

Welcome to PVTV LEARNING, from ParkerVision. This curriculum represents the most advanced and effective way to teach high school and college students the science of modern television broadcast. Until now, most broadcast curriculums focused on methodology that evolved over 30 years ago. This curriculum, however, covers basic production techniques and equipment, and then transports the students into the advanced automation technologies that are quickly becoming the norm in today's television broadcast industry.

If you have elected to download only the PDF versions of the Teacher's and Student's Editions of PVTV LEARNING, feel free to jump right into teaching. Throughout the chapters, you will see references made to additional materials in the way of on-line lessons and tests, and explanatory videos and animations.

This additional material is available to educators at a significantly discounted cost in electronic format (on a CD ROM). For more information on obtaining this additional material for your school, visit our LEARNING web site at [www.PVTVLEARNING.com](http://www.PVTVLEARNING.com) or contact us as shown below.

ParkerVision, Inc.  
8493 Baymeadows Way  
Jacksonville, Florida 32256  
e-mail: [sales@parkervision.com](mailto:sales@parkervision.com)  
Tel: 904-737-1367  
Fax: 904-731-0958  
[www.parkervision.com](http://www.parkervision.com)

This Curriculum Furnished By:

**PARKER**  **VISION**<sup>®</sup>

See all of our advanced broadcast technology products at:  
[www.PVTV.com](http://www.PVTV.com)



# Types of Light

Lighting is a third partner, although a silent one, with video and audio. Without light it is virtually impossible to make television images. Lighting has both a technical and an aesthetic function in television.

With enough light, and with control over its quality and direction, you can create excellent pictures. You will see the image details clearly without any graininess or picture noise, and the color will be as accurate as possible. The amount of light in a shot determines how clearly we see the images in the picture. The type of light affects the color.

## online LESSON: 1

### Objectives:

After completing this section you will be able to

- identify different light sources
- describe color measurement of light

Lighting also affects the mood of a scene. A character who walks into a shadowy room conveys one mood, while one walking into a well-lit room conveys another.

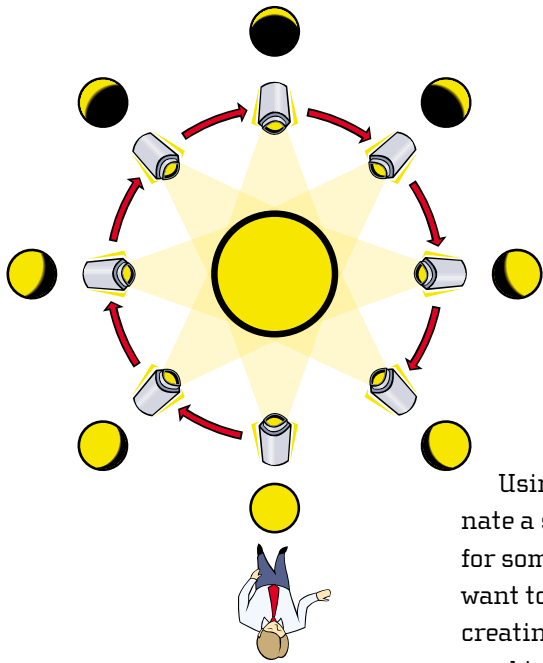
So, whether using natural light, artificial light or a combination of both, if you understand some basic principles you can make better decisions about how to use lighting to enhance your shots.

There must be sufficient light for the video camera to make an acceptable picture. This means that there must be enough light reflected off a scene to produce an image. You have already learned that the intensity (or brightness) of the light on a subject affects how

well a camera can see it. Too little light, and the picture will be dark and underexposed. In dim light an image is soft, and it is hard to distinguish color. The subject may not be clearly visible, and there will be a lot of graininess to the image. (This is called picture "noise.") In bright light the image becomes much sharper and clearer.

Video cameras need more light than many types of film cameras to make good images. Different video cameras also need different amounts of light. As you begin to work with your cameras, you'll get a better sense of how much light they need.

One way to create technically good pictures is to find a bright environment and properly place your subject so there are no harsh or unflattering shadows. The light that already exists in any environment is its **BASE LIGHT**. If you turn the lights off in a room, you are lowering the base light level. If you turn on more lights, you are raising the base light level. Base light can be even, diffused light and works to illuminate a scene, but we usually do not think of it as lighting.



Using only base light to illuminate a scene may be good enough for some productions, but if you want to get into the aesthetics of creating a particular look, you need to think more about lighting. This means you want light to direct attention to specific areas of the picture and downplay other areas.

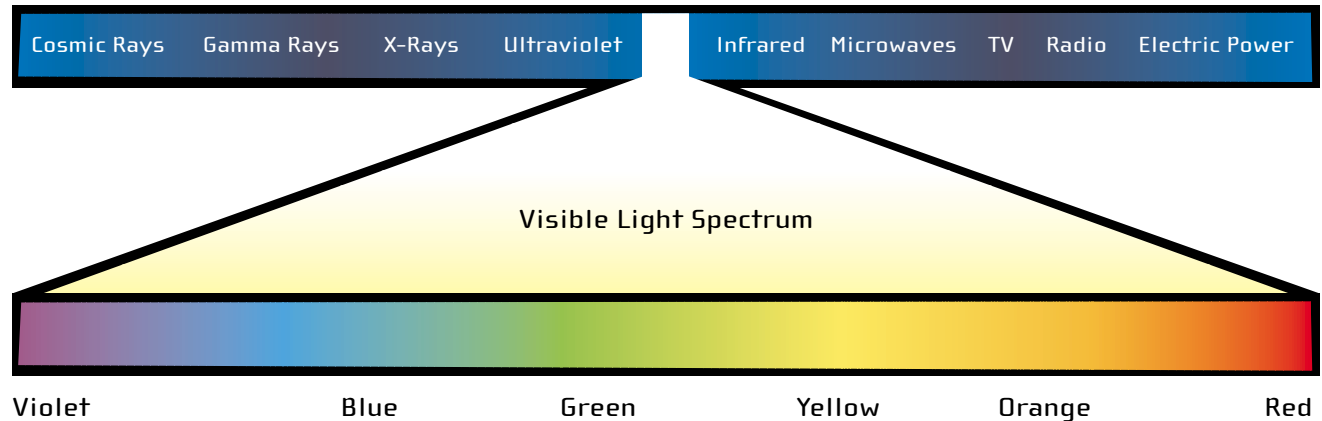
The direction of a light source affects the way light and shadow fall on a subject. The direction of the light is determined by how you position both the subject and the lighting fixture. Light coming from directly in front of a subject along the camera lens axis reduces texture, modeling and shape. Light from the side emphasizes shape and modeling.

Light's "quality" refers to whether it is **HARD OR SOFT**, or how it is dispersed. Hard light creates sharp, well-defined, dark shadows. It is created by direct sunlight and directional focused lighting fixtures. Hard light brings out the shapes and textures of the subject. Soft light is diffused and creates very few or no shadows, much like the light outdoors on an overcast or cloudy day. When lighting a subject you will probably want to use a combination of

hard and soft light.

Light also determines the color an object will appear onscreen. Our eyes see all light as the same color; however, white light is really an almost equal mixture of colors across the full spectrum of red, orange, yellow, green, blue, indigo and violet.

Our eye compensates for these variations of color temperature naturally. The video camera does not. A white object will always look white to our eye under pretty much any kind of light. The same is not true for a video camera because the type of light affects the color of the object. The exact color and tone of the light is called its **COLOR TEMPERATURE**. The color characteristics are classified on a Kelvin (K) color temperature scale. It measures only the degree of red or blue in the light, not the degree of heat or brightness. The higher the color temperature number, the more prominent the blue tones. Color temperature is not the same as how hot the light actually is.



online  
LESSON:  
1

Selecting a particular type of light affects the color of your shot. As the light gets brighter or as the light source changes, the color temperature changes. Daylight has more blue undertones. Video lights usually have more red. Incandescent lights (those in your home) are even redder. Fluorescent lights tend to give off a greenish color.

Here's a guide to the color temperature of some common light sources:

Candles - 1930K

Dawn/Dusk - 2000–3000K

Household lights - 2600–2900K

Video lamps - 3200K

Daylight (average) - 5600K

Blue sky/Bright sun - 12000–18000K

The varying color temperature of light is one of the reasons you must white balance your camera. White balancing adjusts the camera circuitry for the color temperature of the prevailing light. White balancing tells the camera that under this color of light, a particu-

lar color will look white to the human eye. Naturally, you must re-white balance whenever there is a change in lighting.

Some cameras will white balance continuously and automatically using an automatic white balance function. However, sometimes manual white balance is better: when light conditions change quickly; when the light source in the subject is different from the light falling on the camera; when either the foreground or background is monochromatic (the same color or shade); when shooting under fluorescent types of light; when shooting outdoors just after sunset.

To manually white balance a camera you typically select a color temperature for the dominant light source on the scene; place a white object or card in that area; point the camera at the white object, completely filling the frame; focus the camera on it; and then perform the white balance command.

## <<<rewind

online  
LESSON:  
1

1. Give an example of how lighting can affect the mood of a shot.

---

---

2. What is the scale by which the color temperature of light is measured?

---

---

3. What does color temperature have to do with adjusting your camera before shooting?

---

---

---

# Three-

Now it's time to discuss how you should position your lights to create different effects. The most natural and commonplace setup is to position a main light slightly above your subject at a 45-degree angle to the person's face. Some shadows will be apparent, but that's okay. Since light and shadow are results of geometric relationships, you can control shadows, hide them or use them to your advantage.

## online LESSON: 2

### Objectives:

After completing this section you will be able to

- Define three-point lighting
- Light a subject using three-point lighting technique

A simple lighting plan that works well for studio applications is called **THREE-POINT LIGHTING**. Your main light source, called the **KEY LIGHT**, is usually placed at a 45-degree angle opposite the subject that you're lighting. The key light's purpose is to brighten the subject. It determines the overall look of the scene and is perceived as the primary light source by the viewer. It creates the principal shadows and reveals the depth and texture of the subject. Think of a key light as a replacement for the sun on a bright day. Key lights can cast

very deep and unflattering shadows. That is why other light sources are needed to fill in and create a more balanced look.

The second light in the three-point plan is the **BACK LIGHT**. Usually a hard light, it is placed directly above and behind the subject in such a way that it won't be visible in the shot. It should be pointed toward the subject and create a subtle rim of light around the edges of the subject. It helps separate the subject from the background.

The third light is **FILL LIGHT**. A fill light is a soft or diffused light used to soften the contrast created by the key light and the back light. The fill light is placed at a 45-degree angle on the opposite side of the camera from the key light. It should create no new shadows in the scene but should help reduce the contrast created by the other two lights.

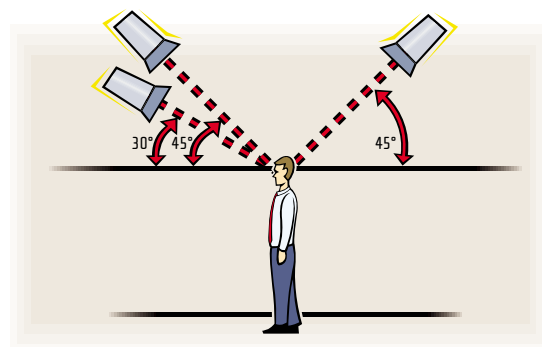
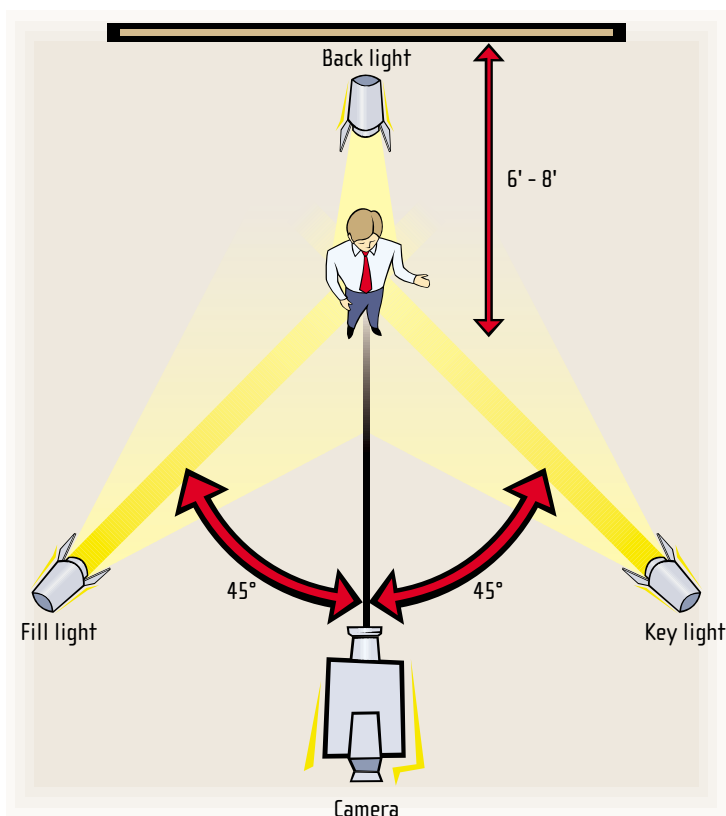
online  
LESSON:  
2

When these three lights are placed correctly, the subject will be in the middle of a triangle that is formed by them.

Here are a few things to remember when setting up a three-point lighting system. The key light and the back light should be about equal in brightness. The fill light should be only about half as bright as the key light. If there's not enough space for a back light, turn

the back light around and aim it directly at the wall. The back light then bounces off the wall and gives some separation to the subject; just make sure it does not make the background brighter than the subject. If your subject has dark hair or clothing, use more back light than you would for a lighter subject or someone dressed in light clothing.

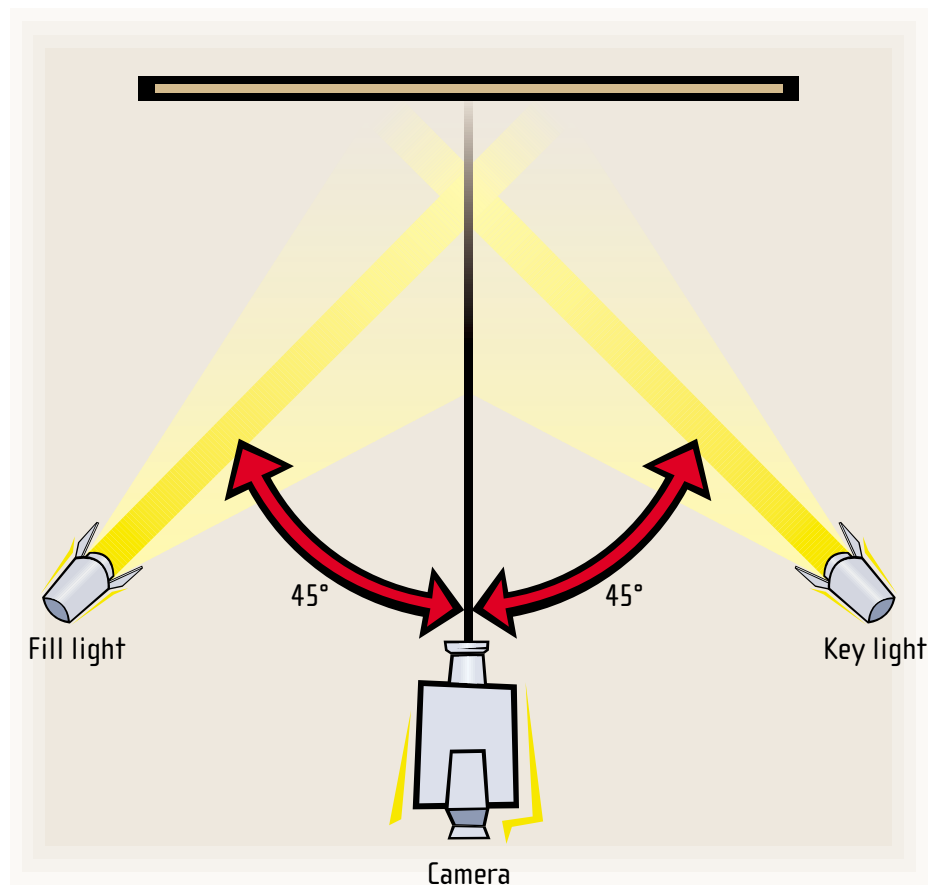
The positioning that we show for three-point lighting is just the starting point. One other light you may use is a **BACKGROUND** light. This light is used to illuminate the background of the scene, raise the base light level and lessen the contrast between the subject and the background. The subject, the mood and the shot requirements all may require variations. The important thing is that the lighting be on the scene and in the proper proportions to get the look you want.



Sometimes you may need to light a flat surface, such as a graphics card, a photograph or even a background. In this case you want to make sure that the surface is evenly lit. Lighting from directly in front of the camera on the axis of the lens will create uneven illumination or hot spots.

The best way to light something flat is to use two soft or diffused lights positioned at 30 to 45 degrees on either side of the camera. Soft lights are preferable because a hard light would exaggerate surface textures and unevenness.

online  
LESSONS:  
1-3



## <<<rewind

online  
LESSON:  
2

1. Describe the role of each light when using three-point lighting.

---

---

---

2. What is the rule when lighting a subject with dark hair or clothing or light hair or clothing?

---

---

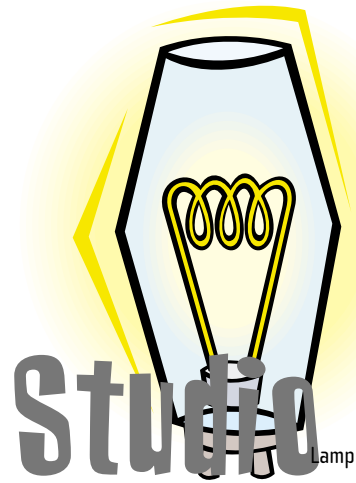
---

3. What can you do with a back light if there is not enough room to place directly behind the subject?

---

---

---



There are many different types of specialized lights used in television production. We use the term **FIXTURE** to describe the entire lighting instrument, and the term **Lamp** to describe the light source. The lamps most commonly used in these fixtures are tungsten-halogen filaments with quartz enclosures (which is why they are sometimes called quartz lights).

online  
LESSON:  
3

## Objectives:

After completing this section you will be able to

- Identify different lighting fixtures used in a studio
- Describe the uses of studio lighting fixtures
- Describe and observe safety rules when using studio lights

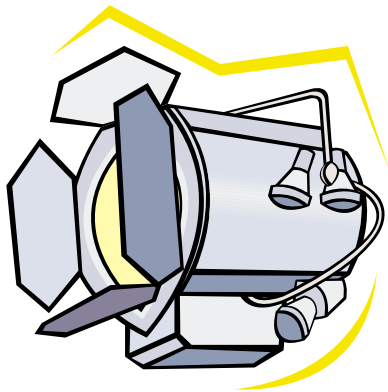
Television lamps consume a great deal of power, and the fixtures can heat up a small area very quickly. Adjust your lights and then bring them down until it is time to record. This conserves energy and keeps the area cooler for the talent. It will also extend the life of your lamps, which are much more expensive than standard bulbs used in the home or office.

Television lights require that you follow certain safety practices. Handling lights should be done with the utmost care! A combination of glass and a filament heated to high temperatures (the lamp) and lighting fixtures that require large electrical loads equals potentially dangerous conditions.

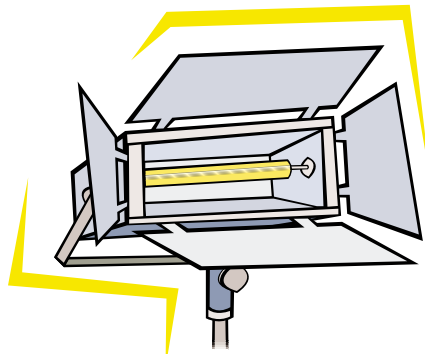
Observing safety rules will prevent accidents. Ignoring the rules may cause serious injury or even death, so take these precautions very seriously. TV lights are made of a special quartz glass, and they

get extremely hot. This makes them sensitive to dirt, fingerprints and the oils from your fingers. Any substance left from touching the lamp with your bare fingers can make the lamp explode. Don't touch the glass of the lamp with your fingers. When replacing a lamp, use a clean piece of paper, plastic or the foam packaging, and **NEVER** replace it when it is warm. Always turn the fixture off and unplug it when changing a lamp. If you must move or focus a light while it is on, first let your lights warm up. Bring them up slowly, especially if the room is very cold. Always wear safety gloves when adjusting lights.

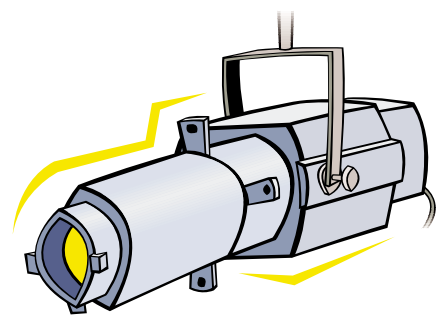
The **FRESNEL** (pronounced frah-nell) is considered the most versatile of studio lights. A fresnel fixture has a glass lens on the front that can be adjusted from a narrow, concentrated beam to a more diffused type of light. This lens allows you to focus the light to create a hard, concentrated beam over a small area, or unfocus the light to create a more diffuse, softer illumination spread out over a wider area. The fresnel can be used as a key light, back light and, when slightly diffused, as a fill light.



Fresnel



Broad



Ellipsoidal

online  
LESSON:  
3

The **SCOOP** gives out a softer lighting effect but still retains some directionality. Scoops can be used as fill lights or to raise the base light level in an area.

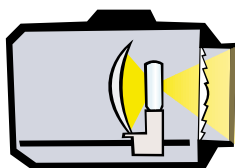
A **BROAD** is an open-faced light that holds one or more elongated, tube-like lamps. They produce a very soft, diffused light. Broads are used to light a large area when you need to cover a lot of action. These fixtures are also often seen in use on news sets. They can hang from a batten or be placed on a stand, which is often wheeled. They come in two sizes, large and small.

**ELLIPSOIDAL** lights have a lens and a focus lever to give precise control over the beam of light produced. These lights are often used to create patterns on the background of a scene. You will see them used to create slashes of light in the background of a set; or, in conjunction with special color filters called **GELS**, they can throw colored patterns on the scene.

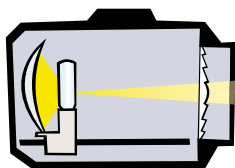
You can put metal plates with patterns cut in them (called cookies) in front of ellipsoidal lights to project a pattern on a background.

Sometimes these instruments are called **CYC LIGHTS**. Cyc is short for cyclorama, which is the name for the curtain that hangs in the studio. Cyc lights are usually placed on the studio floor facing upward toward the cyc (curtain) and can be used to change the color of the background.

To get these fixtures into the proper position, you either mount them on floor stands or attach them to a lighting grid. A lighting grid can be stationary or, in elaborate production facilities, can be moved up and down automatically. The lighting grid consists of a power rail with electrical outlets, and a series of large steel poles that support the lighting fixtures. The lighting grid provides great flexibility for proper light placement and minimizes the chances of getting light stands in shots.



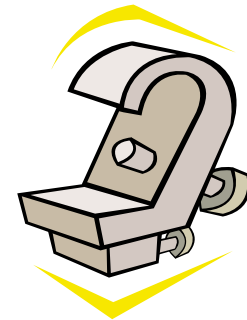
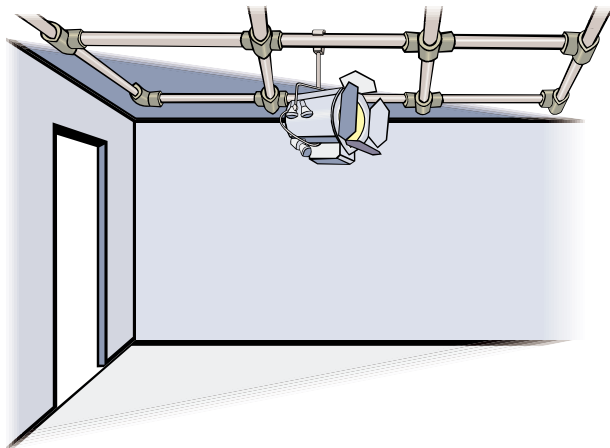
Wide flood beam



Spot beam



Scoop



C-clamp

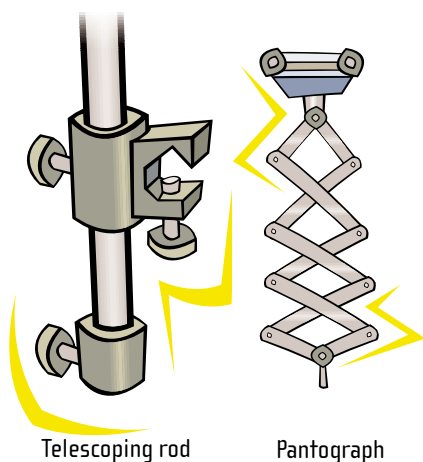
A **C-CLAMP** is used to attach the lights to the poles (battens) on the grid and let you turn and position the light. A safety cable is used with the C-clamp as a backup in case the light fixture comes loose. The safety cable should loop around the handle of the fixture and the batten on the grid.

grid in the studio. Each light fixture should have a safety cable in addition to the C-clamp that attaches it to the lighting batten.

Use a safety ladder specifically designed for studio use that can be locked down. Watch out for lighting fixtures when moving the ladder. Never move the ladder with someone on it. Move the ladder into position and then climb up. Avoid using the very top step whenever possible. Ladders can become top heavy and fall if there is too much weight at the very top of the steps. It is helpful to have a basket or other type of receptacle by the top of the ladder to hold tools or the lamps to be changed. Position the ladder so you don't have to lean or stretch to reach the fixture.

When replacing lamps, turn off the power. When bringing power back up, do it slowly so there won't be a dramatic temperature change that could cause the light to blow. Always stay behind the light. And a final note on safety: Do as professional gaffers (lighting experts) do, and wear heavy safety gloves.

With a stationary grid the lights are adjusted upward or downward to the proper height with either telescoping rods or pantographs. Telescoping rods are less expensive than pantographs, but pantographs offer a little more flexibility of movement.

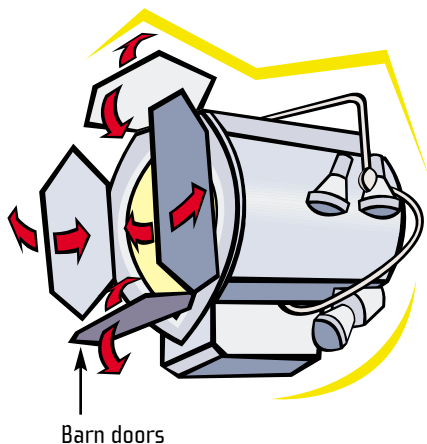


Telescoping rod

Pantograph

Directional control of a fixture is available through accessories that attach to the light. **BARN DOORS** are black hinged panels – the doors – that are used to direct or concentrate the spill of light to a specific area or out of an area by positioning the individual doors. These are attached to the front of the light fixture in a frame so they can be rotated into the desired position. Never close them down all the way to block all the light, as this may cause the lamp to overheat.

Work in pairs when changing lights and moving fixtures on the



Barn doors

## <<<rewind

online  
LESSON:  
3

1. List the different types of lighting fixtures in a studio.

---

---

---

2. Describe how lights are attached to the lighting grid.

---

---

---

3. What do fresnels and ellipsoidals have in common?

---

---

---

4. Describe at least five safety measures to prevent injury when working with studio lights.

---

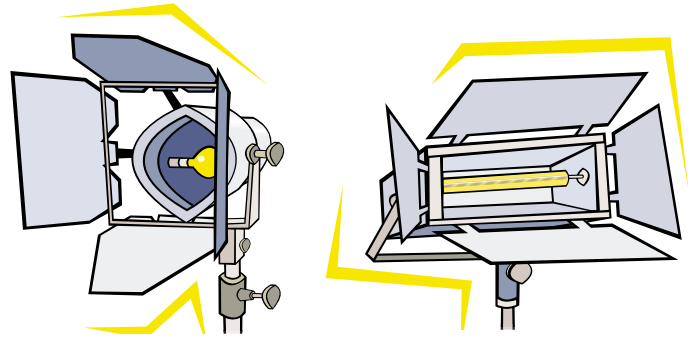
---

---

---

---

# ENG Lighting



When shooting outside the studio, you must evaluate what light is available and work from there. Lighting can be affected by the time of day, subject placement and camera angle. If it's a bright, sunny day, note which way the sun is facing. You may not want your subject facing the sun directly if it's too bright. Reduce the contrast of the scene so that no portion of the picture is over- or underexposed. Try placing your subject at an angle to the sun. If one side of the face is shadowed, use a reflector or white card to bounce light onto the face. Or place the subject in front of the sun and use the reflector to bounce light back onto his/her face.

online  
LESSONS:  
4 • 5

## Objectives:

After completing this section you will be able to

- Name several different lighting techniques to compensate for inadequate light
- Adapt lighting techniques to field conditions
- Describe and observe safety rules when using ENG lights
- Estimate power requirements when using lights

On a cloudy or overcast day you will get uniform soft light on the subject. This can create a very flat-looking picture, so you might want to consider using a reflector or portable light to bring out the subject a little more. (Remember, if you are using a light outdoors, it must be color corrected to match the color temperature of the daylight.)

When time allows, use a portable lighting kit and the three-point lighting technique you learned earlier. The lights you use will be smaller versions of those found in the studio, but will probably not have focusing lenses. They will still get very hot, so always let them cool down before you move them.

Scout the nearest source of power and make sure the outlets can handle the additional power needed. Video equipment, and especially lighting, uses a lot of electricity, so make sure you estimate your power requirements to avoid blowing a circuit.

The power requirements of a system are determined in **WATTS**. Wattage is a measure of how much power or energy is consumed by a device when it is operating. To find the total number of watts a piece of equipment uses, multiply the device's electrical current or amp rating by the line voltage. All plug-in video equipment you'll use in the United States runs on 120 volts AC. (Electricity in your home outlets is typically 120 volts. "Volts" or "voltage" refers to this source of operating electricity.)

Something that is rated at 1 amp (a camcorder) will use 120 volts x 1 amp = 120 watts. The formula is: volts x amps = watts.

Lights require the largest chunk of electrical power; most other pieces of equipment, such as camcorders and monitors, generally take less than one amp each. Video lamps are rated in watts, and electrical circuit breakers are

online  
LESSONS:  
5 • 6

marked in amps. You can calculate backward from watts ratings to estimate amp loads a circuit can handle:  $\text{watts} \div \text{volts} = \text{amps}$ .

A 100-watt light bulb uses .83 amp. ( $100 \div 120 \text{ volts} = .83 \text{ amp}$ ). A typical location light of 600 watts uses 5 amps ( $600 \div 120 = 5$ ). A 20-amp circuit will be able to handle three lamps rated at 600 watts, if there's nothing else already on that line. With a 20-amp circuit, you do not want to exceed 1850 watts. If you have a 15-amp circuit, you generally should not exceed a total lamp wattage of 1350 watts, if there's nothing else already on that line. A hint: here in the United States you can simply divide the number of watts by 100 for a quick estimate of the amps needed.

If you're concerned about the load or need more capacity, take an extension cord and share the load with a separate circuit, perhaps from a different room.

If you are using portable lights on stands, there are some addi-

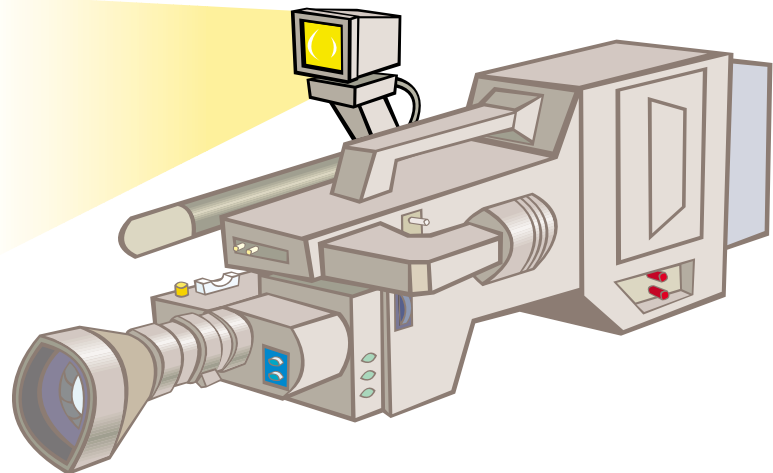
tional precautions you should take. Extend the light stand legs as wide as they can go. Loosely wrap the power cord from the lamp down around the light pole and then down under the legs. Use gaffer's tape to tape the cord to the floor if people or vehicles will be moving past the light. Once the lighting fixture cord is secure, anchor the legs of the stand to the floor with gaffer's tape. Sandbags draped over each leg will also help steady them. Finally, block off the area using chairs or some other type of barrier.

Use safety gloves when adjusting lights. They become extremely hot very quickly. Turn off the light before unplugging it from the outlet. Don't unplug it by pulling on the cord. Grasp the plug and pull from there. This avoids weakening the connection from cord to plug. Let the light cool before moving and packing.

ENG crews often don't have time to set up any type of field lighting at all. They sometimes use a light mounted on the camera handle. This lights the subject just enough to capture an image, but can result in a "caught in the headlights" effect.

Anytime you use a quartz lamp outdoors, you will need to use a special filter or gel that corrects the quartz light to the color temperature of the sunlight.

You can't light all subjects or situations the same way. Take into consideration skin tone, hair color, clothes and the background. If you're inside, avoid shooting in front of a window, or your subject will appear in silhouette. Instead, close the blinds or reverse positions with the subject. Try to build a balance of moderate contrast between all of the elements in the frame.



## <<<rewind

online  
LESSONS:  
4-6

1. If your subject is fair-haired and wearing light clothes and it is a very bright day, what could you do to improve and correct the resulting lighting problems?

---

---

---

2. If you are selecting a location and know you'll use a portable light kit, list in priority order the three most important things to consider.

---

---

---

3. What are the two formulas you need to know to accurately calculate electrical requirements?

---

---

---

4. What measures can you take to safely secure portable light stands?

---

---

---