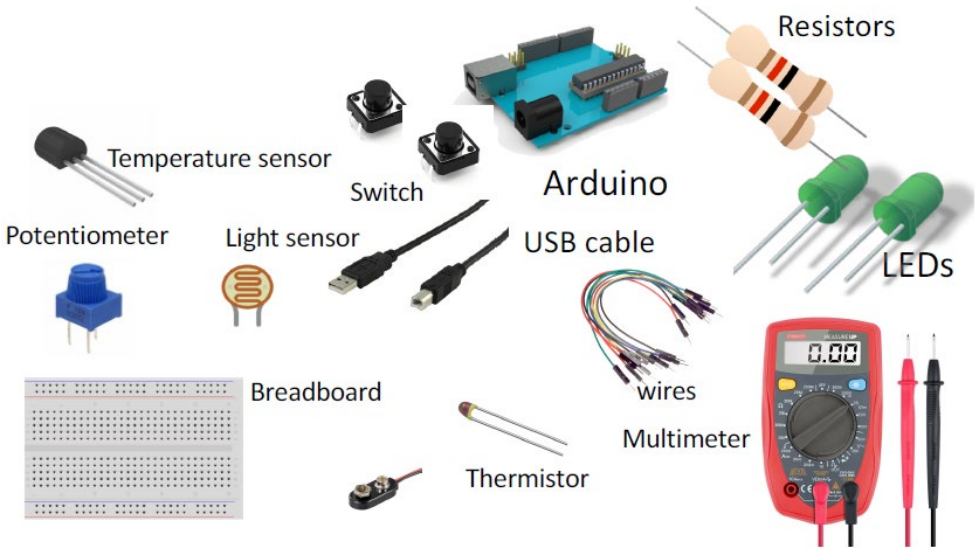
Smart Farm
Basic Electronic

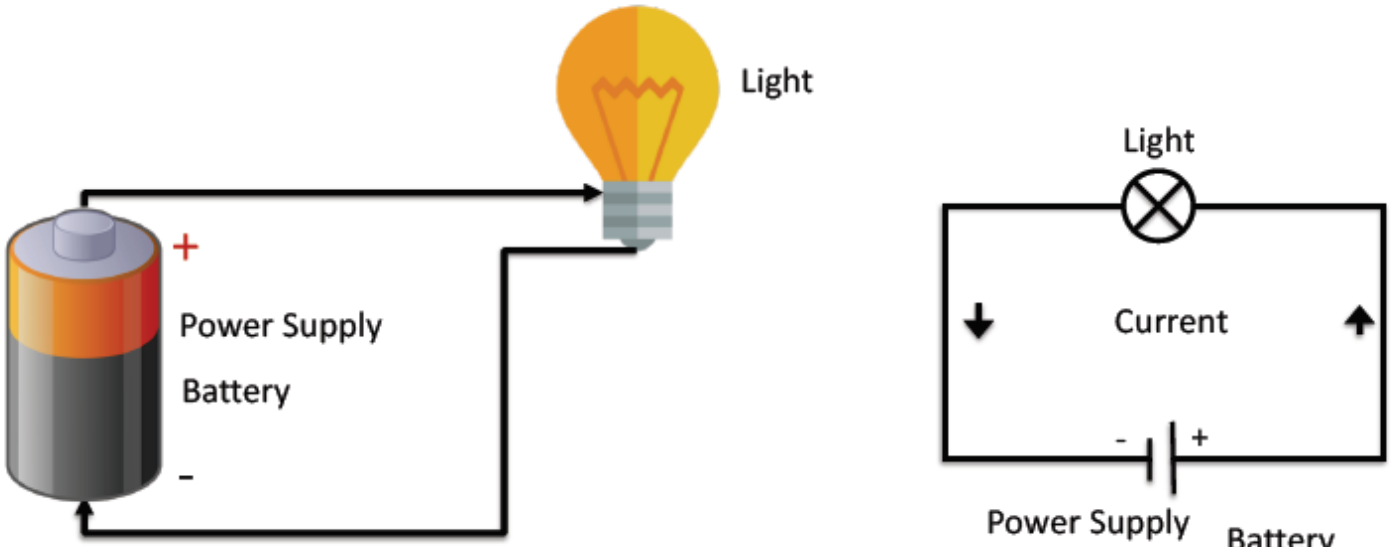
Dr. Jirapipat Thanyaphongphat


Resistors
Temperature sensor
Switch
Arduino
Potentiometer
Light sensor
USB cable
LEDs
wires
Breadboard
Multimeter
Thermistor

EQUIPMENT

Electrical Circuit

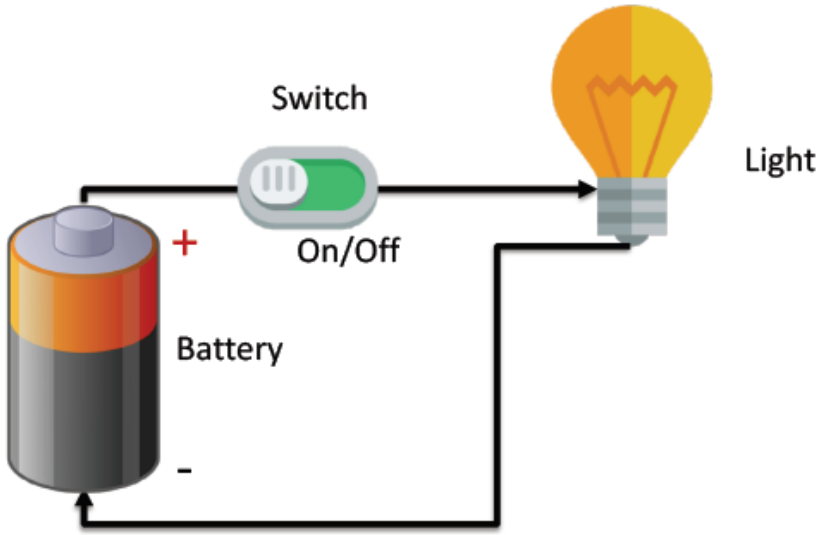
Here you see a basic Electrical Circuit:

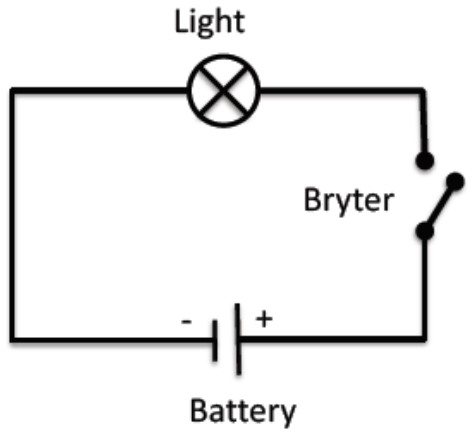


ELECTRONICS FOUNDATION

Electrical Circuit with a Switch

Here you see a basic Electrical Circuit with a Switch:



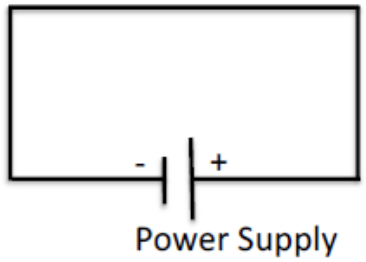


ELECTRONICS FOUNDATION

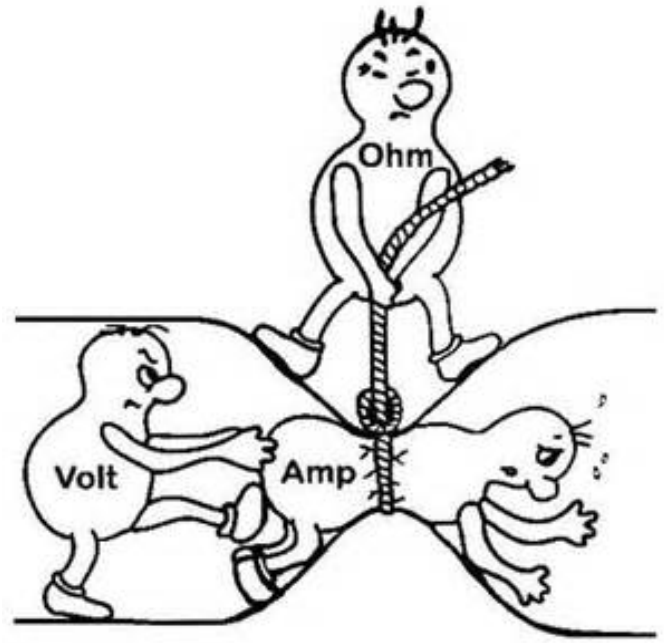
Short Circuit

- We must never connect positive and negative side to a power source without having an electrical component in between.
- If you do, it is called a short circuit.
- For example, if you short circuit a battery, the battery will get very hot and the battery will run out very quickly.
- Some batteries may also start to burn.
- When it starts to smoke from electrical components, it happens because it has become too hot.
- In most cases, it means that the component is broken.

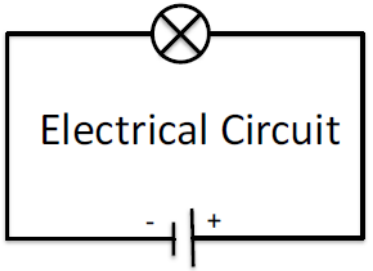
Short Circuit!!



ELECTRONICS FOUNDATION



Ohms Law



This is Ohms Law:

$$U = RI$$

U – Voltage [V]
R – Resistance [Ω]
I – Current [A]

$$R = \frac{U}{I} \qquad I = \frac{U}{R}$$

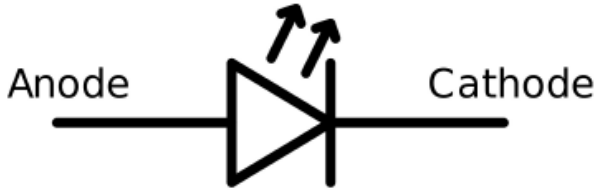
ELECTRONICS FOUNDATION

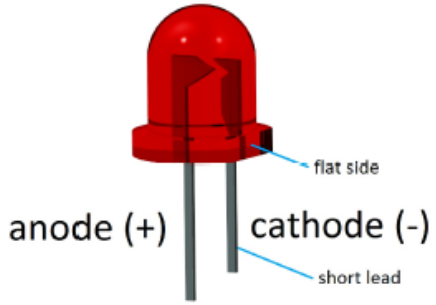
Multimeter

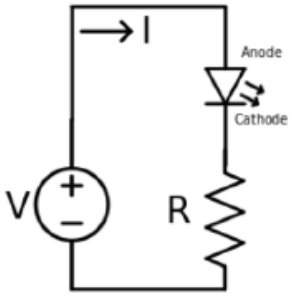
You can use a Multimeter to measure current, voltage, resistance, etc. in an electric circuit.

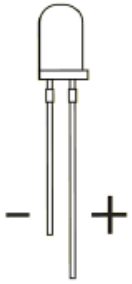
ELECTRONICS FOUNDATION

Light-Emitting Diode - LED









ELECTRONICS FOUNDATION

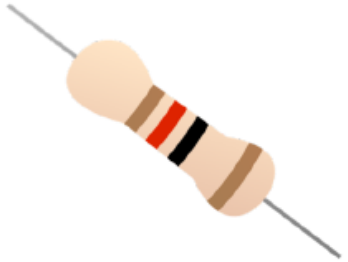
Resistors

Resistance is measured in Ohm (Ω)

Resistors comes in many sizes, e.g., 220Ω , 270Ω, 330Ω, 1kΩm 10kΩ, ...

The resistance can be found using Ohms Law

$U = RI$

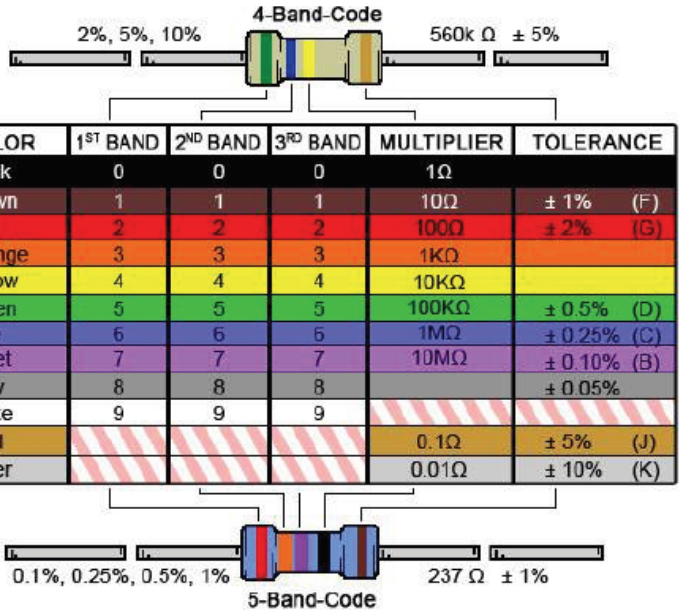


https://en.wikipedia.org/wiki/Resistor

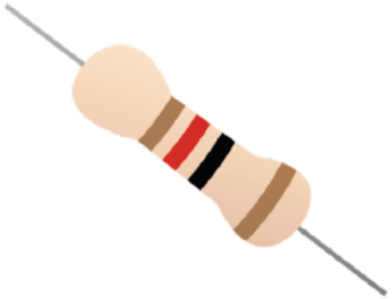
Electrical symbol:

ELECTRONICS FOUNDATION

Resistor Color Codes



COLOR	1ST BAND	2ND BAND	3RD BAND	MULTIPLIER	TOLERANCE
Black	0	0	0	1Ω	
Brown	1	1	1	10Ω	± 1% (F)
Red	2	2	2	100Ω	± 2% (G)
Orange	3	3	3	1KΩ	
Yellow	4	4	4	10KΩ	
Green	5	5	5	100KΩ	± 0.5% (D)
Blue	6	6	6	1MΩ	± 0.25% (C)
Violet	7	7	7	10MΩ	± 0.10% (B)
Grey	8	8	8		± 0.05%
White	9	9	9		
Gold				0.1Ω	± 5% (J)
Silver				0.01Ω	± 10% (K)



ELECTRONICS FOUNDATION

Resistor Color Codes

TRY IT OUT!

What is the values for your resistors?

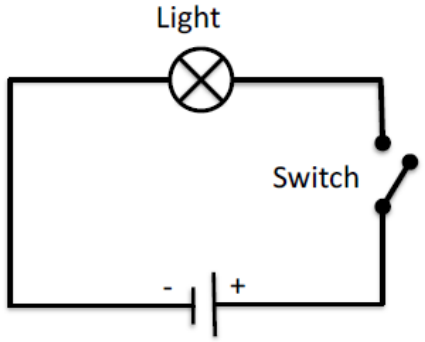
Use a «Resistor Color Code Calculator», which you can find on Internet

ELECTRONICS FOUNDATION

Switch

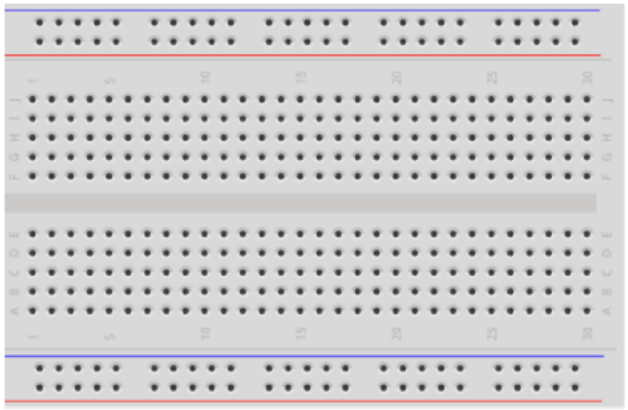
A switch breaks the flow of current through a circuit when open. When closed, the current will flow unobstructed through the circuit.

A switch comes in many flavors

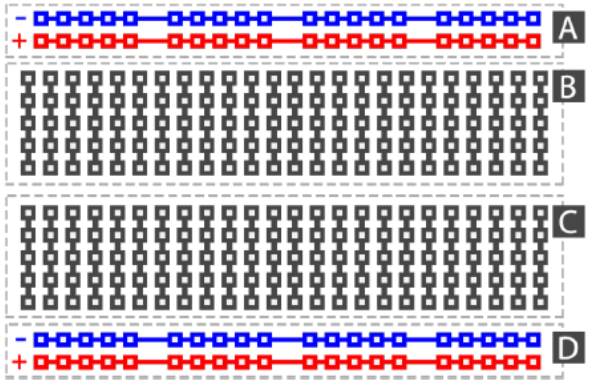


ELECTRONICS FOUNDATION

Breadboard



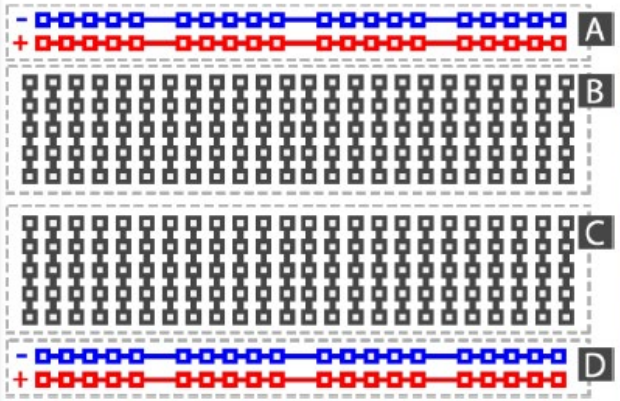
A breadboard is used to wire electric components together

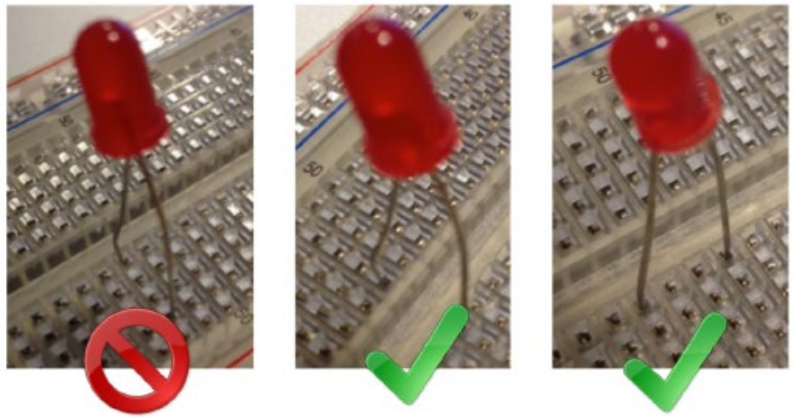


ELECTRONICS FOUNDATION

Breadboard – Correct Wiring

Make sure not to short-circuit the components that you wire on the breadboard





ELECTRONICS FOUNDATION

PLAY AND EXPLORE

WWW.TINKERCAD.COM

- Use the simulator to test your circuit design at any time.
- If you want to simulate other pre-made designs, check out the Starter Circuits, which you can find by clicking the "+ Components" button and then selecting the "Starters" tab.

PLAY AND EXPLORE

WWW.TINKERCAD.COM

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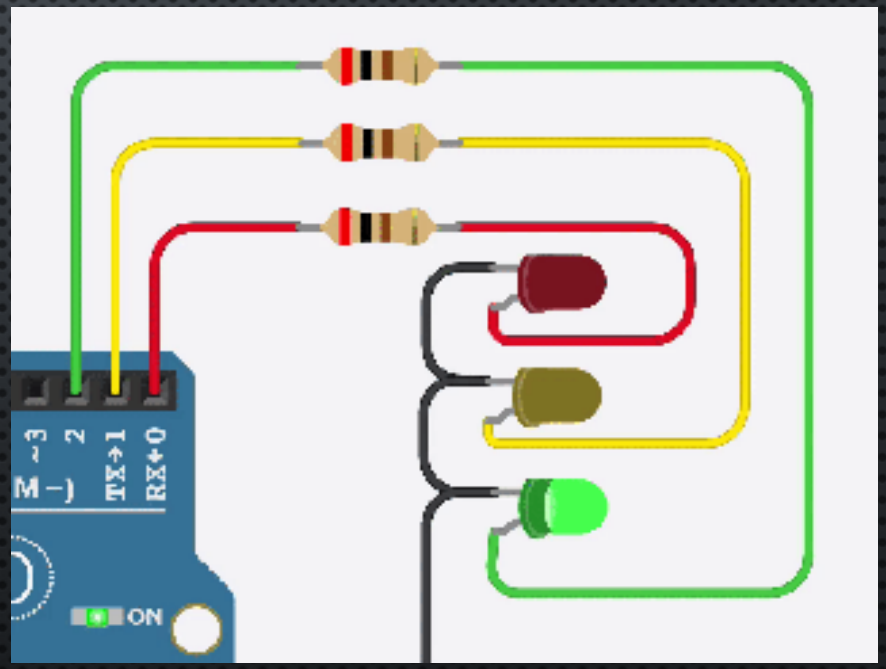
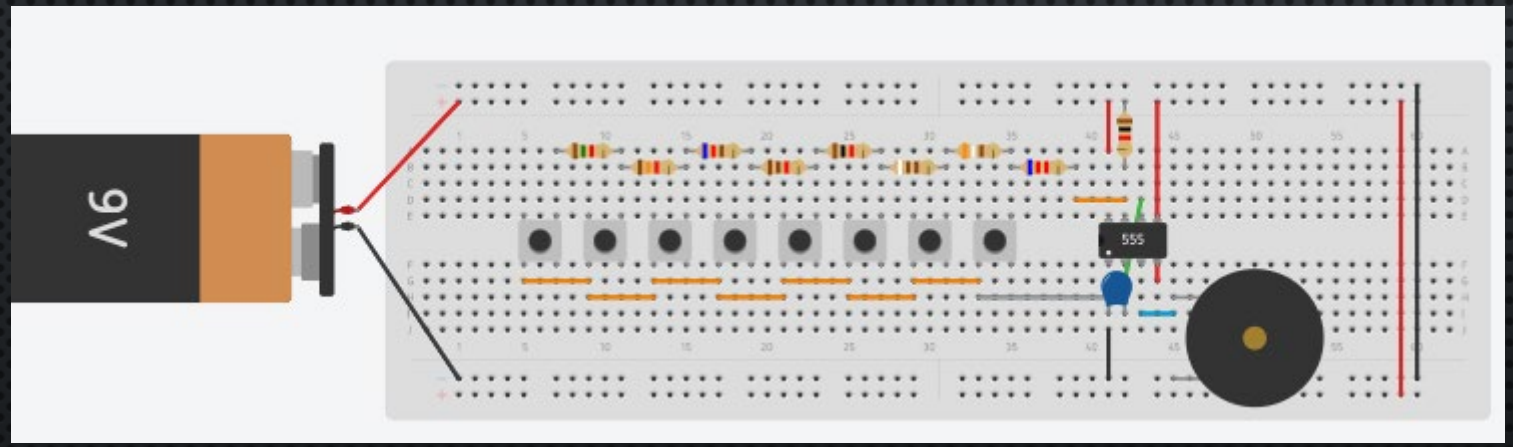
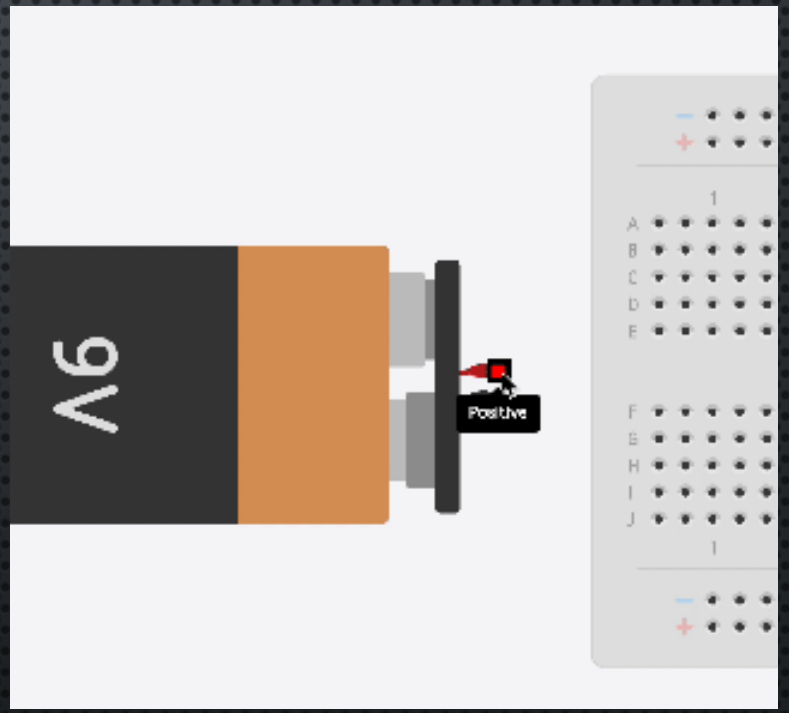


PLAY AND EXPLORE

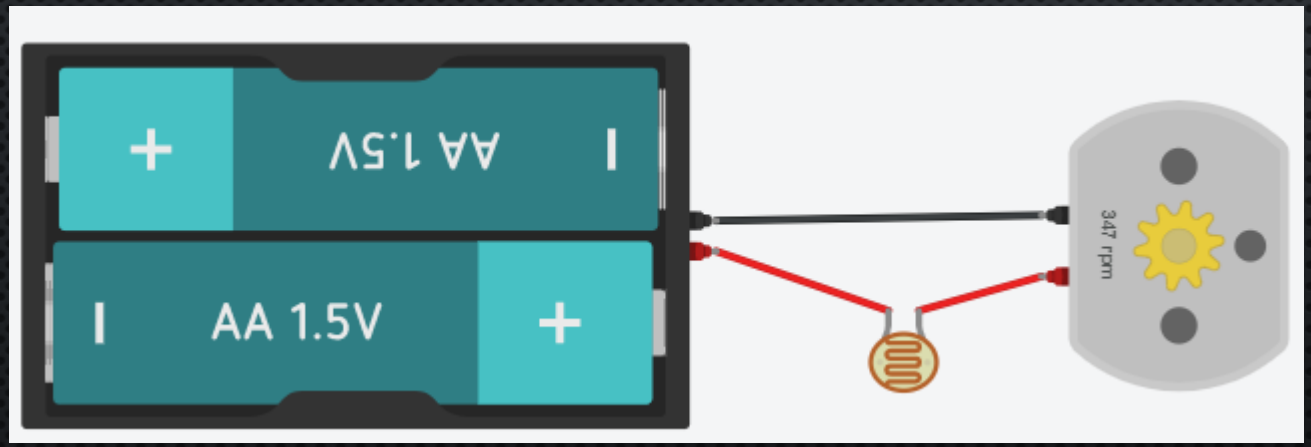
- Wire the Positive and Negative Side of the Battery

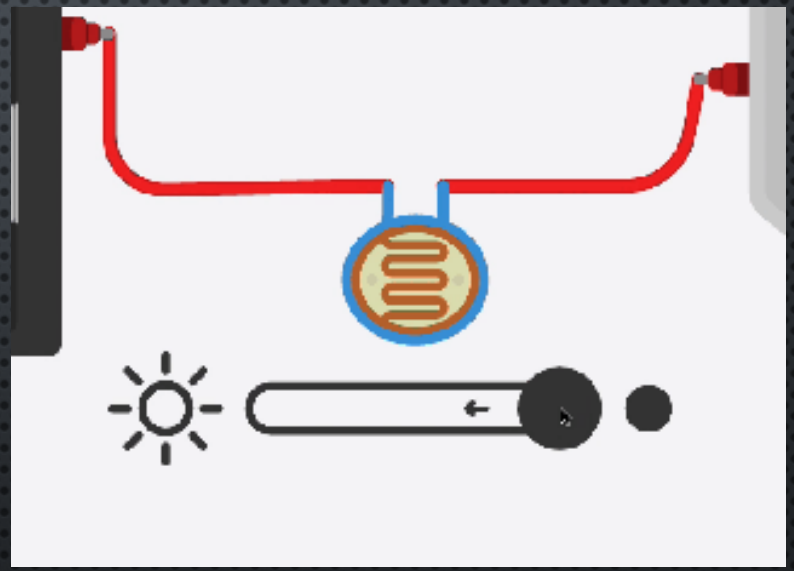




PLAY AND EXPLORE

- How to add components to make an interactive motor controller.
- Add a Photoresistor

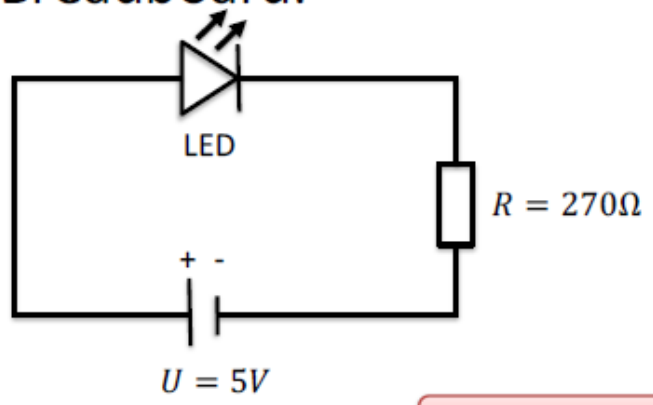




Electrical Cuircuit

TRY IT OUT!

Make the following circuit using the Arduino board and a Breadboard:



Equipment:
- Breadboard
- LED
- Resistor
- Wires
- Multi-meter

Note! No Arduino Program is needed in this example

Example 1

FIND THE RESISTOR SIZE

Why do you need a Resistor?

If the current becomes to large, the LED will be destroyed. To prevent this to happen, we will use a Resistor to limit the amount of current in the cuircuit.

What should be the size of the Resistor?

A LED typically need a current like 20mA (can be found in the LED Datasheet).
We use Ohm's Law:

$$U = RI$$

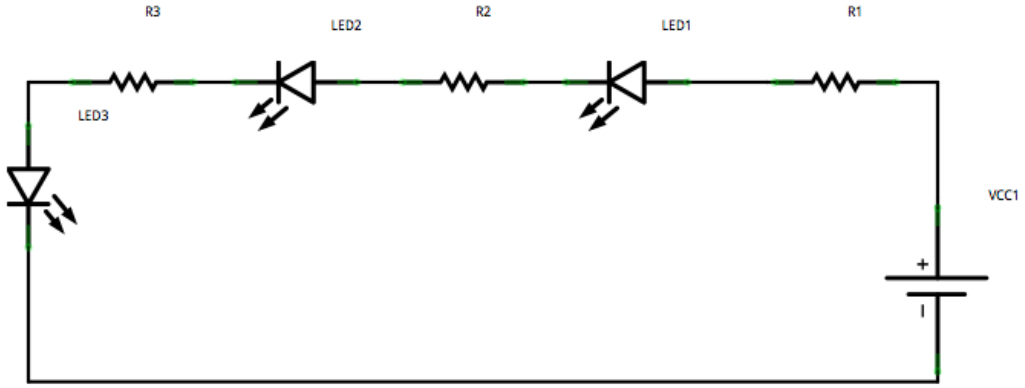
Arduino gives U=5V and I=20mA. We then get:

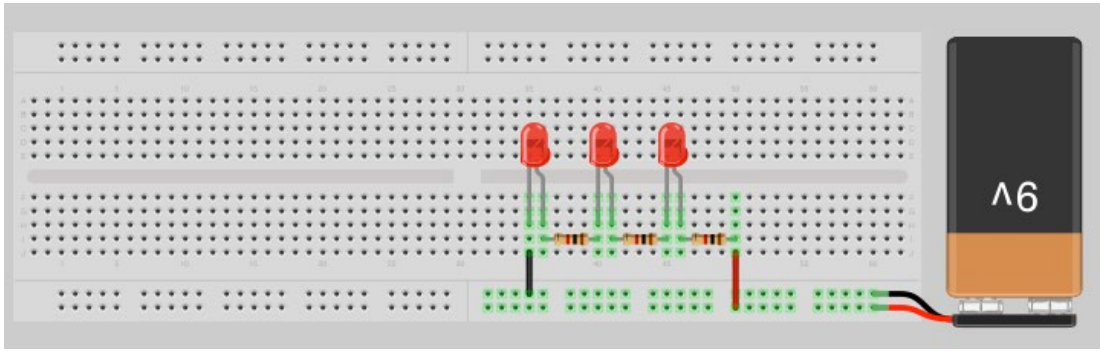
$$R = \frac{U}{I}$$

The Resistor needed will be $R = \frac{5V}{0.02A} = 250\Omega$. Resistors with R=250Ω is not so common, so we can use the closest Resistors we have, e.g., 270Ω

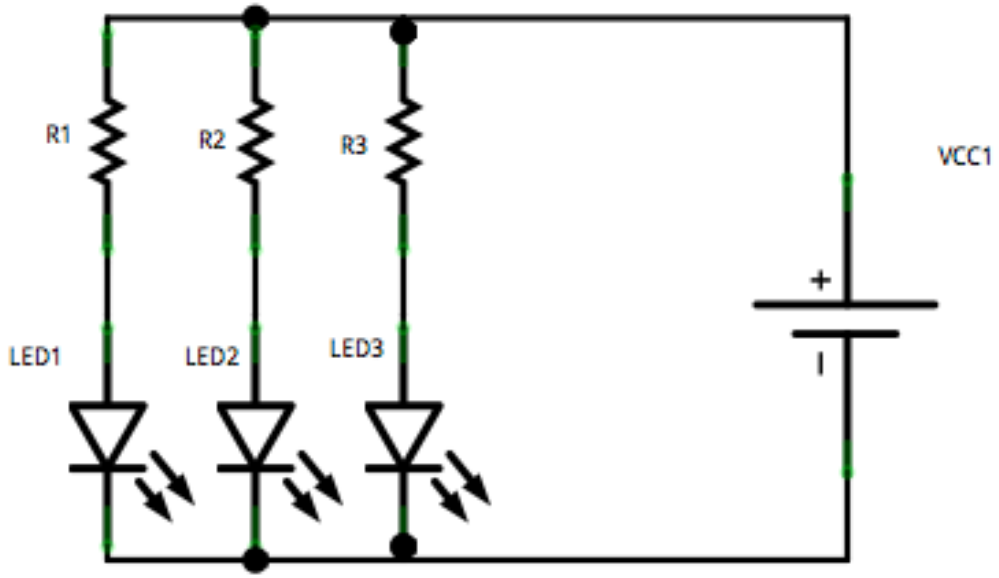
Example 1

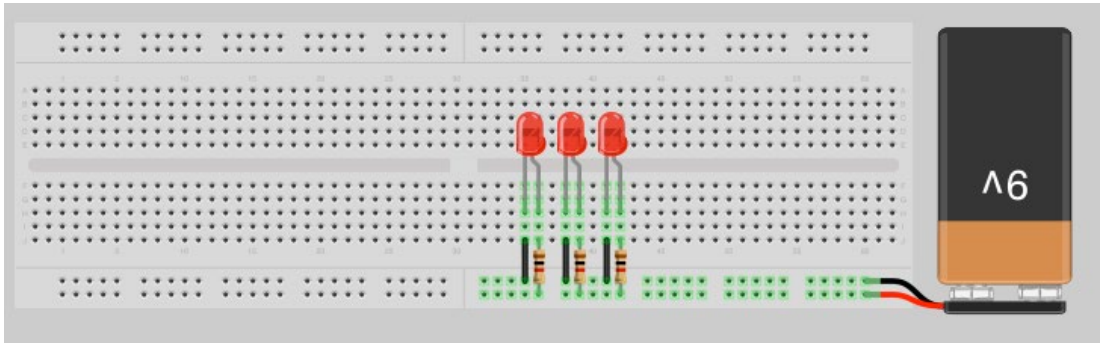
FIND THE RESISTOR SIZE



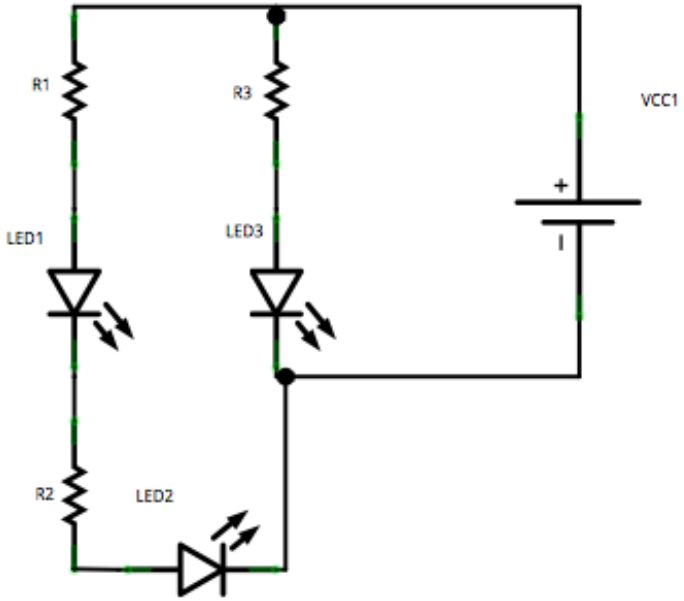


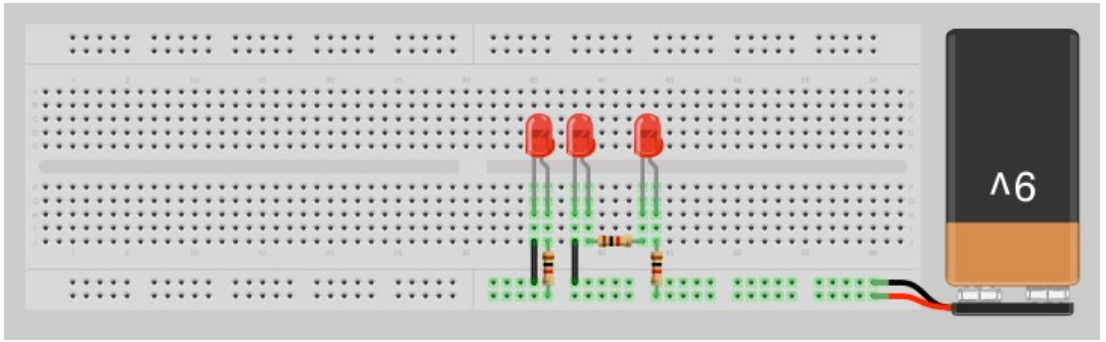
SERIES CIRCUIT EXAMPLE





PARALLEL CIRCUIT EXAMPLE





PARALLEL AND SERIES CIRCUIT EXAMPLE

ESP32 CPU

Arduino	ESP8266	ESP32
AVR ATMega328P	Tensilica Xtensa LX106	Tensilica Xtensa LX6
8 bit	32 bit	32 bit
1 core	1 core	2 core *
20 MHz	80/160 MHz	160/240 MHz
2 KB RAM	160 KB RAM	520 KB RAM
32 KB Flash	1 - 4 MB Flash	4 - 16 MB Flash

ARDUINO-ESP8266-ESP32

Q & A