or 3000K. Somewhat cooler light sources commonly used in offices include 3500K and 4100K. Very cool color temperatures, often used to match daylight, are 5000K and 65000K.



Kelvin Scale

Kelvin temperature is a numerical measurement that describes the color appearance of the light produced by the lamp and the color appearance of the lamp itself, expressed on the Kelvin (K) scale.

The science behind determining color temperature values starts with the theoretical black body radiator, a block of black metal through which electric current is passed (performed as a computer model). As the metal is heated, it turns red-yellow, then white, then blue; as the temperature of the metal is measured at any given color produced, we then match the color to that temperature and a color temperature value is determined. The color appearance of various light sources therefore can be defined in terms of Color/Kelvin Temperature, measured in "degree" Kelvin (K)

In application, the Kelvin temperature of lamps is used to categorize them as warm, neutral or cool sources. The terms are not directly related to temperature; instead, they describe how the light source appears visually. Warm sources actually have a lower color temperature (3500K or less), producing a red-yellow appearance. Neutral sources (between 3500K and 4100K) tend to have

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a yellow appearance. A lamp with a color temperature of 5000K is considered pure white light (Full Spectrum) with the lamp becoming bluer in color as the color temperature is increased.

Warm light sources are traditionally used for applications where warm colors or earth tones dominate the environment, and where there is a need to impart a feeling of comfort, coziness and relaxation.

Cool light sources (5000K+) with high color rendering capabilities, such as Full Spectrum lights, are traditionally used for applications where there is a need to enhance all colors equally, such as retail stores to stimulate sales, or to increase productivity and reduce errors within the office environment and to motivate the customer or employee through enhanced "see-ability".

There are various instruments which can measure light in Kelvin. These range in size, cost, accuracy and complexity from smartphone apps priced at a few dollars to hand-held devices costing around a thousand dollars to large industrial hardware systems that fill a small room and cost tens of thousands of dollars.

Why does Kelvin Matter?

Selecting light sources with a specific Kelvin temperature is important to businesses for many reasons.

1. Choosing a neutral color light source helps to maintain a consistent color for branding.
   The two largest Do-It-Yourself warehouse stores in the United States employ very different colors in their corporate branding. One uses a bright blue, while the other uses a deep orange. If Orange were to illuminate their signage with a blue LED light source, the illuminated sign's brownish appearance would be quite different from the eye-catching orange shoppers would see during the day when their signs are lit by ambient light. Conversely, a warm yellow light behind the faces of Blue's logo would give the viewer a hint to green in the logo rather than the bright blue the company has adopted.
2. Natural Daylight color helps increase brand recognition and promote consumer comfort, by minimizing distraction caused by visual variations between currently viewed images and those stored in human memory.
   Human eyes are accustomed to average daylight color light (6500K), so the brain does not have to correct for variances in light color.
3. Neutral, familiar light colors increase shopper trust and enhance buyer motivation.
   The Retail Merchandising industry has studied the effects of light color and color rendering accuracy in the retail environment and has acknowledged that it "...plays a major role in supporting retail operations, from attracting customers, to enabling the evaluation of merchandise, to facilitating the completion of the sale. Lighting also contributes to the identity, comfort, and visual quality of the retail store. Ideally, then, lighting should support the retailer's desired image and work in concert with other design components to promote sales." (Guide to Light and Color in Retail Merchandising, Vol. 8, Issue 1)

(For a look at the impact a color cast can have on a company's logo, go to http://www.colorhexa.com/colorblend. Or for a thorough overview of the science of color, see http://physics.info/color.)