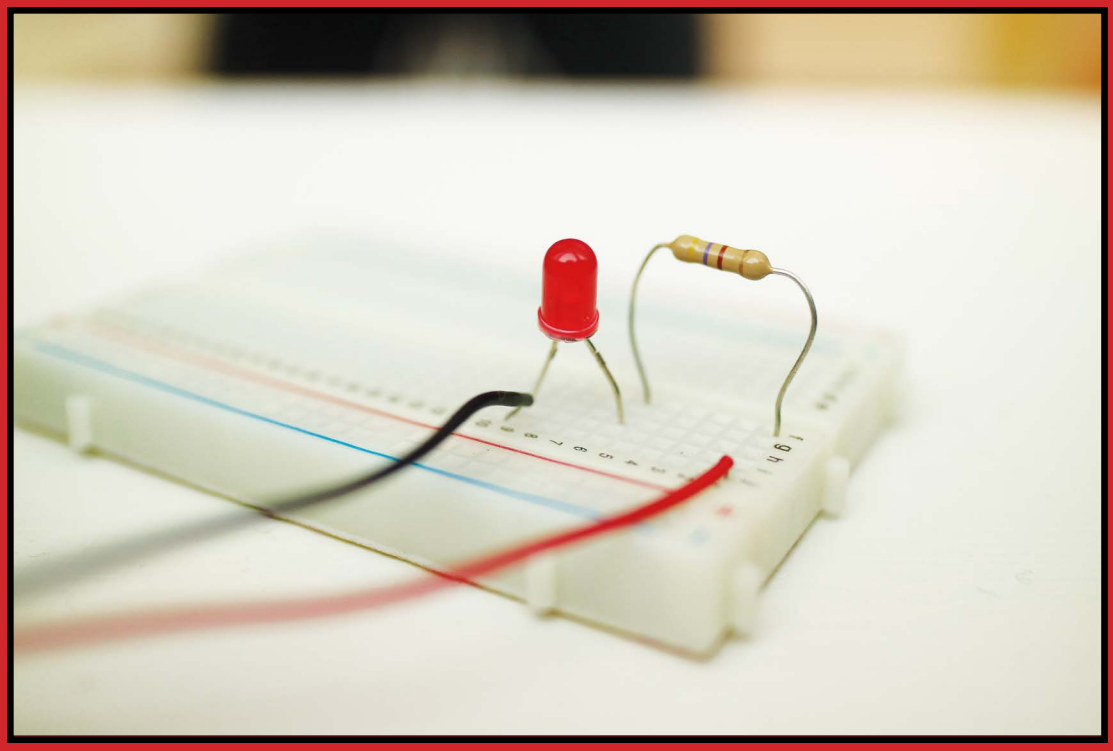
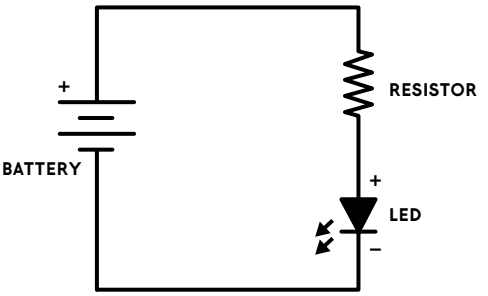
BUILD YOUR FIRST BREADBOARD CIRCUIT

THIS SIMPLE CIRCUIT TURNS ON A LIGHT-EMITTING DIODE (LED).



THE CIRCUIT DIAGRAM



THE PARTS LIST

PART	VALUE	DESCRIPTION
Battery	9 V	Standard 9 V battery
Battery clip		Component that connects the battery to the breadboard
Breadboard		Plastic board with around 400 holes
Resistor	470 Ω	Component that reduces the current through the LED
LED	Red	Standard-output light-emitting diode
Jumper wires		Two breadboard jumper wires in different colors

BUILDING THE CIRCUIT

To build this circuit, all you need is a battery, a resistor, and an LED. The resistor reduces the amount of current that flows through the LED. You'll always want a resistor in series with an LED, but it doesn't matter whether you place it before or after the LED. When you add a resistor in series with a circuit, you get less current in the whole circuit. If you don't use a resistor, you risk breaking the LED.

Connecting the Resistor

For this circuit, you'll need a resistor of 470 Ω, or ohms. If you look closely at a resistor, you'll notice it has several colored bands. These colors tell you the value of the resistor. To find a 470 Ω resistor, look for a resistor that has colored bands in this order: yellow, purple, brown, and gold or silver (see Figure 1).

FIGURE 1
A 470 Ω resistor

NOTE

In "Resistor Color Codes" on page 64, you'll find a table that explains the color coding of a resistor.

Connect one pin of the 470 Ω resistor to the top row of column F and attach the other pin to row 7 in the same column, as shown in Figure 2. It doesn't matter which pin you place where; the resistor can be connected either way around.

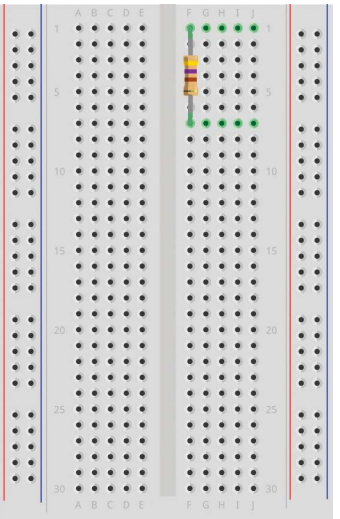


FIGURE 2
Connecting the resistor to the breadboard

Connecting the LED

Now you'll connect your LED to the breadboard. An LED has two sides, called *anode* and *cathode*. For the LED to work, you need to connect the anode to the positive side (+) of the battery and the cathode to the negative side (–). For simplicity's sake, let's call them the positive pin and the negative pin of the LED. I've marked them in Figure 3.

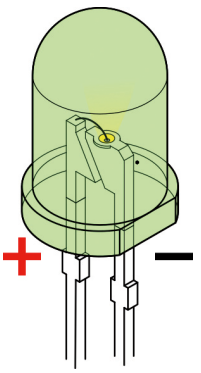


FIGURE 3
An LED with its positive and negative pins

There are two ways to tell which pin is which. Look closely at your LED. If one pin is longer than the other, that's the positive side. If both pins are the same length, look more closely at the round edge at the bottom of the plastic housing. One side of the housing should be flat, as in Figure 3; that's the negative pin. If you're still having a hard time distinguishing between the two pins, place the LED on a flat surface and roll it so you can find the flat side.

Connect your LED's positive pin to column H, row 7, and then connect the negative pin to column H, row 10. Check your connections against Figure 4.

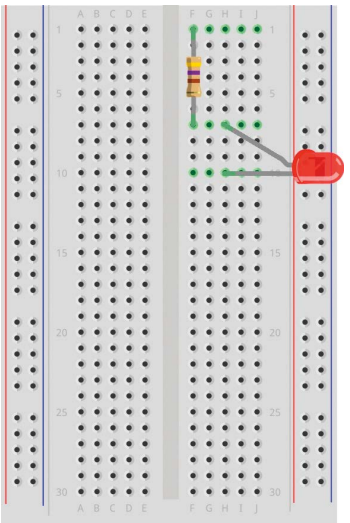


FIGURE 4
Connecting an LED in series with a resistor

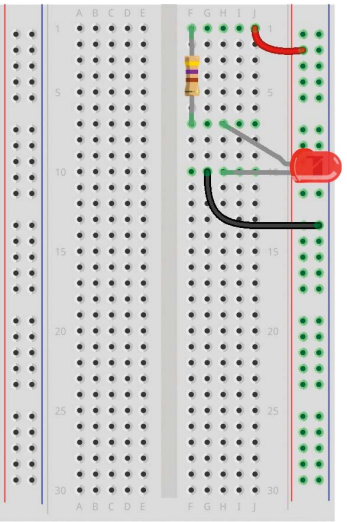
Now the positive pin of the LED is connected to the resistor—as shown in the circuit diagram—but the negative pin, like the upper pin of the resistor, isn't connected to anything.

Connecting to the Power Supply Columns

Next you need to connect wires from the power supply area on the right side of the breadboard to the appropriate rows in the right-hand component area.

If you look at the circuit diagram again, you can see that you need to connect the positive terminal of the battery to the top-most lead of the resistor—the lead in row 1. So use a jumper wire to connect row 1 to the positive column in the supply area. It's common to use the column with a red line next to it as the positive one (to match the red wire of the battery clip). Then connect the LED's negative pin—in row 10—to the negative column in the supply area. Use Figure 5 as a reference.

FIGURE 5
Connecting the component area to the supply area of a breadboard

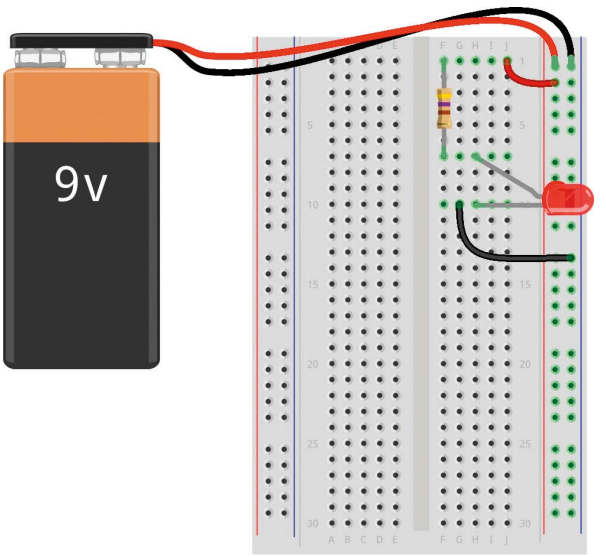


Connecting the Battery

You have your components in place, and you've properly connected the components to the supply area. Now you only need to connect the battery.

First, connect your battery clip to your battery, making sure the exposed metal of the red and black wires does not touch. Next, connect the red wire from your battery clip to the positive column of the right-hand supply area. Finally, connect the black wire from your battery clip to the negative column. Check your circuit against Figure 6.

FIGURE 6
Connecting a battery to a breadboard's supply area



The LED should now be lit up!

WHAT IF THE LED DOES NOT LIGHT UP?

If your LED isn't lighting up, go through each connection on the breadboard to make sure everything is exactly as described in the previous steps.

If you've connected everything correctly and it's still not working, you might have connected the LED the wrong way. Flip it around and try again.

If it's *still* not working, check the resistance value of your resistor using the table in "Resistor Color Codes" on page 64. Your resistor should be 470 Ω.

Still not working? Well, then your LED is likely dead, unfortunately. This can happen easily if you connect it directly to the battery—that is, without putting it in series with a resistor. Replace your LED and try again.

YOU'RE READY TO BUILD THE NINE CIRCUITS!

Now that you've built your first breadboard circuit, you're almost ready to move on to this book's nine circuit projects. First, though, I recommend that you play around a little with the circuit you built in this chapter. Try to really understand why those connections make the circuit work. Understanding this is crucial to building the rest of the circuits in this book. A good test is to see if you can build the circuit again in the *left-hand* component and power supply areas, just by looking at the circuit diagram.

For all the circuits in this book, you'll need a breadboard, a bunch of breadboard jumper wires, a battery, and a battery clip. But for simplicity's sake, you won't see these components in the parts list.

The circuits are sorted by difficulty, starting from the easiest. The challenge is to figure out how to connect each of the circuits on the breadboard. Some of the later circuits might be challenging if you don't have any previous experience with circuits, but the trick is to not give up.

You can find resources for all the circuits through the book's website at *https://nostarch.com/circuits/.*