# day86 Breadboards

We are going to learn some electronics while using Arduinos. Our best friend when tinkering with electronics is the breadboard. It looks like this image to the right.

A breadboard lets us connect electronic components and wires without having to make permanent connections. We can try something, change it, then remove it, and use all of the parts again another day.

Underneath the surface of the breadboard are metal strips that connect some of the holes with other holes in a way that lets us make circuits. Understanding how these things work is important.
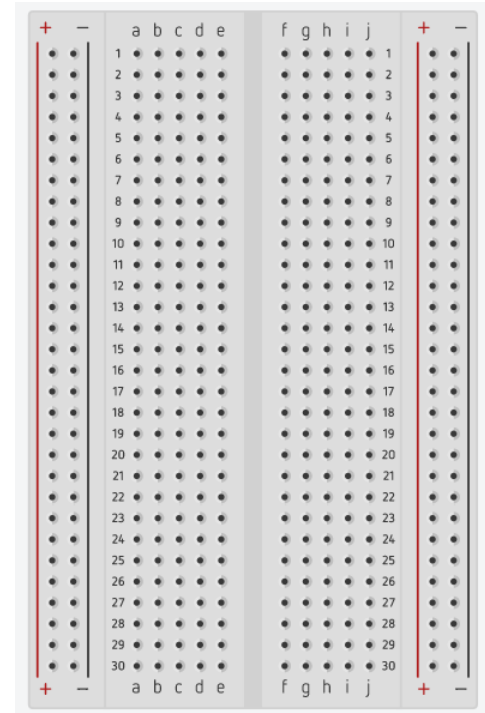
1. Power rails

First, running down the left and right sides of the breadboard are the (+) and (-) power columns, sometimes called "rails". Find the + rail running up and down on the left side of the breadboard. Every hole in that line is connected to every other hole in that same vertical line. I have highlighted the entire rail here in this image to the left.
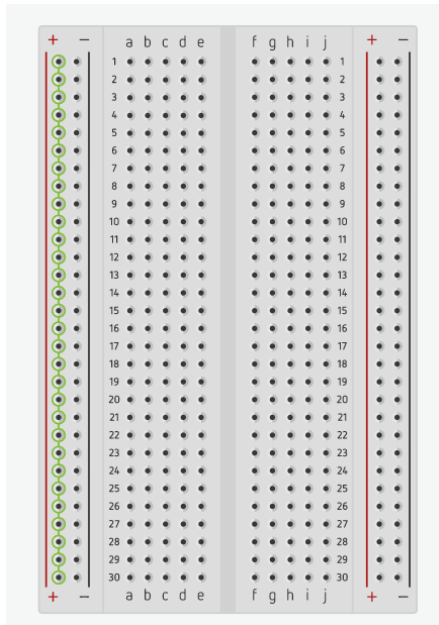
This means if you plug a wire in near the top that provides 5 volts of electricity, any component that also plugs in on any one of the other 29 holes in that highlighted row will receive 5 volts of electricity.

We use rails to power or connect more than one component at a time. We don't always use them when making circuits, but it's important to understand how they work.

We actually most often use the (-) rail which we will connect to the negative GND or ground side of our circuits. For example three LED lights that you want to turn on at different times would have separate positive power circuits but could all have their negative sides wired to the negative power rail to ground. Don't worry, this will make more sense once we start making circuits.

2. Rows

Rows in a breadboard are numbered 1 through 30 with columns labeled with letters (a through j)

In the image to the right I have highlighted row 8 on the left side. Each hole in row 8 on that side is connected to each other hole on that same side (the green circled holes). In other words, holes 8a, 8b, 8c, 8d, and 8e are all electrically connected to each other, and NOT to 8f, 8g, etc. on the other side. (8f through 8j ARE connected to each other, just not to the left side of things.)
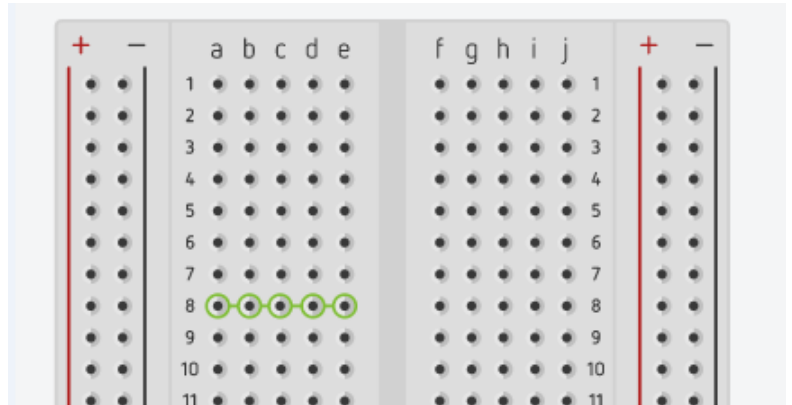
3. Connecting components

To connect parts to the breadboard and each other we place parts into the holes. There is a gentle push you have to give a wire to get it in, then it is usually held in place lightly. To remove a part just pull it out.
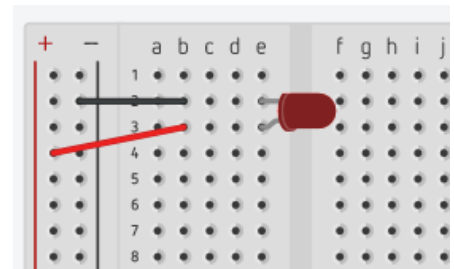
4. How to place a part

This is the key: how do you put a part in a breadboard so that a circuit will work? Here's the #1 thing to remember: the different leads on a part need to go into different *rows* on the board. Let's take a specific example, the LED light, something we'll use a ton of.

LED lights have two legs, one positive and one negative (the positive is the longer leg). Ideally you put an LED onto the breadboard somewhat like I did in this image to the right. The negative leg is in hole 2e and the positive leg is in hole 3e.
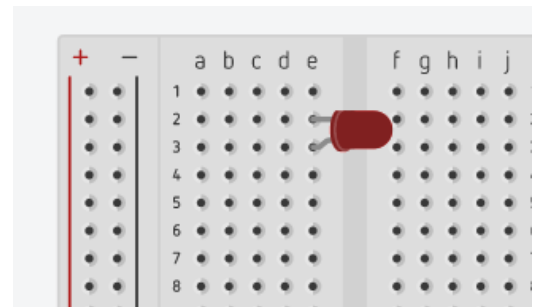
We then connect the two legs to other parts of a circuit using jumper wires (short wires that have pins on each end to make them easy to insert into breadboards). In this case I connected the positive side to the + power rail and the negative side to the - power rail. Each circuit is different, and I'll give you diagrams and instructions to tell you what to do.

One more thing on the next page.

5. How <u>NOT</u> to place a part

What is wrong with how this LED is place on this breadboard?
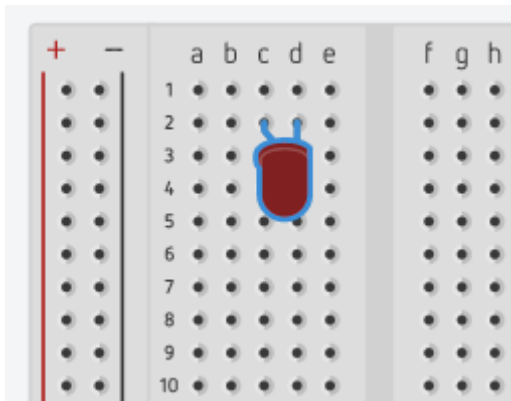
(Answer on the next page, try to figure it out before you peek.)

The problem is that both the positive and negative legs of the LED we put into row 2. Remember, ALL of row 2's holes are connected to each other. A part like an LED will not work if both of its legs are connected to each other! One leg has to get power (the positive or + side) and the other has to run back to the ground or negative (-) side of the battery or circuit.
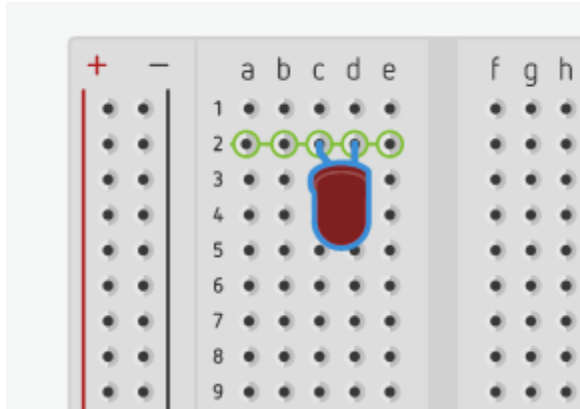
I have highlighted the row in the image above. You would never plug a part in with both legs on the same row, it just doesn't make sense and will not work.

In our next assignment we will build our first breadboard circuit.