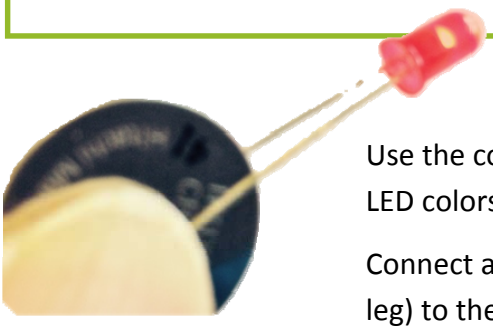
Exploring LEDs and Solar Power



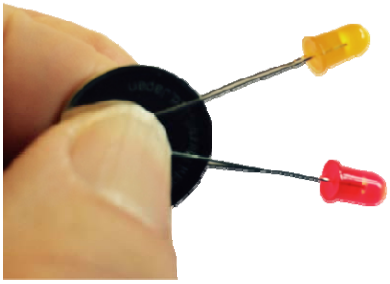
Use the coin cell battery to identify the various LED colors.

Connect an LED by touching the anode (longer leg) to the positive(+) side of the battery and the other leg (the cathode) to the back(-) side.

LEDs are diodes and diodes have polarity. That is, electrons can flow through a diode in only one direction, so if you touch the anode to the negative side of the battery and the cathode to the positive, nothing happens.

Flashing RGB LEDs have small integrated chips that cause the LED to blink red, green, and blue.

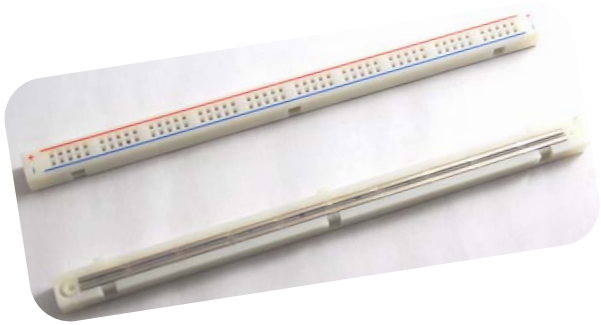
Investigate possible circuit combinations.



- How many red LEDs can light at once?
- How many blue LEDs?
- How many white LEDs?
- What happens when you mix colors?
- Which combinations of LEDs cause some bulbs not to light? Which LEDs stay on and which go out?
- What happens when the RGB LED is in a circuit with each of the other colors?

Use the prototyping breadboard with the coin battery to explore various LED colors and combinations.

Using a breadboard is an easy way to experiment with circuits. They come in many sizes. This breadboard has two parallel strips of conducting metal along the length of each side. Each strip has fifty connected holes, called tie points, but the two sides do not touch each other.



ABOUT LEDs

Light emitting diodes or LEDs create light when electrons are pushed through two different semiconductor materials. The two materials are layered together so that electrons can only flow in one direction. The moving electrons release photons that we see as colored light. The type of semiconductor material determines the color of the LED light. Some LED bulbs also have colored covers to make them easier to identify.

Materials in the Kit

1 coin battery (CR2032)
1 coin battery holder
1 two-strip 100 point-breadboard
2 M/M jumper wires
Paper clip
LEDs
- 3 red
- 3 green
- 3 yellow
- 3 blue
- 3 orange
- 3 pink
- 3 violet
- 3 white
- 2 Flashing RGB

1- small solar cell

Other supplies

Clear tape
Scissors

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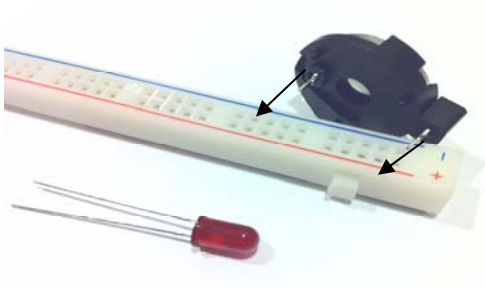
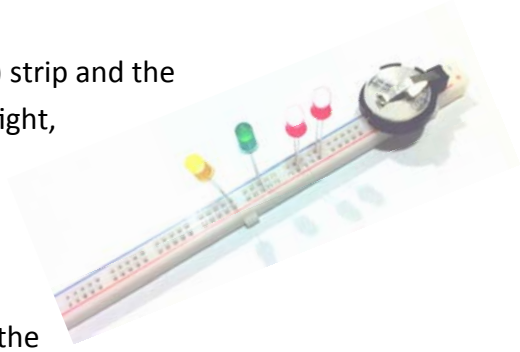
Put the coin battery in the battery holder so you can see the side with the writing and + symbol.

Connect the battery to the breadboard by connecting the prong near the tab on the battery to the red strip (positive) and the other to the blue strip (negative or ground).



Connect an LED by pushing the anode (longer leg) into a tie on the red (+) strip and the other leg (the cathode) into the blue (-) strip. If all your connections are tight, you should see the LED light.



- How many LEDs can you power at one time? How many of each color?
- What happens when you mix colors? Which colors can be wired into the same circuit? Does the order matter?
- Which combinations of LEDs cause some bulbs not to light? Which LEDs stay on and which go out?
- What happens when the RGB LED is in a circuit with each of the other colors?

What causes the power in your neighborhood to go out? Sometimes or a squirrel creates a short circuit or a tree creates an easy route to the ground and causes a short circuit to the power system. Create a short circuit on your breadboard. Make one bulb light and then add a shorting wire by pushing one end of a paper clip or a small wire into the + strip and the other end in the - strip.

Why does the light go off? Where is the current going? Why is it called a short circuit?

Make several bulbs light and then add a shorting wire. Do all of the bulbs do the same thing?

Does it matter if the shorting wire is before the bulbs, between bulbs, or after the bulbs?

Make several bulbs light and then push one end of the wire into a tie on the red strip, touch the other end to the cathode of a bulb. Does it matter which bulb you touch or where the wire is placed?

Whenever one path in a circuit has less resistance, a short circuit occurs, and the current flows through that path only. So if a squirrel touches two places in a circuit, the poor critter becomes the short path.

How can this explain how LEDs of one color cause others to not light?

MORE ABOUT LEDS

LEDs don't create heat like other lights so they are more efficient light sources and they last longer than traditional light bulbs. LED lighting is becoming more common. They are used to light supermarket freezer sections, streetlights and traffic lights, automobile taillights, and have been installed to light the giant signs in Time Square in New York City. Where do you see LEDs?

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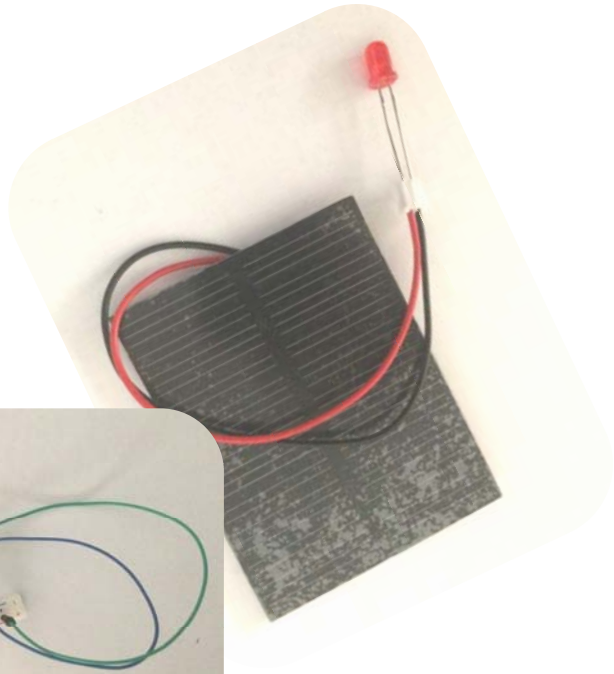
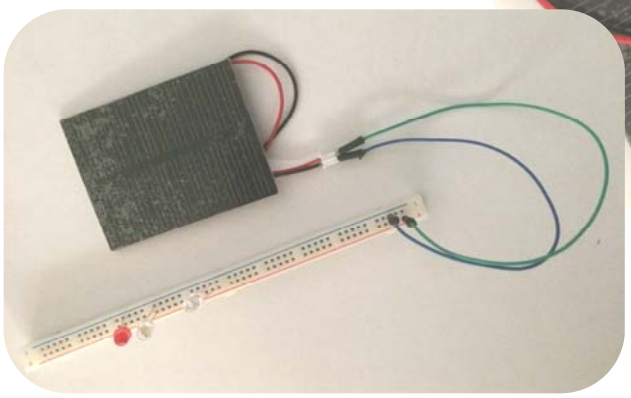
Use solar power to light an LED. Push the legs of an LED into the connector on the solar panel. Think about polarity and connect the longer leg (anode) to the red lead. Place the solar panel in the sunlight or under a lamp with a 100 W incandescent bulb. Sunlight is the best light source for your solar panel, and fluorescent light probably won't work.



- What color LED did you use? Try other colors.
- Which LED colors light with less power from the solar



Use the solar panel with the breadboard. Push one end of each the jumper wires into the connector on the solar panel. Push the other ends of the jumper wires into the breadboard. Remember to connect the red lead of the solar panel to the red rail on the breadboard.

- Put several LEDs into the breadboard. The lights will appear brighter when you look down at the tops.
- How many can you light?
- Try various color combinations.
- Do all three violet LEDs light at one time? Do they work with the pink?
- Cover half of the solar panel. What happens to the lights? Try shading different amounts of the panel.
- How do various light sources affect the performance of the solar panel? Try direct sunlight, light from a window, incandescent light bulbs, fluorescent lighting.
- What happens when you change the angle of the light source?
- Based on your observations, what can you say about the amount of power needed by a solar calculator?

Photovoltaic (PV) cells, or solar cells produce electricity directly from light. PV powered calculators have been common for many years, and PV cells have become especially useful for providing electricity in places that are not near conventional sources. Where do you see solar cells?

LEDs focus their light in one direction so they appear brighter when viewed from a particular direction.

LEDs come in many sizes, shapes, and colors. Some colors need more power than others. The wavelength of emitted light determines the LED color. Shorter wavelengths, that is colors at the lower end of the spectrum, require lower voltages.

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