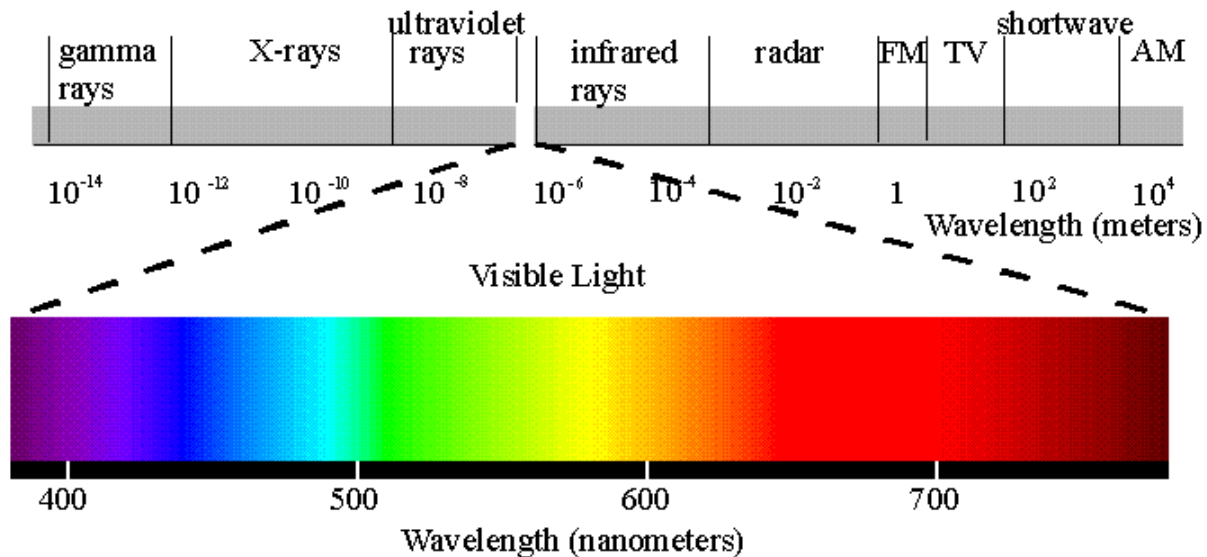


**SAMPLE**  
**LIGHTING SYSTEMS**

**TRAINING MODULE**

**Introduction:** Lighting systems play an important factor in a hotel ranging from the guest’s ability to see and their comfort level, to the productivity of employee work, to the operation and efficiency of the building’s physical plant, and even to creating a hotel’s brand recognition. Lighting affects the operation and load on a property’s HVAC systems which in turn effects energy management and cost. Lighting provides sufficient illumination for an activity or task to take place in a given area. Lighting systems affect how one perceives textures of building materials and their colors. Many hotels, such as casinos, use lighting to attract customers to an area or showcase a particular product or source of revenue. Lighting plays a significant role through out the property from safety and security to the design of the building façade and window placement to the operation of your property’s building systems.

**Theory:** Let’s start with a few basic terms and concepts surrounding a thorough understanding of light sources and their systems. *Visible light* is radiant energy that can be seen by the human eye. Light is radiated as energy in the form of wavelengths and frequency as found in the electromagnetic spectrum. Only a small portion of the spectrum can actually be seen by the human eye. The human eye sees certain colors based upon the characteristics of the energy much like the ability of the human ear to hear certain sound waves based upon their properties.



**ELECTROMAGNETIC SPECTRUM**

The area of spectrum less than 380 nm is ultra violet energy and the area of spectrum longer than 770 nm is infrared energy. Both of these radiant energies are invisible to the human eye.

**Reflectance** is the light that is transmitted back to the eye and not absorbed by the surface it is shining on. The light transmitted or reflected back to the eye is what gives an object its color. Light, being the source for all visible color is what gives an object a certain color and is based upon the amount of light both reflected and absorbed by the object one is viewing. For example a blue bedspread found in a guestroom absorbs almost all light except the blue light which is reflected back to the eye. The blue one sees is made up of energy

represented by wavelengths and their frequency found at the lower-end of the spectrum representing shorter wavelengths and other colors like violet and green. At the other end of the energy spectrum are longer wavelengths representing yellow, orange and red, with red being the longest.

Reflectance is reduced by decreasing lamp output, dirt and dust on the lamps, and dirt on the walls and ceilings. Light in a hotel room needs to be delivered in a fashion that enables guests to see effectively and comfortably. Good lighting provides your guests and building occupants with both visual comfort and productivity through both the level of illumination and the quality of illumination. Well-designed lighting in a hotel should seek to maximize guest comfortable and employee productivity within a reasonable cost environment.

An important concept to understand is how the color of an object is affected by the source of light shining on it. White light is composed of all colors in a rainbow, however different light sources contain varying amounts of each of these colors. **Color rendition** is that light source's ability to provide a perceived color similar to the color found from sunlight shining upon an object. Both sunlight and incandescent lighting have a color rendition index (CRI) of 100. A lamp's CRI is a number between 0 and 100 indicating how closely the lamp resembles daylight or incandescent lighting. The color appearance of light is often referred to as the color temperature. This correlated color temperature (CCT) is measured in degrees Kelvin or "K." Lamps with a CCT below 3500K are found to be "warm" producing a reddish or yellow light conversely lamps over 4000K are considered "cool" and give out bluish or white light. The color temperature influences guest comfort and employee productivity. Certain colors produce a mood or ambience in your hotel. Maintenance personnel should be aware that most lamps include specifications for both the CRI and CCT values.

Light is expressed and measured by standard units and methods. The **footcandle** is a measure of illuminance. One footcandle is the light intensity of a standard size candle providing light on one square foot of surface one foot away from the light source. The **lumen** is a unit of light measuring the source's output. Illumination is a measure of the light's intensity striking a surface and is measured in footcandles; one footcandle is the density or light level intensity of one lumen per square foot. The lux is a metric term for a light intensity of one lumen per square meter.

Light comes in only two forms; either natural sunlight or artificial light. Both sources are found in your hotel and contribute to the design and comfort of your property. The proper use of lighting is critical to your property as it:

- Makes your guests feel comfortable and attracts them to both your property and intended areas
- Creates an aesthetically pleasing work environment for you employees
- Provides sufficient levels of light for tasks and activities of both guest and employee
- Helps establish you property's brand by communicating a concept
- Highlights an area or an object like a piece of art or sculpture
- Creates a mood such as found with varying illumination and colors for different venues
- Provides minimum levels for safety and security of guests and employees
- Effects energy and life cycle costs including initial purchase, installation and maintenance costs

**Natural Light:** Natural or sunlight is the most common source of light and the least expensive of any light source. As lighting energy accounts for a significant portion of a property's total energy use, the use of natural lighting is important in any hotel design and daily operation. The use of natural light for interior hotel and restaurant lighting is typically enjoyed by guests, but its efficiency and cost effectiveness needs to be balanced with some of its uses shortcomings. Natural light can cause some materials and fabrics to fade and others such as some thermal plastics to discolor. Natural light creates considerable solar heat gain and impacts a designer's choice of windows and window coverings. At times natural light can be a source of distraction resulting from unwanted glares or sudden brightness. Natural light's biggest attraction above its inherent energy savings is the psychological effect it has on guests and employees as they perhaps focus on some attractive scenic view or your property's well maintained grounds.

### **Artificial Light**

Artificial light is all other light except natural sunlight. Artificial light is often characterized by its color rendering index or its efficiency as expressed in lumens per watt. Two broad categories define the majority of artificial lights found at a hotel; incandescent lamps and electric discharge lamps.

**Incandescent Lamps:** An incandescent lamp is simply a sealed glass bulb with a filament inside. The filament is a highly electrically resistant wire. An electric current is passed through the filament producing enough heat to cause a glow or incandescence within the bulb which is viewed as visible light. The bulb is usually coated to diffuse the light produced by the filament. The lamp typically has a base for the electrical connection. Incandescent bulbs are the most common form of artificial light in guestrooms and residences.