Setting the Stage
Episode 11:
Mood Lighting-
Theatrical Lighting
Design for Rockin’

SC Grade 3, 4, 6, & 8
NC Grades 4 & 6
SOUTH CAROLINA STATE STANDARDS

**3.P.3A.1** Obtain and communicate information to develop models showing how electrical energy can be transformed into other forms of energy (including motion, sound, heat, or light).

**3.P.3A.2** Develop and use models to describe the path of an electric current in a complete simple circuit as it accomplishes a task (such as lighting a bulb or making a sound).

**4.P.4A.2** Analyze and interpret data from observations and measurements to describe how the apparent brightness of light can vary as a result of the distance and intensity of the light source.

**6.P.3A.4** Develop and use models to exemplify how magnetic fields produced by electrical energy flow in a circuit is interrelated in electromagnets, generators, and simple electrical motors.

**8.S.1A.1** Ask questions to (1) generate hypotheses for scientific investigations, (2) refine models, explanations, or designs, or (3) extend the results of investigations or challenge claims.

**8.S.1A.2** Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.

NORTH CAROLINA STATE STANDARDS

**4.P.3** Recognize that energy takes various forms that may be grouped based on their interaction with matter.

**4.P.3.1** Recognize the basic forms of energy (light, sound, heat, electrical, and magnetic) as the ability to cause motion or create change.

**6.P.1.2** Explain the relationship among visible light, the electromagnetic spectrum, and sight.
Part I - Timeline of Lighting Design

Sunlight

According to Prague Youth Theater, the Greeks and the Romans are credited for the beginning of theater light design. They would strategically build theaters to use natural sunlight to light the stage. The original theaters were built on a hill and would face the sun to help keep the sun out of the audience's eyes. Typically, the Greek and Roman plays would begin early in the morning and last all day. If the Greeks and Romans wanted to alter the sun's light, they would use large mirrors to create different types of moods.1

Candles

In 1545, an Italian architect, Sebastiano Serlio, began to expand theater design and lighting effects. Theaters began to use candles to illuminate their performances. By placing a flask of colored water (amber, red, and blue) in front of the candles, actors could use color lighting to set different moods for their scenes. Candles were also placed on the front of the stage to illuminate the actors' faces.2

Close to this time in England, there were two main theaters, The Globe Theatre and the Blackfriars Theatre. The Globe Theatre was an open theater and was used during the summer months where sunlight could be used for lighting. The Blackfriars Theatre was a smaller indoor theater, which relied on candles for lighting during the winter months. The candles were made from tallow, beef fat, or sheep fat. These were cheaper than beeswax but would burn faster. During these winter performances, over 100 candles would be used per performance.3

---

PART I - TIMELINE OF LIGHTING DESIGN

Oil Lamp

In 1783, the kerosene lamp with an adjustable wick was invented and began to replace candles in the theater. These oil lamps provided better lighting control but also required constant maintenance, smelled unpleasant, and did not reduce the risk of fires.4

Gas

Near the end of the eighteenth century, William Murdock developed a method to distill gas from coal for illumination. This method was adapted by Fredrick Winsor, who was the first to create gas lighting for the stage. Gas lighting could be controlled from a distance by how much gas was supplied to each set of lights. For the first time, lights could be dimmed, which made the performance more realistic.5

Electric and Modern

Even though gas lighting was a huge feat for theater lighting, it did come with some major flaws. Gas produced lots of heat, dangerous vapors, and caused many fires due to gas leaks. It wasn’t until 1878 that Joseph Swan was credited for the world’s first incandescent electric lamp. Theaters still used the same principle lighting design (footlights, strip lights, and border lights), but all were replaced with electrical lights. As technology advanced, designers started to experiment with color and create complex lighting plots. Gels, translucent sheets of colored plastic, would be used to change the color of the lights. In 2007, the more expensive LED light was created to change colors without using gels. These lights can also be programmed to move to a certain spot on the stage.

---

4Eaton, “Lighting the Stage.
PART II - WORKSHOP VIDEO

CLICK THE IMAGE ABOVE TO WATCH THE WORKSHOP

In the workshop video, Head Lighting Technician, David, explains the art and science behind theatrical light design.
“When designing, we choose different lights to shine on our subject and need to take some things into consideration: directions of light, contrast, and color mixing. With different light directions, we create different shadows which is called contrast. With contrast, we can set different moods for the performance.” Light designers also have to consider colors when setting the mood of the performance. Designers use gel filters to produce different color light and mix them to create even more colors.

David also described how we now have access to LED (light emitting diode) fixtures which means that one light can be made of hundreds of LEDs instead of an old-fashioned lamp. With the lighting console, technicians can change the colors live during the concert.
Dating back to early Italian theater, theaters have been experimenting with colored lights to evoke different moods and emotions on stage. In the workshop, David describes how light position plays a crucial role in setting the mood for performances. He discusses how there are four main positions for stage lighting.

**Front lights** are the primary source of light for most scenes. The front lights should enhance the scenery and compliment the performer's skin tone.\(^6\)

**Back lights** come from behind, are absorbed, and create a dark void in front of the performer and their face. With light like this, you create contrast.

**Side lights** illuminate one side of the performer's body.

**Top lights** produce light that is directly overhead and is often used as a wash light to add color to the stage.

---

PART IV - MOOD LIGHTING

Psychologically, we attribute colors with different emotions. Light designers use colored lights to match the moods on stage. Have you ever heard of the phrase “seeing red”? This phrase is used to describe someone who is emotionally stirred up with anger. Since we tend to attribute the color red with anger, light designers often use red lights to evoke that emotion on stage. Keeping this in mind, light designers mix colors to illuminate the stage. In Ri-Dog Rock Show, David combines blue (coolness) with magenta (love) lights to create a positive, upbeat presence.
PART V - EXPERIMENT

Before you begin the experiments, you will need a science notebook. Use your science notebook to document the scientific process for each one of the experiments. **Include one drawing of each experiment in your science notebook as part of your response.**

1. Ask a question: what are we trying to find out?

2. Gather information and observe: what do you know about this topic?

3. Make a hypothesis: what do you think will happen?

4. Experiment and test your hypothesis.

5. Analyze your test results.

6. Present a conclusion: what happened? Was your hypothesis correct or incorrect? What did you learn?
PART V - EXPERIMENT

Experiment 1 - Kaleidoscopes

In the workshop video, David explains the process in setting the mood for shows with light designs. By mixing light intensity, the color and direction of lights, designers can create different contrasts and emotions for performances. Using what you have learned about light design, you are going to create three mixed color pallets to evoke three different emotions.

Materials:
- Empty toilet paper roll
- Mylar sheets of mirrored sheets (Michaels, Amazon, or Home Depot)
- Scissors
- Tape
- White cardstock
- Bendy straw
- Markers, stickers, or other materials for decorating your spinning circles
- Paint for the tube

Instructions:
1. Begin by painting your cardboard tube and set it aside to dry.

2. Next, you’ll need to cut your mylar/mirror sheets into three equal strips. You’ll want the size to be just right so the finished kaleidoscope insert fits snuggly in your cardboard tube and won’t fall out.

3. Line up your mylar strips, leave a tiny space between each one. (Place the shiniest/least scratched sides face down). Tape them together over the spaces.

4. Fold the taped mylar into a triangular prism and tape along the top to hold in place.
PART V - EXPERIMENT

Experiment 1 - Kaleidoscopes

5. When inserted into the tube, it should fit snugly.

6. Cut off the end of a flexible straw and tape it along the top of your tube with the flexible part of the straw hanging over the edge.

7. Cut out three circles with 3.75 inch diameters and poke a hole in the center of each circle. For the next part, design each circle to evoke a different emotion. Think about color choices, symbols, and patterns.

8. In your science notebook, write a few sentences describing your three circles. Why did you choose those colors? What emotions are you trying to evoke?

9. Place the circle onto your straw with the design facing the kaleidoscope. You want the hole to fit over the flexible portion of the straw so it will turn easily.

10. Look inside your kaleidoscope and slowly spin your wheel to see the colors and patterns blend together!
PART V - EXPERIMENT

Experiment 2 - Light Box

In the workshop, Dave and Colin discuss how they can change the color of light for shows by using gels. Gels are thin sheets of plastic made in more colors than you can imagine. With different gel filters placed over the light we can produce different colors. In this experiment, you will be creating your own gels and will combine them together to create different mood lighting.

**Materials:**
- Shoebox or small cardboard box
- Colored cellophane or plastic sheet protector
- Sharpies
- Popsicle sticks
- Glue
- Flashlight
- Black tape
- Hot glue gun

**Instructions:**

1. First, get a shoebox or small cardboard box. Make sure your box is completely dark on the inside. Use black tape to make sure any holes or creases are covered.

2. At one end of your box, length-wise, cut a hole that can fit the head of a flashlight. Tape it in place to make sure no additional light will come in.

3. Next, create your colored gels. Use four popsicle sticks to create a square frame. If you are using cellophane paper, measure the frame and cut out a square. Hot glue the square piece of cellophane onto the back of the frame. If you are using sheet protectors, do the same by measuring the squares. Color the squares one color each with a Sharpie. The less white spots in your square, the brighter color your square will be.
PART V - EXPERIMENT

Experiment 2 - Light Box

4. Going back to your box, on the opposite end of your light, measure one of your square gels and cut out that square shape from your box.

5. Now it’s time to experiment! Set your box on a table with a gel slide square facing the wall. Turn on the light to see your colored gel shine bright onto the wall. Combine the gels to experiment with mixing colors.

6. Experiment with the light source. What do you notice about the colors if the gel is farther away? What about if you bring the light source closer to the gels? Write two sentences in your science notebook describing the relationship between distance and the intensity of the light source.

7. In your science notebook, draw a truss (as described in Episode 9) and design your light combination if you were to star in your own rock show! When designing, record your color options and mixings. What emotion are you trying to evoke in your rock show?

8. As part of your sketch, draw yourself on stage and add light positions based on what you have learned in the workshop about light design.

PART V - EXPERIMENT

Experiment 3 - Light Circuits

In the workshop, we learn that theaters now have access to LED lights. LED stands for Light Emitting Diode. One light can be made of hundreds of LEDs instead of an old fashioned lamp. Technology has come a long way with electricity, but lights still run on the same basic circuits. What is a light circuit? “An electric circuit is an unbroken path along which an electric current exists and/or is able to flow. A simple electrical circuit consists of a power source, two conducting wires (one end of each being attached to each terminal of the cell), and a small lamp to which the free ends of the wires leading from the cell are attached. When the connections are made properly, the circuit will ‘close’ and current will flow through the circuit and light the lamp.”

Materials:
- Card stock paper
- Copper tape, ¼ inch wide and double sided conductive
- Scissors
- 3V lithium button battery
- 5mm LEDs of assorted colors

Instructions:
Before designing your own circuit, there are a few things to keep in mind. There needs to be a direct path from the negative end of the battery through the light and back to the positive end of the battery.

1. If you look at the 5mm LED you will notice that it has two pins. One pin is slightly longer than the other one. The longer pin is the positive end and the shorter pin is the negative end. Electrons must flow from the negative end of the battery to the negative end of the LED. If the LED is oriented incorrectly, it will not light up.
PART V - EXPERIMENT

Experiment 3 - Light Circuits

2. In your design, use copper tape to attach each pin of the LED to either side of the gap. It is really important that the two pins do not touch each other and that there is a gap in the tape so that the light does not get short circuited.

3. With those things in mind, you are ready to design your circuit! Start by sketching out your design in your science notebook and label the (-) (+) sides of your LED and battery. Build your design on the cardstock with the copper tape. Did you have success? Did you need to make any changes? Once you find success with one LED light, see if you can design a new circuit using more than one.

4. In your science notebook, write down at least four facts that you learned about circuits. Make sure to include some key vocabulary that you have learned.

Explore More Resources

Light Circuits
Exploring Emotions Through Colors

CITATIONS


Setting the Stage is presented in part by:

- Dominion Energy®
  Actions Speak Louder
- AT&T
- South Carolina Ports

Setting the Stage
Episode 11:
Mood Lighting-
Theatrical Lighting
Design for Rockin’