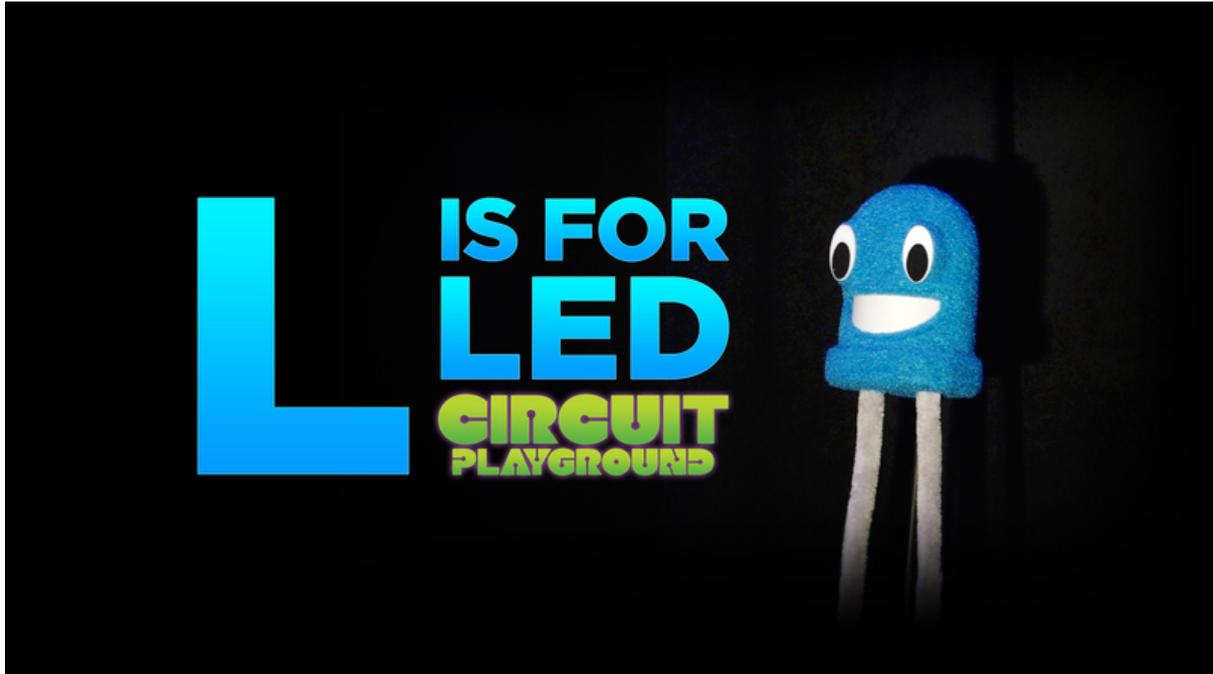




# Circuit Playground: L is for LED

Created by Collin Cunningham



<https://learn.adafruit.com/circuit-playground-l-is-for-led>

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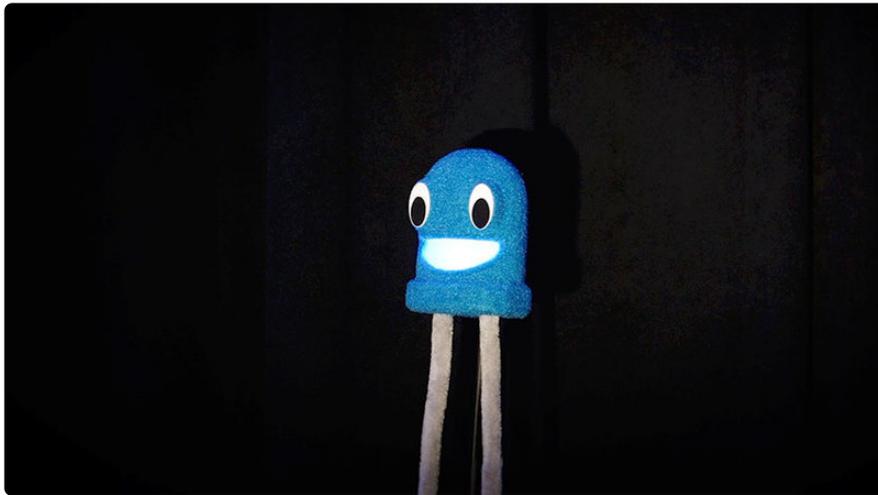
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# Video

Billie's got the blues and Adabot has lots of questions. Learn about how an LED works with Adabot and the Circuit Playground components!

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## Transcript



**BILLIE:** I gotta right to sing the blues, I gotta right to moan inside ...

I gotta right to sit and cry, down by the river ...



**ADABOT:** Whoa! What's that music?

**RUBY:** That's just Billie!

**ADABOT:** Really? - she sounds kind of sad ...

**GUS:** Yeah, don't go nuts. Billie's just got the blues again.

**ADABOT:** Ohhhh ...



**ADABOT:** Hey Billie, Why so blue?

**BILLIE:** I suppose that's just the way I am.

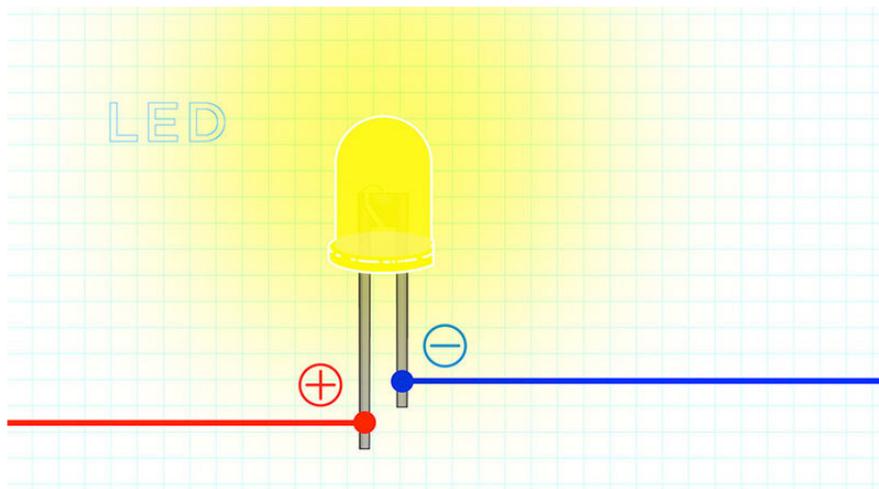
**ADABOT:** So, you've always been blue?

**GUS:** Yeah, well - she's made with **Gallium Nitride**.

**ADABOT:** Gallium what? What are you talking about?

**RUBY:** Well, Adabot - inside every **LED** is a small **crystal** ...

**ADABOT:** Oh, really ...



**RUBY:** When you connect the short leg of an LED to **ground**, and the longer leg to **positive voltage** - voila!

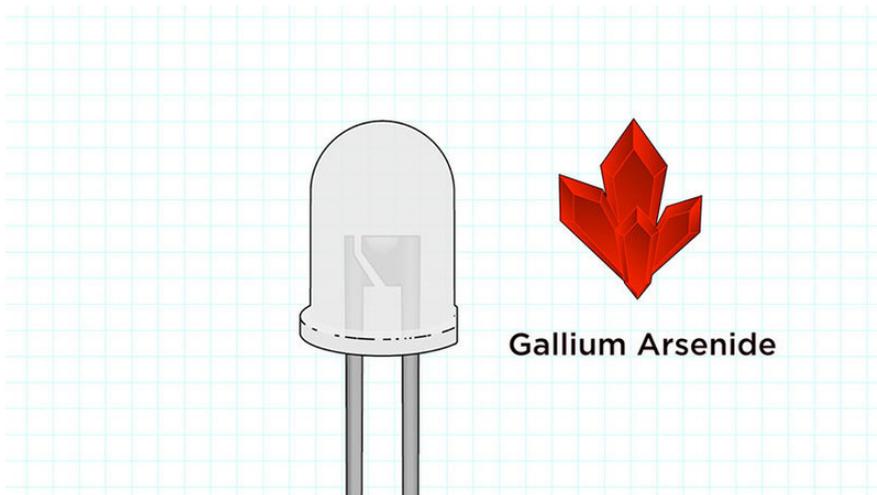
**GUS:** The crystal glows and the LED lights up!



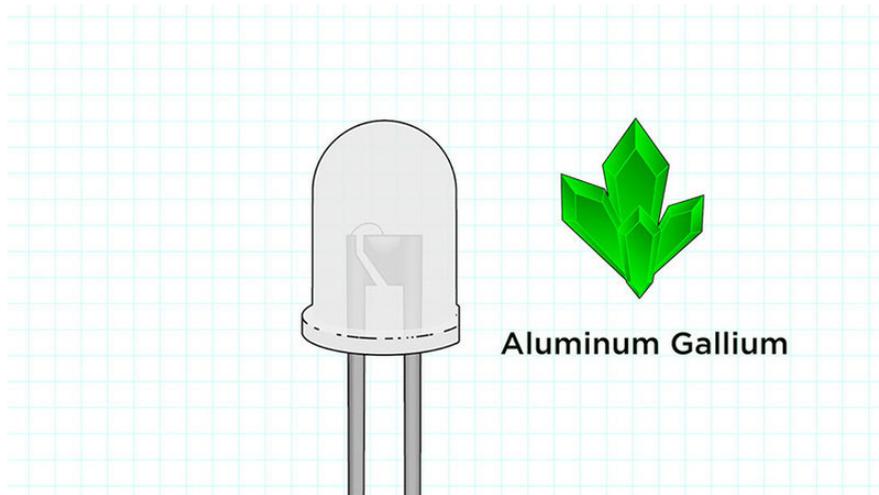
**ADABOT:** Very cool - so when **electricity** flows **through** an LED's crystal, it creates light! But why are LEDs certain colors in the first place?

**RUBY:** The type of crystal used in an LED determines that LED's color.

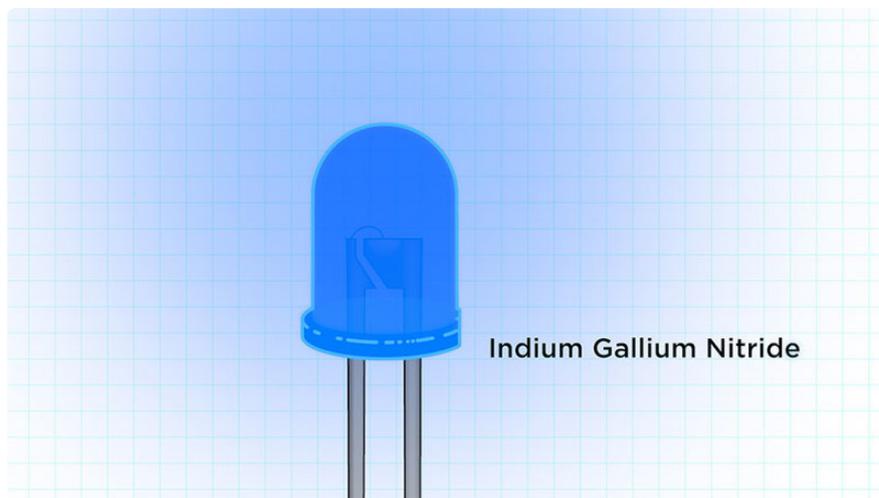
**ADABOT:** Oh - interesting!



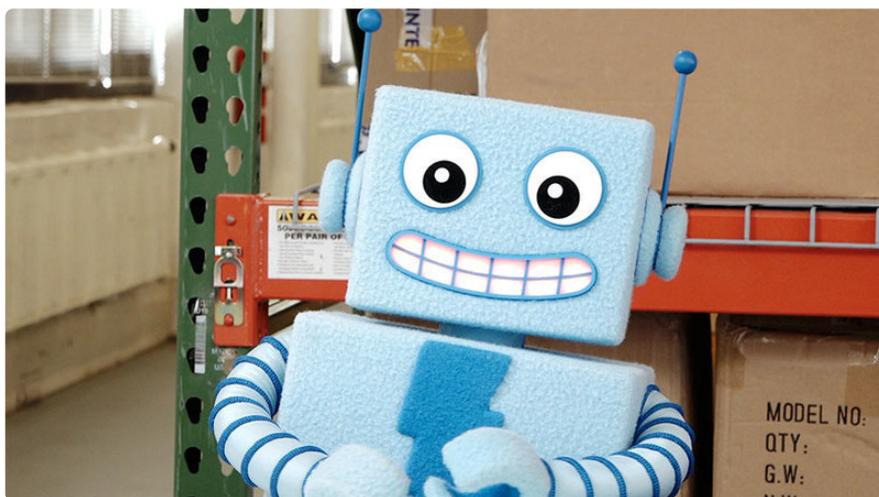
**RUBY:** A red LED like me uses a type of crystal made of **Gallium Arsenide** - that's two elements, **Gallium** and **Arsenic**, mixed together.



**GUS:** I use an **Aluminium Gallium** crystal to get so green.



**BILLIE:** and **Indium Gallium Nitride** is what makes me so blue.

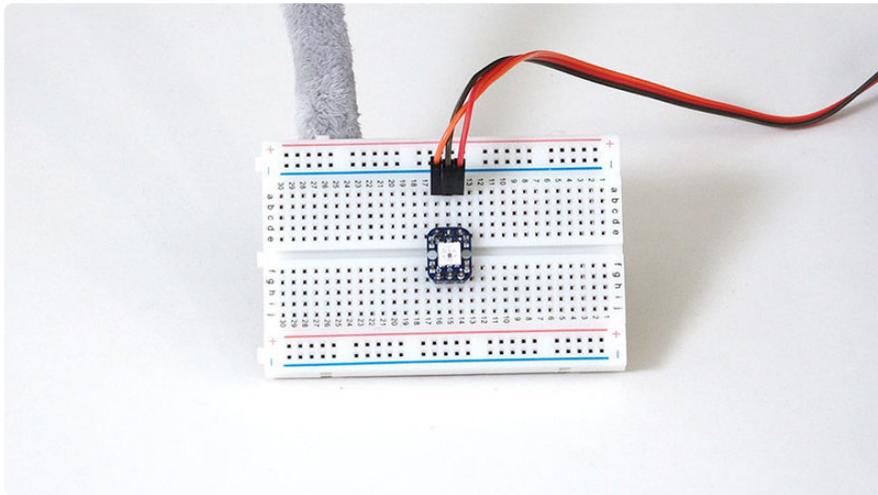


**ADABOT:** Oh - so different crystals make different colored light!

**RUBY:** Yeah!

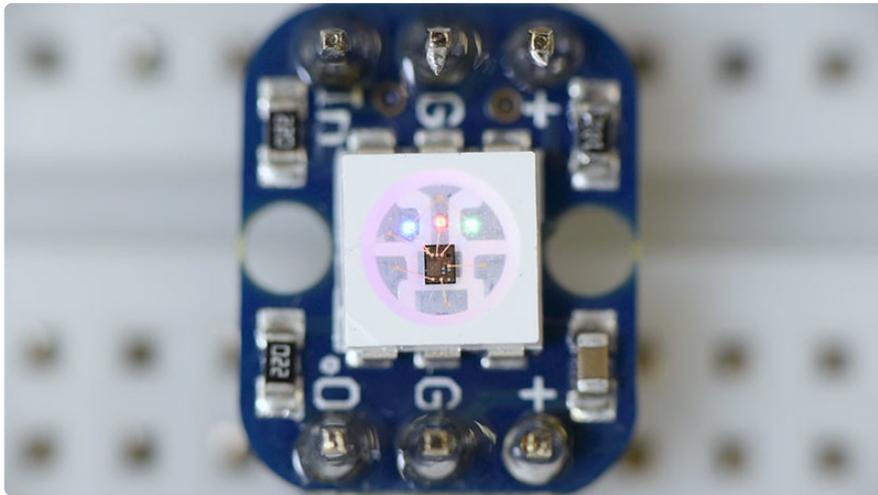
**ADABOT:** But I've also seen LEDs that change color? How do they do that?

**RUBY:** Well, we usually call those color-changing LEDs – **RGB** LEDs.



**BILLIE:** Hey - I've got an RGB LED here.

**RUBY:** Oh good - Let's take a closer look to see how they work ...

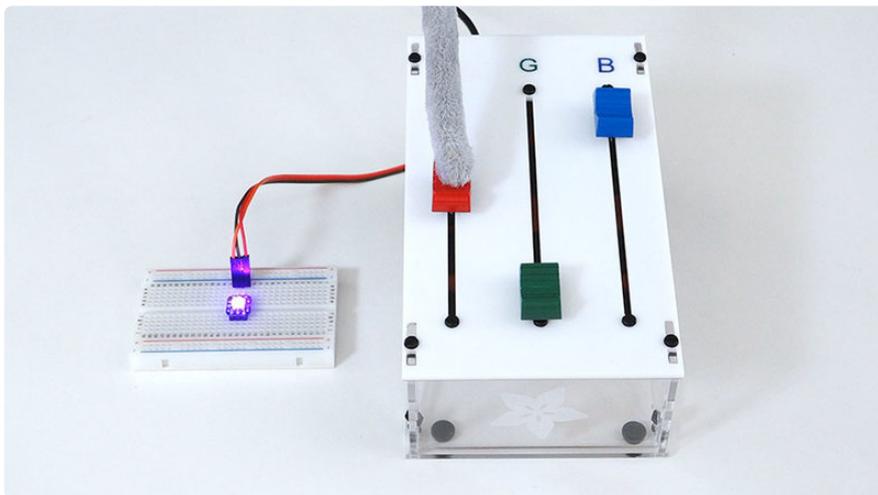


**RUBY:** We call them **RGB** because inside every one of them are three different types of crystals - one that makes **red** light, one that makes **green** light, and one that makes **blue**.

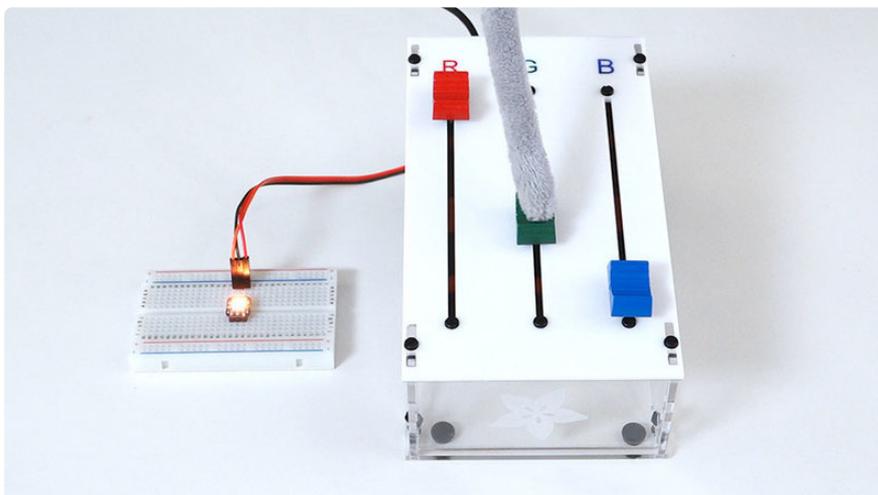


**ADABOT:** ohh, R - G - B – red, green, blue!

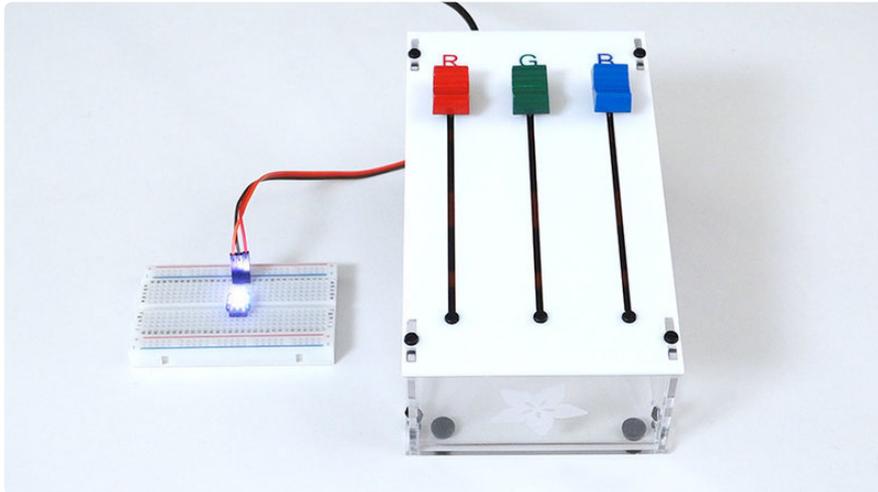
**RUBY:** Exactly - and by mixing red green and blue - we can make pretty much any color we want!



**GUS:** like, say - purple ...



**BILLIE:** or orange ...



**RUBY:** Or even white!



**ADABOT:** Wow - thanks, guys! LEDs make a lot more sense now!

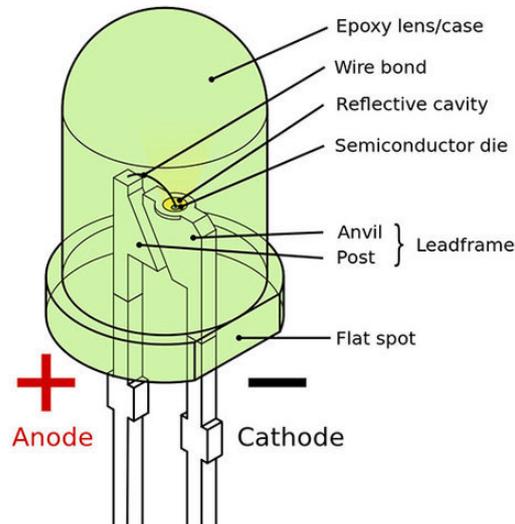
**RUBY:** You're very welcome, Adabot. LEDs are in so many **electronic devices**, **screens**, **billboards**, – even **light bulbs** ...

**BILLIE:** It's really important to understand how they work!

**ADABOT:** You know, Billie - you may be blue, but you light up my life.

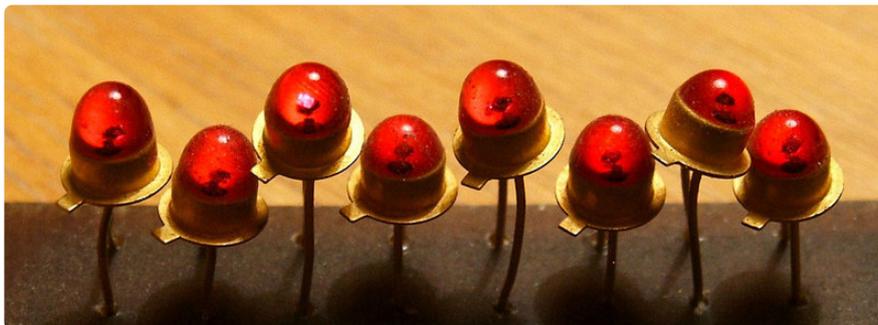
**GUS, RUBY, BILLIE:** Awwwwwww ...

# Learn More



From [Wikipedia \(https://adafru.it/wFI\)](https://adafru.it/wFI)

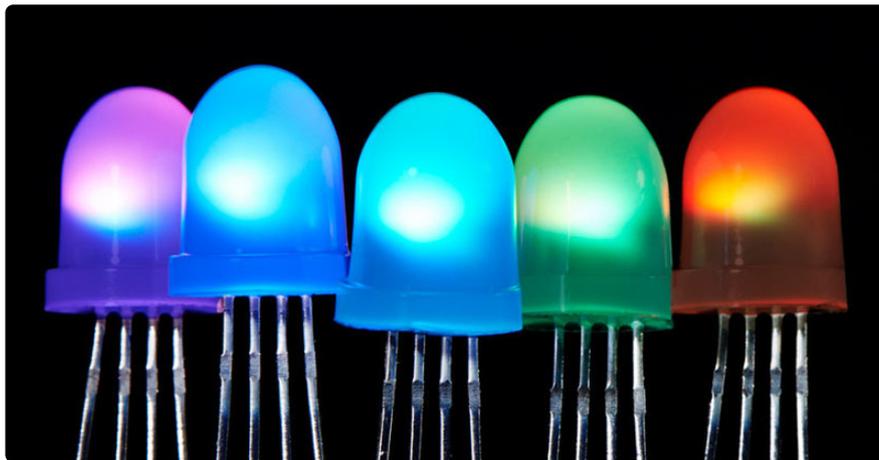
A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–n junction diode that emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. LEDs are typically small (less than 1 mm) and integrated optical components may be used to shape the radiation pattern.



Appearing as practical electronic components in 1962, the earliest LEDs emitted low-intensity infrared light. Infrared LEDs are still frequently used as transmitting elements in remote-control circuits, such as those in remote controls for a wide variety of consumer electronics. The first visible-light LEDs were also of low intensity and limited to red. Modern LEDs are

available across the visible, ultraviolet, and infrared wavelengths, with very high brightness.

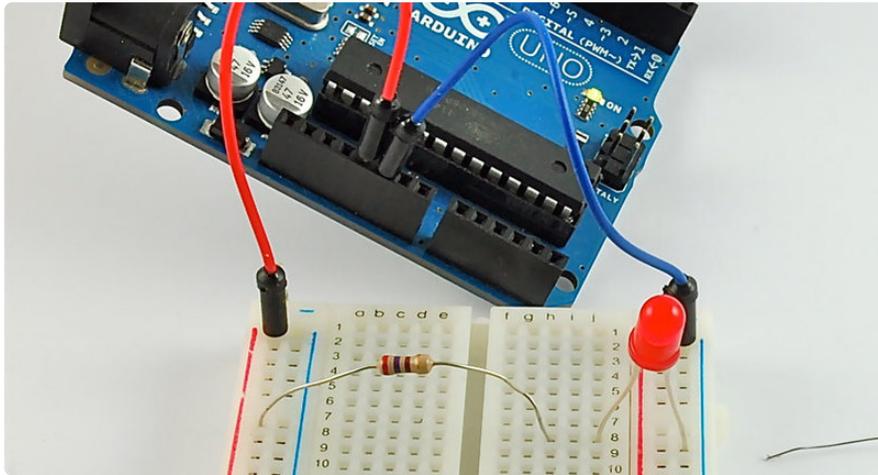
Early LEDs were often used as indicator lamps for electronic devices, replacing small incandescent bulbs. They were soon packaged into numeric readouts in the form of seven-segment displays and were commonly seen in digital clocks. Recent developments have produced LEDs suitable for environmental and task lighting. LEDs have led to new displays and sensors, while their high switching rates are useful in advanced communications technology.



LEDs have many advantages over incandescent light sources, including lower energy consumption, longer lifetime, improved physical robustness, smaller size, and faster switching. Light-emitting diodes are used in applications as diverse as aviation lighting, automotive headlamps, advertising, general lighting, traffic signals, camera flashes, and lighted wallpaper. As of 2017, LED lights home room lighting are as cheap or cheaper than compact fluorescent lamp sources of comparable output. They are also significantly more energy efficient and, arguably, have fewer environmental concerns linked to their disposal.

[Read more \(https://adafru.it/wFI\)](https://adafru.it/wFI)

# Use Arduino to control an LED



Check out the [Arduino Lesson 2. LEDs guide](https://adafru.it/wFJ) (<https://adafru.it/wFJ>) to learn how to use an LED, breadboard, and microcontroller to flash an LED.

## All About LEDs



Learn everything you ever wanted to know about LEDs from anode to cathode with our thorough [All About LEDs guide](https://adafru.it/uuC) (<https://adafru.it/uuC>)!

## ... and more

- [MAKE Presents: The LED](https://adafru.it/wFK) (<https://adafru.it/wFK>)
- [LED Resistor Calculator](https://adafru.it/Biu) (<https://adafru.it/Biu>)
- [Oct. 9, 1962: First Visible LED Is Demonstrated](https://adafru.it/wFM) (<https://adafru.it/wFM>)

- [50 Years of LED Technology \(https://adafru.it/wFN\)](https://adafru.it/wFN)