

Intro to Circuits Lab

with Homemade Dough

What is a circuit?

Electricity flows in a loop called a circuit, which begins and ends at the battery pack. Electricity takes the path of least resistance, meaning it goes through whatever loop is easiest to flow through.

Conductive Dough

- 1 cup water.
- 1 ½ cup flour.
- ¼ cup salt.
- 3Tbsp cream of tartar
(or 9 Tbsp of lemon juice)
- 1Tbsp vegetable oil
- Food coloring (optional)

Reserve ½ cup flour, and mix the remaining ingredients in a medium-sized pot. Cook over medium heat, stirring continuously. The mixture will begin to boil and get chunky. Keep stirring until a ball forms in the center of the pot. Once a ball forms, turn off the heat and remove the dough to a lightly floured surface.

CAUTION: *The dough will be very hot!*
Flatten it and let it cool for a couple of minutes before handling.

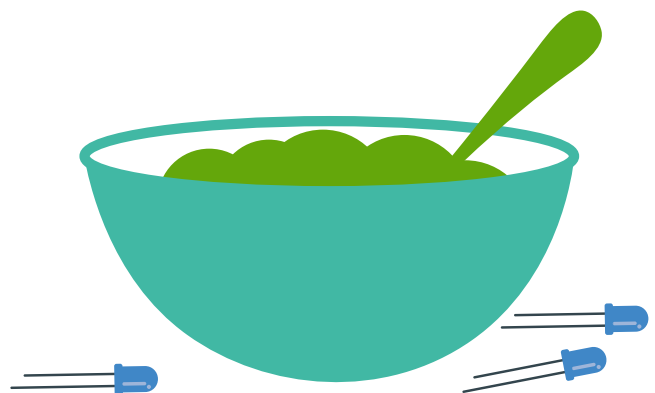
Slowly knead the remaining flour into the ball until you've reached the desired consistency.

Insulating Dough (Optional)

- 1 ½ cup flour
- ½ cup sugar
- 3Tbsp vegetable oil
- ½ cup distilled or deionized water
- Food coloring (optional)

Mix the dry ingredients and oil in a pot or large bowl. Mix in 1Tbsp of deionized water and knead; repeat until the mixture becomes moist and dough-like.

Remove the mixture from the pot or bowl, and slowly knead flour into it until it attains a firm consistency. You should use almost the entire ½ cup of flour.



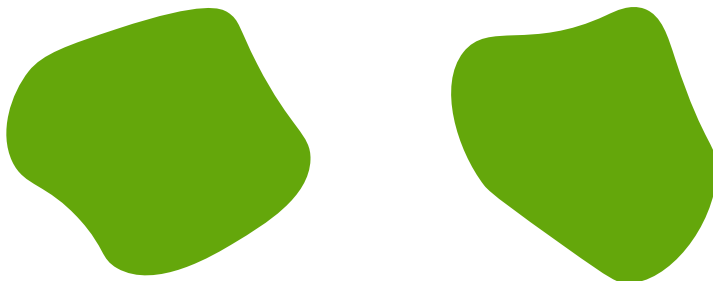
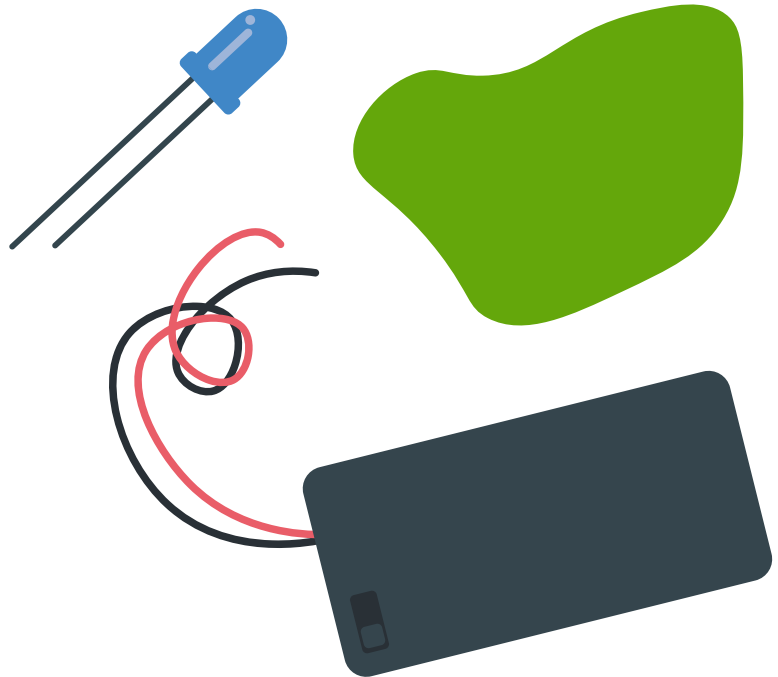
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Activity #1: Simple Circuit

Can an LED work in either direction?

Materials

- Conductive Dough
- Insulating Dough (Optional)
- Battery Pack
([Suggested Product](#))
- 2 AA Batteries
- 1 LED ([Suggested Product](#))

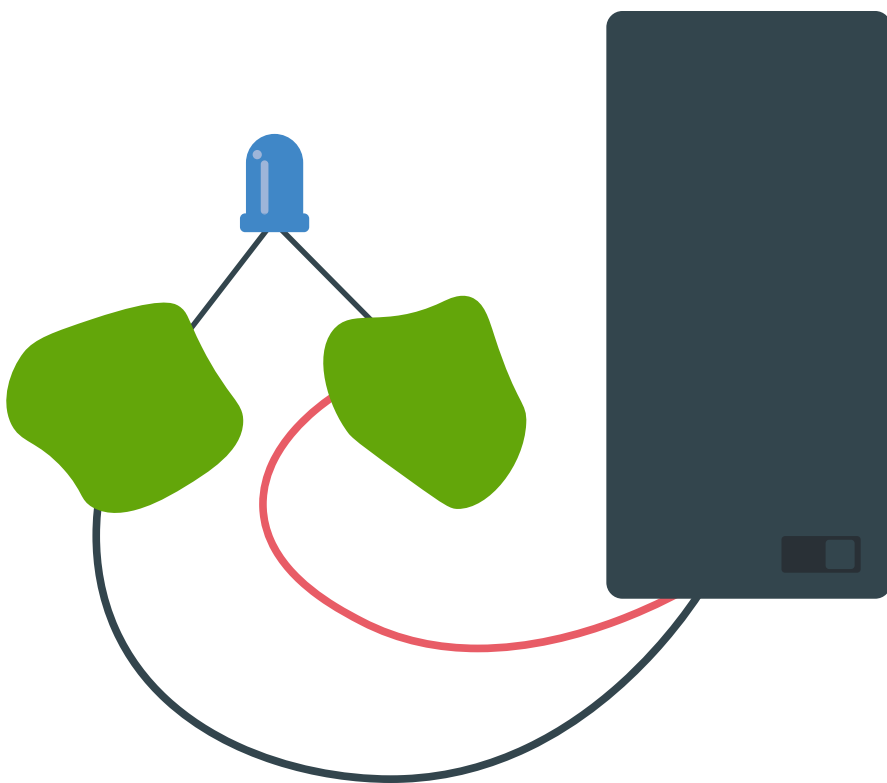
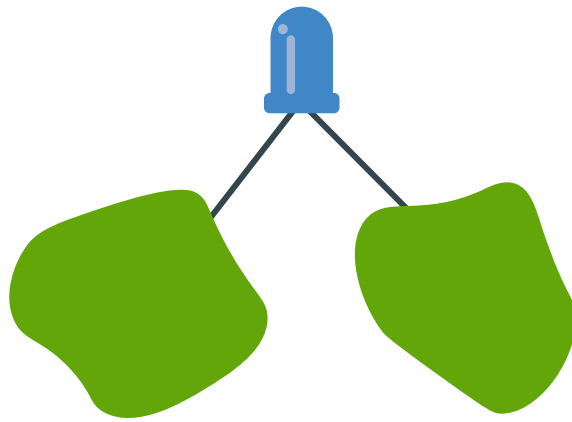


Step 1:

Make two balls of conductive (green) dough. If you want, you can place the insulating dough between the conductive dough to keep the balls from touching.

Step 2:

Place an LED between the two balls.



Step 3:

Connect the Red wire to one green ball and the Black wire to the other green ball.

Questions:

- Does the LED light up? YES or NO
- What if you change the wires? YES or NO
- Which lead of the LED does the red wire need to be connected to? LONGER or SHORTER

Takeaway: The LED only works in one direction.

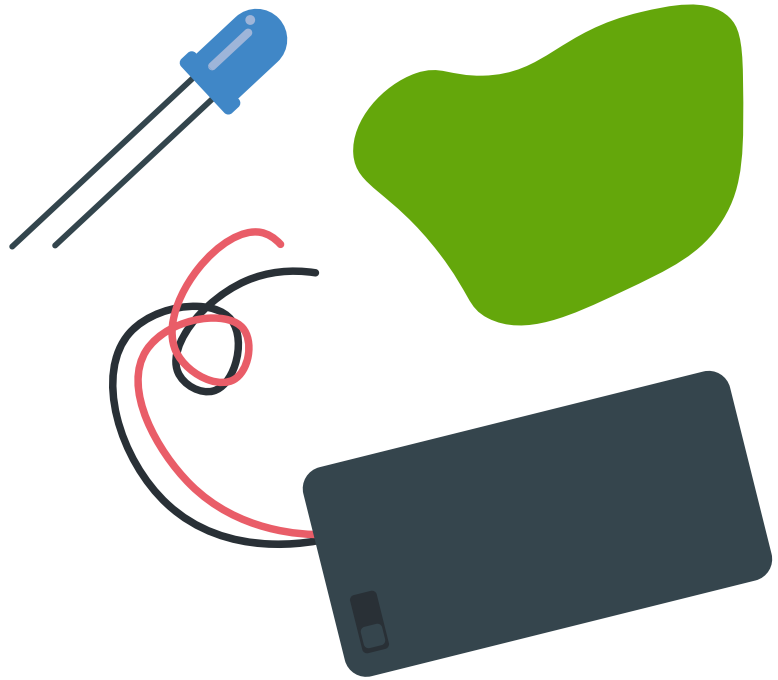
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Activity #2: Series Circuit

What happens if you remove an LED from a series circuit?

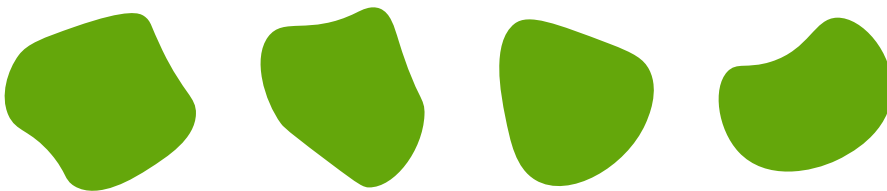
Materials

- Conductive Dough
- Insulating Dough (Optional)
- Battery Pack
([Suggested Product](#))
- 2 AA Batteries
- 3 LEDs ([Suggested Product](#))



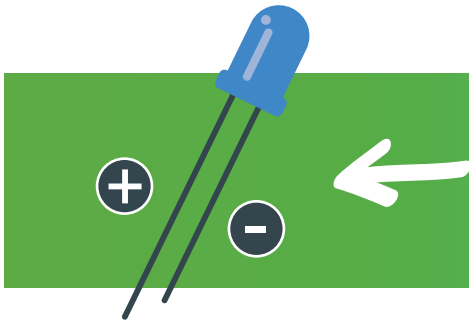
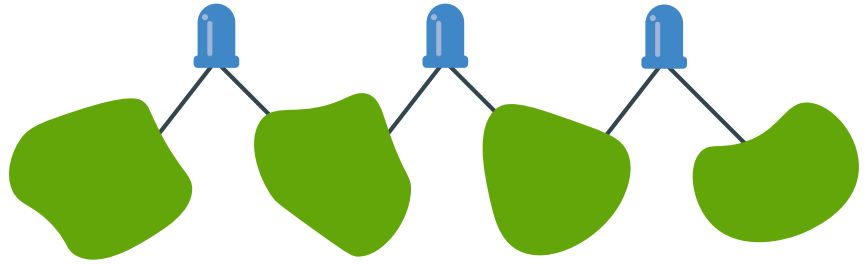
Step 1:

Make four balls of conductive (green) dough. You can place the insulating dough between the conductive dough to keep the balls from touching.



Step 2:

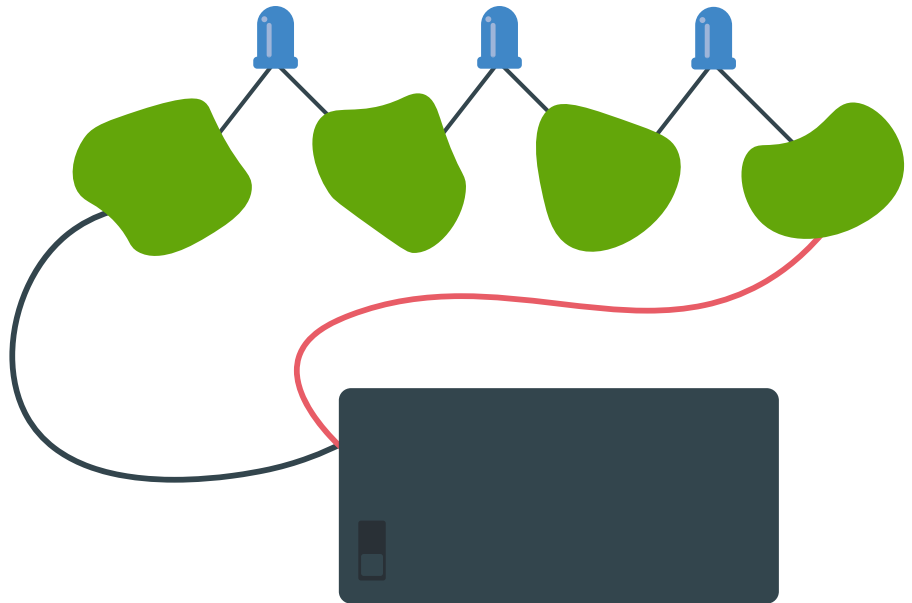
Place an LED between each pair of balls with the longer leads all to the left (three total).



LEDs have leads of two different lengths, one positive and one negative. For this activity, keep the longer leg facing the left.

Step 3:

Connect the Red and Black wires to the balls on the ends.



Questions:

- Do the other lights remain on when one LED is removed? YES or NO

Takeaway: If one of the LEDs is taken out, the entire circuit is broken and all of the lights will go out.

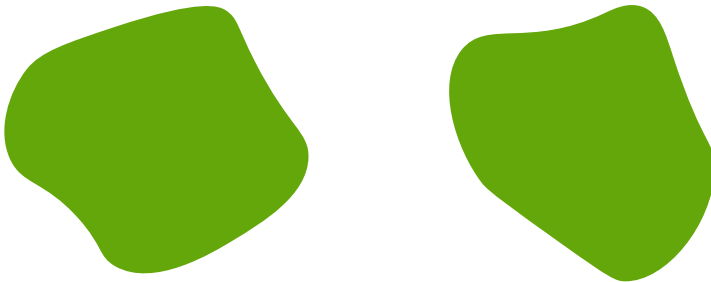
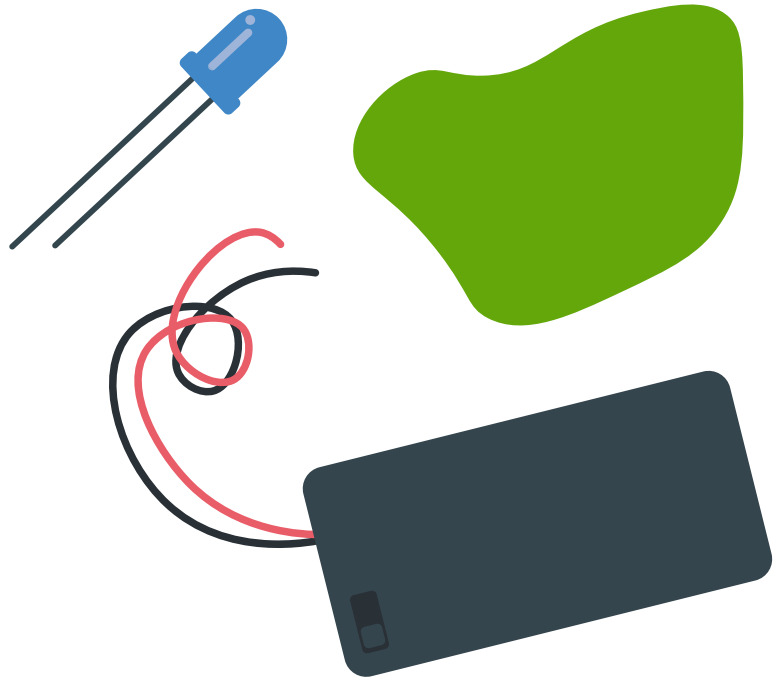
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Activity #3: Parallel Circuit

What happens if you remove an LED from a parallel circuit?

Materials

- Conductive Dough
- Insulating Dough (Optional)
- Battery Pack
([Suggested Product](#))
- 2 AA Batteries
- 2 LEDs ([Suggested Product](#))

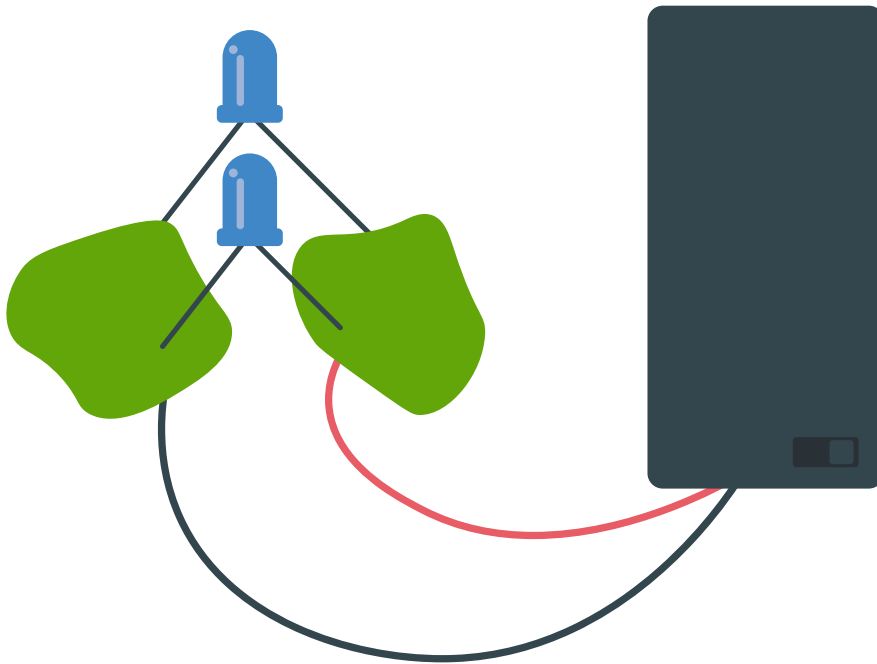
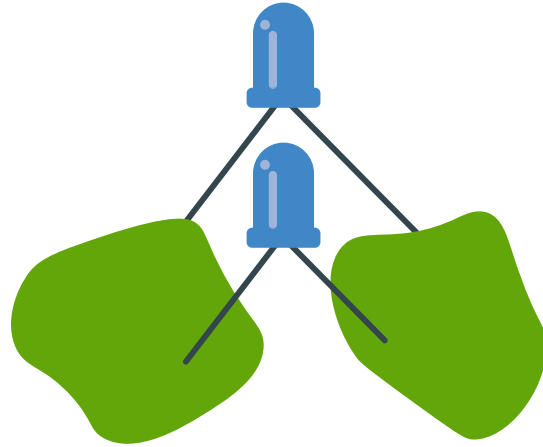


Step 1:

Make two balls of conductive (green) dough. If you want, you can place the insulating dough between the conductive dough to keep the balls from touching.

Step 2:

Place two or three LEDs between the two balls.
(Make sure all long leads are in same ball.)



Step 3:

Connect the Red wire to one green ball and the Black wire to the other green ball.

Questions:

- Do all of the LEDs light up? YES or NO
- Do the other lights remain on when one LED is removed? YES or NO

Takeaway: LEDs or other electrical items are connected to the dough each in their own loop or circuit. Since electricity flows through each LED independently, if one is removed or burns out, the others will continue to shine brightly.

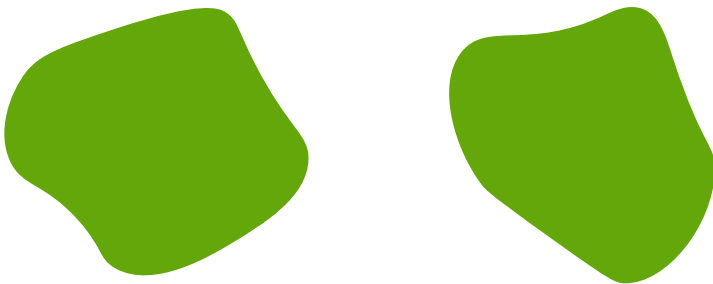
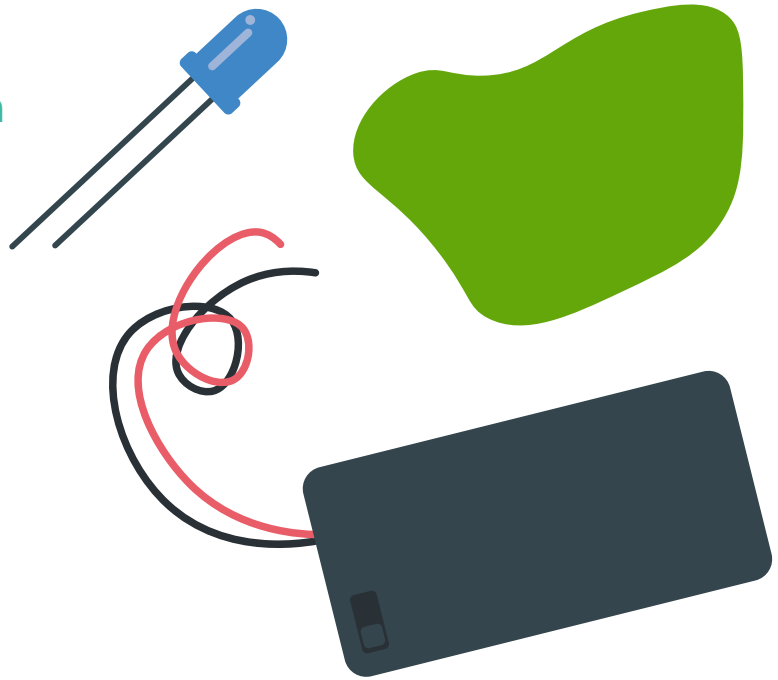
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Activity #4: More Parallel Circuits

What happens to the brightness of the LEDs when you add more LEDs?

Materials

- Conductive Dough
- Insulating Dough (Optional)
- Battery Pack
([Suggested Product](#))
- 2 AA Batteries
- 3 LEDs ([Suggested Product](#))

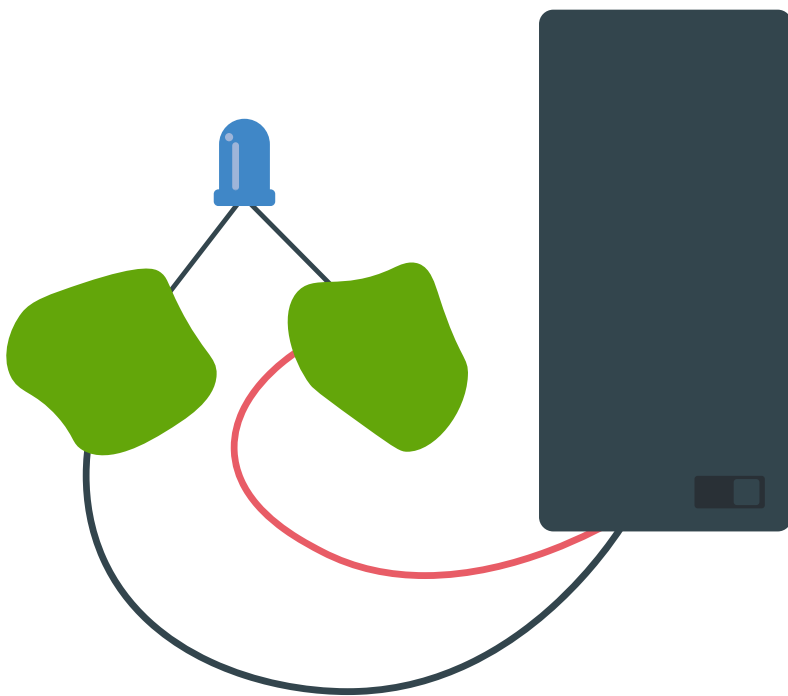
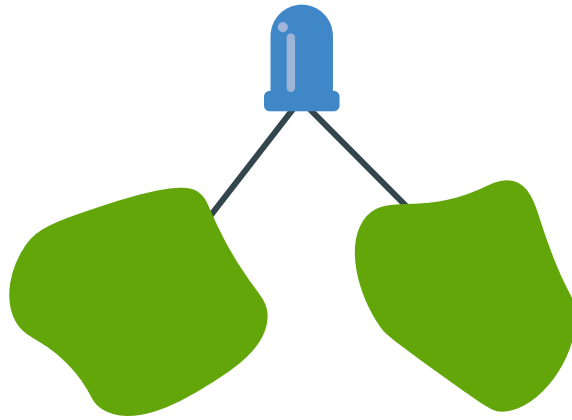


Step 1:

Make two balls of conductive (green) dough. If you want, you can place the insulating dough between the conductive dough to keep the balls from touching.

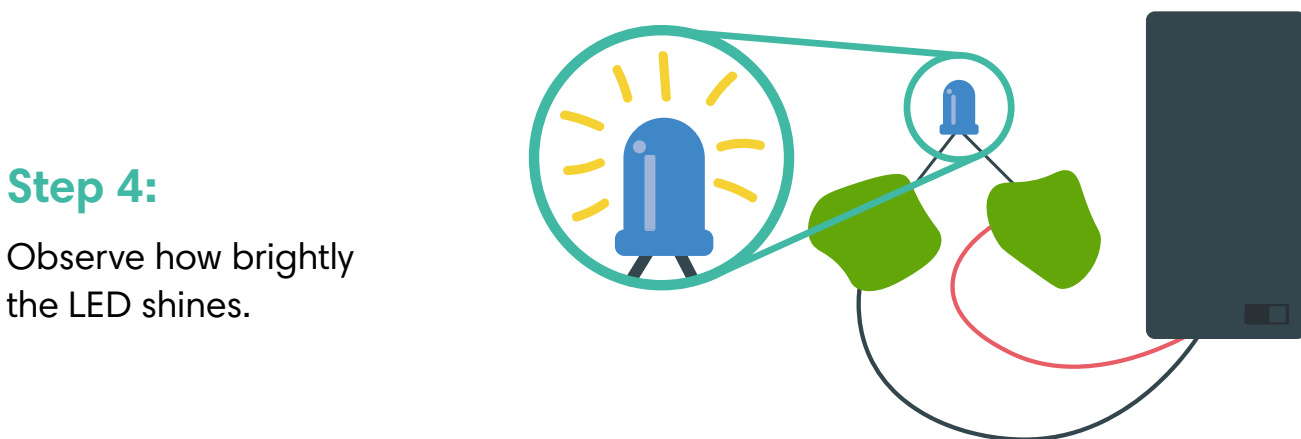
Step 2:

Place an LED between the two balls.



Step 3:

Connect the Red wire to one green ball and the Black wire to the other green ball.

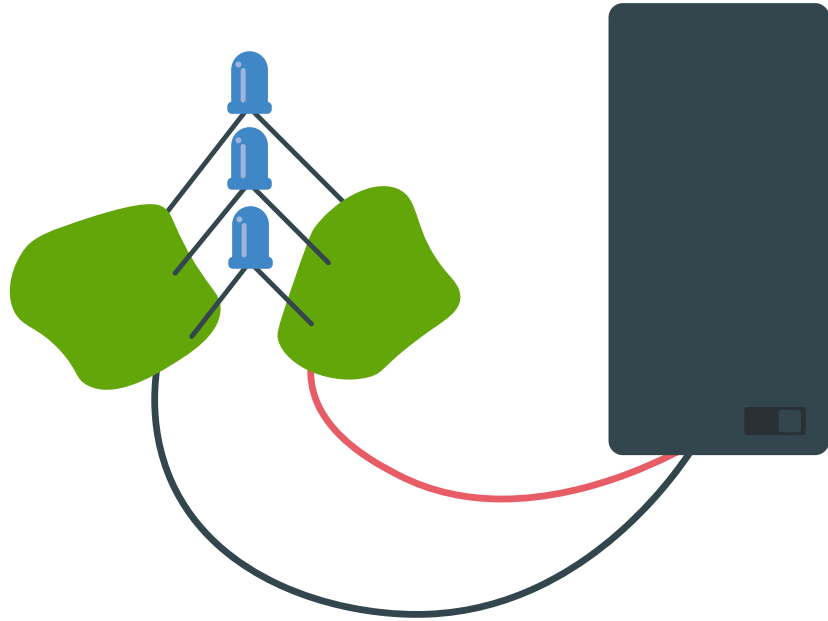


Step 4:

Observe how brightly the LED shines.

Step 5:

Add additional LEDs, paying attention to which way the leads are facing.



Questions:

- Does the brightness change when additional LEDs were added? YES or NO
- Is the light brighter with one or multiple LEDs? One or multiple

Takeaway: LEDs can be added. However, they will get more dim because there is less electricity available to power them.

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More Information

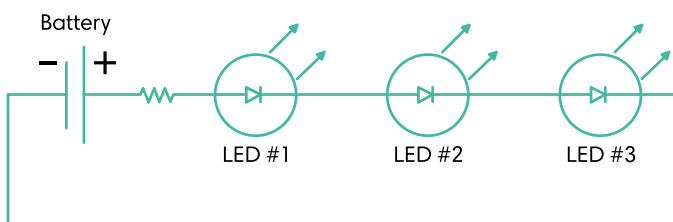
Series Circuits

A series circuit only allows one path for the electricity to flow through. The LED only works in one direction.

The longer wire or lead is positive and should align with the positive (red) wire of the battery pack.

Never directly connect an LED to a battery because it will burn out. More LEDs can be added however they will get more dim because there is less electricity available to power them.

If one of the LEDs is taken out, the entire circuit is broken and all of the lights will go out.

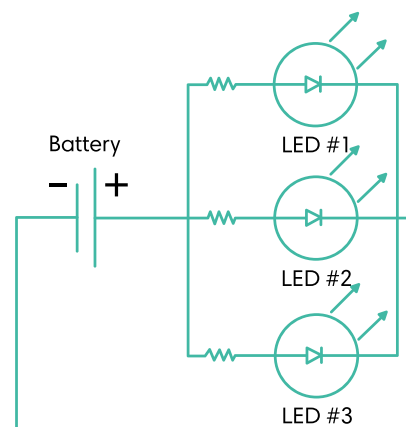


Parallel Circuits

A parallel circuit allows multiple paths for electricity to flow through.

The LED only works in one direction. Make sure the longer wire or lead is towards the positive (red) side.

LEDs or other electrical items are connected to the dough each in their own loop or circuit. Since electricity flows through each LED independently, if one is removed or burns out, the others will continue to shine brightly.



Conductive Dough Pro Tip:

Clean all leads, LED legs and any surface that makes contact with the conductive dough after the activity using a damp towel. The salt from the conductive dough can erode contacts over time.