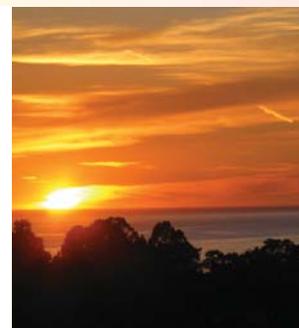
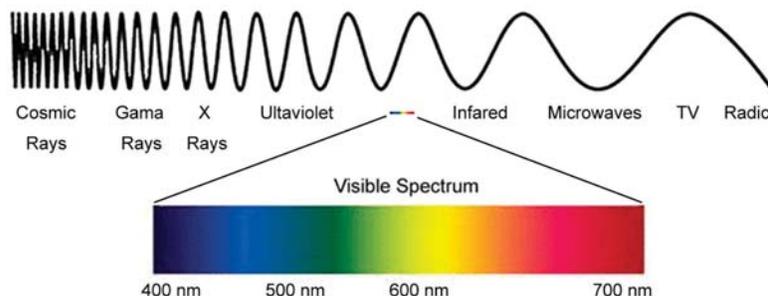


Gemstones & Light – The Basics

Without light, there is no color. Without light, the \$50,000 ruby would be worth nothing... it would not be red... it would not be beautiful... and it would not be saleable! What we see as color are the wavelengths we call visible light, reflected back to our eye; the rest of the colors are absorbed. So, to see a color, it must be in the light source. For our gemstones to be beautiful, they must have proper lighting.



by Dana Schorr and Trish Reynoso

Value of gems is determined by three components—the color, clarity, and cut. Of course rarity and demand play a role in value as well. Of the three components of value, color by far has the most dramatic effect on the value. The perceived color of a gemstone can overshadow all the other variables affecting the price including size, shape, clarity, and quality of faceting.

The color of a gemstone does not emanate by itself, from within the gemstone. Color comes from light and the interaction of light energy with trace elements within the gemstone. Like fireworks or light split by a prism, various wavelengths are seen as different colors.



Light actually has a physical effect on the human body. People fall in love with a particular color for many different reasons. Some emotions are proven to actually be caused by light. There is even a new science called *chromotherapy* studying the effects of light on our mental and physical well-being. There are many qualities and effects of light that the jewelry industry can start using to more effectively market and sell our gemstones and jewelry.

To use light effectively, we must understand light. In this first installment we will provide an understanding of

the properties of light, how they affect us physically and our perception of colored gemstones. You will understand the differences between different types of illuminants including daylight and artificial light. We will explain how to analyze your lighting needs and how to use light in your store or office. We will also present ideas for the establishment of measurable criteria and standards for evaluating lighting sources in the jewelry industry.

Future issues of *GMN* will cover the science of lighting, designing lighting for your store or office, and the politics of lighting with ideas for the future.

Challenges

Do any of these examples sound familiar to you? Here are many real world examples of situations that have occurred to us or to other dealers we know regarding gems and lighting. A gemstone purchased



in Thailand does not look the same when it is brought back home. A \$3,000/ct stone in Thailand appears to be worth only \$2,000/ct back in the U.S. office. A

pink tourmaline purchased at a trade show does not look as pink in your office as it did under the booth lights. The beautiful deep blue tanzanite that a customer requested and was willing to pay top dollar for,

is returned with a note claiming that the stone is violet, not the rich blue color as was requested.

Here are more examples. A jeweler is upset because the matching sapphires you sent him do not match at all when shown in his store to his customer. A company has multiple offices in the U.S. and the sales staff are having a hard time matching inventory when items are sent from different locations. The company cuts, grades and sells in multiple countries and the differences in color grading coming from the cutters does not seem to make any sense. All gems need to be re-graded after importing.

History

Historically, north noon daylight (daylight means indirect sunlight) in the northern hemisphere has been considered the “perfect” light to evaluate and grade gemstones. According to Richard Hughes in his book *Ruby and Sapphire*, “...rubies (and other red stones) look best during the midday hours. Sapphires, in contrast, look best in the early morning or late afternoon.” The quality of daylight actually changes from time of day and from place to place.

Until Thomas Edison invented the light bulb, we were limited to daylight and firelight (candles, oil, gaslight, etc.) to illuminate our gemstones. The invention of the incandescent lamp allowed us to have an efficient dependable lighting source 24 hours per day. However, this light is different from daylight and gemstones do not look the same and may not appear as beautiful.

Today there are light sources that attempt to simulate natural daylight. These lamps are much better than standard incandescent lamps in mimicking daylight and they are improving every year.

Due to specific technical problems in their trade, some industries (automotive, graphic arts, textile and apparel, paint, dye and pigment manufacturers) started working with lighting scientists to try to understand and develop lights that would more accurately render color and expose very slight differences in hue, tone, and saturation that was affecting quality control.

Many trades (not including the jewelry trade) have established domestic ANSI and international ISO standards to determine what is actually a satisfactory illuminant.

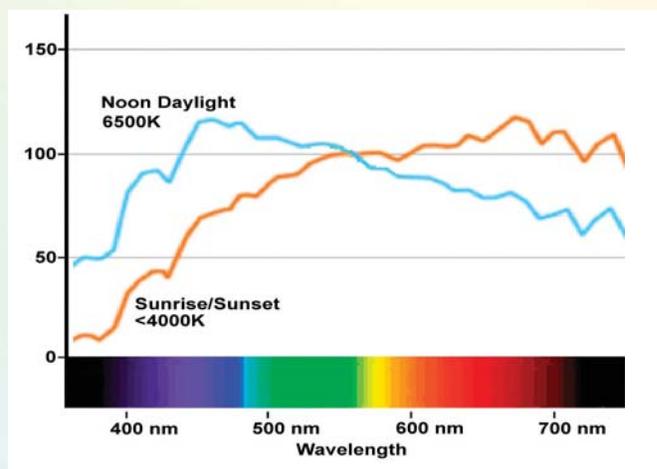
In the jewelry trade it was not until sometime in the late 1900s that a “standard” was discussed in our industry. That standard for diamond grading was proclaimed to be “D65” or 6500 degree Kelvin lamps. The trade has assumed that this light is best for all gems and jewelry, but is it? A good standard should be reproducible, stable, and be the best lighting for gemstones and jewelry. Perhaps this is not true. A \$400/ct tanzanite under daylight could sell for \$500/ct or more under 6500K standard lighting lamps. Some may say that this is deceptive, since the color under a different standard could appear less expensive.

So, what is the best lighting source? To make these important decisions, technical information and terminology are important. The knowledge that will be presented in the rest of this series will be some of the most important information about gemstones that you will ever learn. This article will begin with the basic terms.

Terminology

Light & Color

Light is a small section of wavelengths in the electromagnetic spectrum. These particular wavelengths, when they strike sensors (rods and cones) in the human eye, are interpreted as color. Light is perceived as many colors depending on the wavelength being viewed. “White” light is an even combination of all of those visible wavelengths scattered randomly while black is perceived when all wavelengths have been absorbed.



Lamps - Illuminants

Light sources are both natural and artificial. They can be lamps, bulbs and other source of light including sunlight and moonlight - anything that can be used to illuminate an object.

Grading of Lamps

Three basic systems are used to describe the quality of light. You must be careful in making decisions based on any one of these terms alone because even though they are helpful they are not necessarily accurate under all situations leading to mistakes.

Kelvin. This term specifies the hue or color of a light source as a color temperature. This color temperature is measured in degrees Kelvin. A higher temperature, for example 6500K (Kelvin) would indicate a whiter and “cooler” light source, while a lower 3500K would indicate a yellower or warmer lamp.

CRI. Color Rendering Index is used to describe how well a lamp renders the colors (looks natural) of an object being illuminated. A high CRI of 98 would mean

that you can tell the difference between two different but very similar colors and they would both look natural. A low CRI of 62 would mean that it may be difficult to tell the difference between two similar colors.

SPD. This is the Spectral Power Distribution Curve. A graphical representation of the amount of energy emitted by a light source across the visible spectrum. This is the most accurate of all representations of the light output of a lamp.

Lamps – Bulbs

There are many types of lamps available to be used in your store or office. The following are the most common and useable.

Daylight – natural. The best light for viewing gemstones and the best for your body and brain.

Incandescent. Man-made illuminants that result when a piece of wire is heated. These lamps are very high in the red and infrared (and physically hot) and low in the blue unless they are filtered. Incandescent lighting includes standard screw-in bulbs, halogen bulbs, coated halogen bulbs, filtered tungsten halogen, “daylight” halogen and MR16’s.

Fluorescent. Fluorescent lamps produce their light by the electrical excitation of phosphors. There are several types of fluorescent lamps available but only two that are important to the jewelry trade. The most common and used in most homes and offices are “cool white” fluorescent bulbs. The second type is a “daylight” fluorescent lamp and it is designed to mimic natural daylight.

LED. The LED is the newest technology on the market. They are generally of low wattage so you need many bulbs to illuminate a display case effectively. They use very little power, last a long time and can be designed to mimic daylight and be used as “spots.”

Other Lamps. There are other types of lamps but they are not readily available for use in the jewelry industry.

How We Perceive Color

There are four variables that affect how we perceive color.

1. **Light Source**
2. **Object being viewed**
3. **Observer**
4. **Environment**

The first two have already been presented.

The Observer

All of the following can affect how you perceive color. If you are tired or have not been sleeping well. Drinking of alcohol or taking some forms of medication. Reading or vision correction glasses that are tinted. Any form of illness. Genetic color deficiencies. Your sex—1 of 250 women are color vision deficient, while 1 of 12 men are deficient.

Light can also affect how you, your employees and your customers feel. Your eyes have more than the two receptors we all know about - rods and cones. In fact, there are other receptors that react to various wavelengths of light energy that can make you weaker or stronger, calm or fidgety, low energy or high, inattentive or attentive. Which of these ways would you rather have your employees and customers feel?

The Environment

There are many ways the environment can influence perceived color. These can be organized into 2 categories. Uncontrollable—location in the world, season, time of day, weather, pollution. Controllable—ambient lighting, direct lighting, colors of the wall, floor, rugs, artwork and counters.

All these factors will affect how a light source illuminates your gemstones and jewelry and how you perceive the color of the items you are illuminating. These environmental factors can dramatically change your perception of the color of the gemstone you are viewing and therefore its market price.

Synopsis

Many factors determine the best illuminant for each situation. Some lights are better for illuminating gemstones, others are better for setting a “mood,” and others will make your customers and employees feel better and work better. ♦

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Dana Schorr is the owner of Schorr Marketing and Sales, a company which imports and exports colored gemstones, both rough and faceted and finished jewelry. Schorr Marketing is a member of AGTA and has been appointed to several AGTA and ICA committees. Trish Reynoso is a past president of the Mission Section of the Illuminating Engineering Society of North America. She leads her lighting design community in professional development.