STUDENT STUDY GUIDE

Step-by-Step STUDY GUIDE
for the Mr Circuit Lab 1

Mr Circuit Lab 1 (#1101-LAB)
contains the printed Lab Manual, the printed Study Guide,
printed Student Progress Sheet, and
16 bags of experiment parts.

Step-by-Step STUDY GUIDE for Lesson 1: "Basic Electron Theory"

Step L1-1: Find Page 4 of the Lab Manual, which is Lesson 1.

Step L1-2: Open this link https://bit.ly/3wioVYk **to watch the video presentation for this lesson and take the online quiz until you get 100%.**

Step-by-Step STUDY GUIDE for Lesson 2: "Electronic Component Identification"

Step L2-1: Find Pages 5, 6, and 7 of the Lab Manual, which is Lesson 2.

Step L1-2: Open this link https://bit.ly/3wioVYk **to watch the video presentation for this lesson and take the online quiz until you get 100%.**

Step-by-Step STUDY GUIDE for Lesson 3: "How to use the Resistor Color Code"

Step L3-1: Find Pages 8 and 9 of the Lab Manual, which is Lesson 3.

Step L1-2: Open this link https://bit.ly/3wioVYk **to watch the video presentation for this lesson and take the online quiz until you get 100%.**

Step-by-Step STUDY GUIDE for Lesson 4: "How to use the Solderless Circuit Board"

Step L4-1: Find Pages 10 and 11 of the Lab Manual, which is Lesson 4.

Step L1-2: Open this link https://bit.ly/3wioVYk **to watch the video presentation for this lesson and take the online quiz until you get 100%.**

STUDY GUIDE 01 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 1: "How a Resistor Works"

Step E1-1: Find Page 12 of the Lab Manual, which is Experiment 1

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Step E1-2: Watch the video for Experiment #1 while following the instructions

Step E1-3. **Find all the parts needed for Experiment #1**:

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

Step E1-4: Now, using the Pictorial Diagram on 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

Step E1-6: 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.

Step E1-7: 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? _____

Step E1-8: 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?_____

Step E1-9: 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? _____

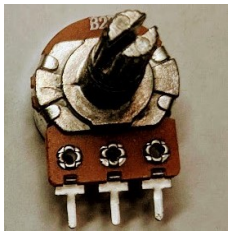
Step E1-10: Conclusion: You should have observed that the higher the Ohms of the resistor, the dimmer the LED. The more Ohms in the resistor, the fewer the electrons that will flow, and the dimmer the LED. Therefore, a resistor restricts the flow of electrons.

Step E1-11: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 1 Quiz

STUDY GUIDE 02 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk



_____ Experiment 2: "How a Potentiometer Works"

Step E2-1: Find Page 13 of the Lab Manual, which is Experiment 2.

Step E2-2: Watch the video for Experiment #2 while following the instructions.

Step E2-3. **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

Step E2-4: 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

Step E2-5: 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 Potentiometer all the way clockwise and then counter clockwise. The LED should get brighter and dimmer as you twist the shaft.

Step E2-6: 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.

Step E2-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 2 Quiz

STUDY GUIDE 03 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 3: "How a Photocell Works"

Step E3-1: Find Page 14 of the Lab Manual, which is Experiment 3.

Step E3-2: Watch the video for Experiment #3 while following the instructions.

Step E3-3. **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

Step E3-4: 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

Step E3-5: 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.

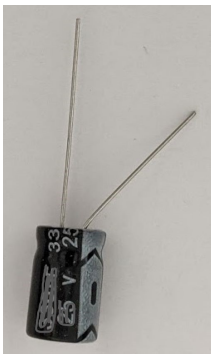
Step E3-6: Conclusion: You should have observed that the more light hitting the top of the Photocell, the brighter the LED. Thus, the resistance in Ohms of the Photocell goes down when light hits the top of it. Therefore, a Photocell varies its resistance with light. The more light, the lower the resistance.

Step E3-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 3 Quiz

STUDY GUIDE 04 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk



_____ Experiment 4: "How a Capacitor Works"

Step E4-1: Find Page 15 of the Lab Manual, which is Experiment 4.
Step E4-2: Watch the video for Experiment #4 while following the instructions.

Step E4-3. **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

Step E4-4: 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

Step E4-5: 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.

Step E4-6: 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

Step E4-7: 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.

Step E4-8: 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.

Step E4-9: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 4 Quiz

STUDY GUIDE 05 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 5: "How a Speaker Works"

Step E5-1: Find Page 16 of the Lab Manual, which is Experiment 5.

Step E5-2: Watch the video for Experiment #5 while following the instructions.

Step E5-3. **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

Step E5-4: 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

Step E5-5: 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.

Step E5-6: Conclusion: You should have observed that a Speaker is a device that converts electrical current into sound waves.

Step E5-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 5 Quiz

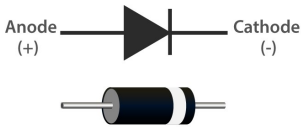
STUDY GUIDE 06 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 6: "How a Diode Works"

Step E6-1: Find Page 17 of the Lab Manual, which is Experiment 6.

Step E6-2: Watch the video for Experiment #6 while following the instructions.



Step E6-3. **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

Step E6-4: 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

Step E6-5: 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.

Step E6-6: 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.

Step E6-7: 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.

Step E6-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 6 Quiz

STUDY GUIDE 07 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 7: "How an SCR (Silicon Control Rectifier) Works"

Step E7-1: Find Page 18 of the Lab Manual, which is Experiment 7.

Step E7-2: Watch the video for Experiment #7 while following the instructions.

Step E7-3. **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

Step E7-4: 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

Step E7-5: 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.

Step E7-6: 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.

Step E7-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

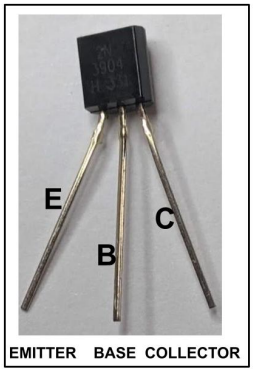
Experiment 7 Quiz

STUDY GUIDE 08 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 8: "How an NPN Transistor Works"

Step E8-1: Find Page 19 of the Lab Manual, which is Experiment 8.



Step E8-2: Watch the video for Experiment #8 while following the instructions.

Step E8-3. **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

Step E8-4: 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

Step E8-5: 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.

Step E8-6: 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.

Step E8-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 8 Quiz

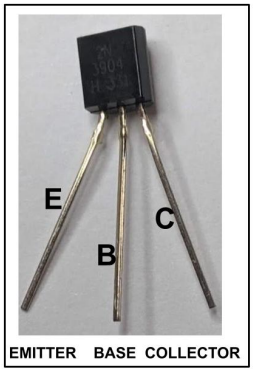
STUDY GUIDE 09 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 9: "How an PNP Transistor Works"

Step E9-1: Find Page 20 of the Lab Manual, which is Experiment 9.

Step E9-2: Watch the video for Experiment #9 while following the instructions.



Step E9-3. **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

Step E9-4: 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

Step E9-5: 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.

Step E9-6: Conclusion: You should have observed in this simple experiment that an 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.

Step E9-7: Now, put all the parts back into their plastic bags and you will be ready to go on to the next Experiment.

Experiment 9 Quiz

STUDY GUIDE 10 for the Mr Circuit STEM Electronics Learning Lab 1

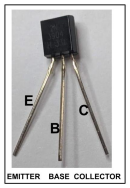
Link to video presentations and quizzes - https://bit.ly/3wioVYk

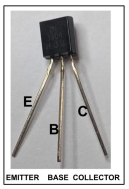
_____ Experiment 10: "How a Two-Transistor Oscillator Works"

Step E10-1: Find Page 21 of the Lab Manual, which is Experiment 10.

Step E10-2: Watch the video for Experiment #10 while following the instructions.

Step E10-3. **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

Step E10-4: 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

Step E10-5: 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.

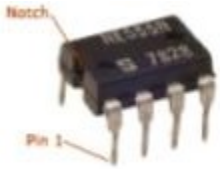
Step E10-6: Conclusion: You should have observed in this simple experiment that an PNP Transistor and an NPN Transistor can be used to create a two-transistor oscillator circuit.

Step E10-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 10 Quiz

STUDY GUIDE 11 for the Mr Circuit STEM Electronics Learning Lab 1

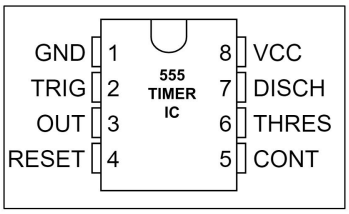
Link to video presentations and quizzes - https://bit.ly/3wioVYk



_____ Experiment 11: "How a 555 Timer IC Works"

Step E11-1: Find Page 22 of the Lab Manual, which is Experiment 11.

Step E11-2: Watch the video for Experiment #11 while following the instructions.



Step E11-3. **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

Step E11-4: 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 the16k 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

Step E11-5: 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 E11-6: 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.

Step E11-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

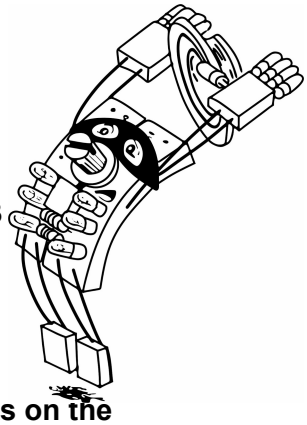
Experiment 11 Quiz

STUDY GUIDE 12 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 12: "Build a Burglar Alarm Circuit"

Step E12-1: Find Page 23 of the Lab Manual, which is Experiment 12.
Step E12-2: Watch the video for Experiment #12 while following the instructions.
Step E12-3. **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

Step E12-4: 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

Step E12-5: 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.

Step E12-6: 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.

Step E12-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 12 Quiz

STUDY GUIDE 13 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 13: "Build an Automatic Night Light Circuit"

Step E13-1: Find Page 24 of the Lab Manual, which is Experiment 13.

Step E13-2: Watch the video for Experiment #13 while following the instructions.

Step E13-3. **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

Step E13-4: 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

Step E13-5: 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.

Step E13-6: 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.

Step E13-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 13 Quiz

STUDY GUIDE 14 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 14: "Build a DC to DC Power Supply Circuit"

Step E14-1: Find Page 25 of the Lab Manual, which is Experiment 14.

Step E14-2: Watch the video for Experiment #14 while following the instructions.

Step E14-3. **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

Step E14-4: 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

Step E14-5: 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.

Step E14-6: 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.

Step E14-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 14 Quiz

STUDY GUIDE 15 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 15: "Build an Electronic Metronome Circuit"

Step E15-1: Find Page 26 of the Lab Manual, which is Experiment 15.

Step E15-2: Watch the video for Experiment #15 while following the instructions.

Step E15-3. **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

Step E15-4: 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 holes1a 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

Step E15-5: 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.

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Step E15-6: 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.

Step E15-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 15 Quiz

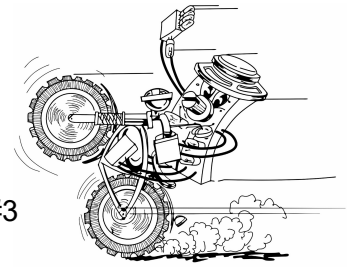
STUDY GUIDE 16 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 16: "Build an Electronic Motorcycle Circuit"

Step E16-1: Find Page 27 of the Lab Manual, which is Experiment 16.

Step E16-2: Watch the video for Experiment #16 while following the instructions.



Step E16-3. **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

Step E16-4: 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
Installone 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 holes1a 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

Step E16-5: 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?

.

Step E16-6: 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.

Step E16-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 16 Quiz

STUDY GUIDE 17 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

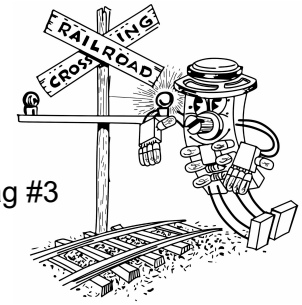
_____ Experiment 17: "Build a Railroad Lights Circuit"

Step E17-1: Find Page 28 of the Lab Manual, which is Experiment 17.

Step E17-2: Watch the video for Experiment #17 while following the instructions.

Step E17-3. **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.

Step E17-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 17 Quiz

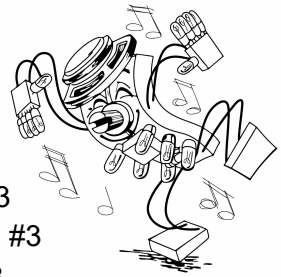
STUDY GUIDE 18 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 18: "Build a Variable Lights Circuit"

Step E18-1: Find Page 29 of the Lab Manual, which is Experiment 18.

Step E18-2: Watch the video for Experiment #18 while following the instructions.



Step E18-3. **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

Step E18-4: 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

Step E18-5: 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.

Step E18-6: 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.

Step E18-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

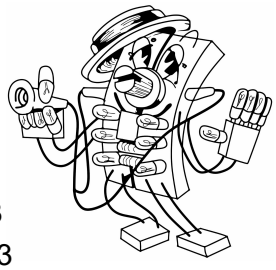
Experiment 18 Quiz

STUDY GUIDE 19 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 19: "Build a Continuity Tester Circuit"

Step E19-1: Find Page 30 of the Lab Manual, which is Experiment 19.
Step E19-2: Watch the video for Experiment #19 while following the instructions.
Step E19-3. **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

Step E19-4: 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

Step E19-5: Touch the battery to the Battery Snap and the Speaker should <u>not</u> 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.
Step E19-6: Conclusion: You should have observed in this simple experiment that a 555 Timer IC can be used to make a continuity checker.
Step E19-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

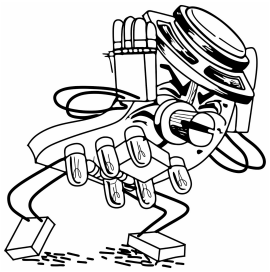
Experiment 19 Quiz

STUDY GUIDE 20 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 20: "Build an Audio Generator Circuit"

Step E20-1: Find Page 31 of the Lab Manual, which is Experiment 20.
Step E20-2: Watch the video for Experiment #20 while following the instructions.
Step E20-3. **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

Step E20-4: 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

Step E20-5: 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 E20-6: Conclusion: You should have observed in this simple experiment that a 555 Timer IC can be used to generate audio frequencies.

Step E20-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 20 Quiz

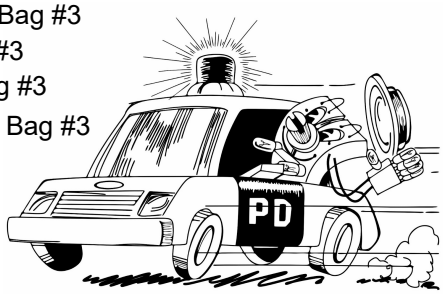
STUDY GUIDE 21 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 21: "Build an Electronic Police Siren Circuit"

Step E21-1: Find Page 32 of the Lab Manual, which is Experiment 21.
Step E21-2: Watch the video for Experiment #21.
Step E21-3. **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



Step E21-4: 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

Step E21-5: 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.

Step E21-7:Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 21 Quiz

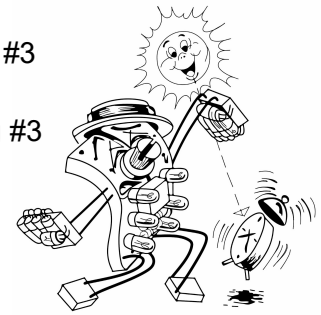
STUDY GUIDE 22 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 22: "Build a Wake-Up Alarm Circuit"

Step E22-1: Find Page 33 of the Lab Manual, which is Experiment 22.
Step E22-2: Watch the video for Experiment #22 while following the instructions.
Step E22-3. **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



Step E22-4: 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

Step E22-5: 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!
Step E22-6: Conclusion: You should have observed in this simple experiment that a 555 Timer IC and a Photocell to make a Wake-Up Alarm.

Step E22-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

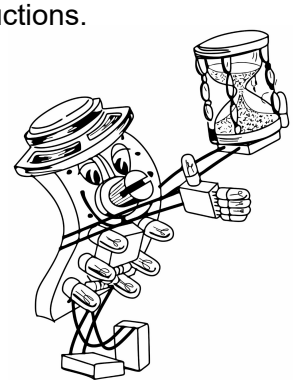
Experiment 22 Quiz

STUDY GUIDE 23 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 23: "Build a Variable Timer Circuit"

Step E23-1: Find Page 34 of the Lab Manual, which is Experiment 23.
Step E23-2: Watch the video for Experiment #23 while following the instructions.
Step E23-3. **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

Step E23-4: 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

Step E23-5: 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.
Step E23-6: Conclusion: You should have observed in this simple experiment that a 555 Timer IC and a Photocell to make a Wake-Up Alarm.

Step E23-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 23 Quiz

STUDY GUIDE 24 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 24: "Build a Moisture Detector Circuit"

Step E24-1: Find Page 35 of the Lab Manual, which is Experiment 24.
Step E24-2: Watch the video for Experiment #24 while following the instructions.
Step E24-3. **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

Step E24-4: 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

Step E24-5: 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.
Step E24-6: Conclusion: You should have observed in this simple experiment that a 555 Timer IC can be used to make a moisture detector.

Step E24-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

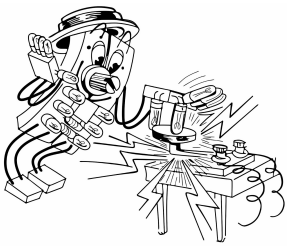
Experiment 24 Quiz

STUDY GUIDE 25 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 25: "Build a Code Oscillator Circuit"

Step E25-1: Find Page 36 of the Lab Manual, which is Experiment 25.
Step E25-2: Watch the video for Experiment #25 while following the instructions.
Step E25-3. **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

Step E25-4: 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

Step E25-5: 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.
Step E25-6: Conclusion: You should have observed in this simple experiment that a 555 Timer IC can be used to make a code oscillator.
Step E25-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 25 Quiz

STUDY GUIDE 26 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 26: "Build an Audible Water Detector Circuit"

Step E26-1: Find Page 37 of the Lab Manual, which is Experiment 26

.

Step E26-2: Watch the video for Experiment #26 while following the instructions.

Step E26-3. **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

Step E26-4: 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

Step E26-5: 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.

Step E26-6: Conclusion: You should have observed in this simple experiment that a 555 Timer IC can be used to make a water detector.

Step E26-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 26 Quiz

STUDY GUIDE 27 for the Mr Circuit STEM Electronics Learning Lab 1

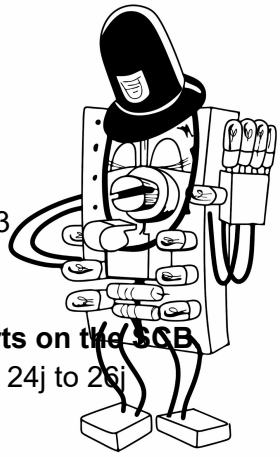
Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 27: "Build an English Police Siren Circuit"

Step E27-1: Find Page 38 of the Lab Manual, which is Experiment 27.

Step E27-2: Watch the video for Experiment #27

Step E27-3. **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
seven Jumper Wires in Bag #16

Step E27-4: 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
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
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

Step E27-5: 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.

Step E27-6: 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.

Step E27-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

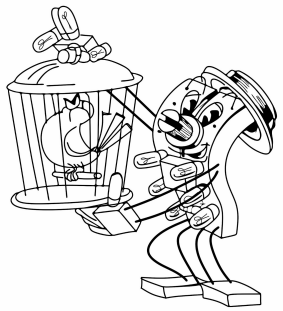
Experiment 27 Quiz

STUDY GUIDE 28 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 28: "Build an Electronic Canary Circuit"

Step E28-1: Find Page 39 of the Lab Manual, which is Experiment 28.
Step E28-2: Watch the video for Experiment #28 while following the instructions.
Step E28-3. **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

Step E28-4: 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

Step E28-5: 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.
Step E28-6: 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.
Step E28-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz. **Experiment 28 Quiz**

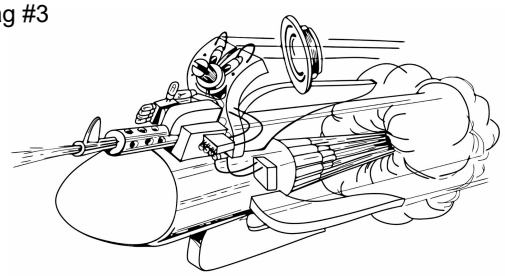
STUDY GUIDE 29 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 29: "Build a Space Machine Gun Circuit"

Step E29-1: Find Page 40 of the Lab Manual, which is Experiment 29.
Step E29-2: Watch the video for Experiment #29.
Step E29-3. **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



Step E29-4: 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

Step E29-5: 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.

Step E29-6: 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.

Step E29-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz. **Experiment 29 Quiz**

STUDY GUIDE 30 for the Mr Circuit STEM Electronics Learning Lab 1

Link to video presentations and quizzes - https://bit.ly/3wioVYk

_____ Experiment 30: "Build an Ultrasonic Pest Repeller Circuit"

Step E30-1: Find Page 41 of the Lab Manual, which is Experiment 30.
Step E30-2: Watch the video for Experiment #30 while following the instructions.
Step E30-3. **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

Step E30-4: 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)

Step E30-5: 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.
Step E30-6: 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.
Step E30-7: Now take the practice quiz until you get 100% and then put all the parts back into the plastic bags and ask the teacher for the written quiz.

Experiment 30 Quiz