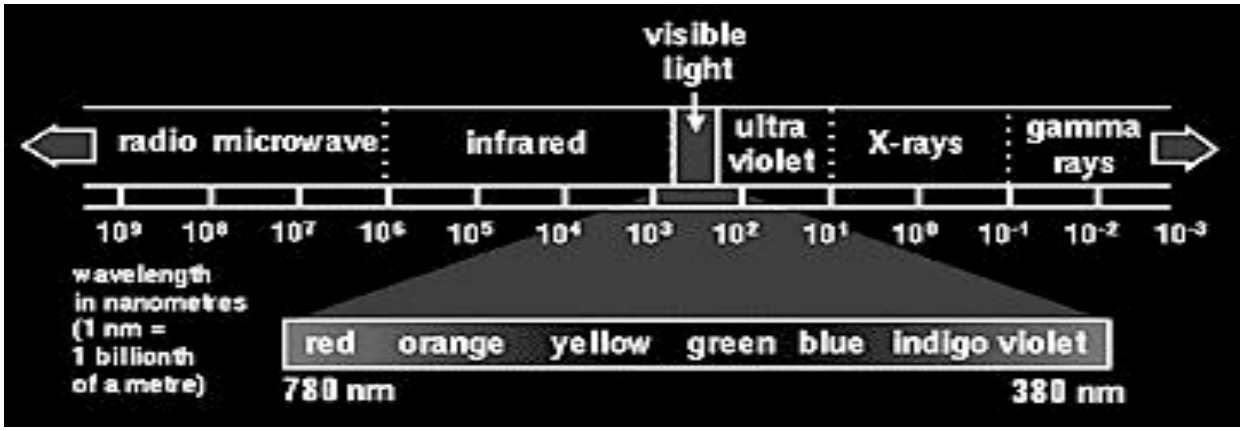
Light

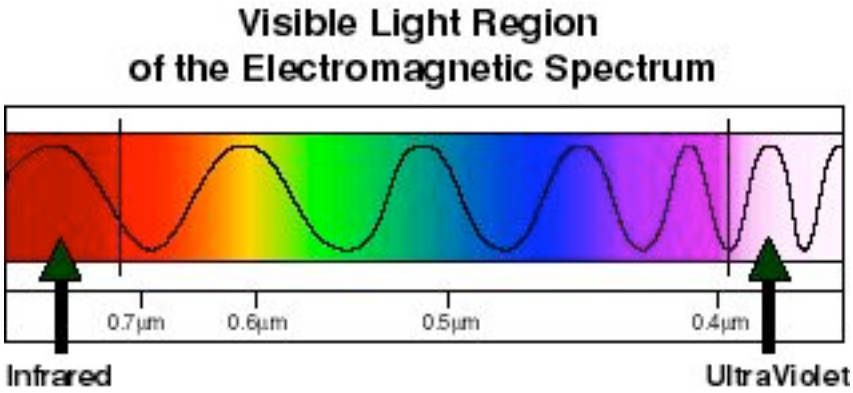
With your eyes you see it everywhere...

Without it you see nothing...

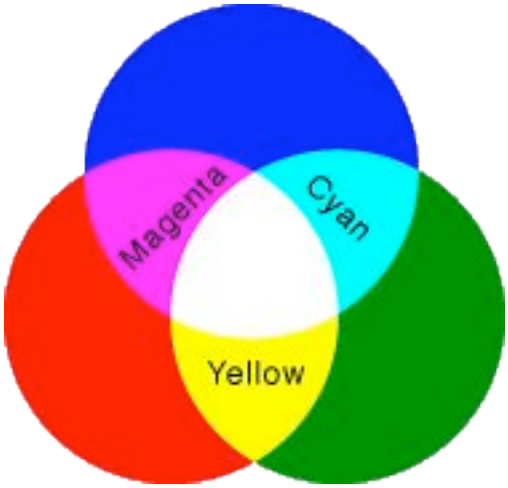
Learn the aesthetics and theory of lighting, color theory, composition for film and video. Topics include: seeing the light, color's many moods, framing the composition. The goal is to give the student filmmaker a look into some of the professional techniques and theories necessary to conceive and create lighting setups for stills or moving images.



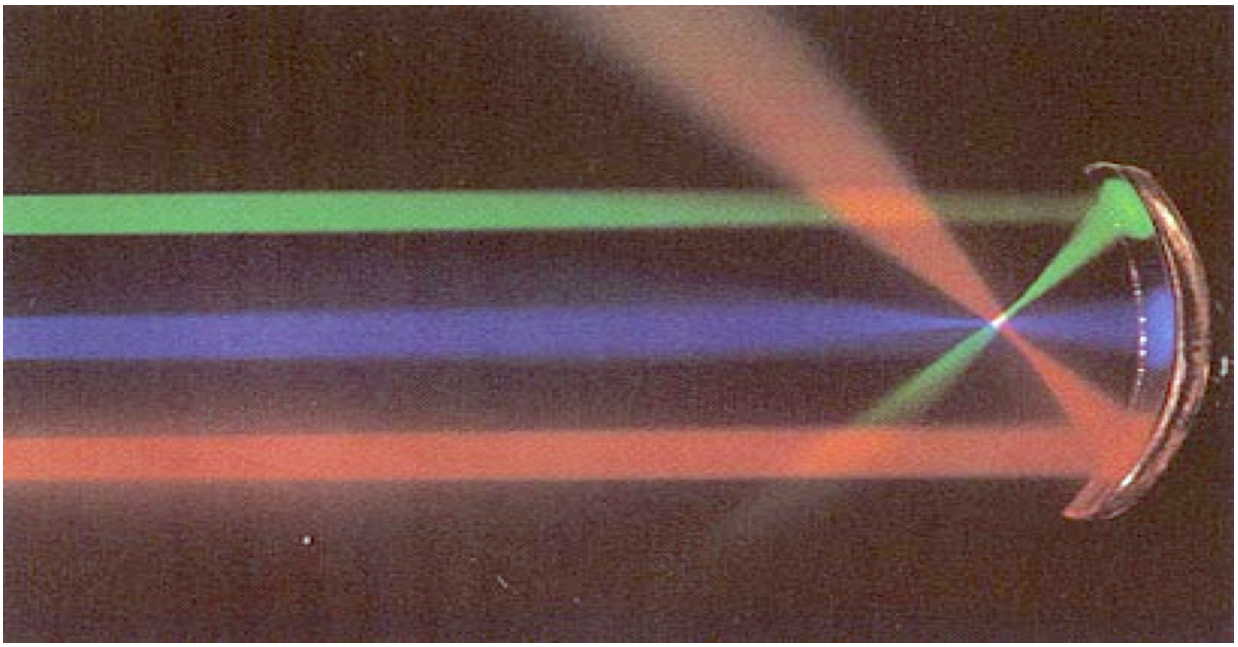
Visible light is part of the electromagnetic spectrum.



Visible Spectrum (daylight film)



White light is formed where red, blue and green light overlap



Color Temperature in Kelvin
Sun - 5800 k
Shade - 15000 k

Kelvin	Celsius	Fahrenheit	
0	-273	-459	absolute zero
100	-173	-279.4	
273	0	32	water freezes
310	37	98.6	human body temperature
373	100	212	water boils (STP)
755	482	900	oven on cleaning setting
5840	5567	10053	Sun's Temperature

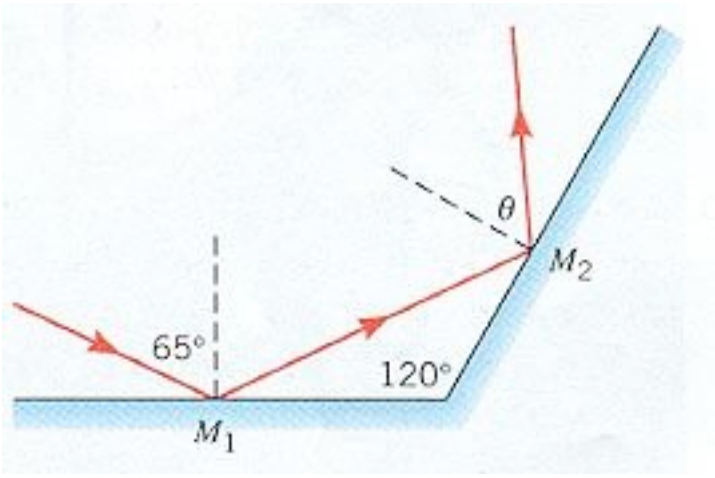
Kelvin temperature is color of light emitted compared to a piece of iron heated to a specific Kelvin temperature.

Light 'temperature' gets higher as the light gets bluer. Imagine a bar of metal being heated in a fire - first it glows red, then, as it gets hotter, it turns white and finally almost blue. That is when the maximum temperature is reached.

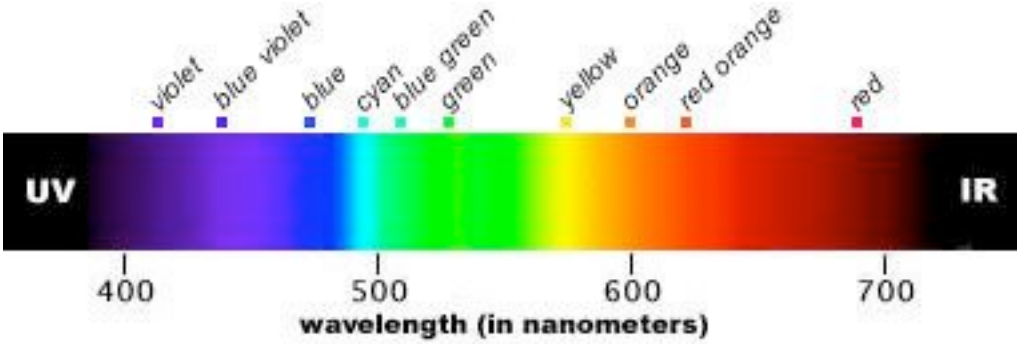
Color temperatures are quantified by the Kelvin scale. This gives a reading of about 2500k for the average household (tungsten) light bulb, and something around 5500k for outdoor light when the sun is shining brightly with just a few little clouds in the sky. When the sun is obscured by cloud, the Kelvin temperature can rise to around 8500k. Much higher temperatures occur when we step into the shade on a bright sunny day with a very clear blue sky. Then the Kelvin temperature can reach anything up to 15000k.

Refraction

Refraction is the bending of light as it passes between materials of different density.

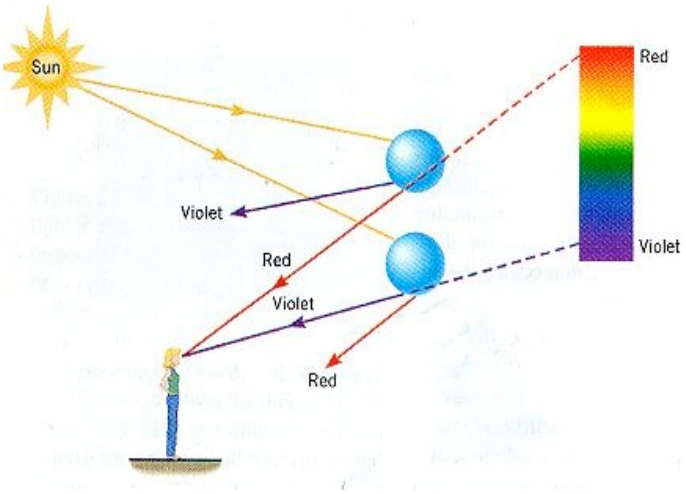


Refraction - Forming a Rainbow

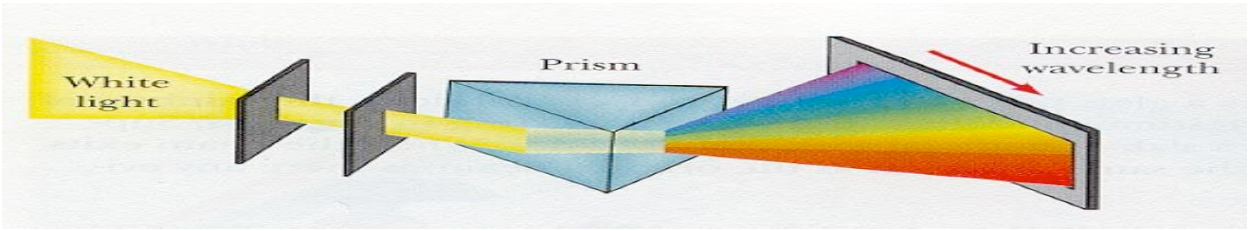


An observer sees red light coming from droplets of water higher in the sky, while droplets of water lower in the sky send violet light to the eye.

Differential Color Refraction is the dispersion of white light into its individual colors by a glass prism. As visible light exits the prism, it is refracted and separated into a magnificent display of colors.



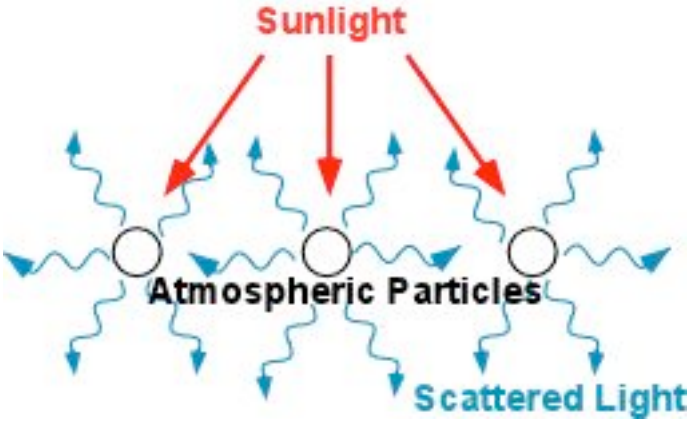
Each color from the original beam of light has its own particular wavelength (or color) and each wavelength is slowed differently by the glass. The amount of refraction increases as the wavelength of light decreases. Shorter wavelengths of light (violet and blue) are slowed more and consequently experience more bending than do the longer wavelengths (orange and red).



Note: Shorter wavelengths of light are bent more than the longer; blue more than red.

Diffuse Reflection
Atmosphere

Different from reflection, where radiation is deflected in one direction, some particles and molecules found in the atmosphere have the ability to scatter solar radiation in all directions.



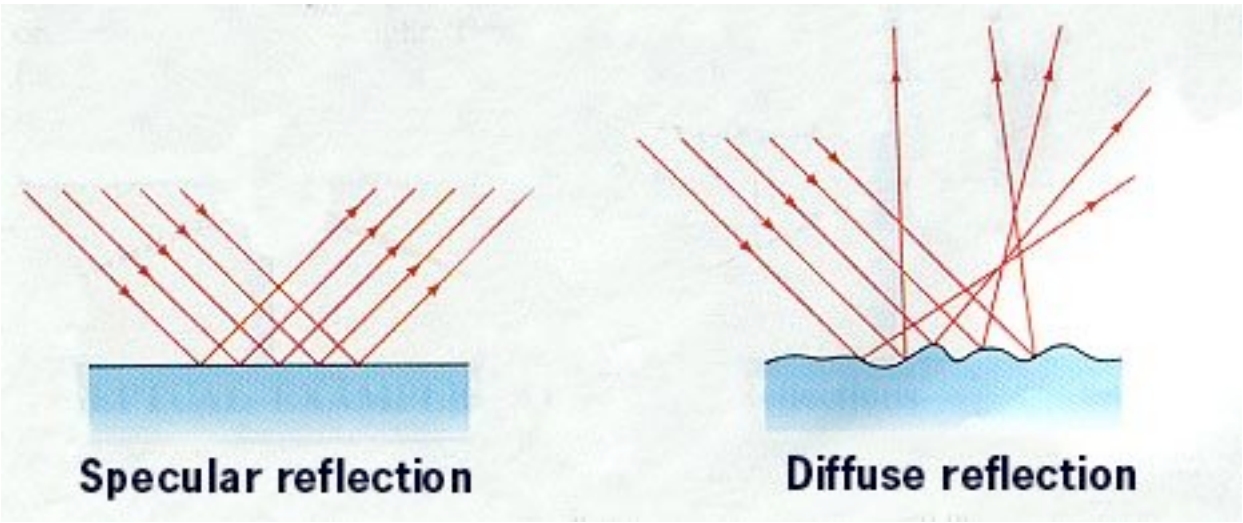
Blue skies are produced as shorter wavelengths of the incoming visible light (violet and blue) are selectively scattered by small molecules of oxygen and nitrogen -- which are much smaller than the wavelength of the light. The violet and blue light has been scattered over and over by the molecules all throughout the atmosphere, so our eyes register it as blue light coming from all directions.

Atmosphere
Weather

Blue haze creates a feeling of depth.

Clouds & Fog affect the amount and color (Kelvin) of lightSpecular Reflection

Specular vs Diffuse Reflection

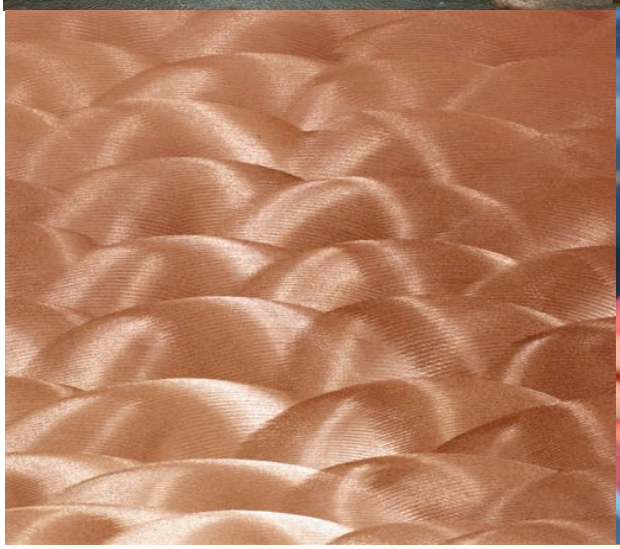


Specular reflection **Diffuse reflection**

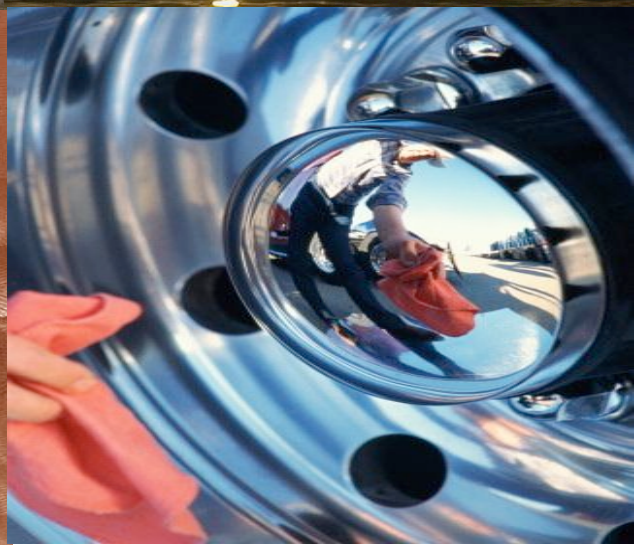
Specular Reflection - **Surfaces**

Water (diffuse)

Water (specular)

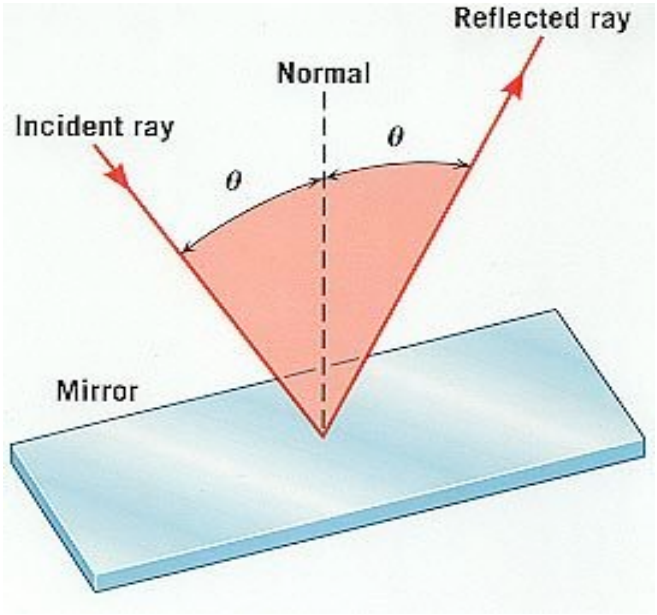


Metal (diffuse)

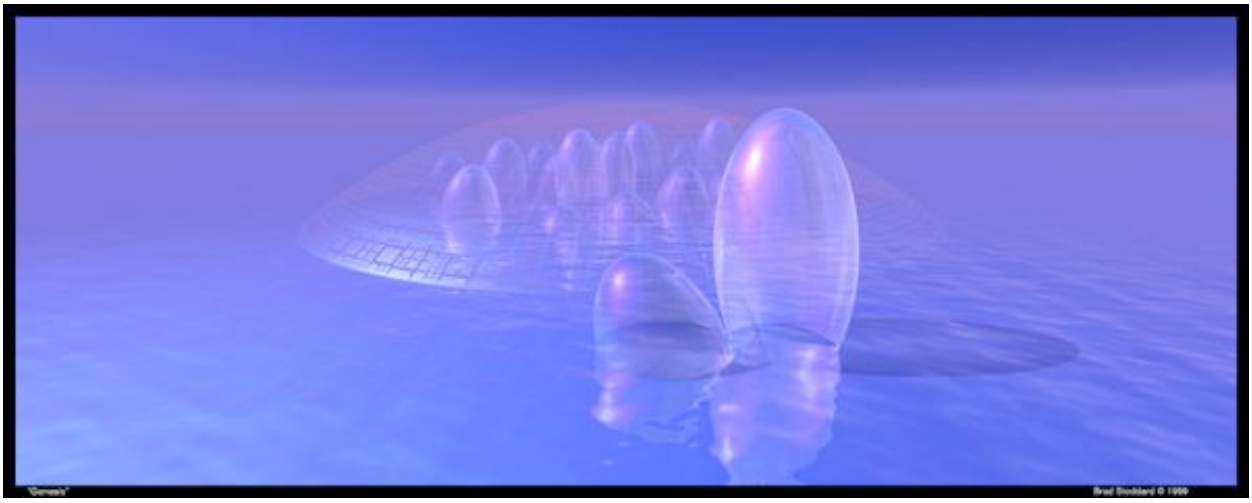


Metal (specular)

Law of reflection



When light is reflected off any surface, the **angle of incidence** is always equal to the **angle of reflection.**



Reflections follow the law of the angle of incidence

Time of Day

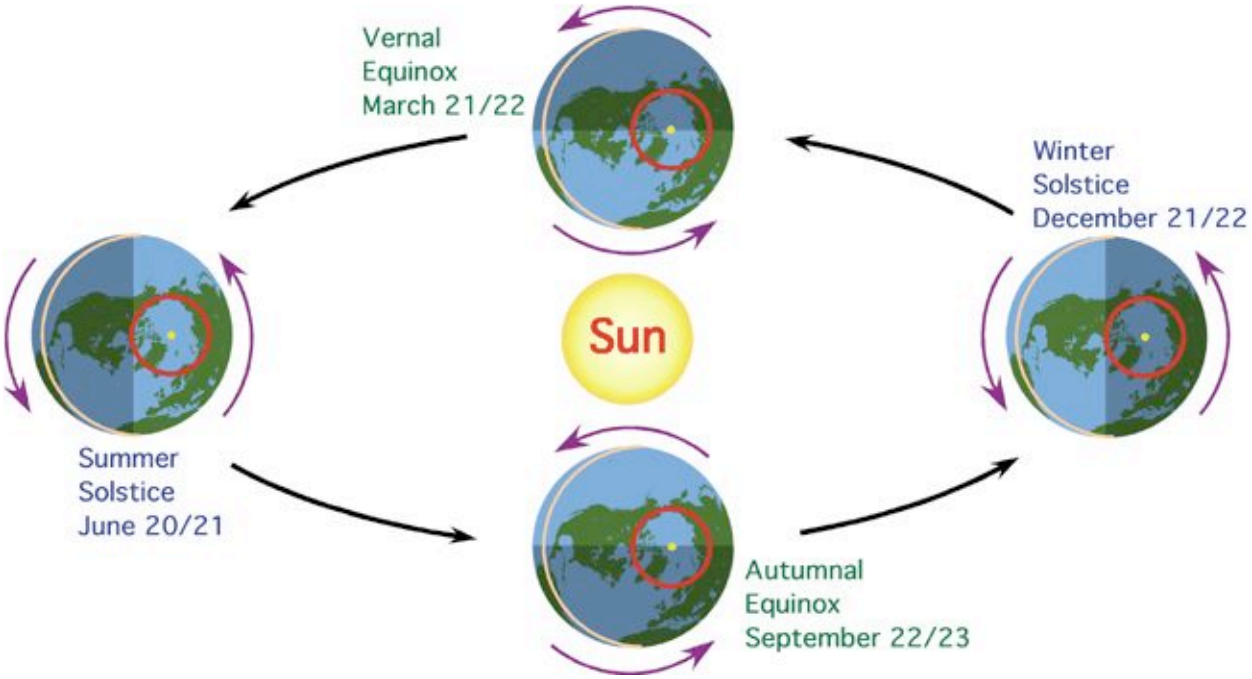
Sunrise/Sunset

Morning/Evening

Around Noon
Mid Day Light is flat

Latitude

Your location on the globe
Time of year + Latitude



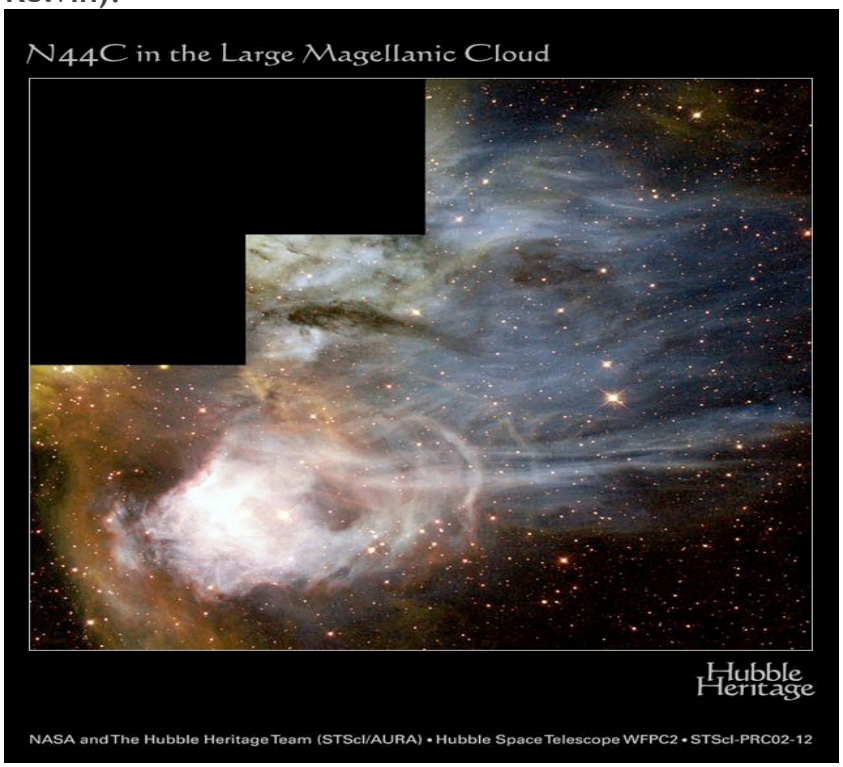
Night Light
Color temperature - Moon – 15000+ k
Moonshine

The moon reflects the sun as well as light from the earth.

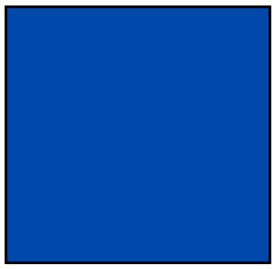
Moon and stars just after sunset

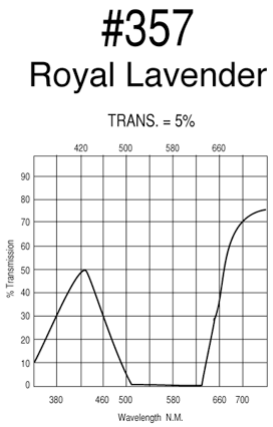
Stars

N44C is peculiar because the star mainly responsible for illuminating the nebula is unusually hot. The most massive stars, ranging from 10-50 times more massive than the Sun, have maximum temperatures of 54,000 to 90,000 degrees Fahrenheit (30,000 to 50,000 degrees Kelvin). The star illuminating N44C appears to be significantly hotter, with a temperature of about 135,000 degrees Fahrenheit **(75,000 degrees Kelvin)**!



Day for Night





Rosco Filters

Supergel #357: Royal Lavender
A rich lavender which will enhance blue and red costumes and scenic pieces.

Excellent for nighttime scenes. Rich, vivid accents, good in backgrounds.
(Trans.= 5%)

376 Bermuda Blue. A soothing green blue. A good conventional moonlight color.

Day For Night

Daylight Photograph no adjustment

Daylight Photograph Color Adjustment for Night

Color temperature

Fire
Tungsten
Halogen
Mercury Vapor
Florescent

Color temperatures are quantified by the Kelvin scale.

1800k log fire or candle
2845k 100 W tungsten light bulb
3200k photoflood lights for indoor photography and movies
2800 to 3200k Quartz Halogen Studio Lights
3500 flash bulbs
6500 fluorescent lights
Mercury Vapor

To get around the problem of matching film to lighting, photographers use films of different "color temperature" or white balance digital cameras. The color temperature of film is indexed in degrees Kelvin (K). To represent the north sky on an overcast day, a fluorescent light of 7500k would be needed.

General Use

3200 Kelvin Used as a primary light source for retail applications. Ceramic metal halide.

4000 Kelvin: Used in general lighting; factories: parking lots, warehouses - most common North American type of metal halide lamp (sodium-scandium chemistry)

5000 - 5500 Kelvin Daylight lamps: Usually the highest color rendering -- common for European type lamps that are used in indoor and high quality lighting applications.

Color Constancy

The medium through which light passes can change its spectral distribution. Due to **color constancy** , we normally tend to see colors as staying more or less the same. If, however, the color change is relatively extreme, it will be noticed. The color of sunrises and sunsets for example, can vary greatly depending on the time of day, latitude, season of the year, weather conditions, and air quality.

Florescent

Scene under incandescent lighting

Same scene under fluorescent lighting