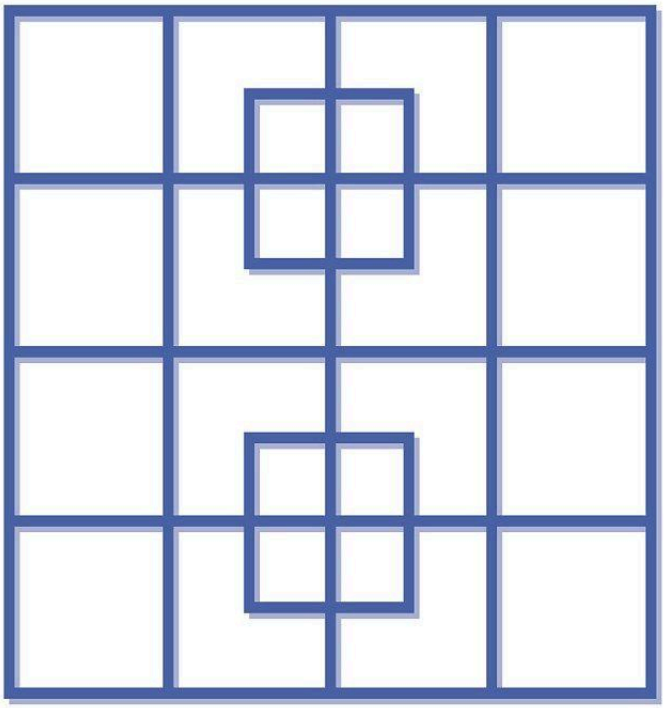
Tech Club
Class 2: Circuit City

VOCABULARY:

- **Motor:** A device that changes electrical energy into mechanical energy, often creating motion.
- **Origami**: The Japanese art of transforming a flat sheet of paper into a three-dimensional object by folding it.
- **Parallel circuit**: A circuit that has two or more paths for electricity to flow through.
- **Robot**: A mechanism guided by automatic controls.
- **Serial circuit**: A circuit with components are connected in a single, unbroken path.
- **Switch**: An electrical component that can disconnect or connect the conducting path in an electrical circuit.



5. How many squares are in the picture?

RUNNING PARALLEL

BACKGROUND:

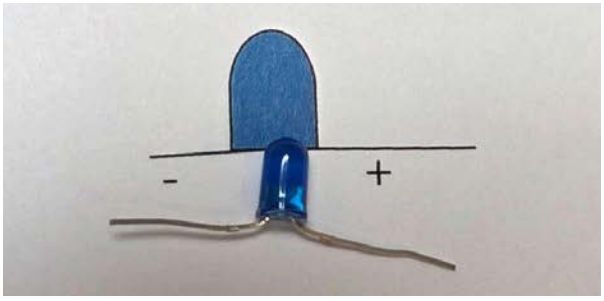
So far, every circuit you have made was a serial circuit, which means all the components are placed along a single path. This often looks like a continuous loop, such as the resistor circuit from the previous day. Serial circuits are easier to create and use less wiring, but if one component breaks the entire circuit fails. Another type of circuit, called a parallel circuit, creates multiple complete paths for electricity to flow through. This means that even if one branch of the circuit is broken, the other branches still work because the electricity still has a path to follow. Today you are going to learn a simple parallel circuit that lights up two LEDs.

STEPS:

1. Your Class Leader will give you a **parallel circuit worksheet**. What do you notice about it?

2. You will make a parallel circuit today. Make a hypothesis about what will happen if one part of the parallel circuit is removed - will the rest of the circuit still work?

3. You will receive **2 LEDs and 4 pieces of 2" maker tape.** Bend both LEDs.



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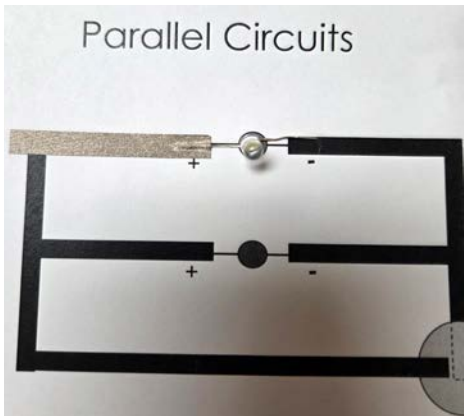
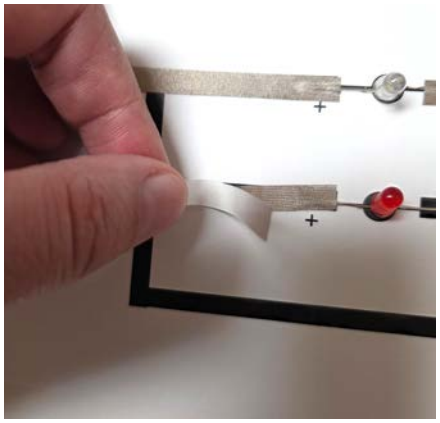
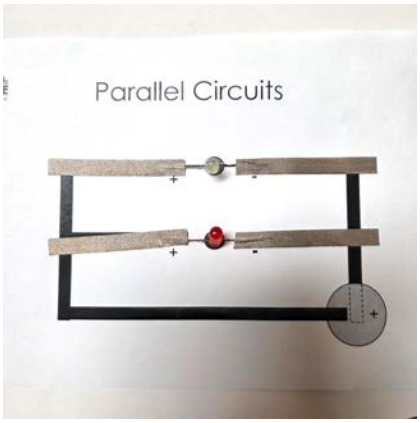
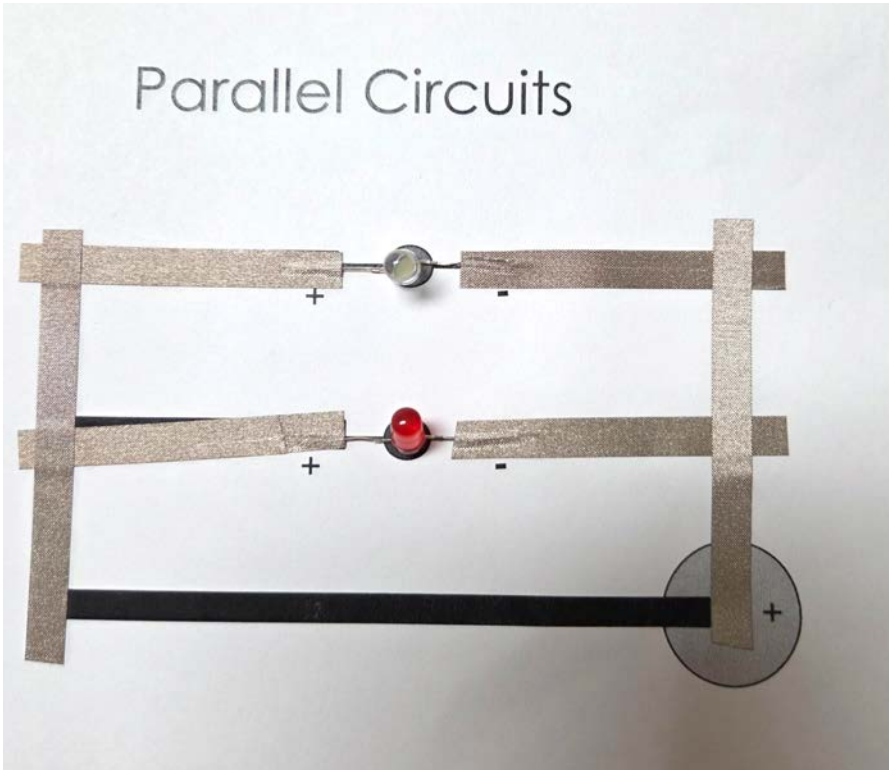
4. Tape the LEDs in place on the worksheet with the maker tape. This tape will be the four horizontal pieces that cover the LED legs.



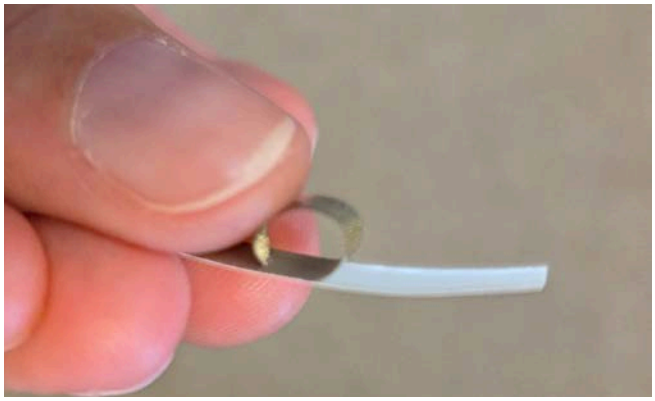



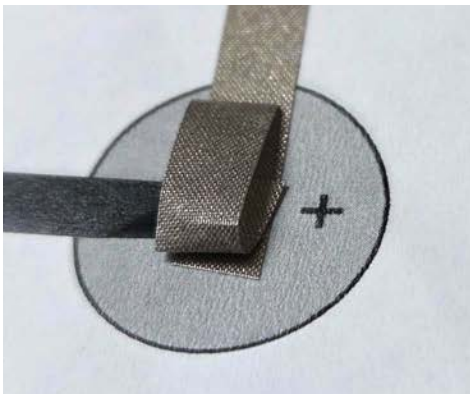
5. Next you will receive **two 2.5" pieces of maker tape**. Apply these pieces to the two vertical lines of the circuit, making sure to go over the horizontal maker tape pieces connected to the LEDs



6. Your Class Leader will give you **one button battery, a 1" piece of maker tape and a 4" piece of maker tape**.

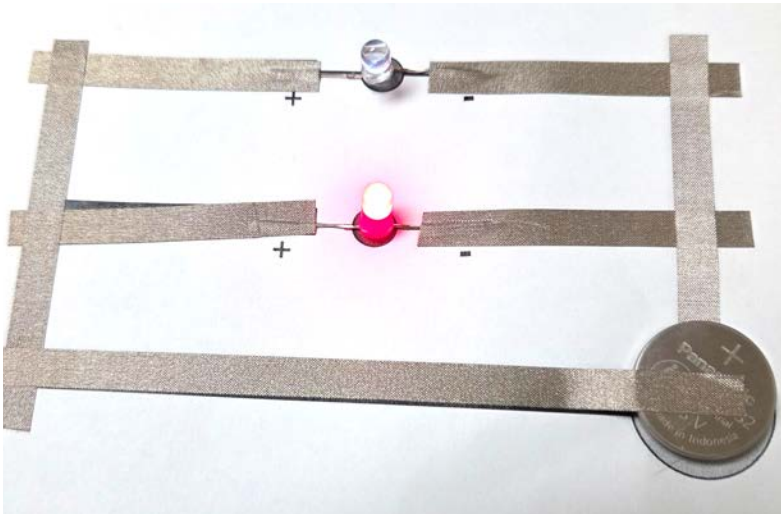
7. Roll the 1" piece of maker tape into a loop and place it over the piece of tape that runs through the battery circle of the circuit.



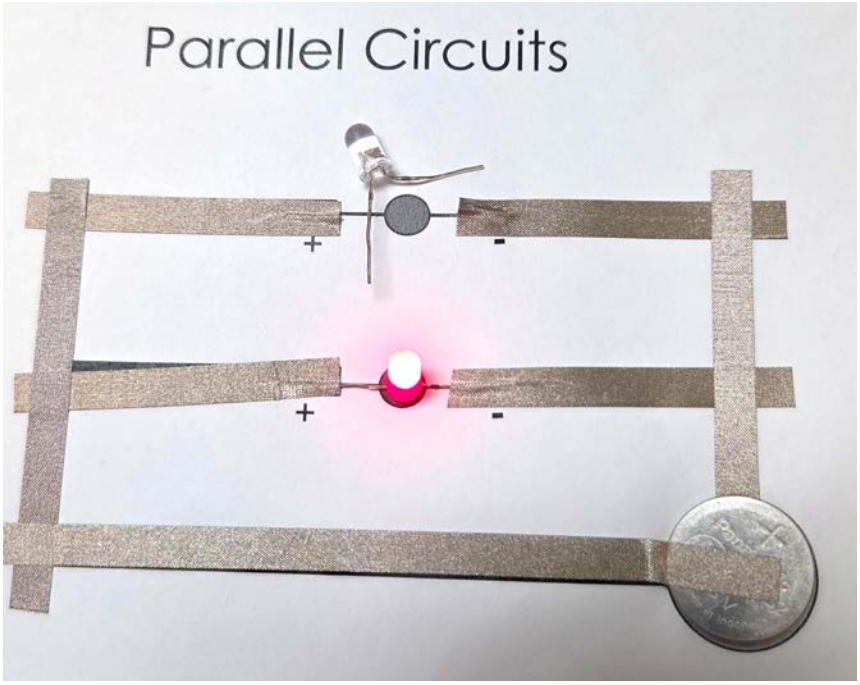


8. Place the battery negative side down on top of the loop.

9. Using the 4" piece of maker tape, connect the left side of the circuit to the top of the battery (positive side). Both LEDs should light up.



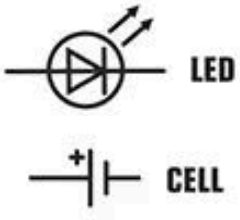
10. Test your hypothesis! Gently remove one of the LEDs by sliding it out from under the maker tape.



11. Was your hypothesis supported?

Yes or **No**

12. Can you draw a circuit diagram for this circuit?



13. Remove the battery to be used in the next activity. Set the rest of your circuit aside to take home.

SWITCH IT UP

BACKGROUND:

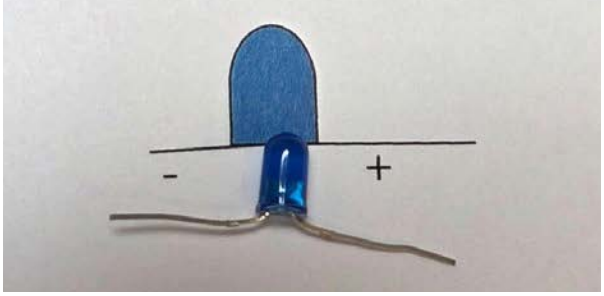
In this activity you will make your first electrical switch. Switches are important pieces of technology found in homes, schools, and even in our pockets! We use rocker switches to control lights, micro switches in fire alarms, and touch switches on our phones. All of these switches allow us to control when electricity is flowing through a device.

STEPS:

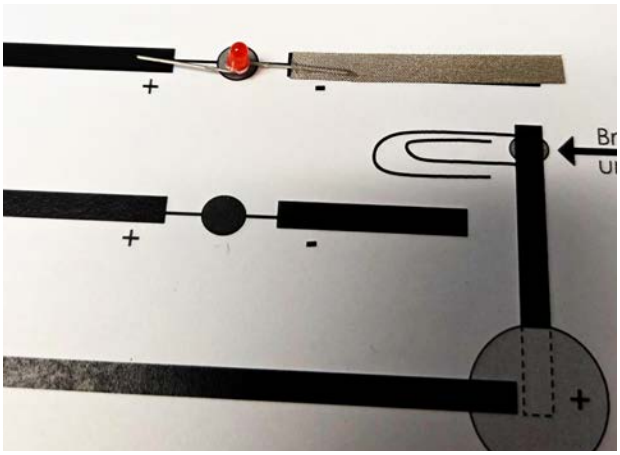
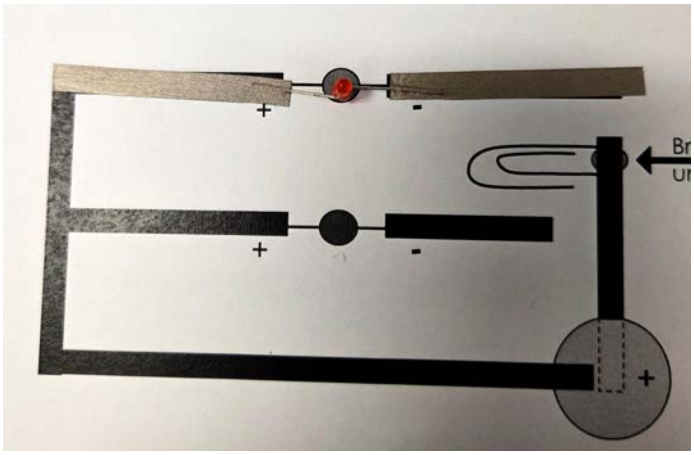
1. Do you think you can make a switch using a paperclip? Write your hypothesis here:

2. Look at the **paperclip switch circuit worksheet**. What components do you see on this sheet?

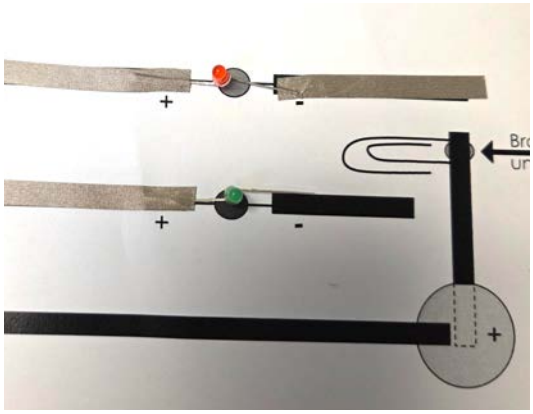
3. You will receive **two LEDs and three pieces of 1 ¾" maker tape.** Bend the legs of the LEDs like you did in the previous activity.



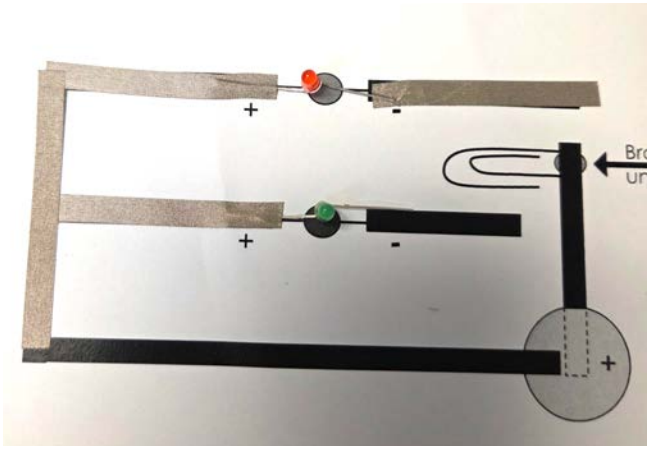
4. Tape one LED in place on the top circle using two of the pieces of maker tape

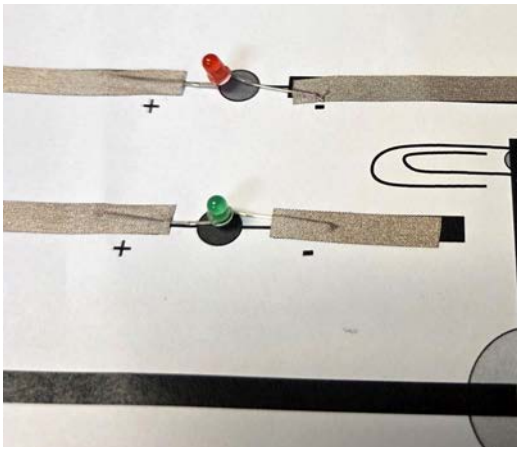
5. Place the 2nd LED in the middle of the circuit and tape down the left (positive) leg only. It's OK if the maker tape goes past the lines on the template.



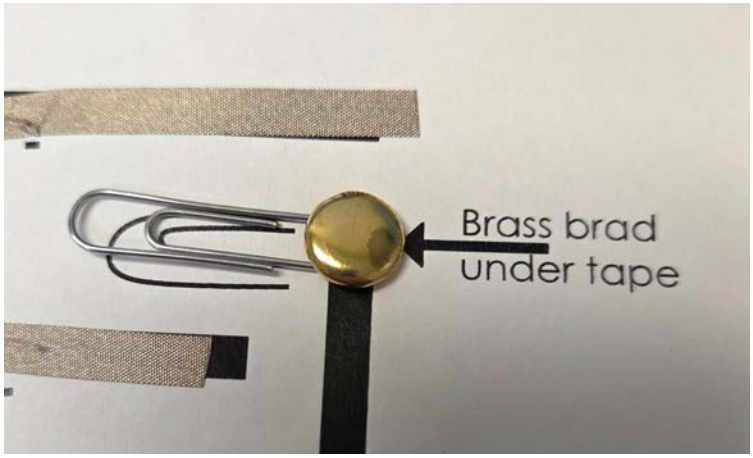
6. Your Class Leader will give you **one piece of 2 ¼" maker tape.** Apply this piece to the vertical line of the circuit on the left, making sure to go over the horizontal maker tape pieces connected to the LEDs.



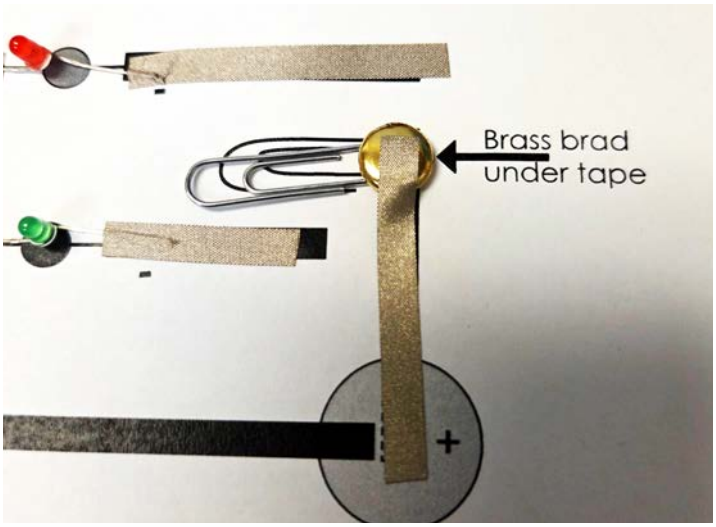
7. You will receive **one 1" piece of maker tape, one brass brad, and one paperclip**. Cover the remaining LED leg with the 1" maker tape.



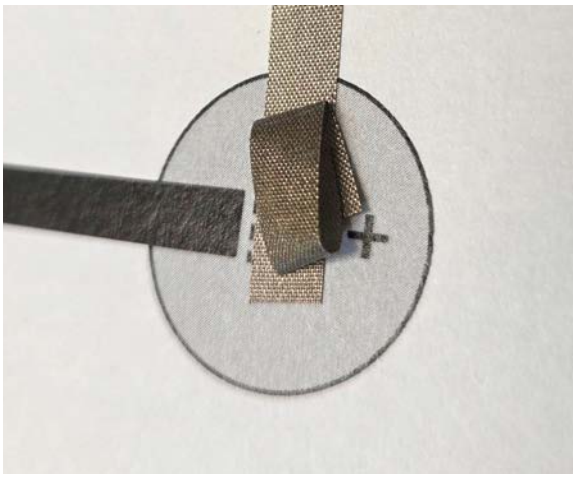
8. Thread the brad through the paperclip, then poke the brad through the paper where indicated on the circuit diagram.



9. Use a **1 ¾" piece of maker tape** to cover the right-hand vertical line of the circuit, including the top of the brad.

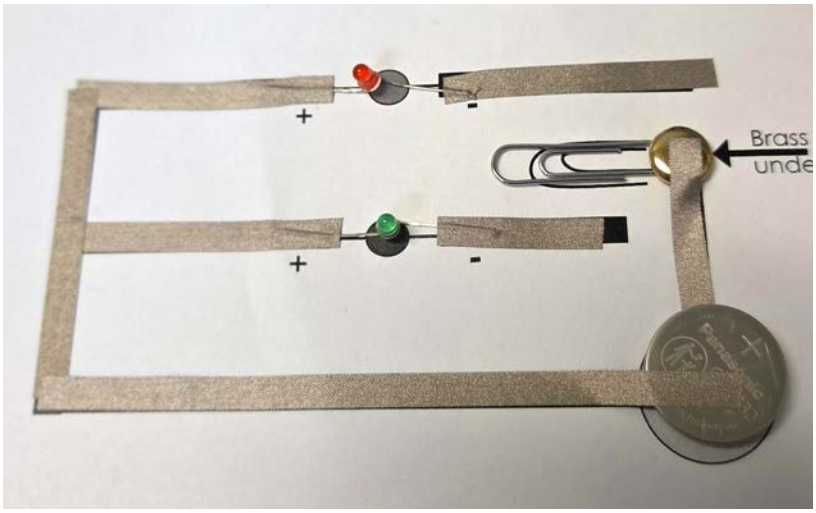


10. Finally, You will receive **one 1' piece of maker tape and one 4" piece of maker tape**. Make sure you have your **battery** from the previous activity.
11. Use the 1" piece of maker tape to make a tape loop and place it over the piece of tape that runs through the battery circle of the circuit.

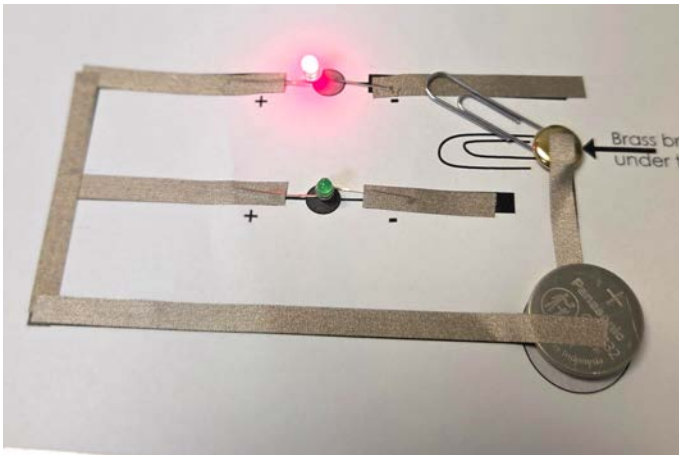


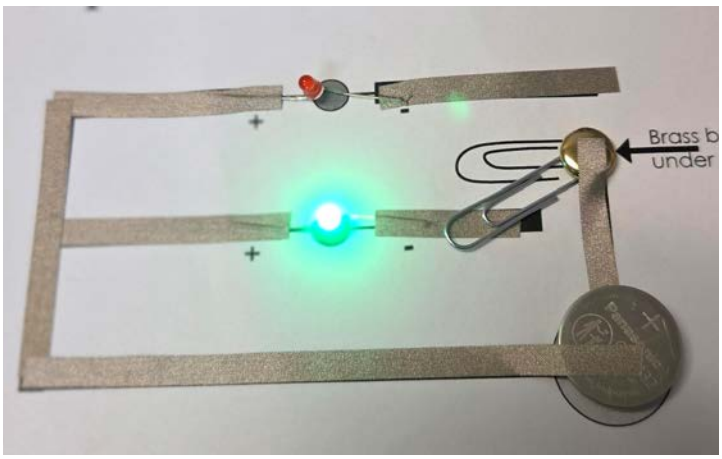
12. Place the battery negative side down on top of the tape loop and press down to make a good connection.

13. Using the 4" piece of maker tape, connect the left side of the circuit to the top of the battery.



14. Slide the switch to connect the top LED to the paper clip, then change to the bottom LED. Each LED should light up when connected.

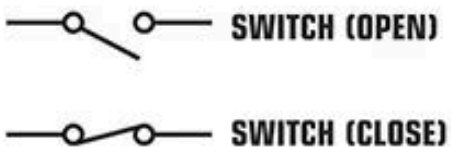




14. Was your hypothesis supported?

Yes or **No**

15. Can you draw a circuit diagram for this circuit?



16. Make sure to either disconnect the battery or keep the paperclip in between the maker tape strips when not using the circuit. This will prevent the battery from running out.

DOMO ARRIGATO, MR. ROBOTO

BACKGROUND:

In early science fiction, robots were thought of as machines that looked like and imitated humans. Today, we see that robots come in many forms, from the remote controlled Mars rover Curiosity, to the toys called Hexbots. We even have robots made completely of software called bots, which are programmed to generate internet results or do other repetitive tasks. In this activity, you will make one of the simplest types of robot using a small vibrating motor and some basic origami.

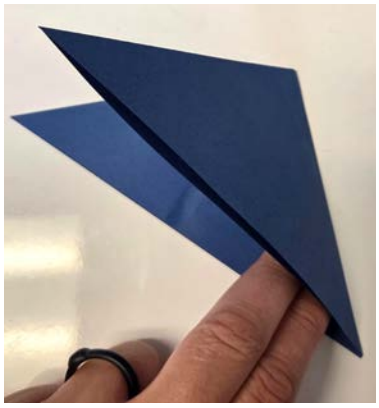
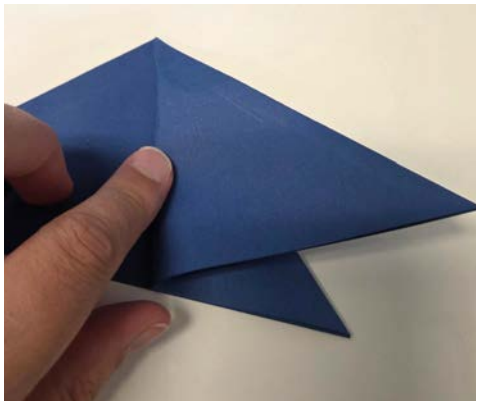
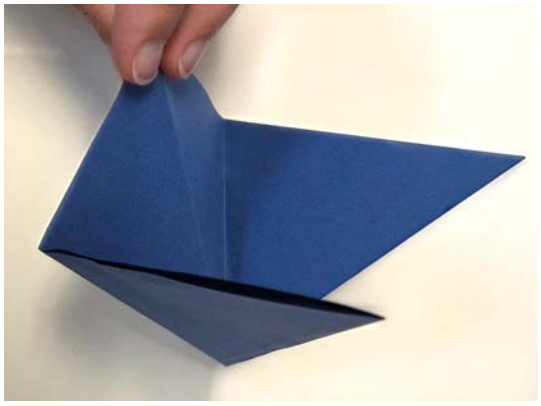
ENGINEER SPOTLIGHT:

Danielle Boyer, Robot Inventor

Danielle Boyer is an Ojibwe robotics inventor who invented EKGAR when she was 18. Her goal with EKGAR, which stands for Every Kid Gets A Robot, was to make a robot that any kid could use to learn coding. She also created the SkoBot to teach and preserve Indigenous languages, and is currently working on a new material to replace all the plastic in EKGAR! Let's be roboticists like Ms. Boyer and make our own simple robots.

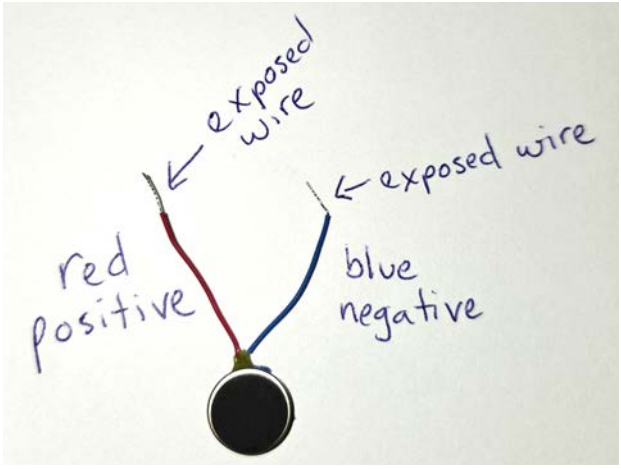
STEPS:

1. Look at the **piece of origami paper and origami folding instructions** given to you by your Class Leader. Follow the instructions for folding the origami butterfly.

2. If students want to decorate their origami butterflies, they can do so now with the available **crayons**.
3. You will receive **one button motor**. How do you think the motor can attach to your origami butterfly?

4. The wires on the motor are just like the legs of LEDs. The red wire is positive and the blue wire is negative.



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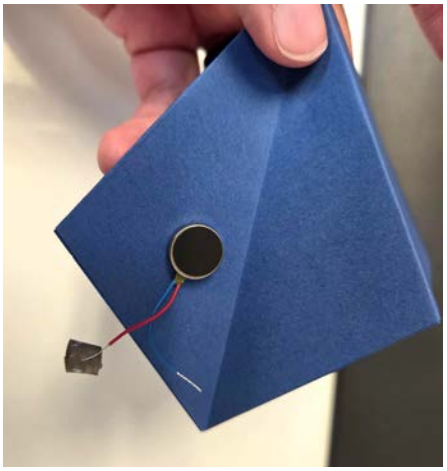
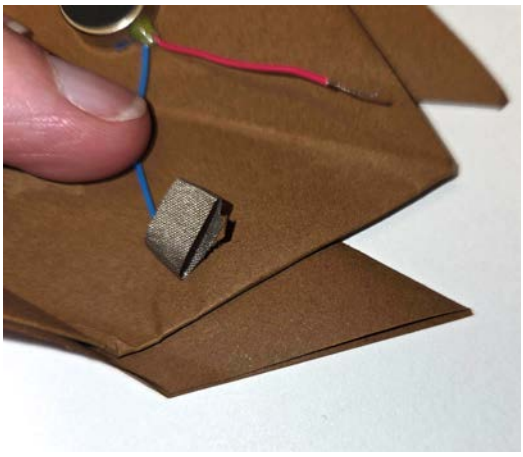
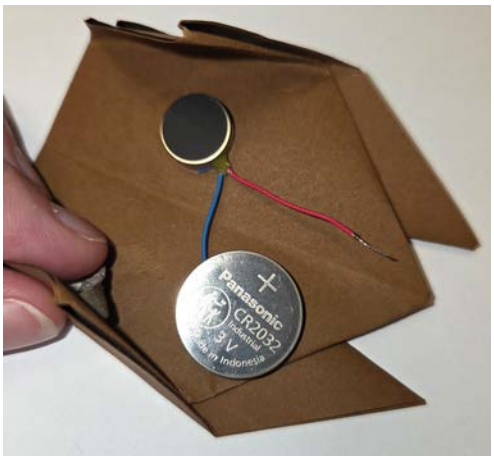
5. Peel the backing off the yellow side of the button motor and stick the motor to the bottom of the origami. The motor should be near the middle.



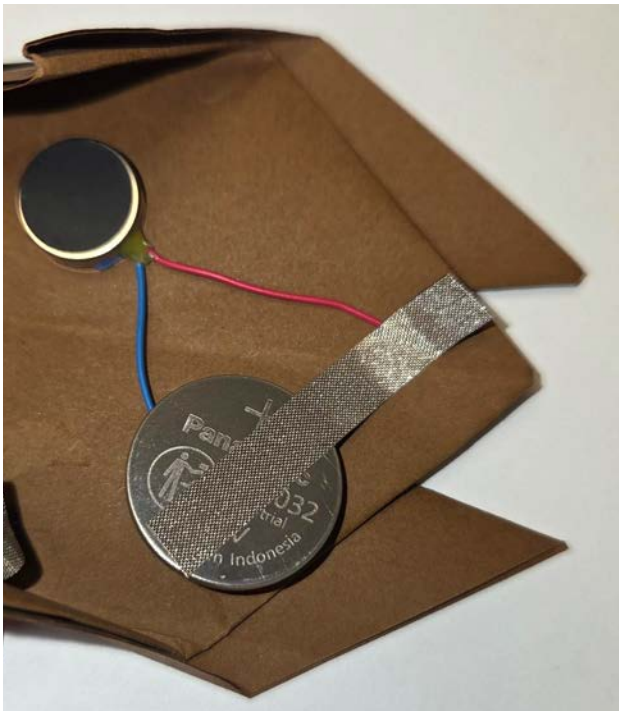
6. You will receive **one piece of 1.5" maker tape**. Make a tape loop with this piece of maker tape and stick it on top of the exposed end of the blue wire.



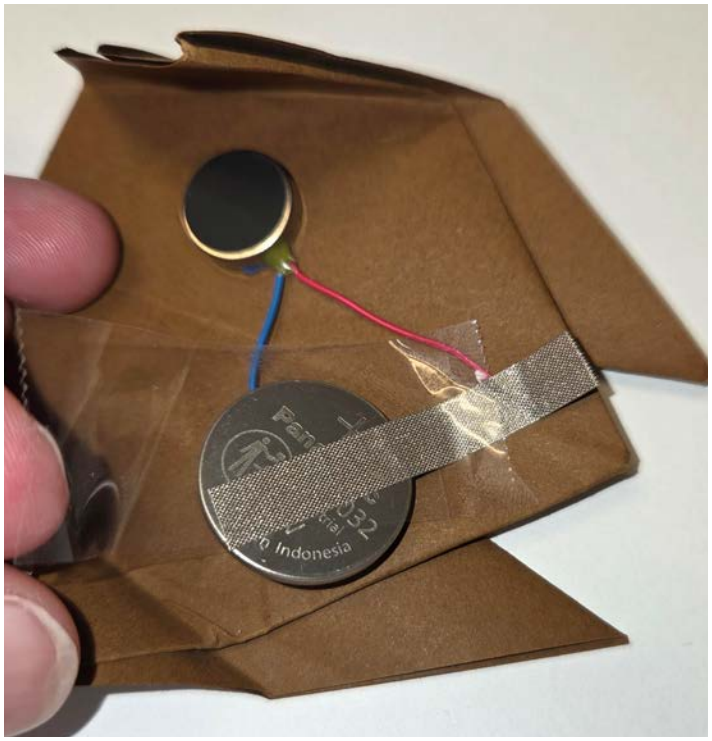
7. You will now receive **one button battery and one additional piece of 1.5" maker tape** to each student. Place the battery on top of the tape loop, negative side down.



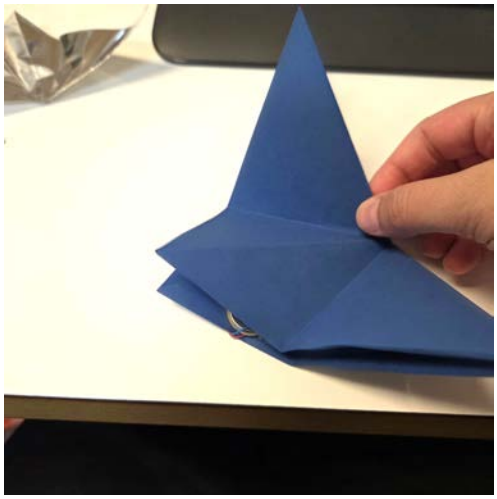
8. Connect the exposed part of the red wire to the positive side of the battery with the 2nd piece of maker tape. The motor should start vibrating!



9. You might want to use a small piece of **Scotch tape** to hold the battery onto the origami bug. This might require some teamwork because the motors will be buzzing!

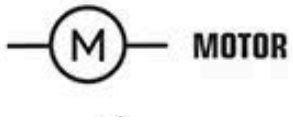


10. What happens when you place the butterfly on the table?



11. Carefully peel the battery off the maker tape loop connecting it to the origami paper. This will stop the robot and let you take it home without draining the battery.

12. Can you draw this circuit diagram?



13. You can try the origami cicada at home!

FOR FUN! Make it to the center of the maze!