Project: Circuit Bugs

Introduction – 5 minutes

Today we are going to all be Electrical Engineers. Electrical engineering is a field of engineering that deals with the study and application of electricity and electronics. Electrical engineers work in teams or individually to design new and better electronics; they also test equipment, solve problems, and design digital computers. Today, we are going to create circuits.

Does anyone know what a circuit is? See if the girls have any answers.

A circuit is a path for electricity. If a circuit is closed, electricity will flow. If a circuit is open, electricity will not flow and an electrical device such as a flashlight will not work. Switches are used to open and close circuits. Electrical power can do things such as make light, sound, and movement.

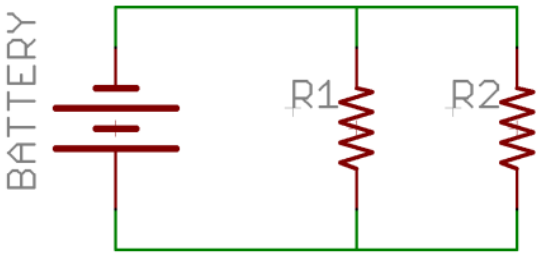
Today we will learn about the 2 most common electric circuits, the series circuit and the parallel circuit. Then, each girl will make a circuit bug (parallel circuit).

In parallel circuits, each light has its own branch, so all but one light could be burned out, and the last one will still function.

In a series circuit, each light must function to complete the circuit. If one light burns out, a series circuit breaks and none of the lights will work.

An electric circuit is described in a picture called a schematic. The schematic is a simple pictorial representation of all the components of the circuit.

Parallel Circuit

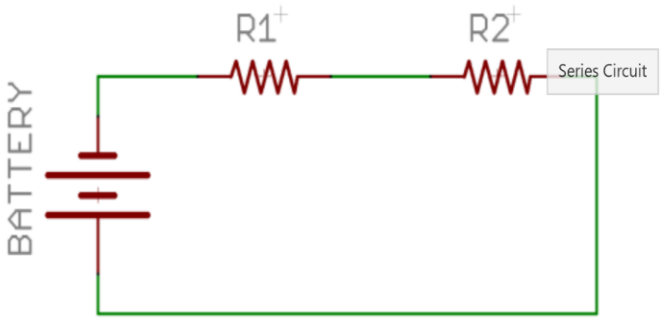


R1 stands for Resistor 1, and is representative of one LED (light emitting diode).

R2 stands for Resistor 2, and represents the second LED.

The battery voltage (V) is the same across R1 and R2. The electric current from the battery flows across both LEDs, half of the current flowing through LED 1 (R1) and half of the current flowing through LED 2 (R2). Note since we are using LEDs with the same (equal) resistance the current is the same across each LED.

Serial Circuit

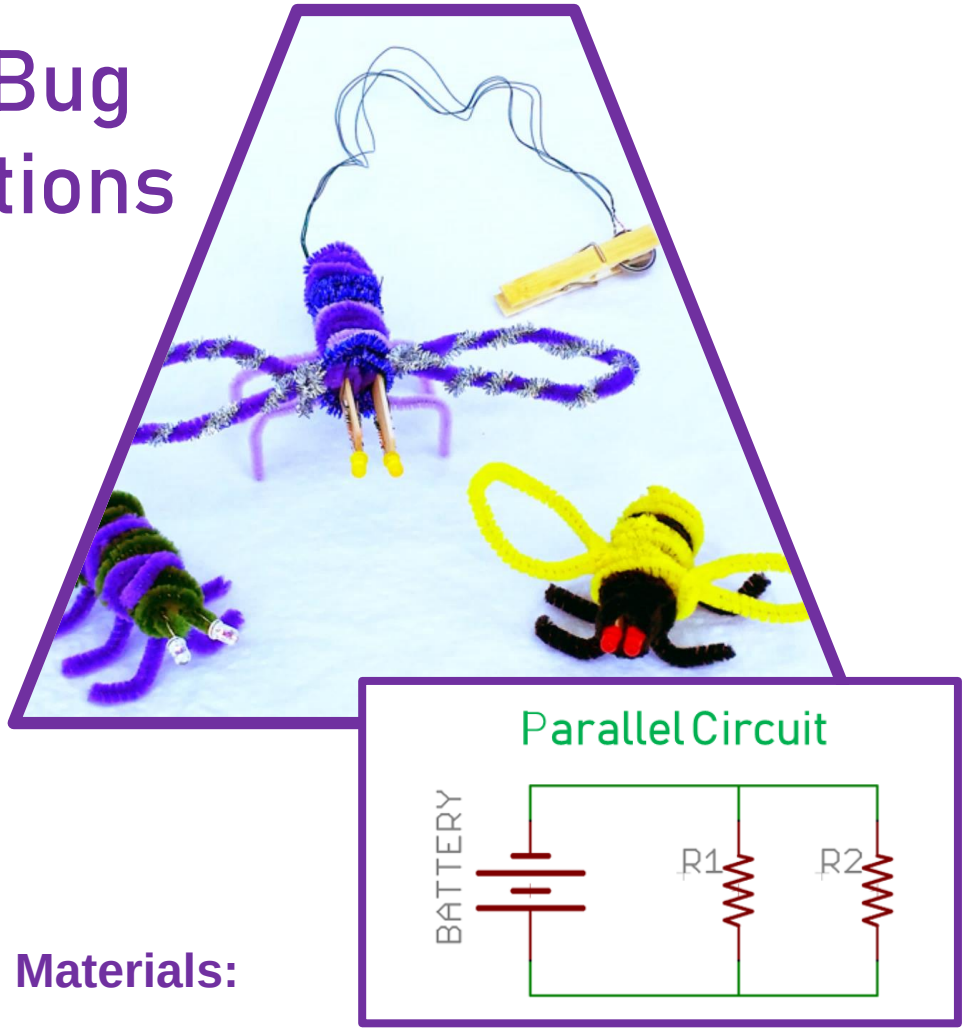


R1 stands for Resistor 1, and is representative of one LED (light emitting diode).

R2 stands for Resistor 2, and represents the second LED.

In a series circuit, current flows through one component then the next component and so on. In a series circuit, the current is the same across every element and the total voltage across each component adds up to the voltage of the battery.

Circuit Bug Instructions



Circuit Bug Materials:

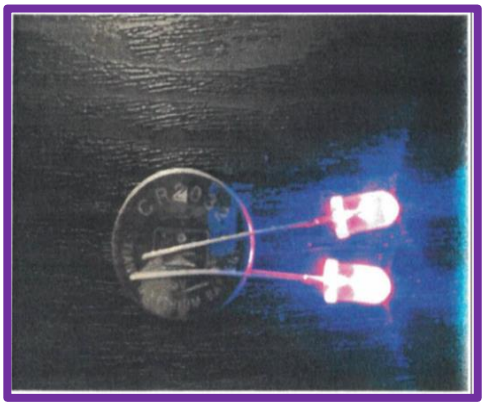
To make your own Circuit Bug you have kits with the following materials:

- 2 each approximately 9 inches long yellow wire
- 2 each approximately 9 inches long black wire
- 1 clothespin
- 1 small popsicle stick
- 4 pipe cleaners
- 2 LED lights

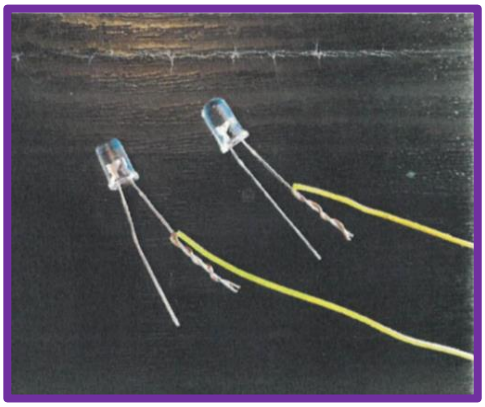
Circuit Bug Instructions:
(Allow 45 minutes to do this activity.)

1. Check your bag to make sure you have all of the materials listed above.

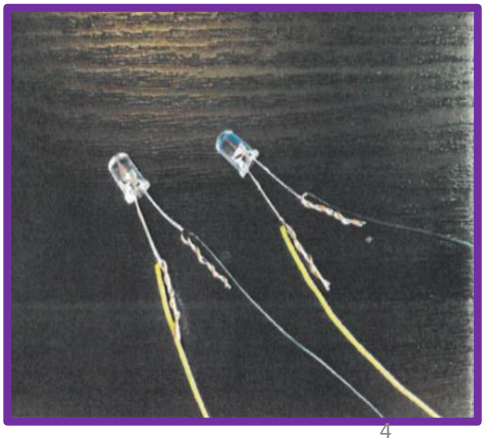
2. **TEST** both LEDs to make sure they work. Place the battery between both legs of the LEDs.
   - The longest leg on the LED is the positive leg and should touch the side of the battery that has a + sign.
   - The shorter leg should touch the other side of the battery.
   - If the LEDs light up proceed to #3. If the LEDs do not work, get a new LED from the spare parts box.



3. Twist (splice) the **YELLOW** wire (POS +) to the longest LED leg (POS +) for both LEDs.
   - NOTE: You can bend the LEDs to twist the wire onto the leg, but not too much or they may break.

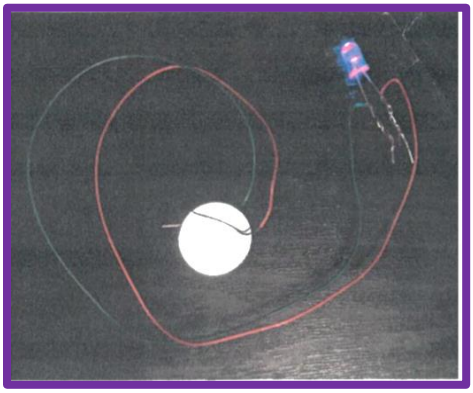


4. Twist (splice) the **BLACK** wire (NEG -) to the shortest LED leg (NEG -) for both LEDs.

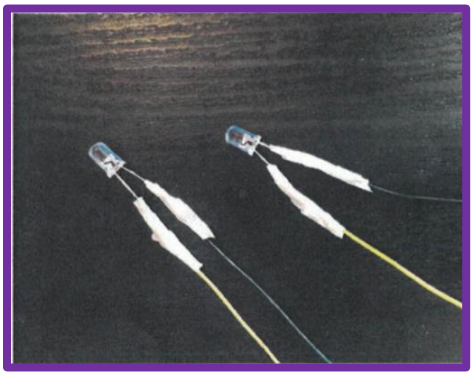


Circuit Bug Instructions (Cont):

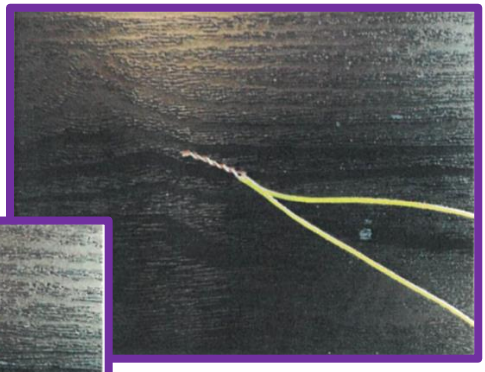
5. **TEST** the LEDs to make sure they still work
   - Touch the **YELLOW** wire (POS+) to the side of the battery that has a + sign and touch the **BLACK** wire (NEG -) to the other side of the battery.
   - Perform this test for both LEDs. If they work, proceed to #6. If they do not work, ask someone to help you troubleshoot the problem.



6. Wrap each leg of the LED's (4) with electrical tape to keep the wire in place.



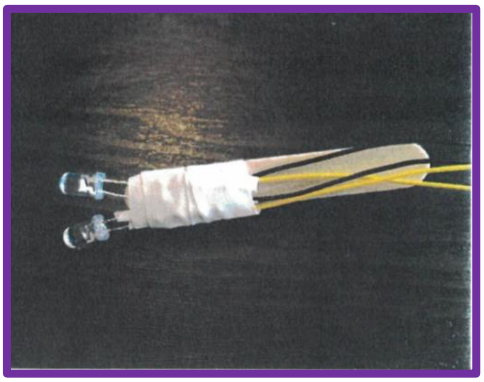
7. Twist (splice) the two **YELLOW** wires together and the two **BLACK** wires together.



Circuit Bug Instructions (Cont):

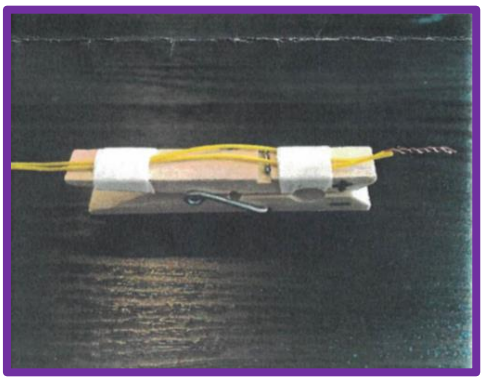
8. **TEST** the LEDs by touching the twisted YELLOW wire (POS +) to the side of the battery that has a + sign and touch the twisted BLACK wires (NEG -) to the other side of the battery.
   - If the LEDs light up proceed to #9. If they do not work, ask someone to help you troubleshoot the problem.

9. Tape the wires that are closest to the LEDs to the small popsicle stick, which will be the bugs body. The LEDs should extend past the bug's body.

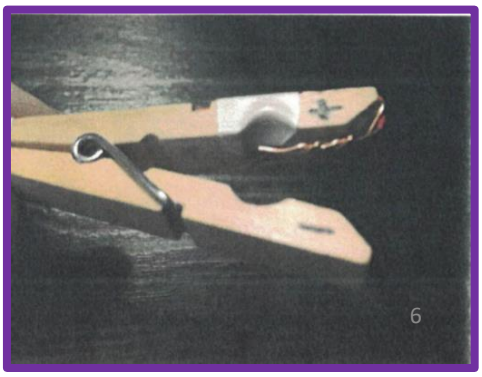


10. **TEST** the LEDs again by touching the twisted **YELLOW** wire (POS +) to the side of the battery with a + sign and touch the twisted **BLACK** wires (NEG -) to the other side of the battery.
    - If the LEDs light up proceed to #11. If they do not work, ask someone to help you troubleshoot the problem.

11. Place the **YELLOW** wires (POS +) on the POSITIVE leg of the clothespin so that the stripped part of the wire hangs over the clothespin. Tape the wire in place.

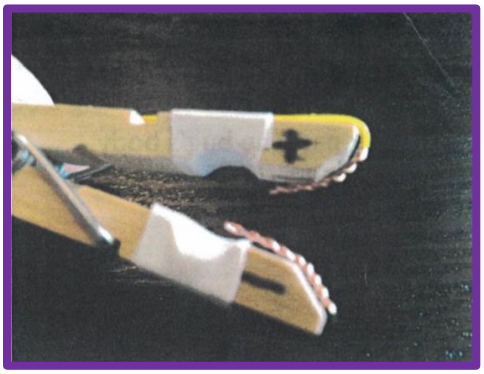


12. Bend the stripped wire over the top of the clothespin.



Circuit Bug Instructions (Cont):

13. Repeat #11 and #12 using the BLACK wire (NEG -).



14. **TEST** the LEDs by placing the battery between the Positive (+) and Negative (-) sides of the clothespin. The side of the battery that has a + sign should touch the side of the clothespin with a + sign.

15. You are now ready to decorate your bug using the pipe cleaners. You can make it look like any kind of bug. When you're done, test it one last time!