

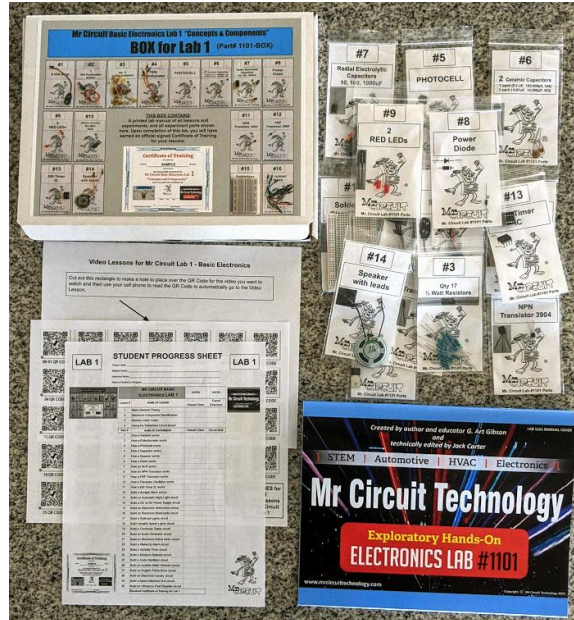
**TITLE PAGE:**

# Mr Circuit Lab 1

## Basic Electronics Concepts and Components (#1101)

# TEACHER LESSON PLANS

## for STEM and TECHNOLOGY Program.



This lab allows you to add **EXCITEMENT** to your **TECHNOLOGY TRAINING** in your **STEM** program without any prior knowledge of electronics. These lesson plans give you a **TEACHER DIALOG** to read to introduce electronics concepts to your students. You do not need any prior training or experience. For any questions or to order, just call us at 805-295-1642

**EMAIL** [Gary@MrCircuitTechnology.com](mailto:Gary@MrCircuitTechnology.com)

**WEBSITE** [www.MrCircuitTechnology.com](http://www.MrCircuitTechnology.com)

(At the end of each lesson or experiment you can use this **link** to take the class through the Online Quiz for that lesson or experiment <https://bit.ly/3wioVYk> by projecting the quiz onto a Smart Board or other large screen you may have connected to your computer in the classroom.)

(You may also wish to use the Written Quizzes available for the lessons or experiments by going to this **link**, <https://bit.ly/49a14bT> The Answer Keys are also available to print out with this link.)

## Teacher LESSON PLAN

# Lesson #1

Mr Circuit STEM Electronics Learning Lab 1 (#1101)

## “Basic Electron Theory”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student. Then, have your students view the Video Presentation for Lesson #1 with this link <https://bit.ly/3wioVYk>

(Note: At this point, there is no need to hand out any 9-volt batteries. The students will not need them until Experiment 1, which comes after completing Lesson 4 in the Lab 1 Manual.)

**TEACHER DIALOG:** (After your students have seen the video, you can read the following:)

“Please open your Lab Manual to page 3 and observe the pictures and drawings of the electronic parts included in this lab. Did everyone find page 3? OK

“These are the parts that will be used to build the experiments in this lab.

“On page 3, notice the drawings of the Resistors along the left-hand column. How many resistors are in this lab? Count them on page 3. There are 17 resistors in this lab. Under the drawing of each resistor is its value in Ohms followed by the color bands on the resistor. The first resistor shows 10 Ohms with the color bands of Brown, Black, Black, and Gold. These colors are from the Resistor Color Code which you will learn to use in Lesson 3.”

“To the right of the resistors on Page 3, in the middle of the top of the page, is a picture of the Solderless Circuit Board which you will learn how to use in Lesson 4. In the next row down on page 3, you will see drawings of 5 capacitors and to the right of the capacitors you will see a drawing of a Potentiometer and an SCR, a Silicon Control Rectifier.

“In the next row down, you will see a Power Diode, an L.E.D (a light-emitting diode), a Photocell, a 9-Volt Battery Snap, and some Jumper Wires. And, in the bottom row, you will see a 555 Timer Integrated Circuit, another LED, a Pushbutton Switch, an NPN Transistor, and a PNP Transistor. You will learn how to use all these components in electronic circuits as you build experiments on the Solderless Circuit Board.

“Now, open your Lab Manual to Page 4, and let’s copy the diagram of an ATOM as shown in the left column of the page. You can do it with a pen or a pencil on any paper you wish.”

**\*\*\*\*\* TIME FOR QUIZ LESSON #1** <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

# Lesson #2 (4 pages)

## Mr Circuit STEM Electronics Learning Lab 1 (#1101)

# “Electronic Component Identification”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student. Then, have your students view the Video Presentation for Lesson #2 with this link <https://bit.ly/3wioVYk>

(Note: At this point, there is no need to hand out any 9-volt batteries. The students will not need them until Experiment 1, which comes after completing Lesson 4 in the Lab 1 Manual.)

**TEACHER DIALOG:** “In this lab, there are 16 bags of parts. We are going to look at each bag. Please do not open any of the bags as we review them.”

“Now find **Bag #1**. You will see it is a 9V battery snap. Notice that it has a black wire and a red wire. Black is the negative lead and Red is the positive lead. You will use this battery snap with each experiment.”

“Now, find **Bag #2**. You will see it is a Pushbutton Switch. It also has two wire leads. You will use this switch in some of the experiments.”

“Now, find **Bag #3**. You will see it has many resistors. Resistors are used in most of the experiments. If you look closely, you will see that each resistor has color bands painted on it. These color bands tell us the value in ohms and the tolerance of each resistor. You will learn more about this in Lesson 3 and Experiment #1 of this lab.”

“Now, find **Bag #4**. You will see it has a Potentiometer which is a variable resistor which can be adjusted with its shaft. You will notice that it has three wire leads. You will learn more about it in Experiment #2 of this lab.

“Now, find **Bag #5**. You will see it has a Photocell which has two wire leads. You will learn more about it in Experiment #3 of this lab. You will use this photocell in some interesting experiments.”

“Now, find **Bag #6**. You will see it has a Push Button Switch with two wire leads. You will use this switch in some of the experiments.”

## Lesson #2 (page 2 of 4)

### Mr Circuit STEM Electronics Learning Lab 1 (#1101)

# “Electronic Component Identification”

“Now, find **Bag #7**. You will see it has two Ceramic Disc Capacitors. They are small but very important. Each capacitor has two wire leads. You will learn more about them in Experiment #4.”

“Now, find **Bag #8**. You will see it has a Power Diode. It also has two wire leads. It looks somewhat like a resistor but it has very special properties that you will learn about in Experiment #6 in this lab.

“Now, find **Bag #9**. You will see it has two Red Light-Emitting Diodes known as L.E.D.’s. They also each have two wire leads. You will use them throughout the lab in many experiments.”

“Now, find **Bag #10**. You will see it has a Silicon Control Rectifier, known as an S.C.R. An SCR has 3 leads to connect to a circuit. You will learn more about it in Experiment #7.

“Now, find **Bag #11**. You will see it has an NPN Bipolar Transistor. It has three leads to connect to a circuit. You will learn more about it in Experiment #8.”

“Now, find **Bag #12**. You will see it has a PNP Bipolar Transistor. It also has three leads to connect to a circuit. You will learn more about it in Experiment #9.”

“Now, find **Bag #13**. You will see it has what is known as a 555 Timer Integrated Circuit which has 8 pins on it to connect to a circuit. You will learn more about it in Experiment #11.

“Now, find **Bag #14**. You will see it has a Speaker with two wire leads to connect to a circuit. You will use this Speaker to make sounds with some of the circuits in this lab.”

“Now, find **Bag #15**. You will see it has what is known as a “Solderless Breadboard” or a “Solderless Circuit Board”. You will build all the circuits in this lab on this board. You will learn how to use it in Lesson 4.”

“Now, find **Bag #16**. You will see it has an assortment of what are known as “Jumper Wires” which are used to connect circuit components in this lab.”



## Lesson #2 (page 3 of 4)

### Mr Circuit STEM Electronics Learning Lab 1 (#1101)

# “Electronic Component Identification”

**“Now, open your Lab Manual to Pages 5.**

1. “You will notice component labeled #1 is a 9-Volt Battery. To the right of the battery is its Schematic Symbol. Please copy the battery symbol onto a piece of paper.
2. “Look at the components labeled #2, the Switch. There are two types of switches shown.

“The first one shown is a Slide Switch that has two positions, ON and OFF. It is shown in the OFF position. When you slide the lever to the left, it turns the circuit ON. The schematic symbol shows the switch in the OFF position. Draw the symbol for a Slide Switch on a piece of paper.

“The second one is a Normally-Open Push Button Switch. When you press the button, the circuit turns on. The symbol shows the switch in the Open or OFF position. Copy the schematic symbol onto a piece of paper.

**“Do the same thing for the rest of the components on this page.**

3. “Look at the component labeled #3. It is a RESISTOR with bands around it. Copy the symbol on a piece of paper.
4. “Look at the component labeled #4. It is a POTENTIOMETER. It has a shaft and three pins. Copy the schematic symbol onto a piece of paper.
5. “Look at the component labeled #5. It is a PHOTOCELL. It is round and has two leads. Copy the schematic symbol onto a piece of paper.

**“Now, open your Lab Manual to Page 6.**

6. “Look at the component labeled #6. It is a CERAMIC CAPACITOR. It is flat and round and has two leads. Copy the schematic symbol onto a piece of paper.
7. “Look at the component labeled #7. It is an ELECTROLYTIC CAPACITOR. It is shaped like a tin-can and has two leads. Copy the schematic symbol onto a piece of paper.
8. “Look at the component labeled #8. It is a DIODE. It has a cylindrical shape and two leads. Copy the schematic symbol onto a piece of paper.
9. “Look at the component labeled #9. It is a LIGHT-EMITTING DIODE. It has two leads. The shorter one is the Cathode and the other is the Anode. Copy the schematic symbol onto a piece of paper.

**Teacher LESSON PLAN****Lesson #2** (page 4 of 4)**Mr Circuit STEM Electronics Learning Lab 1 (#1101)****“Electronic Component Identification”**

10. “Look at the component labeled #10. It is an S.C.R. It has three leads; Anode, Cathode, and Gate. Copy the schematic symbol onto a piece of paper.
11. “Look at the component labeled #11. It is an NPN TRANSISTOR. It has three leads, Emitter, Base, and Collector. Copy the schematic symbol onto a piece of paper.
12. “Look at the component labeled #12. It is a PNP TRANSISTOR. It has three leads, Emitter, Base, and Collector. Copy the schematic symbol onto a piece of paper.

**“Now, open your Lab Manual to Page 7.**

13. “Look at the component labeled #13. It is an INTEGRATED CIRCUIT. It has eight pins. Copy the schematic symbol onto a piece of paper.
14. “Look at the component labeled #14. It is a SPEAKER. It has two pins to connect to a circuit. Copy the schematic symbol onto a piece of paper.

**\*\*\*\*\* TIME FOR QUIZ LESSON #2** <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

# Lesson #3

## Mr Circuit STEM Electronics Learning Lab 1

### “Resistor Color Code”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student. Then, have your students view the Video Presentation for Lesson #3 with this link <https://bit.ly/3wioVYk>

(Note: At this point, there is no need to hand out any 9-volt batteries. The students will not need them until Experiment 1, which comes after completing Lesson 4 in the Lab 1 Manual.)

**TEACHER DIALOG:** “Please open your Lab Manual to Pages 8 and let’s read the first paragraph and fill in the Pencil Exercise.

1. Resistance is the **OPPOSITION** to current flow.
2. Each resistor contains a certain amount of **RESISTANCE**.
3. Resistance is measured in **OHMS**.
4. A resistor of 20,000 **OHMS** will provide **MORE** opposition to current flow than a resistor of 5,000 **OHMS**.

“On the resistor drawn on top of the right hand column of Page 8, what does the fourth color band indicate? Answer = **TOLERANCE**

“How many different colors are there in the Resistor Color Code listed on Page 8? Answer = **TEN**

“On Page 9, what is the value and tolerance of the resistor with color bands **RED, BLUE, YELLOW, AND GOLD**?

“Red is a 2, Blue is a 6, Yellow means 4 zeroes, and Gold means 5%.

“So we have 26 followed by four zeroes. 260,000 **OHMS** with a Tolerance of plus or minus 5%.

“What is the value and tolerance of the resistor with color bands **BLUE, GREEN, RED, GOLD**? Blue is a 6, Green is a 5, Red is 2 zeroes and Gold is 5%.

“So, we have 65 followed by two zeroes and Gold is 5%. 6,500 **OHMS** with a Tolerance of plus or minus 5%

“What is the value and tolerance of the resistor with color bands **BROWN, BLACK, RED, SILVER**? Brown is a 1, Black is a 0, Red is 2 zeroes, and Silver is 10%.

“So we have 10 followed by 2 zeroes 1,000 **OHMS** with a Tolerance of plus or minus 10%

**\*\*\*\*\* TIME FOR QUIZ LESSON #3** <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

# Lesson #4

## Mr Circuit STEM Electronics Learning Lab 1 (#1101)

### “How to use the Solderless Circuit Board”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student. Then, have your students view the Video Presentation for Lesson 4 with this link <https://bit.ly/3wioVYk>

(Note: At this point, there is no need to hand out any 9-volt batteries. The students will not need them until Experiment 1, which comes after completing Lesson 4 in the Lab 1 Manual.)

**TEACHER DIALOG:** “Please open your Lab Manual to Pages 10 and 11 and let’s review what we learned in the video lesson.

“In the first paragraph it states that a Solderless Circuit Board allows us to assemble circuits without the use of what ? Answer = SOLDER

“All 5 holes in each vertical group are what? Answer = CONNECTED TOGETHER

“The center channel on the board allows us to install what? INTEGRATED CIRCUITS

“In Figure 7 on Page 11, how is the circuit wired wrong? Answer = The Red wire is not in the same vertical group of 5 holes as the lead from Resistor R1.

“How would you correct the wiring in Figure 7 so the circuit would work? Answer = Either move the resistor lead to the same group of holes as the Red battery lead or move the Red Battery lead to the same group of holes as the resistor lead.

**\*\*\*\*\* TIME FOR QUIZ LESSON #4** <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

# Experiment #1 of 30 (2 pages)

Mr Circuit STEM Electronics Learning Lab 1 #1101



## “How a Resistor Works”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then show the Video Presentation for Experiment #1 with this link <https://bit.ly/3wioVYk>

**TEACHER DIALOG:** “In this first experiment, you are going to observe the effects of a resistor on current flow in a circuit. Let’s watch the Video for Experiment #1 and then build the experiment.”

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. (They can use the Pictorial on Page 12 with the steps below OR they can use the online Step-by-Step Instructions for Experiment #1 at <https://bit.ly/3wioVYk> )

**“Let’s take out all the parts needed for Experiment #1 from the bags in your lab.:**

- one Solderless Circuit Board in Bag #15
- One 9-Volt Battery Snap in Bag #1
- one LED (Light Emitting Diode) in Bag #9
- one 100 Ohm resistor (Brown, Black, Brown, Gold) in Bag #3
- one 220 Ohm resistor (Red, Red, Brown, Gold) in Bag #3
- one 1000 (1k) Ohm resistor (Brown, Black, Red, Gold) in Bag #3
- one 6800 (6.8k) Ohm resistor (Blue, Gray, Red, Gold) in Bag #3
- one Jumper Wire in Bag #16”

**“Now, using the Pictorial Diagram on the upper right-hand corner of Page 12, install the parts on the Solderless Circuit Board in this order.**

- Install a 100 Ohm resistor (Brown, Black, Brown, Gold) in holes 15j and 25j
- Install the Jumper Wire in holes labeled 25g and 18a
- Install the LED with the Short Lead in hole 17b and the Long Lead in hole 18b
- Install the Battery Snap, Black lead in hole 17e and Red Lead in hole 15f”

**“Now that the parts are installed with a 100 ohm resistor, lightly touch the battery to the Battery Snap (Note: do not connect it, just touch it lightly.)** You should see the LED light up brightly. If it does not, then please check your wiring carefully and try again. When the LED lights up, be sure to observe how bright it is so you can compare it to the next step.”

**(continued on next page)**

## Teacher LESSON PLAN

# Experiment #1 of 30 (page 2 of 2)

Mr Circuit STEM Electronics Learning Lab 1 #1101



## “How a Resistor Works”

**“Now replace the 100 Ohm resistor with a 220 Ohm resistor.** Touch the battery to the Battery Snap and observe the brightness. Was it brighter or dimmer?” \_\_\_\_\_

**“Now replace the 220 Ohm resistor with a 1000 Ohm resistor.** Touch the battery to the Battery Snap and observe the brightness. Was it brighter or dimmer?” \_\_\_\_\_

**“Now, replace the 1000 Ohm resistor with a 6800 Ohm resistor.** Touch the battery to the Battery Snap and observe the brightness. Was it brighter or dimmer?” \_\_\_\_\_

**“In Conclusion:** You should have observed that the higher the Ohms of the resistor, dimmer the LED. The more Ohms in the resistance, the fewer the electrons that will flow, the dimmer the LED. **Therefore, a resistor serves to restrict the flow of electrons.”**

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

**\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #1** <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

### Experiment #2 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

## “How a Potentiometer Works”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #2 with this link <https://bit.ly/3wioVYk>

**TEACHER DIALOG:** “In this experiment, you are going to observe the effects of a variable resistor on current flow in a circuit.”

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. (They can use the Pictorial on Page 13 with the steps below OR they can use the online Step-by-Step Instructions for Experiment #2 at <https://bit.ly/3wioVYk> )



**“Now find all the parts needed for Experiment #2:**

- one Solderless Circuit Board in Bag #15
- one 9-Volt Battery Snap in Bag #1
- one LED (Light Emitting Diode) in Bag #9
- one 100 Ohm resistor (Brown, Black, Brown, Gold) in Bag #3
- one Potentiometer in Bag #4”

**“Now, using the Pictorial Diagram on Page 13, install the parts on the Solderless Circuit Board in this order.**

- Install a 100 Ohm resistor (Brown, Black, Brown, Gold) in holes 13a and 24a
- Install the LED with the Short Lead in hole 24e and the Long Lead in hole 24f
- Install the Potentiometer, left lead in hole 13h, middle lead in 24i
- Install the Battery Snap, Black lead in hole 13e and Red Lead in hole 13f”

**“Now, lightly touch the battery to the Battery Snap (Note: do not connect it, just touch it lightly.)** You should see the LED light up. If it does not, then please check your wiring carefully and try again. When the LED lights up, go ahead and connect the battery snap to the battery. Then twist the shaft of the Potentiometer all the way clockwise and then counter clockwise. The LED should get brighter and dimmer as you twist the shaft.”

**“In Conclusion:** You should have observed that the Potentiometer varies the brightness of the LED and thus a Potentiometer varies resistance. Therefore, a Potentiometer can be used as a variable resistor.”

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

**\*\*\*\*\* TIME FOR QUIZ EXPERIMENT 2** <https://bit.ly/3wioVYk>



## Teacher LESSON PLAN

### Experiment #3 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

## “How a Photocell Works”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #3 with this link <https://bit.ly/3wioVYk>

**TEACHER DIALOG:**“In this experiment, you are going to observe the effects of a Photocell on current flow in a circuit.”

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. (They can use the Pictorial on Page 14 with the steps below OR they can use the online Step-by-Step Instructions for Experiment #3 at <https://bit.ly/3wioVYk> )

**“Find all the parts needed for Experiment #3:**

- one Solderless Circuit Board in Bag #15
- one 9-Volt Battery Snap in Bag #1
- one LED (Light Emitting Diode) in Bag #9
- one Jumper Wire in Bag #16



**“Now, using the Pictorial Diagram on Page 14, install the parts on the Solderless Circuit Board in this order.**

- Install the LED with the Short Lead in hole 18b and the Long Lead in hole 19b
- Install the Photocell in holes 18g and 19g
- Install a Jumper Wire into holes 19c to 19f
- Install the Battery Snap, Black lead in hole 18e and Red Lead in hole 18f

**“Then, lightly touch the battery to the Battery Snap (Note: do not connect it, just touch it lightly.)** You should see the LED light up. If it does not, then please check your wiring carefully and try again. When the LED lights up, go ahead and connect the battery snap to the battery. Then cover the LED surface with your finger and the LED should get dimmer. The LED should get dimmer and brighter as you put your finger on top of it and remove it.

**“In Conclusion: You should have observed that the more light hitting the top of the Photocell, the brighter the LED.** Thus, the resistance in Ohms of the Photocell goes down when light hits the top of it. Therefore, a Photocell varies its resistance with light. The more light, the lower the resistance.

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

**\*\*\*\*\* TIME FOR QUIZ EXPERIMENT 3** <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

### Experiment #4 of 30 (2 pages)

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

## “How a Capacitor Works”

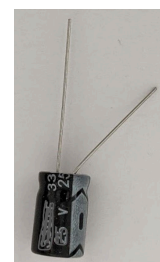
**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #4 with this link <https://bit.ly/3wioVYk>

**TEACHER DIALOG:** “In this experiment, you are going to observe the effects of a Capacitor on current flow in a circuit.”

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. (They can use the Pictorial on Page 15 with the steps below OR they can use the online Step-by-Step Instructions for Experiment #4 at <https://bit.ly/3wioVYk> )

“Find all the parts needed for Experiment #4:

- one Solderless Circuit Board in Bag #15
- one 9-Volt Battery Snap in Bag #1
- one LED (Light Emitting Diode) in Bag #9
- one 220 Ohm resistor (red, red, brown, gold) in Bag #3
- one 1000 (1k) Ohm resistor (brown, black, red, gold) in Bag #3
- one 10uF Electrolytic Capacitor in Bag #7
- one 100uF Electrolytic Capacitor in Bag #7
- one 1000uF Electrolytic Capacitor in Bag #7
- two Jumper Wires in Bag #16



“Now, using the Pictorial Diagram on Page 15, install the parts on the Solderless Circuit Board in this order.

- Install the LED with the Short Lead in hole 27e and the Long Lead in hole 27f
- Install the 1000uF Capacitor, long lead in hole, 16f, short lead in hole 16e
- Install the 220 Ohm resistor (red, red, brown, gold) in holes 9h to 16h
- Install the 1000 Ohm resistor (brown, black, red, gold) in holes 16g and 27g
- Install Jumper Wire #1 in holes 9b to 16a
- Install Jumper Wire #2 in holes 16b to 27a
- Install the Battery Snap, Black lead in hole 9d and Red Lead in hole 9g

“Lightly touch the battery to the Battery Snap (Note: do not connect it, just touch it lightly.) You should see the LED light up. If it does not, then please check your wiring carefully and try again. When the LED lights up, disconnect the battery and the LED should stay lit for a second or two. This shows that the 1000uF capacitor stores a charge which keeps the LED lit for a while when you disconnect the battery.

**(continued on next page)**

## Teacher LESSON PLAN

## Experiment #4 of 30 (page 2 of 2)

### Mr Circuit STEM Electronics Learning Lab 1 #1101



# “How a Capacitor Works”

**“Now replace the 1000uF capacitor with a 100uF capacitor. Do the same thing:**

Connect the battery and then disconnect the battery. The LED should stay lit but for a much shorter time than it did with the 1000uF capacitor. That is because the 100uF doesn't hold as much charge as the 1000uF

**“Now replace the 100uF capacitor with a 10uF capacitor. Do the same thing:**

Connect the battery and then disconnect the battery. The LED should stay lit but for a much shorter time than it did with the 100uF capacitor. The LED will most likely turn right off when you disconnect the battery because it stores such a small charge.

**“Conclusion:** You should have observed that the larger the capacitor, the more charge it will store. A capacitor can store an electrical charge which can cause electrons to flow in a circuit.

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

**\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #4 <https://bit.ly/3wioVYk>**

## Teacher LESSON PLAN

### Experiment #5 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

## “How a Speaker Works”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #5 with this link <https://bit.ly/3wioVYk>

**TEACHER DIALOG:** “In this experiment, you are going to observe how a Speaker converts electrical current into sound.”

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. (They can use the Pictorial on Page 16 with the steps below OR they can use the online Step-by-Step Instructions for Experiment #5 at <https://bit.ly/3wioVYk> )

**Find all the parts needed for Experiment #5:**

- one Solderless Circuit Board in Bag #15
- one 9-Volt Battery Snap in Bag #1
- One 10 Ohm resistor (Brown, Black, Black, Gold) in Bag #3
- one Speaker in Bag #14



**Now, using the Pictorial Diagram on Page 16, install the parts on the Solderless Circuit Board in this order.**

- Install the 10 Ohm resistor (Brown, Black, Black, Gold) in holes 14d and 24d
- Install one lead of the Speaker in hole 14h- leave the other lead loose
- Install the Battery Snap, Black lead in hole 14e and Red Lead in hole 14f

**Connect the battery to the Battery Snap** You should hear nothing until you touch the “loose” lead of the speaker to the 10 Ohm resistor lead that is in hole 24d. When you touch the Speaker lead to the resistor, you cause current to flow in the wire coil inside the Speaker which moves the Speaker cone which is the ‘click’ sound that you hear.

**Conclusion:** You should have observed that a Speaker is a device that converts electrical current into sound waves.

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

**\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #5** <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

## Experiment #6 of 30

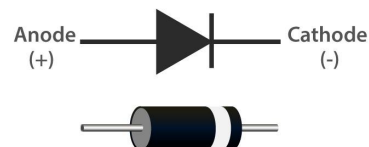
## Mr Circuit STEM Electronics Learning Lab 1 #1101

## “How a Diode Works”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #6 with this link <https://bit.ly/3wioVYk>

**TEACHER DIALOG:** “In this experiment, you are going to observe the effects of a Diode on current flow in a circuit.”

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. (They can use the Pictorial on Page 17 with the steps below OR they can use the online Step-by-Step Instructions for Experiment #6 at <https://bit.ly/3wioVYk> )



“Find all the parts needed for Experiment #6:

- one Solderless Circuit Board in Bag #15
- one 9-Volt Battery Snap in Bag #1
- One 220 Ohm resistor (Red, Red, Brown, Gold) in Bag #3
- one LED (Light Emitting Diode) in Bag #9
- one Diode in Bag #8

“Now, using the Pictorial Diagram on Page 17, install the parts on the Solderless Circuit Board in this order.

- Install the LED with the Short Lead in hole 18g and the Long Lead in hole 17g
- Install the 220 Ohm resistor (Red, Red, Brown, Gold) in holes 20c and 18f
- Install the Battery Snap, Black lead in hole 15e and Red Lead in hole 17f
- Install the Diode, Cathode in hole 15b and Anode in hole 20b

“Lightly touch the battery to the Battery Snap (Note: do not connect it, just touch it lightly.) You should see the LED light up. If it does not, then please check your wiring carefully and try again. When the LED lights up, go ahead and connect the battery snap to the Battery.

“Now reverse the Diode by putting its Cathode lead in hole 20b and its Anode lead in hole 15b. Does the LED stay lit up? It should not because the Diode will only let current run through it in one direction only. The electrons enter the Cathode side of a Diode and come out of the Anode side. And, since we have the Anode connected to the Negative side of the battery, current will not flow and the LED will not light up.

“**Conclusion:** You should have observed that a Diode will only let current flow in one-direction only. Electrons can only enter the Cathode side (the side with the white band) and come out of the Anode side.

After your students have completed the experiment, you can say - - -

“Please disassemble the experiment and put all the parts back into the bags.

\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #6 <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

### Experiment #7 of 30

Mr Circuit STEM Electronics Learning Lab 1 #1101

## “How an SCR Works”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #7 with this link <https://bit.ly/3wioVYk>

### TEACHER DIALOG:

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. (They can use the Pictorial on Page 18 with the steps below OR they can use the online Step-by-Step Instructions for Experiment #7 at <https://bit.ly/3wioVYk> )

”Now, Find all the parts needed for Experiment #7:

- one Solderless Circuit Board in Bag #15
- one 9-Volt Battery Snap in Bag #1
- one LED (Light Emitting Diode) in Bag #9
- one 220 Ohm resistor (red, red, brown, gold) in Bag #3
- one 1000 Ohm resistor (brown, black, red, gold) in Bag #3
- one SCR in Bag #10 (beveled edge is the Gate lead)
- three Jumper Wires in Bag #16



“Now, using the Pictorial Diagram on Page 18, install the parts on the Solderless Circuit Board in this order.

- Install the LED with the Short Lead in hole 23h and the Long Lead in hole 22h
- Install the 220 Ohm resistor (red, red, brown, gold) in holes 11j to 22j
- Install the 1000 (1k) Ohm resistor (brown, black, red, gold) in holes 11g and 20g
- Install the SCR with the Cathode in hole 25e, Anode in hole 26e, Gate in 27e
- Install Jumper Wire #1 in holes 11d to 25a
- Install Jumper Wire #2 in holes 20f and the other end loose to touch Gate on SCR
- Install Jumper Wire #3 in holes 23f to 26d
- Install the Battery Snap, Black lead in hole 11e and Red Lead in hole 11f

“Connect the battery to the Battery Snap. The LED should not light up. Now

touch the “loose” end of the Jumper Wire to the Gate on the SCR. This should cause the SCR to conduct and the LED to light up. You should notice that even when you remove the Jumper Wire from the Gate, the LED remains lit. It will remain lit until you remove the battery from the circuit.

“**Conclusion:** You should have observed that an SCR (Silicon Control Rectifier) is a diode “with a difference”. That is to say, an SCR is a diode with a third lead called the Gate. To cause the SCR to allow current to flow through it, you must put a momentary small positive voltage on the Gate lead.

**After your students have completed the experiment, you can say - - -**

“Please disassemble the experiment and put all the parts back into the bags.

\*\*\*\*\* **TIME FOR QUIZ EXPERIMENT #7** <https://bit.ly/3wioVYk>



## Teacher LESSON PLAN

### Experiment #8 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

## “How an NPN Transistor Works”

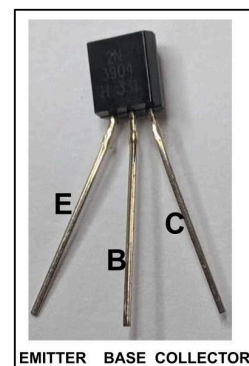
**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #8 with this link <https://bit.ly/3wioVYk>

### TEACHER DIALOG:

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. (They can use the Pictorial on Page 19 with the steps below OR they can use the online Step-by-Step Instructions for Experiment #8 at <https://bit.ly/3wioVYk> )

“Find all the parts needed for Experiment #8:

- one Solderless Circuit Board in Bag #15
- one 9-Volt Battery Snap in Bag #1
- two LEDs (Light Emitting Diodes) in Bag #9
- one 220 Ohm resistor (red, red, brown, gold) in Bag #3
- one 1000 Ohm resistor (brown, black, red, gold) in Bag #3
- one NPN 3904 Transistor in Bag #11
- one Pushbutton Switch in Bag #2
- three Jumper Wires in Bag #16



“Now, using the Pictorial Diagram on Page 19, install the parts on the Solderless Circuit Board in this order.

- Install an LED with the Short Lead in hole 16g and the Long Lead in hole 14g
- Install an LED with the Short Lead in hole 7i and the Long Lead in hole 5i
- Install the 220 Ohm resistor (red, red, brown, gold) in holes 1j to 5j
- Install the 1000 (1k) Ohm resistor (brown, black, red, gold) in holes 1g and 8g
- Install the NPN Transistor - Emitter in hole 15i, Base 16i, Collector 17i
- Install Jumper Wire #1 in holes 1a to 15f
- Install Jumper Wire #2 in holes 9h to 14h
- Install Jumper Wire #3 in holes 7j to 17j
- Install a Pushbutton Switch in holes 8f to 9f
- Install the Battery Snap, Black lead in hole 1e and Red Lead in hole 1f

“Connect the battery to the Battery Snap. The LEDs should not light up. Now press the Pushbutton Switch Both LEDs should light up when the Pushbutton is pressed. You should notice that one LED is a little brighter than the other. The reason is that the current flowing in the NPN Emitter-Collector circuit has more current flowing than the NPN Emitter-Base circuit. This is showing a small current controlling a larger current. This is called Amplification. You will learn more about this as you learn more about transistors.

“**Conclusion:** You should have observed in this simple experiment that an NPN Transistor can be used to Amplify current in a circuit. Therefore we can use a transistor to amplify the small current from a microphone so we can hear the sound from a speaker.

**After your students have completed the experiment, you can say - - -**

“Please disassemble the experiment and put all the parts back into the bags.

\*\*\*\*\* **TIME FOR QUIZ EXPERIMENT #8** <https://bit.ly/3wioVYk>



## Teacher LESSON PLAN

**Experiment #9 of 30****Mr Circuit STEM Electronics Learning Lab 1 #1101****“How a PNP Transistor Works”**

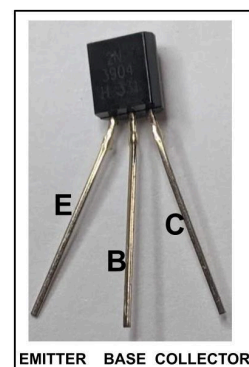
**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #9 with this link <https://bit.ly/3wioVYk>

**TEACHER DIALOG:**

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. (They can use the Pictorial on Page 20 with the steps below OR they can use the online Step-by-Step Instructions for Experiment #9 at <https://bit.ly/3wioVYk> )

“Find all the parts needed for Experiment #9:

- one Solderless Circuit Board in Bag #15
- one 9-Volt Battery Snap in Bag #1
- two LEDs (Light Emitting Diodes) in Bag #9
- one 220 Ohm resistor (red, red, brown, gold) in Bag #3
- one 1000 Ohm resistor (brown, black, red, gold) in Bag #3
- one PNP 3906 Transistor in Bag #12
- one Pushbutton Switch in Bag #2
- three Jumper Wires in Bag #16



“Now, using the Pictorial Diagram on Page 20, install the parts on the Solderless Circuit Board in this order.

- Install an LED with the Short Lead in hole 15g and the Long Lead in hole 17f
- Install an LED with the Short Lead in hole 5i and the Long Lead in hole 7i
- Install the 220 Ohm resistor (red, red, brown, gold) in holes 1j to 5j
- Install the 1000 (1k) Ohm resistor (brown, black, red, gold) in holes 1g and 6g
- Install the PNP Transistor - Emitter in hole 18h, Base 17h, Collector 16h
- Install Jumper Wire #1 in holes 1a to 18f
- Install Jumper Wire #2 in holes 9h to 15h
- Install Jumper Wire #3 in holes 7j to 16j
- Install a Pushbutton Switch in holes 6f to 8f
- Install the Battery Snap, Black lead in hole 1f and Red Lead in hole 1e

“Connect the battery to the Battery Snap. The LEDs should not light up. Now press the Pushbutton Switch Both LEDs should light up when the Pushbutton is pressed. You should notice that one LED is a little brighter than the other. The reason is that the current flowing in the PNP Collector-Emitter circuit has more current flowing than the PNP Base-Emitter Circuit. This is showing a small current controlling a larger current. This is called Amplification. You will learn more about this as you learn more about transistors.

“**Conclusion:** You should have observed in this simple experiment that a PNP Transistor, just like an NPN Transistor, can be used to Amplify current in a circuit. Therefore we can use a transistor to amplify the small current from a microphone so we can hear the sound from a speaker.

**After your students have completed the experiment, you can say - - -**

“Please disassemble the experiment and put all the parts back into the bags.

\*\*\*\*\* **TIME FOR QUIZ EXPERIMENT #9** <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

## Experiment #10 of 30

## Mr Circuit STEM Electronics Learning Lab 1 #1101

## “How a Two-Transistor Oscillator Works”

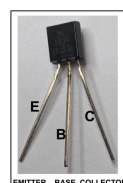
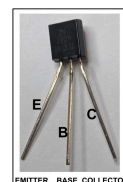
IN CLASS: Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #10 with this link <https://bit.ly/3wioVYk>

## TEACHER DIALOG:

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. (They can use the Pictorial on Page 21 with the steps below OR they can use the online Step-by-Step Instructions for Experiment #10 at <https://bit.ly/3wioVYk> )

“Find all the parts needed for Experiment #10:

- one Solderless Circuit Board in Bag #15
- one 9-Volt Battery Snap in Bag #1
- one 10 Ohm resistor (brown, black black, gold) in Bag #3
- one 47 Ohm resistor (yellow, violet, black, gold) in Bag #3
- one 120k Ohm resistor (brown, red, yellow, gold) in Bag #3
- one NPN 3904 Transistor in Bag #11
- one PNP 3906 Transistor in Bag #12
- one 0.1uF (104) disc capacitor in Bag #6
- one Speaker in Bag #14
- five Jumper Wires in Bag #16



“Now, using the Pictorial Diagram on Page 21, install the parts on the Solderless Circuit Board in this order.

- Install the 10 Ohm resistor (brown, black black, gold) in holes 13b to 18b
- Install the 47 Ohm resistor (yellow, violet, black, gold) in holes 2f and 6f
- Install the 120k Ohm resistor (brown, red, yellow, gold) in holes 1i to 10i
- Install the NPN Transistor - Emitter in hole 9g, Base 10g, Collector 11g
- Install the PNP Transistor - Emitter in hole 13g, Base 14g, Collector 15g
- Install the 0.1uF (104) disc Capacitor in holes 10f to 15f
- Install Jumper Wire #1 in holes 1a to 13a
- Install Jumper Wire #2 in holes 1c to 11f
- Install Jumper Wire #3 in holes 1h to 6h
- Install Jumper Wire #4 in holes 1j to 13j
- Install Jumper Wire #5 in holes 9h to 14h
- Install the Speaker in holes 15h and 18d
- Install the Battery Snap, Black lead in hole 1e and Red Lead in hole 2g

“Connect the battery to the Battery Snap. You should hear a tone coming from the speaker. If you do not, please recheck your wiring and try again. The frequency of the oscillations is controlled by the speed at which capacitor C1 (0.1uf disc capacitor) charges and discharges. If you change the value of the capacitor or the ohm value of the 120k Ohm resistor, the frequency will change.

**Conclusion:** You should have observed in this simple experiment that an PNP Transistor and an NPN Transistor can be used to create a two-transistor oscillator circuit.

After your students have completed the experiment, you can say - - -

“Please disassemble the experiment and put all the parts back into the bags.

\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #10 <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

### Experiment #11 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

## “How a 555 Timer IC Works”

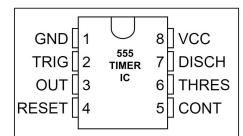
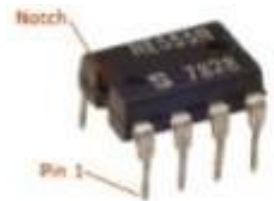
**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #11 with this link <https://bit.ly/3wioVYk>

### TEACHER DIALOG:

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. (They can use the Pictorial on Page 22 with the steps below OR they can use the online Step-by-Step Instructions for Experiment #11 at <https://bit.ly/3wioVYk> )

“Find all the parts needed for Experiment #11:

- one Solderless Circuit Board in Bag #15
- one 9-Volt Battery Snap in Bag #1
- one LED (Light Emitting Diode) in Bag #9
- one 220 Ohm resistor (red, red, brown, gold) in Bag #3
- one 6800 Ohm resistor (blue, gray, red, gold) in Bag #3
- one 16k Ohm resistor (brown, blue, orange, gold) in Bag #3
- one 555 Timer IC in Bag #13
- one 10uF Electrolytic Capacitor in Bag #7
- five Jumper Wires in Bag #16



“Now, using the Pictorial Diagram on Page 22, install the parts on the Solderless Circuit Board in this order.

- Install an LED with the Short Lead in hole 11e and the Long Lead in hole 11f
- Install the 220 Ohm resistor (red, red, brown, gold) in holes 11a to 19a
- Install the 6800 (6.8k) Ohm resistor (blue, gray, red, gold) in holes 17i to 18i
- Install the 16k Ohm resistor (brown, blue, orange, gold) in holes 18h to 19h
- Install the 555 Timer IC with Pin 1 in hole 17e as shown in pictorial
- Install the 10uF Electrolytic Capacitor - Long lead in hole 18b, Short lead in 17b
- Install Jumper Wire #1 in holes 1d to 17a
- Install Jumper Wire #2 in holes 1g to 11g
- Install Jumper Wire #3 in holes 1i to 17h
- Install Jumper Wire #4 in holes 17g to 20c
- Install Jumper Wire #5 in holes 18d to 19g
- Install the Battery Snap, Black lead in hole 1e and Red Lead in hole 1f

“Connect the battery to the Battery Snap. The LED should blink at about one blink per second. You can make it go slower by putting a higher value of capacitance in the circuit. You can change the 10uF capacitor to 100uF and it will slow down a lot.

“**Conclusion:** You should have observed in this simple experiment that a 555 Timer IC can be used to emit pulses at different rates by changing the components connected to it.

After your students have completed the experiment, you can say - - -

“Please disassemble the experiment and put all the parts back into the bags.

\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #11 <https://bit.ly/3wioVYk>

## Experiment #12 of 30

# Mr Circuit STEM Electronics Learning Lab 1 #1101

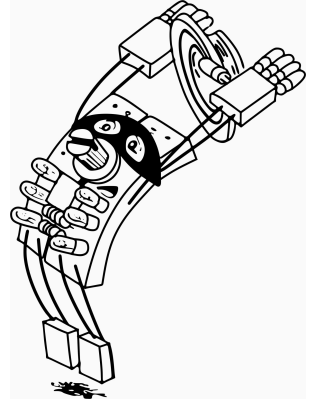
## “Build a Burglar Alarm Circuit”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #12 with this link <https://bit.ly/3wioVYk>

### TEACHER DIALOG:

**After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. Refer to page 23 and find all the parts needed for Experiment #12:**

- one Solderless Circuit Board in Bag #15
- one 9-Volt Battery Snap in Bag #1
- one LED (Light Emitting Diode) in Bag #9
- one 220 Ohm resistor (red, red, brown, gold) in Bag #3
- two 33k Ohm resistor (orange, orange, orange, gold) in Bag #3
- one SCR in Bag #10
- one Diode in Bag #8
- one 0.1uF (104) disc Capacitor in Bag #6
- nine Jumper Wires in Bag #16



**“Now, using the Pictorial Diagram on Page 23, install the parts on the Solderless Circuit Board in this order.**

- Install an LED with the Short Lead in hole 21i and the Long Lead in hole 19i  
Install the 220 Ohm resistor (red, red, brown, gold) in holes 17h to 19h  
Install the 33k Ohm resistor (blue, gray, red, gold) in holes 1h to 5h  
Install the 33k Ohm resistor (brown, blue, orange, gold) in holes 1i to 10i  
Install the SCR with the Cathode in hole 20g, Anode 21g, Gate in hole 22g  
Install the 0.1uF(104) disc Capacitor in holes 12d to 12f  
Install the Diode - Cathode in hole 12g, Anode in hole 5g  
Install Jumper Wire #1 in holes 1j to 17j  
Install Jumper Wire #2 in holes 5d to loose end  
Install Jumper Wire #3 in holes 5f to loose end  
Install Jumper Wire #4 in holes 5c to 12c  
Install Jumper Wire #5 in holes 1a to 5a  
Install Jumper Wire #6 in holes 5b to 20f  
Install Jumper Wire #7 in holes 12h to 22f  
Install Jumper Wire #8 in holes 10j to loose end  
Install Jumper Wire #9 in holes 12i to loose end  
Install the Battery Snap, Black lead in hole 1e and Red Lead in hole 1f

**“Before you connect the battery to the Battery Snap, connect Jumper Wires #2 AND #3, as shown in the pictorial diagram.** When you connect the battery, the LED should not be on. Now, let’s “trip” the alarm by touching Jumper Wires #8 and #9 which are referred to as the “normally open switch on the pictorial on Page 23. The LED should light up. It will stay lit until power is removed from the circuit. The LED is acting like a tripped alarm and once it is tripped it will not shut off until the power is removed.

**“Conclusion:** You should have observed in this simple experiment that an SCR can be used to make a burglar alarm circuit that will not shut off the alarm until all power is removed from the circuit.

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #12 <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

**Experiment #13 of 30****Mr Circuit STEM Electronics Learning Lab 1 #1101****“Build an Automatic Night Light Circuit”**

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #13 with this link <https://bit.ly/3wioVYk>

**TEACHER DIALOG:**

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. Refer to page 24 and find all the parts needed for Experiment #13:

one Solderless Circuit Board in Bag #15  
 one 9-Volt Battery Snap in Bag #1  
 two LEDs (Light Emitting Diodes) in Bag #9  
 one 47 Ohm resistor (yellow, violet, black, gold) in Bag #3  
 two 16k Ohm resistors (brown, blue, orange, gold) in Bag #3  
 one Photocell in Bag #5  
 one NPN 3904 Transistor in Bag #11  
 one Potentiometer in Bag #4  
 three Jumper Wires in Bag #16



**“Now, using the Pictorial Diagram on Page 24, install the parts on the Solderless Circuit Board in this order.**

Install an LED with the Short Lead in hole 9j and the Long Lead in hole 7j  
 Install an LED with the Short Lead in hole 7i and the Long Lead in hole 5i  
 Install the 47 Ohm resistor (yellow, violet, black, gold) in holes 17h to 19h  
 Install the 16k Ohm resistor (brown, blue, orange, gold) in holes 1h to 5h  
 Install the Photocell in holes 10b to 12b  
 Install the NPN 3904 Transistor - Emitter in 13d, Base in 12d, Collector in 11d  
 Install the Potentiometer, edge lead in hole 12c, middle lead in hole 6f  
 Install Jumper Wire #1 in holes 1a to 10c  
 Install Jumper Wire #2 in holes 9g to 11e  
 Install Jumper Wire #3 in holes 10a to 13a  
 Install the Battery Snap, Black lead in hole 1e and Red Lead in hole 1f

**“Connect the battery to the Battery Snap. With the battery connected, adjust the Potentiometer until the LEDs light up and then back off on the Potentiometer until they just turn off. Now, put your finger over the Photocell and the LEDs should light up. When you remove your finger from the top of the Photocell, the LEDs should turn off. This is how it should operate. The LEDs should come on when it starts getting dark in the room.**

**“Conclusion:** You should have observed in this simple experiment that we can use a Photocell to make a circuit that will turn on the light when it gets dark.

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

**\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #13** <https://bit.ly/3wioVYk>



## Teacher LESSON PLAN

### Experiment #14 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

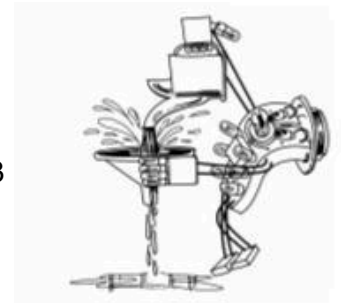
## “Build a DC to DC Power Supply Circuit”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #14 with this link <https://bit.ly/3wioVYk>

### TEACHER DIALOG:

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. Refer to page 25 and find all the parts needed for Experiment #14:

one Solderless Circuit Board in Bag #15  
 one 9-Volt Battery Snap in Bag #1  
 one LED (Light Emitting Diode) in Bag #9  
 one 220 Ohm resistor (red, red, brown, gold) in Bag #3  
 one 6800 Ohm resistor (blue, gray, red, gold) in Bag #3  
 one NPN 3904 Transistor in Bag #11  
 one Potentiometer in Bag #4  
 five Jumper Wires in Bag #16



**“Now, using the Pictorial Diagram on Page 25, install the parts on the Solderless Circuit Board in this order.**

Install an LED with the Short Lead in hole 25e and the Long Lead in hole 25f  
 Install the 220 Ohm resistor (red, red, brown, gold) in holes 13g to 25g  
 Install the 6800 (6.8k) Ohm resistor (blue, gray, red, gold) in holes 13d to 13f  
 Install the NPN 3904 Transistor - Emitter in 13h, Base in 12h, Collector in 11h  
 Install the Potentiometer, edge lead in 1c, middle lead in 12g, other edge in 1j  
 Install Jumper Wire #1 in holes 1i to 11i  
 Install Jumper Wire #2 in holes 1b to 13b  
 Install Jumper Wire #3 in holes 13c and loose end  
 Install Jumper Wire #4 in holes 13a to 25d  
 Install Jumper Wire #5 in holes 13j and loose end  
 Install the Battery Snap, Black lead in hole 1a and Red Lead in hole 1f

**“Connect the battery to the Battery Snap. With the battery connected,** adjust the Potentiometer and observe the LED vary in brightness. This is an indication that the output voltage of this DC to DC Power Supply is varying from 0 to approximately 9 Volts DC. If you were to connect a DC Voltmeter across the Jumper Wires #3 and #5, you could read the exact output voltage. This power supply could be used to run an electronic device such as a transistor radio that draws less than 50 mA of current.

**“Conclusion:** You should have observed in this simple experiment that we can use a Transistor and a Potentiometer to make a Variable DC to DC Power Supply.

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

**\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #14** <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

### Experiment #15 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

## “Build an Electronic Metronome Circuit”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #15 with this link <https://bit.ly/3wioVYk>

### TEACHER DIALOG:

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. Refer to page 26 and find all the parts needed for Experiment #15:

- one Solderless Circuit Board in Bag #15
- one 9-Volt Battery Snap in Bag #1
- one 16k Ohm resistor (brown, blue, orange, gold) in Bag #3
- one NPN 3904 Transistor in Bag #11
- one PNP 3906 Transistor in Bag #12
- one 100uF Electrolytic Capacitor in Bag #7
- one Potentiometer in Bag #4
- one Speaker in Bag #14
- four Jumper Wires in Bag #16



**“Now, using the Pictorial Diagram on Page 26, install the parts on the Solderless Circuit Board in this order.**

- Install one 16k Ohm resistor (brown, blue, orange, gold) in holes 1h to 5h
- Install one NPN 3904 Transistor - Emitter in 11h, Base in 12h, Collector in 13h
- Install one PNP 3906 Transistor - Emitter in 15h, Base in 16h, Collector in 17h
- Install one 100uF Capacitor long lead in hole 12f, short lead in hole 17f
- Install the Potentiometer, middle lead in 5i, other edge in 12j
- Install Jumper Wire #1 in holes 1a to 19a
- Install Jumper Wire #2 in holes 1b to 13f
- Install Jumper Wire #3 in holes 1j to 15j
- Install Jumper Wire #4 in holes 11f to 16 f
- Install the Battery Snap, Black lead in hole 1e and Red Lead in hole 1f

**“Connect the battery to the Battery Snap. With the battery connected, the speaker in the circuit should make a clicking sound like a mechanical metronome. By adjusting the Potentiometer, you can vary the frequency of the ticking. The ticking is generated by a two-transistor oscillator circuit.**

**“Conclusion:** You should have observed in this simple experiment that we can use a Two-Transistor Oscillator and a Potentiometer to make an Electronic Metronome circuit.

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

**\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #15** <https://bit.ly/3wioVYk>



## Teacher LESSON PLAN

### Experiment #16 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

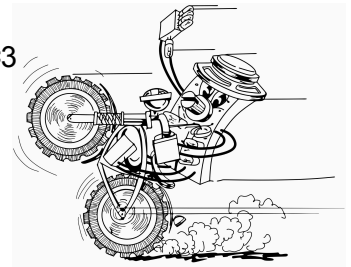
## “Build an Electronic Motorcycle Circuit”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #16 with this link <https://bit.ly/3wioVYk>

### TEACHER DIALOG:

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. Refer to page 27 and find all the parts needed for Experiment #16

one Solderless Circuit Board in Bag #15  
 one 9-Volt Battery Snap in Bag #1  
 one 10 Ohm resistor (brown, black, black, gold) in Bag #3  
 one 3.3k Ohm resistor (orange, orange, red, gold) in Bag #3  
 one NPN 3904 Transistor in Bag #11  
 one PNP 3906 Transistor in Bag #12  
 one 10uF Electrolytic Capacitor in Bag #7  
 one Potentiometer in Bag #4  
 one Speaker in Bag #14  
 three Jumper Wires in Bag #16



**“Now, using the Pictorial Diagram on Page 27, install the parts on the Solderless Circuit Board in this order.**

Install one 10 Ohm resistor (brown, black, black, gold) in holes 1j to 9j  
 Install one 3.3k Ohm resistor (orange, orange, red, gold) in holes 1h to 8h  
 Install one NPN 3904 Transistor - Emitter in 13d, Base in 14d, Collector in 15d  
 Install one PNP 3906 Transistor - Emitter in 18d, Base in 19d, Collector in 20d  
 Install one 10uF Capacitor long lead in hole, 14b, short lead in hole 20b  
 Install the Potentiometer, middle lead in 8j, edge in 14e  
 Install Jumper Wire #1 in holes 1a to 15b  
 Install Jumper Wire #2 in holes 9f to 18e  
 Install Jumper Wire #3 in holes 1j to 15j  
 Install the Battery Snap, Black lead in hole 1e and Red Lead in hole 1f

**“Connect the battery to the Battery Snap. With the battery connected,** the speaker in the circuit should make a sound like a 2-cycle motorcycle engine. By adjusting the Potentiometer, you can vary the frequency of the ‘speed’ of the motorcycle. Are you ready to take a ride?

**“Conclusion:** You should have observed in this simple experiment that we can use a Two-Transistor Oscillator and a Potentiometer to make the sounds of a two-cycle motorcycle engine.

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

**\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #16** <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

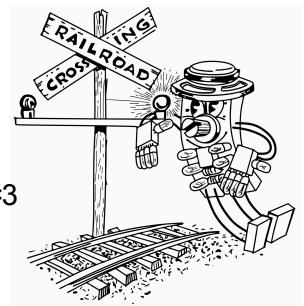
**Experiment #17 of 30****Mr Circuit STEM Electronics Learning Lab 1 #1101****“Build a Railroad Lights Circuit”**

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #17 with this link <https://bit.ly/3wioVYk>

**TEACHER DIALOG:**

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. Refer to page 28 and find all the parts needed for Experiment #17

one Solderless Circuit Board in Bag #15  
 one 9-Volt Battery Snap in Bag #1  
 two LEDs (Light Emitting Diodes) in Bag #9  
 two 220 Ohm resistors (red, red, brown, gold) in Bag #3  
 one 6800 Ohm resistor (blue, gray, red, gold) in Bag #3  
 one 33k Ohm resistor (orange, orange, orange, gold) in Bag #3  
 one 555 Timer IC in Bag #13  
 one 10uF Electrolytic Capacitor in Bag #7  
 six Jumper Wires in Bag #16



**Step E17-4: Now, using the Pictorial Diagram on Page 28, install the parts on the Solderless Circuit Board in this order.**

Install an LED with the Short Lead in hole 22i and the Long Lead in hole 21i  
 Install an LED with the Short Lead in hole 21a and the Long Lead in hole 22a  
 Install the 220 Ohm resistor (red, red, brown, gold) in holes 12c to 22f  
 Install the 220 Ohm resistor (red, red, brown, gold) in holes 12b to 22c  
 Install the 6800 (6.8k) Ohm resistor (blue, gray, red, gold) in holes 10i to 11i  
 Install the 555 Timer IC with Pin 1 in hole 10e as shown in pictorial  
 Install the 10uF Electrolytic Capacitor - Long lead in hole 11c, Short lead in 10c  
 Install Jumper Wire #1 in holes 1a to 10a  
 Install Jumper Wire #2 in holes 1j to 10j  
 Install Jumper Wire #3 in holes 1i to 17h  
 Install Jumper Wire #4 in holes 17g to 20c  
 Install Jumper Wire #5 in holes 18d to 19g  
 Install Jumper Wire #6 in holes 18d to 19g  
 Install the Battery Snap, Black lead in hole 1e and Red Lead in hole 1f

**Step E17-5: Connect the battery to the Battery Snap.** The LED should blink at about one blink per second. You can make it go slower by putting a higher value of capacitance in the circuit. You can change the 10uF capacitor to 100uF and it will slow down a lot.

**Step E17-6: Conclusion:** You should have observed in this simple experiment that a 555 Timer IC can be used to emit pulses at different rates by changing the components connected to it.

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

**\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #17** <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

### Experiment #18 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

## “Build a Variable Speed Lights Circuit”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #18 with this link <https://bit.ly/3wioVYk>

### TEACHER DIALOG:

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. Refer to page 29 and find all the parts needed for Experiment #18

one Solderless Circuit Board in Bag #15  
 one 9-Volt Battery Snap in Bag #1  
 two LEDs (Light Emitting Diodes) in Bag #9  
 two 220 Ohm resistors (red, red, brown, gold) in Bag #3  
 one 1000 Ohm resistor (brown, black, red, gold) in Bag #3  
 one 6800 Ohm resistor (blue, gray, red, gold) in Bag #3  
 one Potentiometer in Bag #4  
 one 555 Timer IC in Bag #13  
 one 10uF Electrolytic Capacitor in Bag #7  
 six Jumper Wires in Bag #16



**“Now, using the Pictorial Diagram on Page 29, install the parts on the Solderless Circuit Board in this order.**

Install an LED with the Short Lead in hole 19j and the Long Lead in hole 18j  
 Install an LED with the Short Lead in hole 19b and the Long Lead in hole 18b  
 Install the 220 Ohm resistor (red, red, brown, gold) in holes 11c to 18c  
 Install the 220 Ohm resistor (red, red, brown, gold) in holes 11d to 19f  
 Install the 6800 (6.8k) Ohm resistor (blue, gray, red, gold) in holes 9i to 10j  
 Install the 555 Timer IC with Pin 1 in hole 9e as shown in pictorial  
 Install the 10uF Electrolytic Capacitor - Long lead in hole 10b, Short lead in 9b  
 Install the Potentiometer, middle lead in 4i, edge in 11h  
 Install Jumper Wire #1 in holes 1a to 19a  
 Install Jumper Wire #2 in holes 1b to 9a  
 Install Jumper Wire #3 in holes 1i to 9j  
 Install Jumper Wire #4 in holes 1j to 18i  
 Install Jumper Wire #5 in holes 9g to 12d  
 Install Jumper Wire #6 in holes 10d to 11g  
 Install the Battery Snap, Black lead in hole 1e and Red Lead in hole 1f

**“Touch the battery to the Battery Snap and the LEDs should blink on and off**  
**If not, recheck your wiring.** When the LEDs are blinking back and forth, you should be able to change the frequency of the blinking by adjusting the Potentiometer.

**“Conclusion:** You should have observed in this simple experiment that a 555 Timer IC can be used to make LEDs blink alternately, one after the other.

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

**\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #18** <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

### Experiment #19 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

## “Build a Continuity Tester Circuit”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #19 with this link <https://bit.ly/3wioVYk>

### TEACHER DIALOG:

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. Refer to page 30 and find all the parts needed for Experiment #19

one Solderless Circuit Board in Bag #15  
 one 9-Volt Battery Snap in Bag #1  
 one 10 Ohm resistor (brown, black, black, gold) in Bag #3  
 one 220 Ohm resistor (red, red, brown, gold) in Bag #3  
 one 1000 Ohm resistor (brown, black, red, gold) in Bag #3  
 one 120k Ohm resistor (brown, red, yellow, gold) in Bag #3  
 one NPN 3904 Transistor in Bag #11  
 one 555 Timer IC in Bag #13  
 one 0.01uF (103) disc Capacitor in Bag #6  
 one Speaker in Bag #14  
 eight Jumper Wires in Bag #16



**“Now, using the Pictorial Diagram on Page 30, install the parts on the Solderless Circuit Board in this order.**

Install the 10 Ohm resistor (brown, black, black, gold) in holes 20j to 23j  
 Install the 220 Ohm resistor (red, red, brown, gold) in holes 17c to 25c  
 Install the 1000 (1k) Ohm resistor (brown, black, red, gold) in holes 15h to 16i  
 Install the 120k Ohm resistor (brown, red, yellow, gold) in holes 16j to 17j  
 Install the 555 Timer IC with Pin 1 in hole 15e as shown in pictorial  
 Install one 0.01uF (103) disc Capacitor in holes 15c to 16b  
 Install one NPN 3904 Transistor -Collector in 24d, Base in 25d, Emitter in 26d  
 Install Jumper Wire #1 in holes 1a to 26a  
 Install Jumper Wire #2 in holes 1c to 15a  
 Install Jumper Wire #3 in holes 1f to loose end  
 Install Jumper Wire #4 in holes 2f to loose end  
 Install Jumper Wire #5 in holes 2j to 20i  
 Install Jumper Wire #6 in holes 2h to 15i  
 Install Jumper Wire #7 in holes 15g to 18c  
 Install Jumper Wire #8 in holes 16d to 17g  
 Install the Battery Snap, Black lead in hole 1e and Red Lead in hole 1f

**“Touch the battery to the Battery Snap and the Speaker should not make a sound until you touch the two Jumper Wires #3 and #4 together. If not, recheck your wiring.** These are the Test Probes for Checking continuity. Touch these two wires to the ends of a good fuse, and the speaker will make a sound indicating there is “continuity” which means the fuse is good. When the LEDs are blinking back and forth, you should be able to change the frequency of the blinking by adjusting the Potentiometer.

**“Conclusion:** You should have observed in this simple experiment that a 555 Timer IC can be used to make a continuity checker.

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

**\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #19** <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

### Experiment #20 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

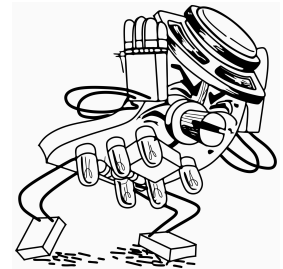
## “Build an Audio Generator Circuit”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #20 with this link <https://bit.ly/3wioVYk>

### TEACHER DIALOG:

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. Refer to page 31 and find all the parts needed for Experiment #20

- one Solderless Circuit Board in Bag #15
- one 9-Volt Battery Snap in Bag #1
- one 10 Ohm resistor (brown, black, black, gold) in Bag #3
- one 220 Ohm resistor (red, red, brown, gold) in Bag #3
- one 1000 Ohm resistor (brown, black, red, gold) in Bag #3
- one 6800 Ohm resistor (blue, gray, red, gold) in Bag #3
- one Potentiometer in Bag #4
- one NPN 3904 Transistor in Bag #11
- one 555 Timer IC in Bag #13
- one 0.01uF (103) disc Capacitor in Bag #6
- one Speaker in Bag #14
- six Jumper Wires in Bag #16



**“Now, using the Pictorial Diagram on Page 31, install the parts on the Solderless Circuit Board in this order.**

- Install the 10 Ohm resistor (brown, black, black, gold) in holes 21i to 24i
- Install the 220 Ohm resistor (red, red, brown, gold) in holes 17d to 23c
- Install the 1000 (1k) Ohm resistor (brown, black, red, gold) in holes 9f to 16g
- Install the 6800 (6.8k) Ohm resistor (blue, gray, red, gold) in holes 15j to 16j
- Install the 555 Timer IC with Pin 1 in hole 15e as shown in pictorial
- Install one 0.01uF (103) disc Capacitor in holes 15c to 16b
- Install one NPN 3904 Transistor -Collector in 22d, Base in 23d, Emitter in 24d
- Install the Potentiometer, middle lead in 9g, edge in 17i
- Install the Speaker in holes 22a to 24h
- Install Jumper Wire #1 in holes 2a to 24a
- Install Jumper Wire #2 in holes 2b to 15a
- Install Jumper Wire #3 in holes 2j to 15i
- Install Jumper Wire #4 in holes 2i to 21j
- Install Jumper Wire #5 in holes 16d to 17g
- Install Jumper Wire #6 in holes 15h to 18d
- Install the Battery Snap, Black lead in hole 2e and Red Lead in hole 2f

**“Touch the battery to the Battery Snap and the Speaker should make a sound. If not, recheck your wiring.** When the speaker makes a sound, you should be able to vary the sound frequency by adjusting the potentiometer. This circuit is called an audio generator because it generates sounds that the human ear can hear.

**“Conclusion:** You should have observed in this simple experiment that a 555 Timer IC can be used to generate audio frequencies.

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

**\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #20** <https://bit.ly/3wioVYk>



## Teacher LESSON PLAN

## Experiment #21 of 30

## Mr Circuit STEM Electronics Learning Lab 1 #1101

**“Build an Electronic Police Siren Circuit”**

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #21 with this link <https://bit.ly/3wioVYk>

**TEACHER DIALOG:**

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. Refer to page 32 and find all the parts needed for Experiment #21

one Solderless Circuit Board in Bag #15  
 one 9-Volt Battery Snap in Bag #1  
 one 10 Ohm resistor (brown, black, black, gold) in Bag #3  
 one 220 Ohm resistor (red, red, brown, gold) in Bag #3  
 one 1000 Ohm resistor (brown, black, red, gold) in Bag #3  
 one 2200 Ohm resistor (red, red, red, gold) in Bag #3  
 one 6800 Ohm resistor (blue, gray, red, gold) in Bag #3  
 one 120k Ohm resistor (brown, red, yellow, gold) in Bag #3  
 one Push Button Switch in Bag #2  
 one NPN 3904 Transistor in Bag #11  
 one 555 Timer IC in Bag #13  
 one 0.01uF (103) disc Capacitor in Bag #6  
 one 1000uF Electrolytic Capacitor in Bag #7  
 one Speaker in Bag #14  
 eight Jumper Wires in Bag #16



**“Now, using the Pictorial Diagram on Page 32, install the parts on the SCB.**

Install the 10 Ohm resistor (brown, black, black, gold) in holes 24j to 25j  
 Install the 220 Ohm resistor (red, red, brown, gold) in holes 19d to 25c  
 Install the 1000 (1k) Ohm resistor (brown, black, red, gold) in holes 17h to 18h  
 Install the 2200 (2.2k) Ohm resistor (red, red, red, gold) in holes 2e to 11g  
 Install the 6800 (6.8k) Ohm resistor (blue, gray, red, gold) in holes 15j to 16j  
 Install the 120k Ohm resistor (brown, red, yellow, gold) in holes 18j to 19j  
 Install the 555 Timer IC with Pin 1 in hole 15e as shown in pictorial  
 Install a 0.01uF (103) disc Capacitor in holes 15c to 16b  
 Install a 1000uF Electrolytic Capacitor Long lead in 11f, Short lead in 11c  
 Install one NPN 3904 Transistor -Collector in 22d, Base in 23d, Emitter in 24d  
 Install a Push Button Switch in holes 1c and 2d  
 Install the Speaker in holes 22a to 24h  
 Install Jumper Wire #1 in holes 2a to 24a  
 Install Jumper Wire #2 in holes 2b to 15a  
 Install Jumper Wire #3 in holes 2j to 15i  
 Install Jumper Wire #4 in holes 2i to 21j  
 Install Jumper Wire #5 in holes 16d to 17g  
 Install Jumper Wire #6 in holes 15h to 18d  
 Install Jumper Wire #7 in holes 15h to 18d  
 Install Jumper Wire #8 in holes 15h to 18d  
 Install the Battery Snap, Black lead in hole 1e and Red Lead in hole 2g

**“Touch the battery to the Battery Snap and the Speaker should make a sound. If not, recheck your wiring.** When the speaker makes a sound, you should be able to vary the sound frequency by adjusting the potentiometer. This circuit is called an audio generator because it generates sounds that the human ear can hear.

**Step E21-6: Conclusion:** You should have observed in this simple experiment that a 555 Timer IC can be used to generate audio frequencies.

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

**\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #21** <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

### Experiment #22 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

## “Build a Wake-Up Alarm Circuit”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #22 with this link <https://bit.ly/3wioVYk>

### TEACHER DIALOG:

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. Refer to page 33 and find all the parts needed for Experiment #22

one Solderless Circuit Board in Bag #15  
 one 9-Volt Battery Snap in Bag #1  
 one 100 Ohm resistor (brown, black, brown, gold) in Bag #3  
 one 220 Ohm resistor (red, red, brown, gold) in Bag #3  
 one 2200 (2.2k) Ohm resistor (red, red, red, gold) in Bag #3  
 one Photocell in Bag #5  
 one NPN 3904 Transistor in Bag #11  
 one 555 Timer IC in Bag #13  
 one 0.01uF (103) disc Capacitor in Bag #6  
 one Speaker in Bag #14  
 six Jumper Wires in Bag #16



**“Now, using the Pictorial Diagram on Page 33, install the parts on the Solderless Circuit Board in this order.**

Install the 100 Ohm resistor (brown, black, brown, gold) in holes 22i to 24i  
 Install the 220 Ohm resistor (red, red, brown, gold) in holes 19d to 25c  
 Install the 2200 (2.2k) Ohm resistor (red, red, red, gold) in holes 17i to 18i  
 Install the 555 Timer IC with Pin 1 in hole 17e as shown in pictorial  
 Install one 0.01uF (103) disc Capacitor in holes 17b to 18c  
 Install one NPN 3904 Transistor -Collector in 24e, Base in 25e, Emitter in 26e  
 Install the Photocell in holes 18j and 19j  
 Install the Speaker in holes 24d to 24h  
 Install Jumper Wire #1 in holes 1a to 26a  
 Install Jumper Wire #2 in holes 1c to 17a  
 Install Jumper Wire #3 in holes 1j to 22h  
 Install Jumper Wire #4 in holes 1h to 17h  
 Install Jumper Wire #5 in holes 18d to 19h  
 Install Jumper Wire #6 in holes 17g to 20d  
 Install the Battery Snap, Black lead in hole 1e and Red Lead in hole 1f

**“Touch the battery to the Battery Snap and the Speaker should make a sound. If not, recheck your wiring.** When the speaker makes a sound, you can cover the Photocell and the sound should diminish to almost nothing. This Wake-Up Alarm is supposed to be silent when it is dark and make noise when it is light. You can put it into a dark drawer or a Refrigerator and when someone opens either one, the circuit will make a sound. Gotcha!

**“Conclusion:** You should have observed in this simple experiment that a 555 Timer IC and a Photocell to make a Wake-Up Alarm.

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

**\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #22** <https://bit.ly/3wioVYk>



## Teacher LESSON PLAN

### Experiment #23 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

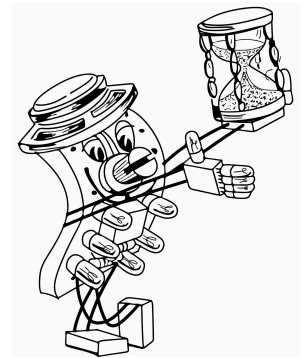
## “Build a Variable Timer Circuit”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #23 with this link <https://bit.ly/3wioVYk>

### TEACHER DIALOG:

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. Refer to page 34 and find all the parts needed for Experiment #23

one Solderless Circuit Board in Bag #15  
 one 9-Volt Battery Snap in Bag #1  
 one LED in Bag #9  
 one 220 Ohm resistor (red, red, brown, gold) in Bag #3  
 one 1000 Ohm resistor (brown, black, red, gold) in Bag #3  
 one 6800 Ohm resistor (blue, gray, red, gold) in Bag #3  
 one Potentiometer in Bag #4  
 one Push Button Switch in Bag #2  
 one 555 Timer IC in Bag #13  
 one 100uF Capacitor in Bag #7  
 seven Jumper Wires in Bag #16



**“Now, using the Pictorial Diagram on Page 34, install the parts on the Solderless Circuit Board in this order.**

Install an LED with the Short Lead in hole 30e and the Long Lead in hole 29e  
 Install the 220 Ohm resistor (red, red, brown, gold) in holes 22a to 29b  
 Install the 1000 (1k) Ohm resistor (brown, black, red, gold) in holes 20h to 21i  
 Install the 6800 (6.8k) Ohm resistor (blue, gray, red, gold) in holes 11b to 21b  
 Install the 555 Timer IC with Pin 1 in hole 20e as shown in pictorial  
 Install a 100uF Capacitor - Long lead in 26f, Short lead in 26e  
 Install the Push Button Switch in holes 20c to 21c  
 Install the Potentiometer, middle lead in 21h, edge in 22i  
 Install Jumper Wire #1 in holes 1a to 26b  
 Install Jumper Wire #2 in holes 1d to 20b  
 Install Jumper Wire #3 in holes 1g to 11e  
 Install Jumper Wire #4 in holes 1i to 20j  
 Install Jumper Wire #5 in holes 20g to 23d  
 Install Jumper Wire #6 in holes 22h to 26j  
 Install Jumper Wire #7 in holes 26a to 30b  
 Install the Battery Snap, Black lead in hole 1e and Red Lead in hole 1f

**“Connect the battery to the Battery Snap and adjust the Potentiometer to the center of its range.** Then Press and Release the Pushbutton Switch. The LED will turn on for a period of time. **If not, recheck your wiring.** You can adjust the time the LED will remain on with the Potentiometer.

**“Conclusion:** You should have observed in this simple experiment that a 555 Timer IC and a Photocell to make a Wake-Up Alarm.

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #23 <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

### Experiment #24 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

## “Build a Moisture Detector Circuit”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #24 with this link <https://bit.ly/3wioVYk>

### TEACHER DIALOG:

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. Refer to page 35 and find all the parts needed for Experiment #24

one Solderless Circuit Board in Bag #15  
 one 9-Volt Battery Snap in Bag #1  
 one LED in Bag #9  
 one 220 Ohm resistor (red, red, brown, gold) in Bag #3  
 one 1000 Ohm resistor (brown, black, red, gold) in Bag #3  
 one 6800 Ohm resistor (blue, gray, red, gold) in Bag #3  
 one 555 Timer IC in Bag #13  
 one 0.01uF (103) disc Capacitor in Bag #6  
 one 10uF Electrolytic Capacitor in Bag #7  
 nine Jumper Wires in Bag #16



**“Now, using the Pictorial Diagram on Page 35, install the parts on the Solderless Circuit Board in this order.**

Install an LED with the Short Lead in hole 27e and the Long Lead in hole 27f  
 Install the 220 Ohm resistor (red, red, brown, gold) in holes 18d to 27c  
 Install the 1000 (1k) Ohm resistor (brown, black, red, gold) in holes 8h to 17i  
 Install the 6800 (6.8k) Ohm resistor (blue, gray, red, gold) in holes 16j to 17j  
 Install the 555 Timer IC with Pin 1 in hole 16e as shown in pictorial  
 Install a 0.01uF (103) Capacitor in holes 22e to 22f  
 Install a 10uF Capacitor - Long lead in hole 17b, Short lead in 16c  
 Install Jumper Wire #1 in holes 3b to 22a  
 Install Jumper Wire #2 in holes 3c to 16b  
 Install Jumper Wire #3 in holes 3i to 16i  
 Install Jumper Wire #4 in holes 3j to 27h  
 Install Jumper Wire #5 in holes 8j and loose end  
 Install Jumper Wire #6 in holes 18j and loose end  
 Install Jumper Wire #7 in holes 19h to 22h  
 Install Jumper Wire #8 in holes 17d to 18h  
 Install Jumper Wire #9 in holes 16g to 19d  
 Install the Battery Snap, Black lead in hole 3e and Red Lead in hole 3f

**“Connect the battery to the Battery Snap and touch Jumper Wires #5 and #6 together. The LED should blink at a fast rate. If not, recheck your wiring.** You can use the loose ends of Jumper Wires #5 and #6 as probes to sense moisture. The more the moisture in the soil, the faster are the blinks.

**“Conclusion:** You should have observed in this simple experiment that a 555 Timer IC can be used to make a moisture detector.

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

**\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #24** <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

### Experiment #25 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

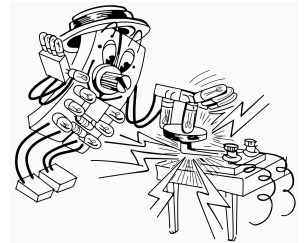
## “Build a Code Oscillator Circuit”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #25 with this link <https://bit.ly/3wioVYk>

### TEACHER DIALOG:

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. Refer to page 36 and find all the parts needed for Experiment #25

one Solderless Circuit Board in Bag #15  
 one 9-Volt Battery Snap in Bag #1  
 one 10 Ohm resistor (brown, black, black, gold) in Bag #3  
 one 220 Ohm resistor (red, red, brown, gold) in Bag #3  
 one 1000 (1k) Ohm resistor (brown, black, red, gold) in Bag #3  
 one 120k Ohm resistor (brown, red, yellow, gold) in Bag #3  
 one 555 Timer IC in Bag #13  
 one Pushbutton Switch in Bag#2  
 one Speaker in Bag #14  
 one 0.01uF (103) disc Capacitor in Bag #6  
 one NPN 3904 Transistor in Bag #11  
 six Jumper Wires in Bag #16



**“Now, using the Pictorial Diagram on Page 36, install the parts on the Solderless Circuit Board in this order.**

Install the 10 Ohm resistor (brown, black, black, gold) in holes 23j to 25i  
 Install the 220 Ohm resistor (red, red, brown, gold) in holes 18c to 24c  
 Install the 1000 (1k) Ohm resistor (brown, black, red, gold) in holes 16i to 17i  
 Install the 120k Ohm resistor (brown, red, yellow, gold) in holes 17j to 18j  
 Install the 555 Timer IC with Pin 1 in hole 16e as shown in pictorial  
 Install a NPN 3904 Transistor -Collector in 23e, Base in 24e, Emitter in 25e  
 Install a Pushbutton Switch in holes 2g to 4g  
 Install a 0.01uF (103) Capacitor in holes 16b to 17c  
 Install a Speaker in holes 23d and 25h  
 Install Jumper Wire #1 in holes 2a to 25a  
 Install Jumper Wire #2 in holes 2b to 16a  
 Install Jumper Wire #3 in holes 2j to 23i  
 Install Jumper Wire #4 in holes 2i to 16j  
 Install Jumper Wire #5 in holes 17d to 18h  
 Install Jumper Wire #6 in holes 16g to 19d  
 Install the Battery Snap, Black lead in hole 2e and Red Lead in hole 4f

**“Connect the battery to the Battery Snap. Press the Pushbutton Switch and you should hear a tone from the speaker. If not, recheck your wiring.** You can use the switch to send code.

**“Conclusion:** You should have observed in this simple experiment that a 555 Timer IC can be used to make a code oscillator.

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

**\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #25** <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

### Experiment #26 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

## “Build an Audible Water Detector Circuit”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #26 with this link <https://bit.ly/3wioVYk>

### TEACHER DIALOG:

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. Refer to page 37 and find all the parts needed for Experiment #26

one Solderless Circuit Board in Bag #15  
 one 9-Volt Battery Snap in Bag #1  
 one 10 Ohm resistor (brown, black, black, gold) in Bag #3  
 one 220 Ohm resistor (red, red, brown, gold) in Bag #3  
 one 1000 (1k) Ohm resistor (brown, black, red, gold) in Bag #3  
 one 120k Ohm resistor (brown, red, yellow, gold) in Bag #3  
 one 555 Timer IC in Bag #13  
 one Speaker in Bag #14  
 one 0.01uF (103) disc Capacitor in Bag #6  
 one NPN 3904 Transistor in Bag #11  
 seven Jumper Wires in Bag #16



**“Now, using the Pictorial Diagram on Page 37, install the parts on the Solderless Circuit Board in this order.**

Install the 10 Ohm resistor (brown, black, black, gold) in holes 22j to 24i  
 Install the 220 Ohm resistor (red, red, brown, gold) in holes 19d to 25c  
 Install the 1000 (1k) Ohm resistor (brown, black, red, gold) in holes 17j to 18j  
 Install the 120k Ohm resistor (brown, red, yellow, gold) in holes 16j to 19j  
 Install the 555 Timer IC with Pin 1 in hole 17e as shown in pictorial  
 Install a NPN 3904 Transistor -Collector in 24e, Base in 25e, Emitter in 26e  
 Install a 0.01uF (103) Capacitor in holes 17d to 18c  
 Install a Speaker in holes 24d to 24i  
 Install Jumper Wire #1 in holes 1a to 26a  
 Install Jumper Wire #2 in holes 1c to 17b  
 Install Jumper Wire #3 in holes 1g to 17h  
 Install Jumper Wire #4 in holes 1h to 22i  
 Install Jumper Wire #5 in holes 19h to loose end  
 Install Jumper Wire #6 in holes 18d to loose end  
 Install Jumper Wire #7 in holes 17g to 20d  
 Install the Battery Snap, Black lead in hole 1e and Red Lead in hole 1f

**“Connect the battery to the Battery Snap. Jumper Wires #5 and #6 are the sensors for water. If you immerse the loose ends of these jumpers in water, the speaker will make a sound. If not, recheck your wiring.**

**“Conclusion:** You should have observed in this simple experiment that a 555 Timer IC can be used to make a water detector.

After your students have completed the experiment, you can say - - -

**“Please disassemble the experiment and put all the parts back into the bags.**

\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #26 <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

### Experiment #27 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

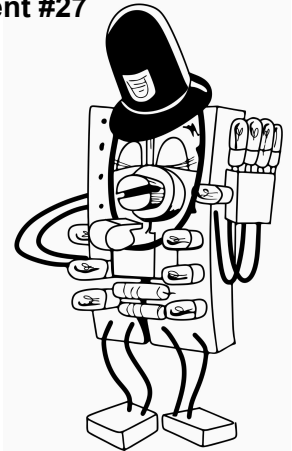
## “Build an English Police Siren Circuit”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #27 with this link <https://bit.ly/3wioVYk>

### TEACHER DIALOG:

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. Refer to page 38 and find all the parts needed for Experiment #27

- one Solderless Circuit Board in Bag #15
- one 9-Volt Battery Snap in Bag #1
- one 10 Ohm resistor (brown, black, black, gold) in Bag #3
- one 220 Ohm resistor (red, red, brown, gold) in Bag #3
- one 1000 (1k) Ohm resistor (brown, black, red, gold) in Bag #3
- one 120k Ohm resistor (brown, red, yellow, gold) in Bag #3
- one 470k Ohm resistor (yellow, violet, yellow, gold) in Bag #3
- one 555 Timer IC in Bag #13
- one Pushbutton Switch in Bag #2
- one Speaker in Bag #14
- one 0.01uF (103) disc Capacitor in Bag #6
- one NPN 3904 Transistor in Bag #11
- seven Jumper Wires in Bag #16



**“Now, using the Pictorial Diagram on Page 38, install the parts on the SCB.**

- Install the 10 Ohm resistor (brown, black, black, gold) in holes 24j to 26j
- Install the 220 Ohm resistor (red, red, brown, gold) in holes 17c to 26c
- Install the 1000 (1k) Ohm resistor (brown, black, red, gold) in holes 15i to 16j
- Install the 120k Ohm resistor (brown, red, yellow, gold) in holes 16i to 17i
- Install the 470k Ohm resistor (yellow, violet, yellow, gold) in holes 8h to 16h
- Install the 555 Timer IC with Pin 1 in hole 15e as shown in pictorial
- Install a NPN 3904 Transistor -Collector in 25e, Base in 26e, Emitter in 27e
- Install a 0.01uF (103) Capacitor in holes 15b to 16b
- Install a Pushbutton Switch in holes 8e and 8f
- Install a Speaker in holes 25d to 26i
- Install Jumper Wire #1 in holes 1a to 27a
- Install Jumper Wire #2 in holes 1b to 15a
- Install Jumper Wire #3 in holes 1h to 15h
- Install Jumper Wire #4 in holes 1j to 24h
- Install Jumper Wire #5 in holes 8d to 16c
- Install Jumper Wire #6 in holes 16d to 17h
- Install Jumper Wire #7 in holes 15g to 18d
- Install the Battery Snap, Black lead in hole 1e and Red Lead in hole 1f

**“Connect the battery to the Battery Snap. The speaker will make a sound. If not, recheck your wiring.** When you press and release the pushbutton, the sound will change, As you press and release the pushbutton you will make a sound similar to an English Police Siren sound.

**“Conclusion:** You should have observed in this simple experiment that a 555 Timer IC can be used to make sounds similar to an English Police Siren.

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

**\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #27** <https://bit.ly/3wioVYk>



## Teacher LESSON PLAN

### Experiment #28 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

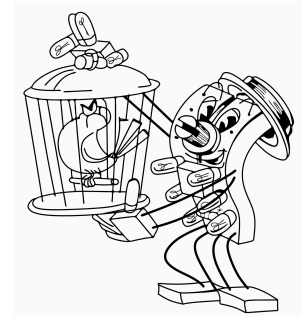
## “Build an Electronic Canary Circuit”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #28 with this link <https://bit.ly/3wioVYk>

#### TEACHER DIALOG:

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. Refer to page 39 and find all the parts needed for Experiment #28 :

one Solderless Circuit Board in Bag #15  
 one 9-Volt Battery Snap in Bag #1  
 one 47 Ohm resistor (yellow, violet, black, gold) in Bag #3  
 two 100 Ohm resistor (brown, black, brown, gold) in Bag #3  
 one 3.3k Ohm resistor (orange, orange, red, gold) in Bag #3  
 one 6.8k Ohm resistor (blue, gray, red, gold) in Bag #3  
 one 33k Ohm resistor (orange, orange, orange, gold) in Bag #3  
 one 555 Timer IC in Bag #13  
 one Pushbutton Switch in Bag #2  
 one Potentiometer in Bag #4  
 one Speaker in Bag #14  
 one 0.01uF (103) disc Capacitor in Bag #6  
 one 0.1uF (104) disc Capacitor in Bag #6  
 one 10uF Electrolytic Capacitor in Bag #7  
 one 1000uF Electrolytic Capacitor in Bag #7  
 one NPN 3904 Transistor in Bag #11  
 one PNP 3906 Transistor in Bag #12  
 nine Jumper Wires in Bag #16



“ Now, using the Pictorial Diagram on Page 39, install the parts on the SCB.

Install a 47 Ohm resistor (yellow, violet, black, gold) in holes 10h to 14h  
 Install a 100 Ohm resistor (brown, black, brown, gold) in holes 1a to 3a  
 Install a 100 Ohm resistor (brown, black, brown, gold) in holes 21c to 26c  
 Install a 3.3k Ohm resistor (orange, orange, red, gold) in holes 24b to 29b  
 Install a 6.8k Ohm resistor (blue, gray, red, gold) in holes 15a to 16b  
 Install a 33k Ohm resistor (orange, orange, orange, gold) in holes 24b to 29b  
 Install the 555 Timer IC with Pin 1 in hole 16f as shown in pictorial (careful!)  
 Install a NPN 3904 Transistor - Emitter in 25h, Base in 26h, Collector in 27h  
 Install a PNP 3906 Transistor - Emitter in 24d, Base in 25d, Collector in 26d  
 Install a 0.01uF Capacitor in 15h to 19h **AND** Install a 0.1uF disc Capacitor in 10i to 14i  
 Install a 10uF Electrolytic Capacitor - Long lead in hole 26f Short lead in hole 26e  
 Install a 1000uF Electrolytic Capacitor - Long lead in hole 1c Short lead in hole 1i  
 Install a Pushbutton Switch in holes 16j to 19j **AND** Install a Speaker in holes 1e to 10g  
 Install a Potentiometer - middle lead in 29c, edge lead in 26g  
 Install Jumper Wire #1 in holes 1b to 24a **AND** Install Jumper Wire #2 in holes 3b to 24a  
 Install Jumper Wire #3 in holes 1j to 27j **AND** Install Jumper Wire #4 in holes 13g to 16d  
 Install Jumper Wire #5 in 14d to 15g **AND** Install Jumper Wire #6 in holes 19f to 21e  
 Install Jumper Wire #7 in holes 21d to 27i **AND** Install Jumper Wire #8 in 25e to 25f  
 Install Jumper Wire #9 in holes 13d to 26a  
 Install the Battery Snap, Black lead in hole 1f and Red Lead in hole 1df

“Connect the battery to the Battery Snap. The speaker will make a sound. If not, recheck your wiring. As you adjust the potentiometer, the circuit will emit all kinds of birds chirping.

“**Conclusion:** You should have observed in this experiment that a 555 Timer IC and a two-transistor oscillator can be used to make chirping sounds similar to a canary.

After your students have completed the experiment, you can say - - - -

“Please disassemble the experiment and put all the parts back into the bags.

\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #28 <https://bit.ly/3wioVYk>

## Teacher LESSON PLAN

### Experiment #29 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

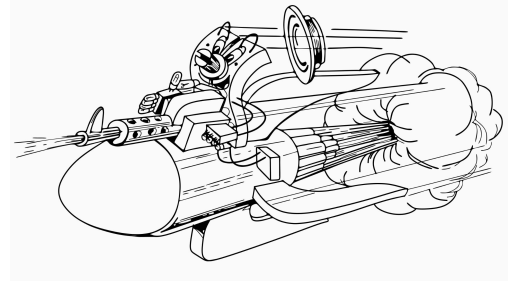
## “Build a Space Machine Gun Circuit”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #29 with this link <https://bit.ly/3wioVYk>

#### TEACHER DIALOG:

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. Refer to page 40 and find all the parts needed for Experiment #29

one Solderless Circuit Board in Bag #15  
 one 9-Volt Battery Snap in Bag #1 **AND** one LED in Bag #9  
 two 47 Ohm resistor (yellow, violet, black, gold) in Bag #3  
 one 100 Ohm resistor (brown, black, brown, gold) in Bag #3  
 one 3.3k Ohm resistor (orange, orange, red, gold) in Bag #3  
 one 6.8k Ohm resistor (blue, gray, red, gold) in Bag #3  
 one 120k Ohm resistor (brown, red, yellow, gold) in Bag #3  
 one 555 Timer IC in Bag #13  
 one Pushbutton Switch in Bag #2  
 one Potentiometer in Bag #4  
 one Speaker in Bag #14  
 one 0.01uF (103) disc Capacitor in Bag #6  
 one 0.1uF (104) disc Capacitor in Bag #6  
 one 10uF Electrolytic Capacitor in Bag #7  
 one 1000uF Electrolytic Capacitor in Bag #7  
 one NPN 3904 Transistor in Bag #11  
 one PNP 3906 Transistor in Bag #12  
 nine Jumper Wires in Bag #16



**“Now, using the Pictorial Diagram on Page 40, install the parts on the SCB.**

Install an LED - Long lead in hole 8g - Short lead in hole 9g  
 Install a 47 Ohm resistor (yellow, violet, black, gold) in holes 9i TO 14i  
 Install a 47 Ohm resistor (yellow, violet, black, gold) in holes 21c to 26c  
 Install a 100 Ohm resistor (brown, black, brown, gold) in holes 1a to 3a  
 Install a 3.3k Ohm resistor (orange, orange, red, gold) in holes 24b to 29b  
 Install a 6.8k Ohm resistor (blue, gray, red, gold) in holes 15a to 16b  
 Install a 120k Ohm resistor brown, red, yellow, gold) in holes 14b to 15b  
 Install the 555 Timer IC with Pin 1 in hole 16f as shown in pictorial (careful!!)  
 Install a NPN 3904 Transistor - Emitter in 25h, Base in 26h, Collector in 27h  
 Install a PNP 3906 Transistor - Emitter in 24d, Base in 25d, Collector in 26d  
 Install a 0.01uF Capacitor in 15h to 19h **AND** Install a 0.1uF disc Capacitor in 9h to 14h  
 Install a 10uF Electrolytic Capacitor - Long lead in hole 26f Short lead in hole 26e  
 Install a 1000uF Electrolytic Capacitor - Long lead in hole 1b Short lead in hole 1i  
 Install a Pushbutton Switch in holes 16i to 19i **AND** Install a Speaker in holes 1d to 8f  
 Install a Potentiometer - middle lead in 26g, edge lead in 29c  
 Install Jumper Wire #1 in holes 1c to 16a **AND** Install Jumper Wire #2 in holes 3b to 24a  
 Install Jumper Wire #3 in holes 1j to 27j **AND** Install Jumper Wire #4 in holes 13g to 16d  
 Install Jumper Wire #5 in 14d to 15g **AND** Install Jumper Wire #6 in holes 19j to 21e  
 Install Jumper Wire #7 in 13c to 26a **AND** Install Jumper Wire #8 in holes 25e to 25g  
 Install Jumper Wire #9 in 13c to 26a  
 Install the Battery Snap, Black lead in hole 1f and Red Lead in hole 1e

**“Connect the battery to the Battery Snap. The speaker will make a sound. If not, recheck your wiring.** As you adjust the potentiometer and press the pushbutton switch, the circuit will emit all kinds of fantasy space machine gun sounds. Have fun protecting Space.

**“Conclusion:** You should have observed in this experiment that a 555 Timer IC and a two-transistor oscillator can be used to emit all kinds of fantasy space machine gun sounds.

**After your students have completed the experiment, you can say - - -**

**“Please disassemble the experiment and put all the parts back into the bags.**

**\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #29** <https://bit.ly/3wioVYk>



## Teacher LESSON PLAN

### Experiment #30 of 30

#### Mr Circuit STEM Electronics Learning Lab 1 #1101

## “Build an UltraSonic Pest Repeller Circuit”

**IN CLASS:** Hand out a Mr Circuit Lab 1 to each student and a 9-volt battery. Then, show the Video Presentation for Experiment #30 with this link <https://bit.ly/3wioVYk>

#### TEACHER DIALOG:

After viewing the video lesson, you can say “Now that we understand how the experiment is supposed to work, let’s wire it up. Refer to page 41 and find all the parts needed for Experiment #30

one Solderless Circuit Board in Bag #15  
 one 9-Volt Battery Snap in Bag #1  
 one LED in Bag #9  
 one 47 Ohm resistor (yellow, violet, black, gold) in Bag #3  
 two 100 Ohm resistor (brown, black, brown, gold) in Bag #3  
 two 1000 Ohm (1k) Ohm resistor (brown, black, red, gold) in Bag #3  
 one 470k Ohm resistor (yellow, violet, yellow, gold) in Bag #3  
 one 555 Timer IC in Bag #13  
 one Speaker in Bag #14  
 one 0.01uF (103) disc Capacitor in Bag #6  
 one 10uF Electrolytic Capacitor in Bag #7  
 one 1000uF Electrolytic Capacitor in Bag #7  
 one NPN 3904 Transistor in Bag #11  
 one PNP 3906 Transistor in Bag #12  
 eleven Jumper Wires in Bag #16



**“Now, using the Pictorial Diagram on Page 41, install the parts on the SCB.**

Install an LED - Long lead in hole 8b - Short lead in hole 9b  
 Install a 47 Ohm resistor (yellow, violet, black, gold) in holes 10h to 15h  
 Install a 100 Ohm resistor (brown, black, brown, gold) in holes 1a to 3a  
 Install a 100 Ohm resistor (brown, black, brown, gold) in holes 21c to 26c  
 Install a 1000 (1k) Ohm resistor (brown, black, red, gold) in holes 15b to 16b  
 Install a 1000 (1k) Ohm resistor (brown, black, red, gold) in holes 16a to 17b  
 Install a 470k Ohm resistor (yellow, violet, yellow, gold) in holes 24b to 29b  
 Install the 555 Timer IC with Pin 1 in hole 17f as shown in pictorial (careful!)  
 Install a NPN 3904 Transistor - Emitter in 25h, Base in 26h, Collector in 27h  
 Install a PNP 3906 Transistor - Emitter in 24d, Base in 25d, Collector in 26d  
 Install a 0.01uF Capacitor in holes 16i to 17i  
 Install a 10uF Electrolytic Capacitor - Long lead in hole 29c Short lead in hole 26e  
 Install a 1000uF Electrolytic Capacitor - Long lead in hole 1c Short lead in hole 1i  
 Install Jumper Wire #1 in holes 3b to 24a **AND** Install Jumper Wire #2 in holes 1b to 17a  
 Install Jumper Wire #3 in holes 1d to 8c **AND** Install Jumper Wire #4 in holes 1j to 27j  
 Install Jumper Wire #5 in 14g to 17d **AND** Install Jumper Wire #6 in holes 15d to 16g  
 Install Jumper Wire #7 in 17j to 21d **AND** Install Jumper Wire #8 in holes 21e to 27i  
 Install Jumper Wire #9 in 26f to 29d **AND** Install Jumper Wire #10 in holes 25e to 25f  
 Install Jumper Wire #11 in holes 14c to 26a  
 Install the Battery Snap, Black lead in hole 1f and Red Lead in hole 1e (careful)

**“Connect the battery to the Battery Snap and the LED should light up. If not, recheck your wiring.** This circuit emits frequencies above the audio range for human hearing.

**“Conclusion:** In this experiment a 555 Timer IC and a two-transistor oscillator are used to emit high frequencies that are known to repel pests.

After your students have completed the experiment, you can say - - -

**“Please disassemble the experiment and put all the parts back into the bags.**

\*\*\*\*\* TIME FOR QUIZ EXPERIMENT #30 <https://bit.ly/3wioVYk>

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