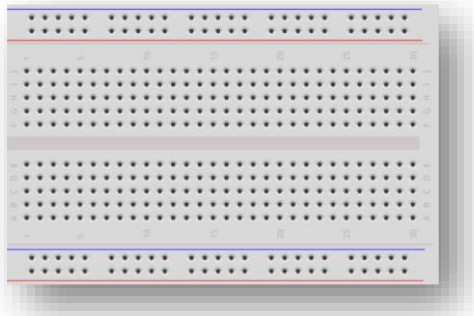
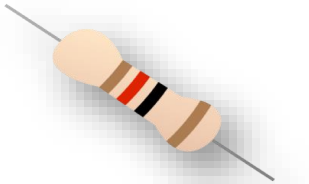
COMPONENTS OF ROBOTS (1)

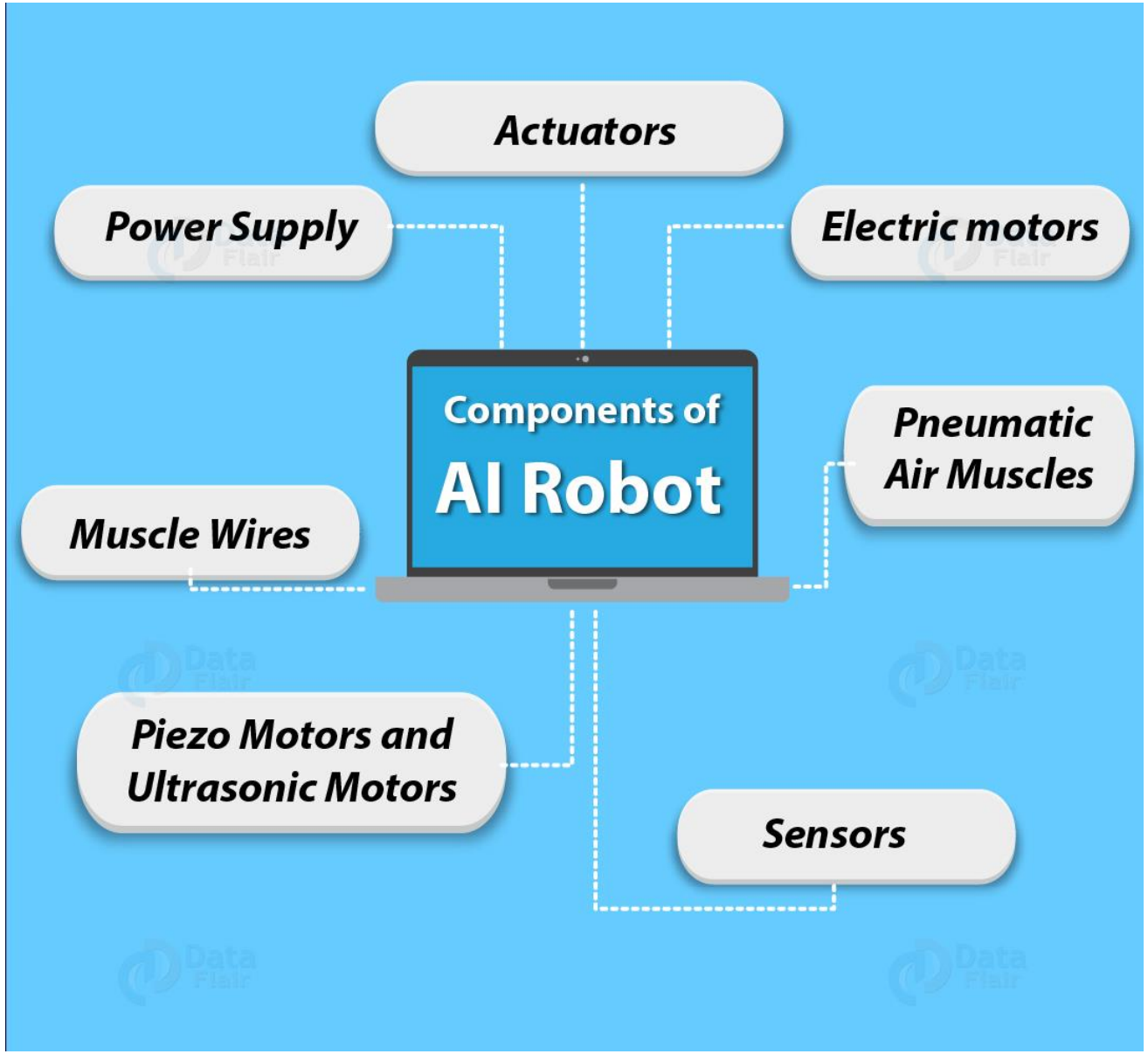
Resistors

Switch

Breadboard



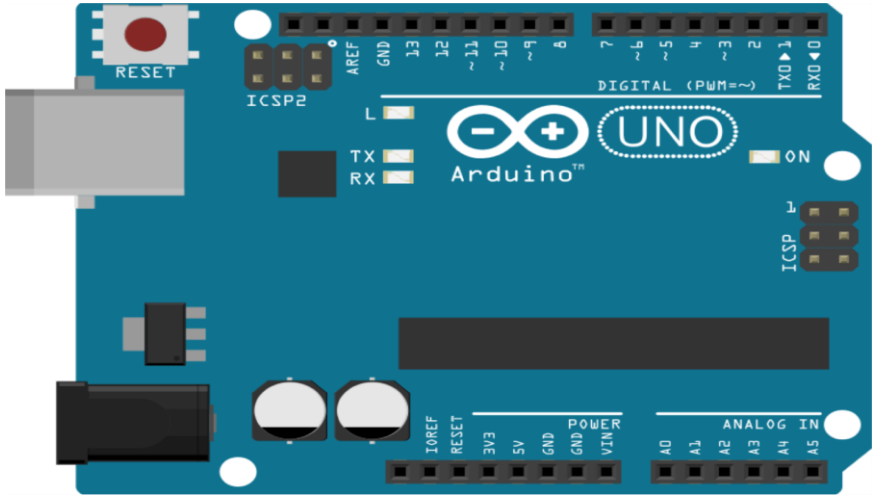



Components of
AI Robot
Actuators
Power Supply
Electric motors
Pneumatic Air Muscles
Muscle Wires
Piezo Motors and Ultrasonic Motors
Sensors

What do you need?

To get started you need the following:

- PC (Windows, Mac, Linux)
- **Arduino UNO** (~200 NOK)
  or a Starter Kit (~800 NOK)
- Software (free)
- Electrical components
  (wires, resistors, etc.)



Components of a Robot

Robots are constructed with the following −

Power Supply − The robots are powered by batteries, solar power, hydraulic, or pneumatic power sources.

Actuators − They convert energy into movement.

Electric motors (AC/DC) − They are required for rotational movement.

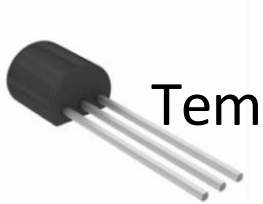
Pneumatic Air Muscles − They contract almost 40% when air is sucked in them.

Muscle Wires − They contract by 5% when electric current is passed through them.

Piezo Motors and Ultrasonic Motors − Best for industrial robots.

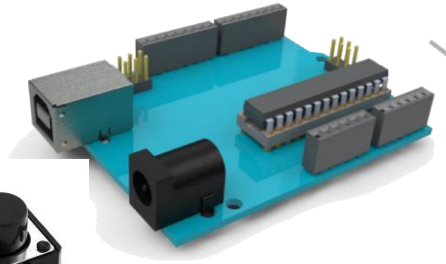
Sensors − They provide knowledge of real time information on the task environment. Robots are equipped with vision sensors to be to compute the depth in the environment. A tactile sensor imitates the mechanical properties of touch receptors of human fingertips.

Equipment

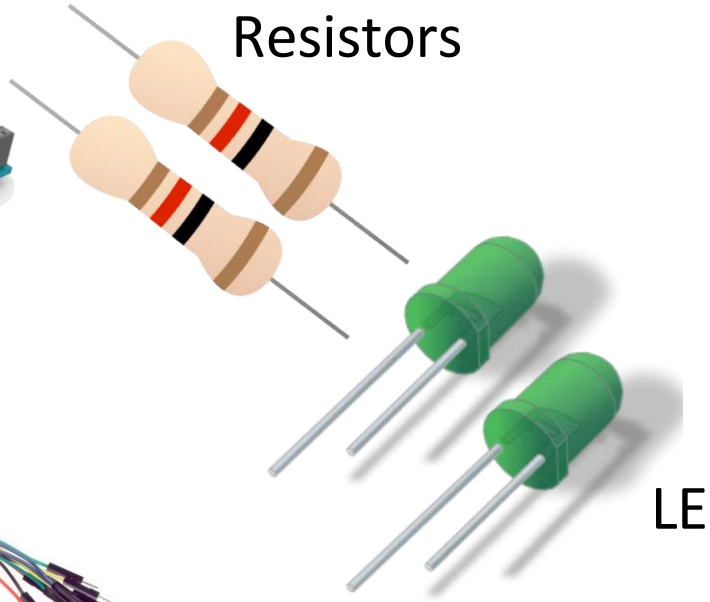


Temperature sensor

Switc



Arduino

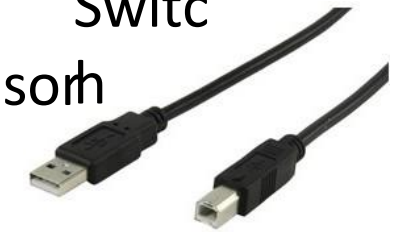


Resistors

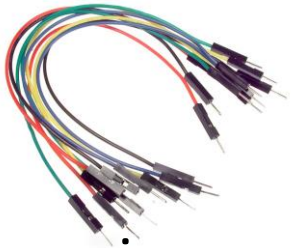
LEDs

Potentiometer

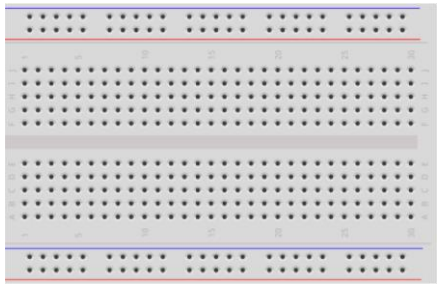
Light sensor



USB cable



wires



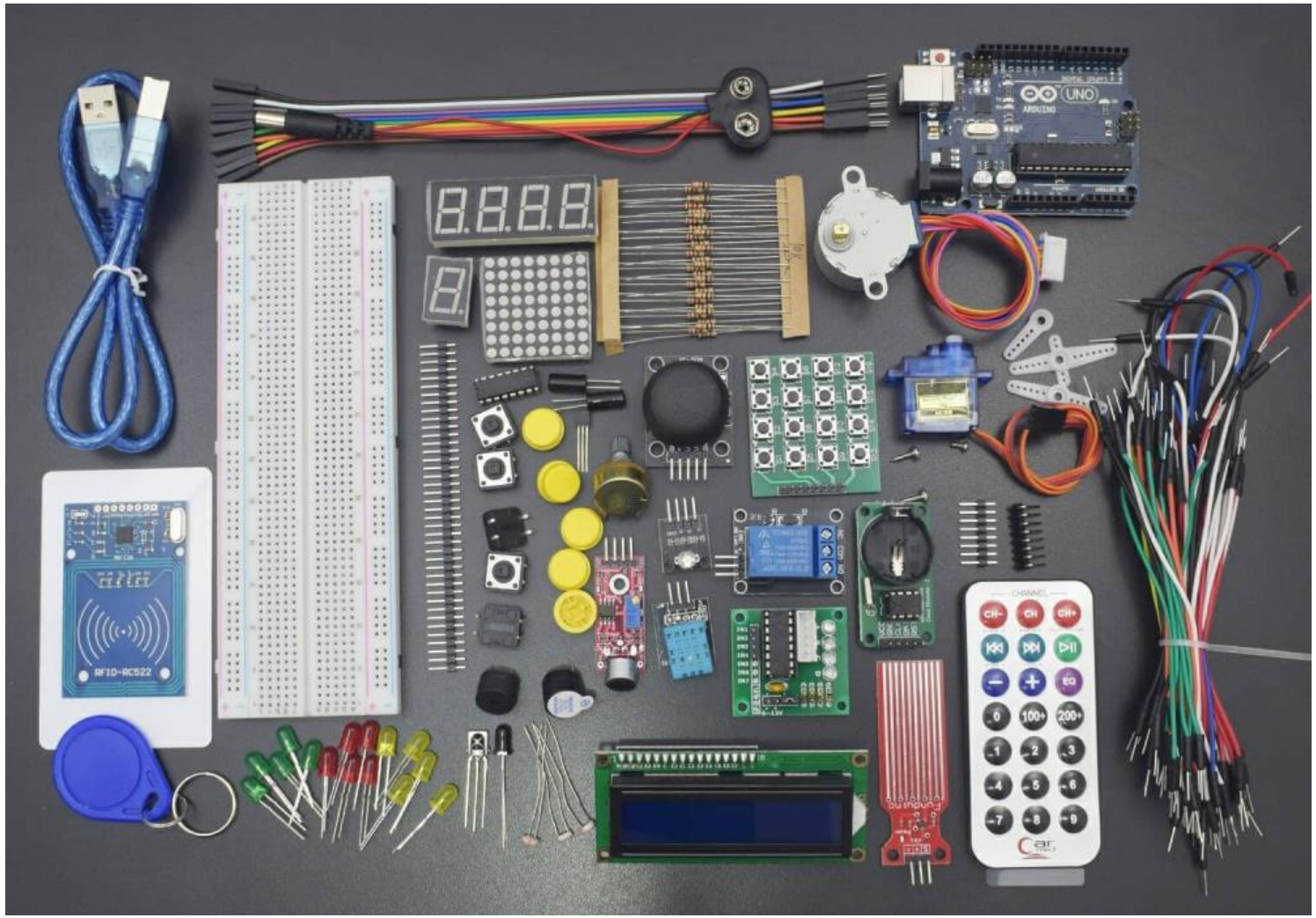
Breadboard

Thermistor

Multimeter

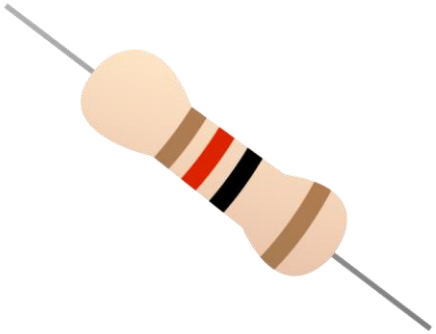
Electrical components

(wires, resistors, etc.)



Resistors

Resistance is measured in Ohm (Ω)



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

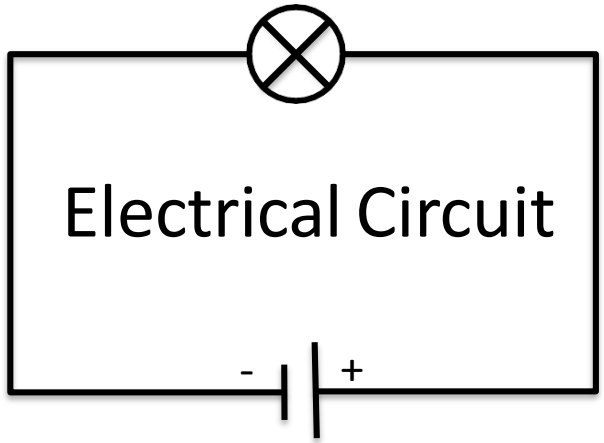
The resistance can be found using Ohms Law

$V = RI$

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

Electrical symbol:

Ohms Law



This is Ohms Law:

$$V = RI$$

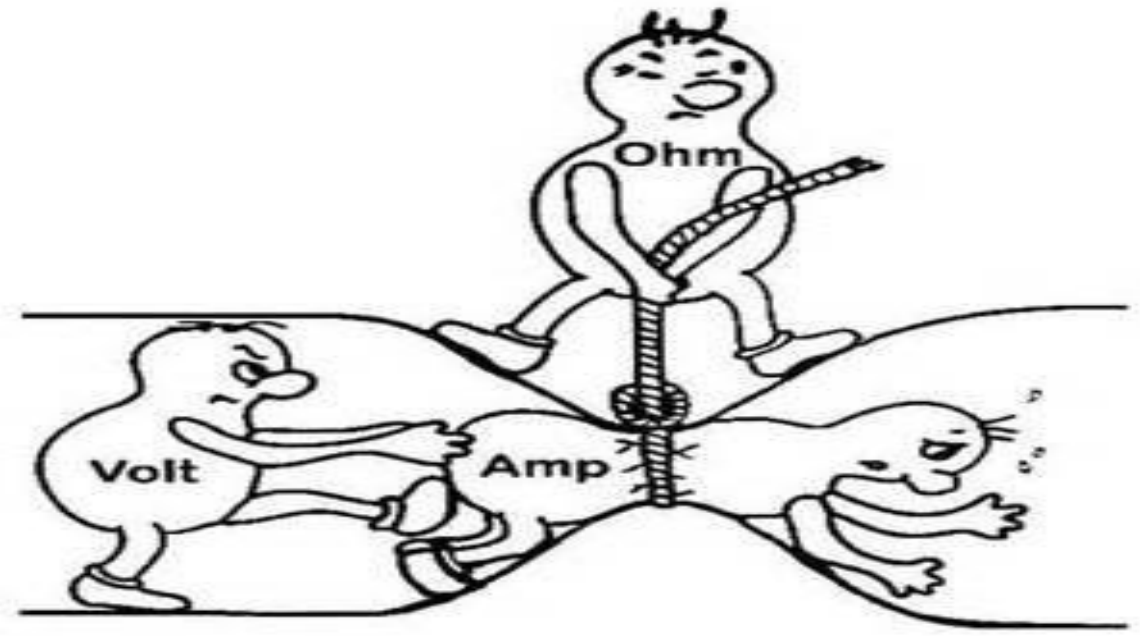
V – Voltage $[V]$ volt
R – Resistance $[\Omega]$ ohm
I – Current [A] ampere

- **I:** التيار الكهربائي Electrical Current (أمبير) Ampere
- **V:** الجهد الكهربائي Electrical Voltage (فولت) Volt
- **R:** المقاومة الكهربائية Electrical Resistance (أوم) Ohm Ω

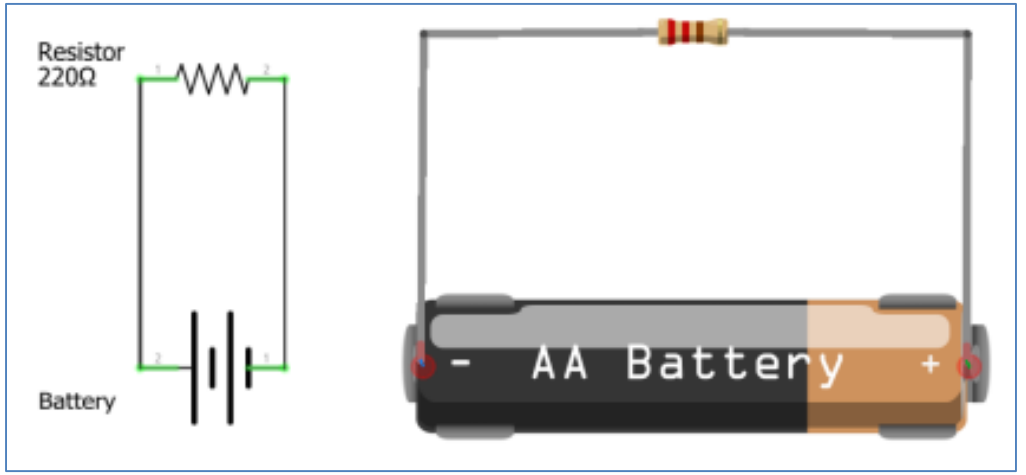
Ohms Law

$$V = RI$$

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



لفهم هذه المعادلة ، سنأخذ المثال التالي ، بطارية 1.2 فولت تم توصيلها إلى مقاومة 220 أوم



لمعرفة التيار الكهربائي الذي يمر من خلال هذه المقاومة.

- الجهد Voltageيساوي 1.2 فولت Volts
- المقاومة تساوي 220 أوم Ω

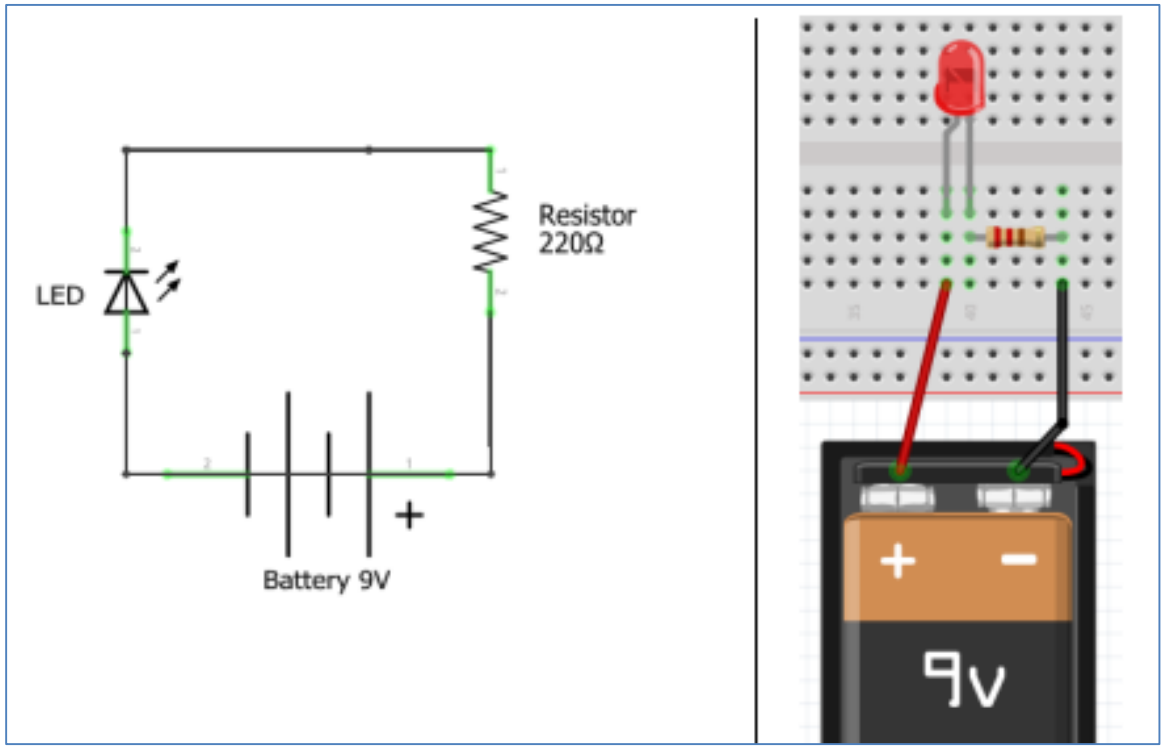
التيار الكهربائي يساوي الجهد قسمة المقاومة

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

$$I = \frac{1.3}{220} \approx 0.0059\ Ampere \approx 5.9\ mA$$

How to find out the resistance value

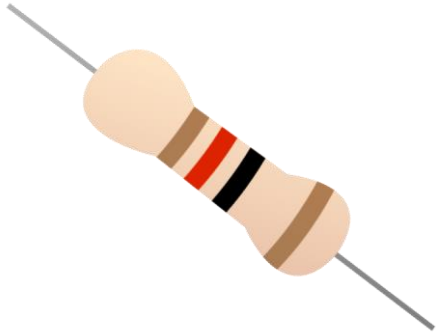
$$R = \frac{V}{I}$$



قيمة المقاومة = (فولتاج البطارية – فولتاج الثنائي الضوئي) / (تيار الثنائي الضوئي)

= (9– 2) / (0.02) = 350 أوم Ω

Resistor Color Codes



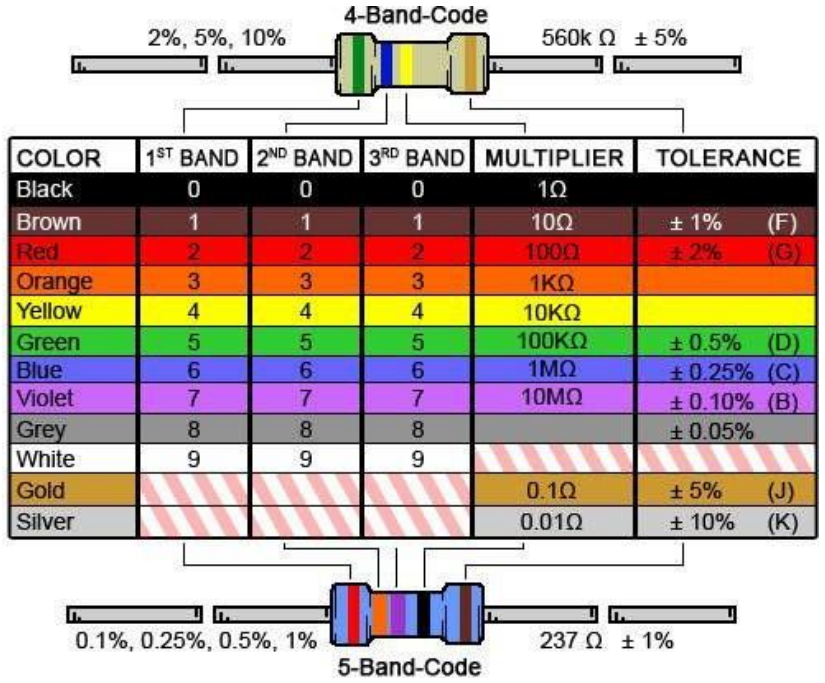
- What is the values for your resistors?
- Use the Color Codes to figure it out
- Use also a Multimeter to see if you get the same results.

Multimeter

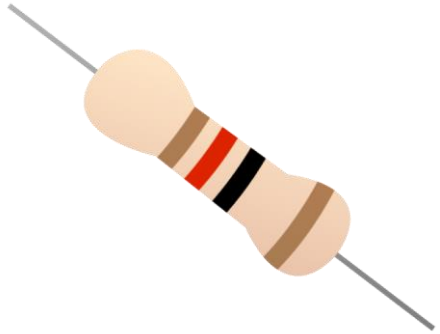
You can use a Multimeter to measure current, voltage, resistance, etc. in an electric circuit.

https://learn.sparkfun.com/tutorials/how-to-use-a-multimeter

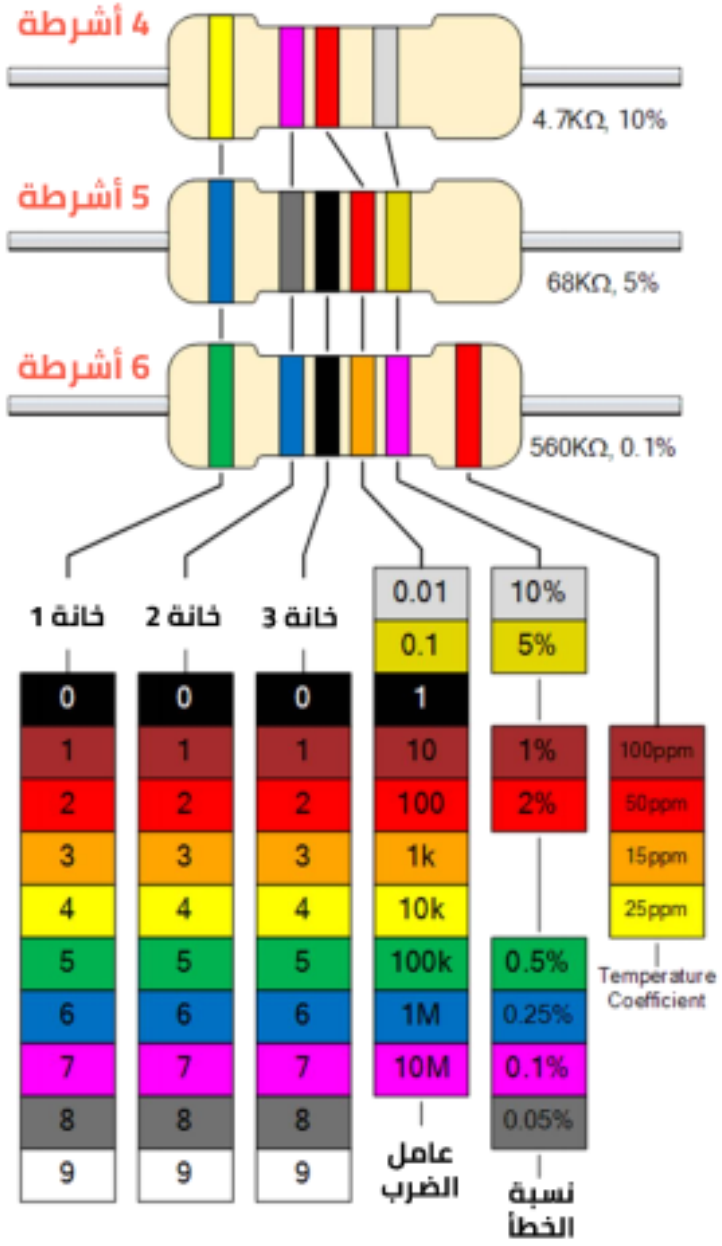
Resistor Color Codes



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)



http://www.allaboutcircuits.com/tools/resistor-color-code-calculator/



الشريط 1 (خانة 1) : بني

الشريط 2 (خانة 2): أسود

الشريط 3 (عامل الضرب): أحمر

الشريط 4 (نسبة الخطأ): ذهبي

بني	أسود	X	أحمر	نسبة الخطأ
1	0	X	100	5%
10		X	100	5%
1000 Ω				5%
1 K Ω				5%

x

الشريط 1 (خانة 1) : أحمر

الشريط 2 (خانة 2): أحمر

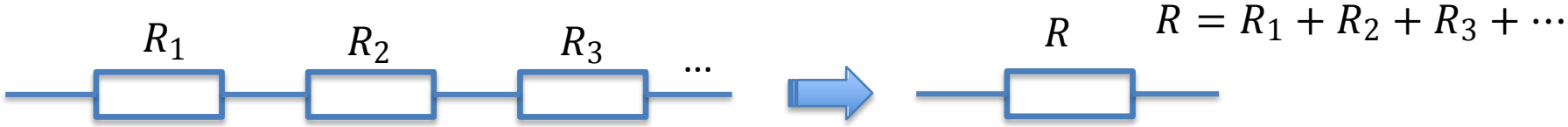
الشريط 3 (عامل الضرب): بني

الشريط 4 (نسبة الخطأ): ذهبي

أحمر	أحمر	X	بني	نسبة الخطأ
2	2	X	10	5%
22		X	10	5%
220 Ω				5%

Resistors in Series and Parallel

Resistors in Series:

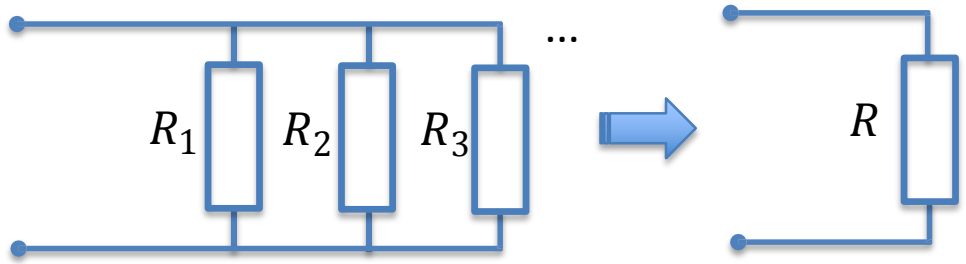


$$R = R_1 + R_2 + R_3 + \cdots$$

The total resistance of resistors connected in series is the sum of their individual resistance values.

When we have resistors in series, the sum of the sub-voltages is equal to the voltage of the voltage source

Resistors in Parallel :



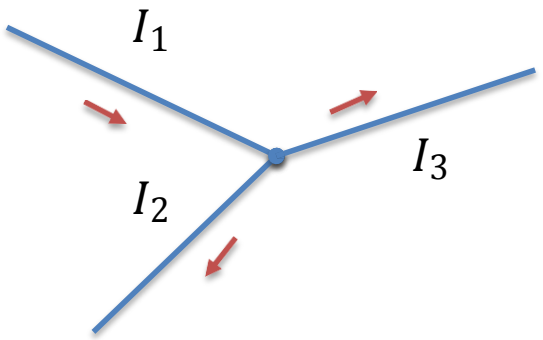
$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots$$

When we have resistors in parallel, the total resistance is always less than the smallest resistors

Kirchhoff's Laws

Kirchhoff's Current Law:

$$\sum_{K=1}^{n} I_k = 0$$

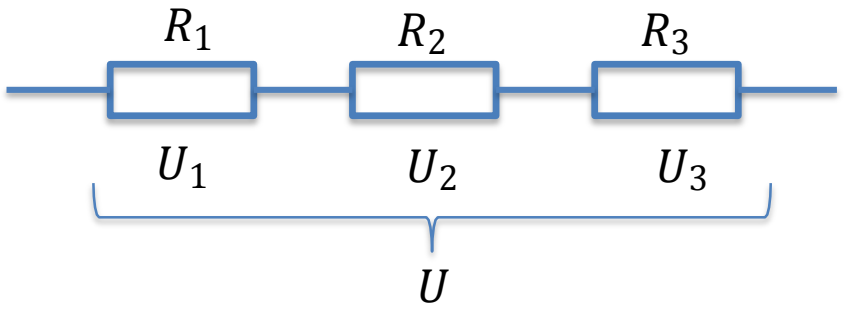


$$I_1 = I_2 + I_3$$

$$I_1 - I_2 - I_3 = 0$$

Kirchhoff's Voltage Law:

$$\sum_{K=1}^{n} U_k = 0$$



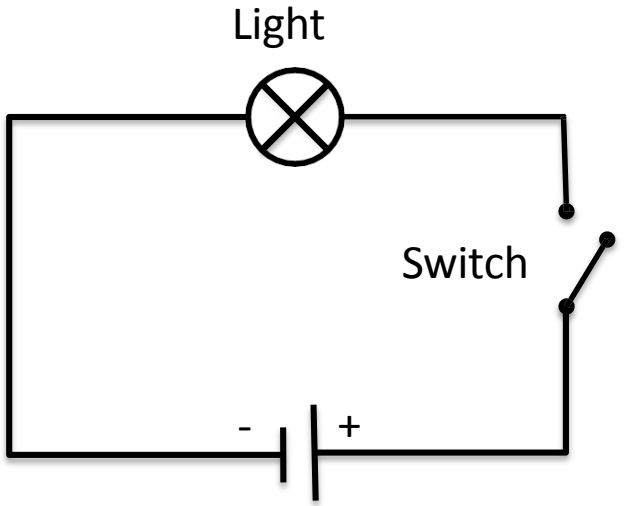
$$U = U_1 + U_2 + U_3 + \cdots$$

https://en.wikipedia.org/wiki/Kirchhoff%27s_circuit_laws

Switch

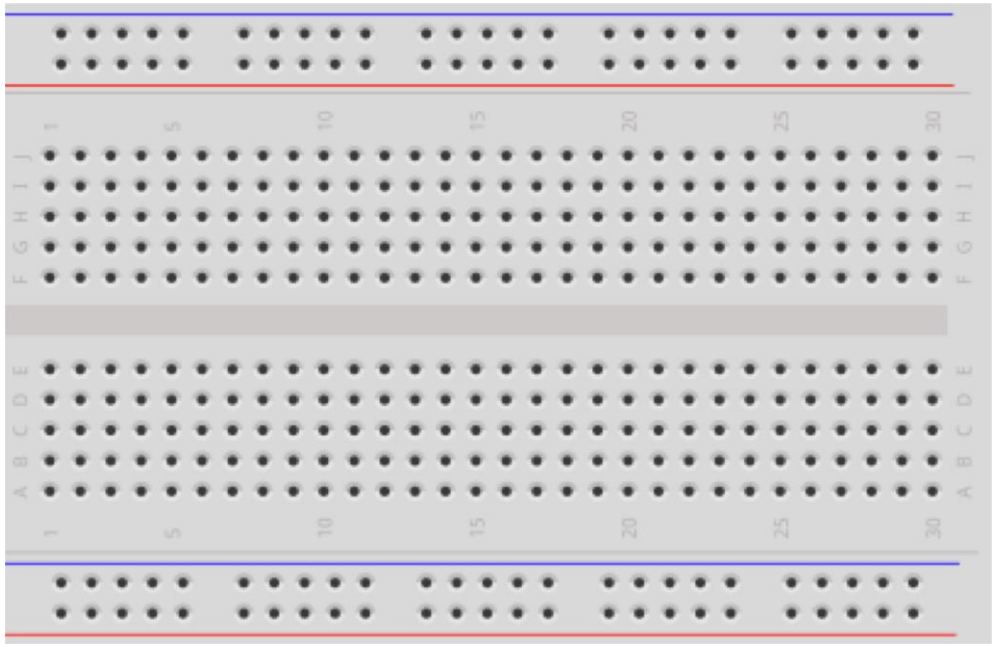
A switch breaks the flow of current through a circuit when open. When closed, the current will flow unobstructed through the circuit.

A switch comes in many flavors

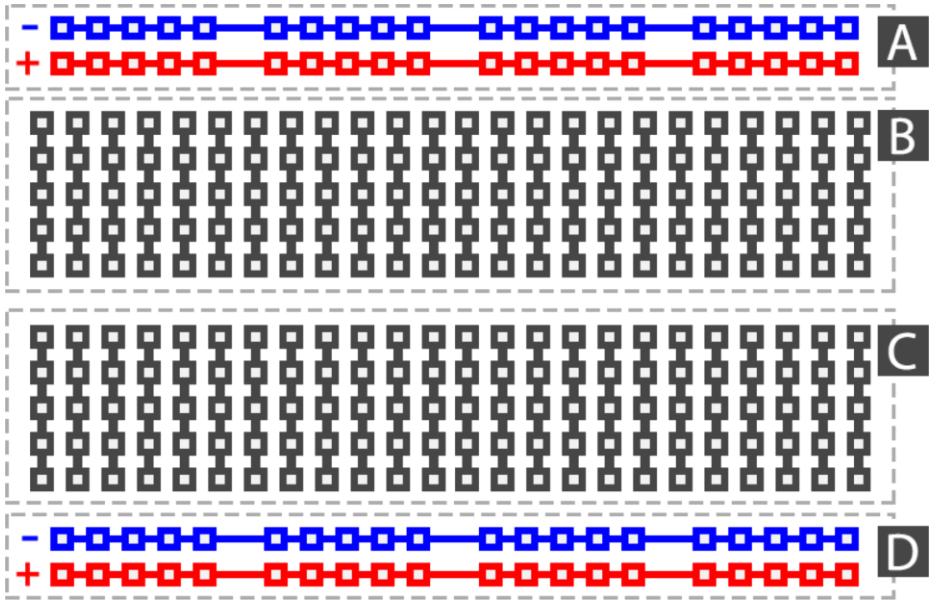


Battery

Breadboard

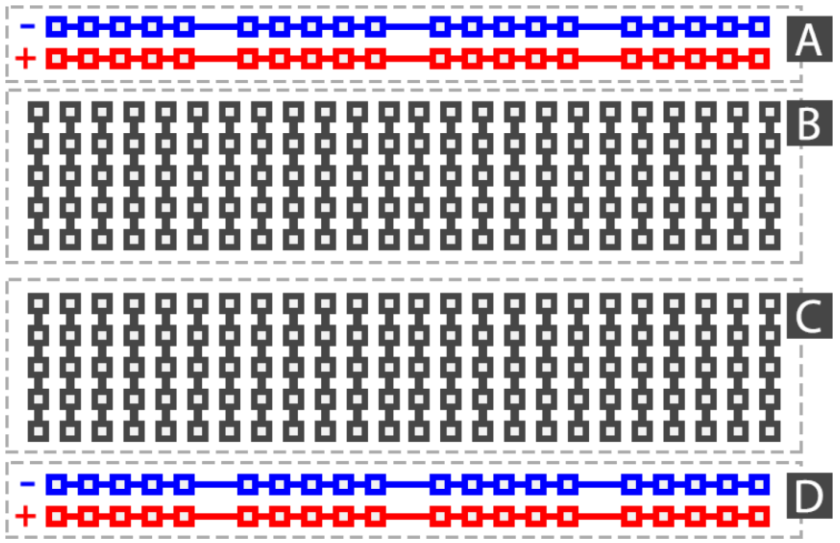


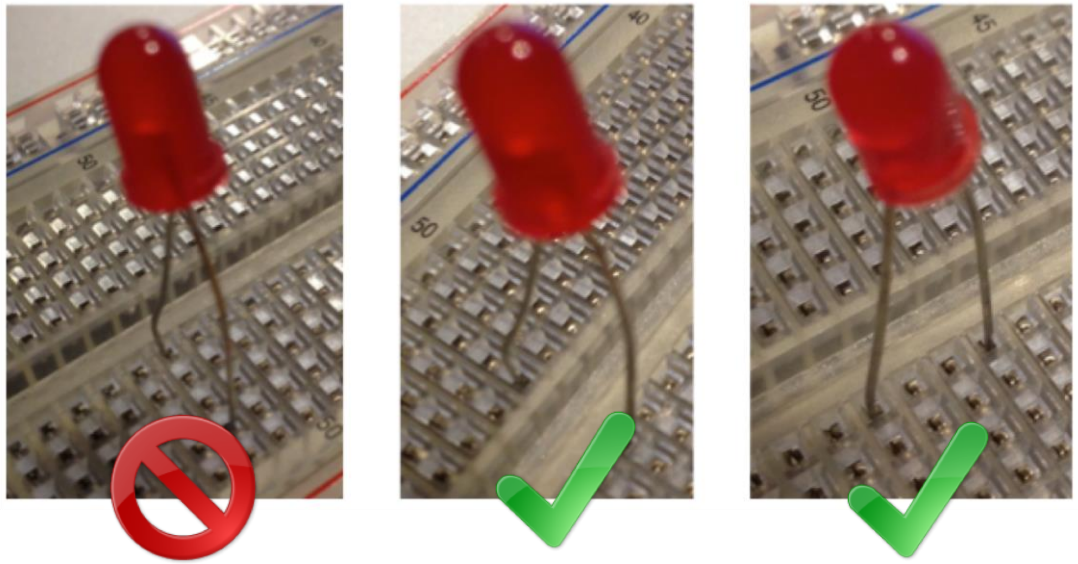
A breadboard is used to wire electric components together

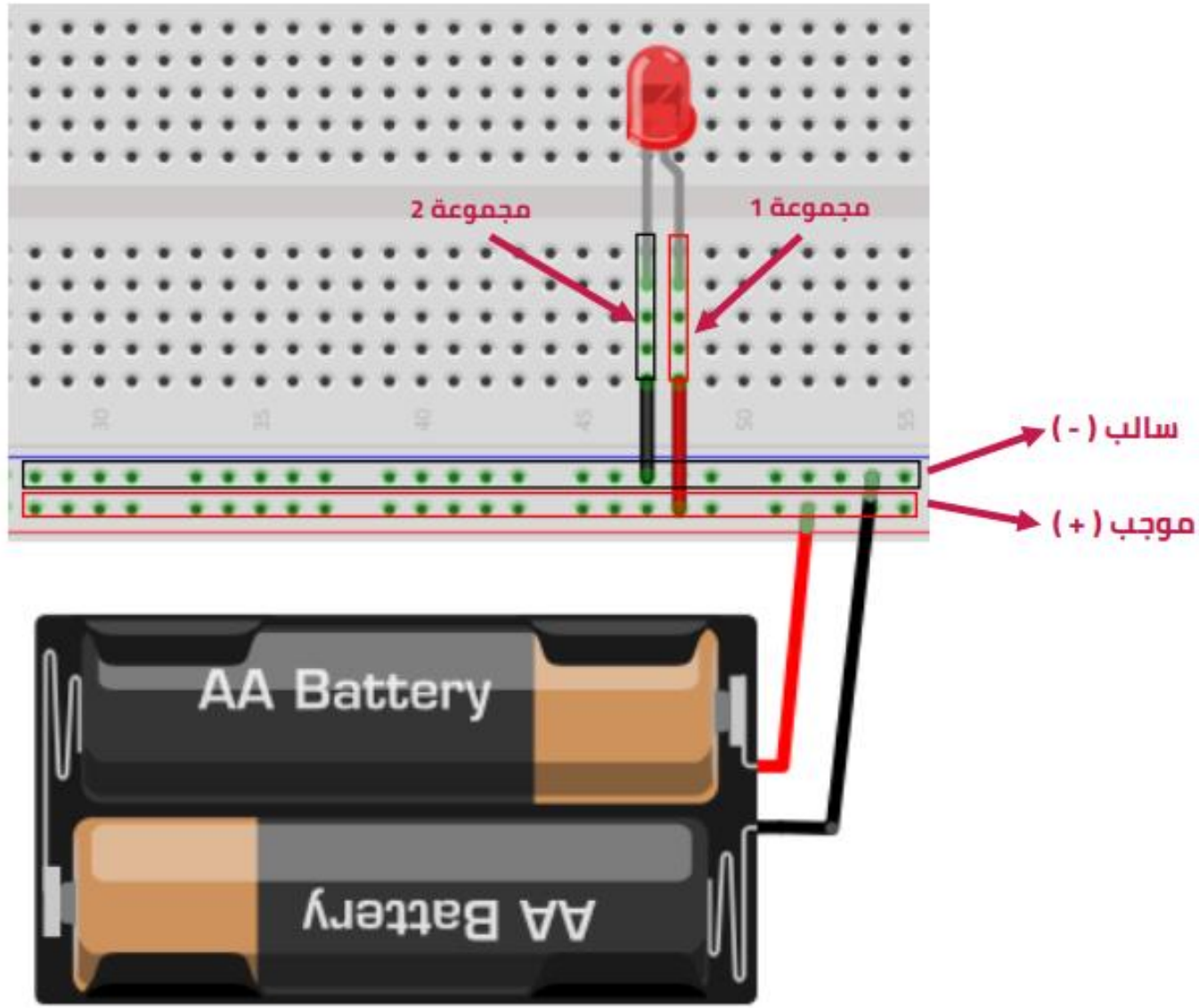


Breadboard – Correct Wiring

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



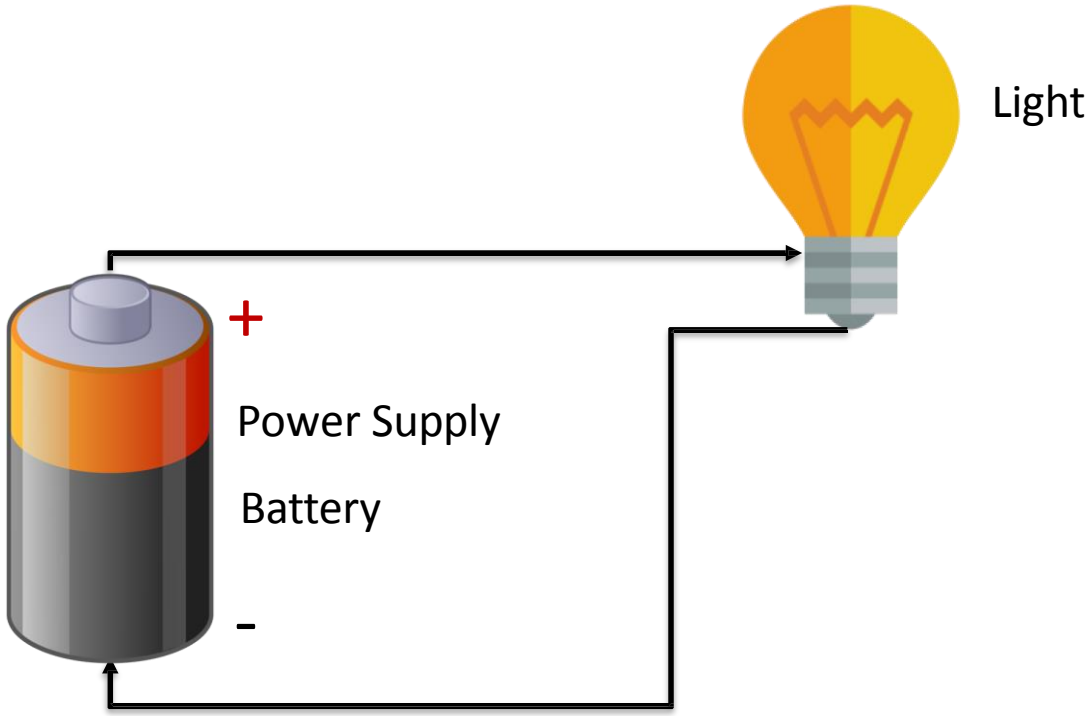


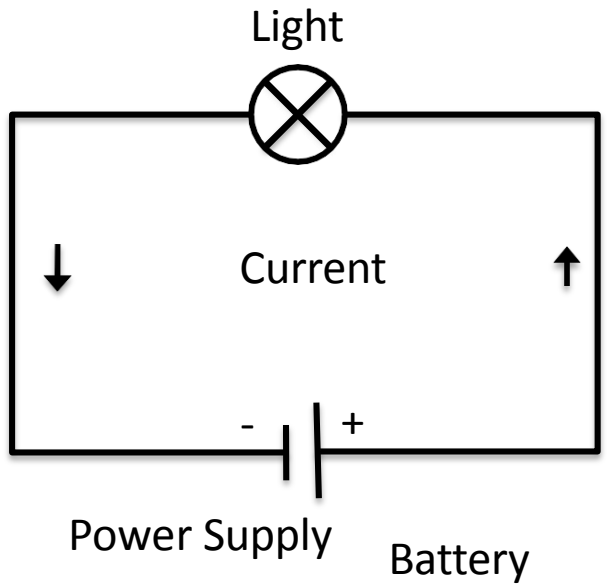

مجموعة 2
مجموعة 1
سالب (-)
موجب (+)
AA Battery
AA Battery

Electronics Foundation

Electrical Circuit

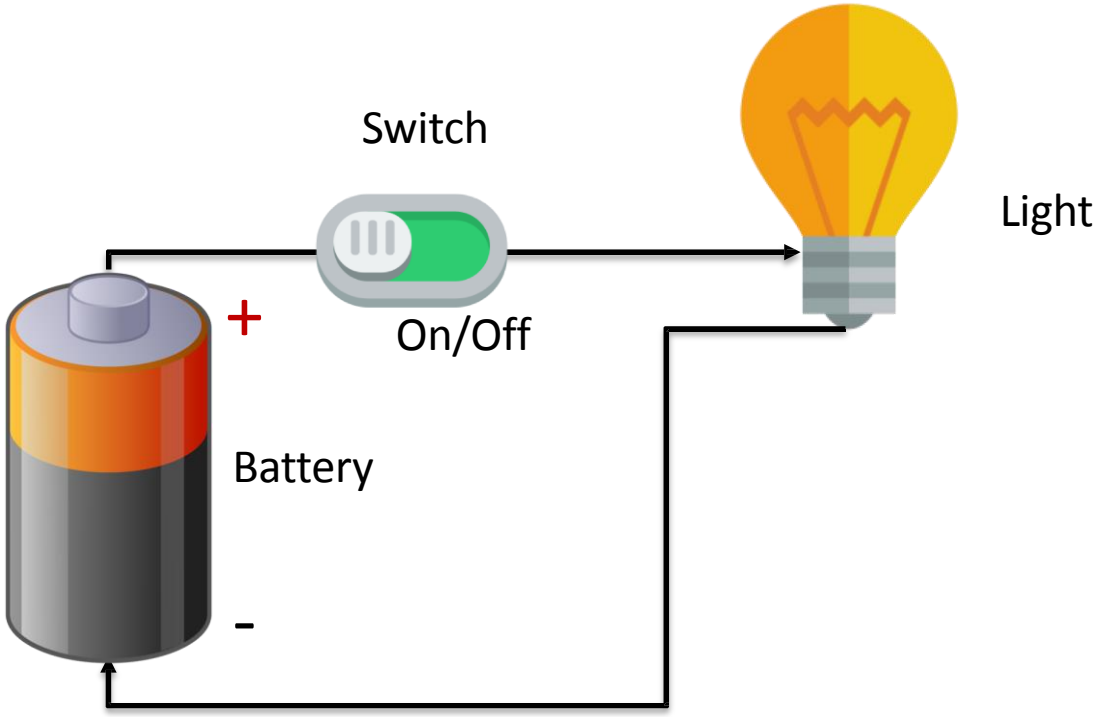
Here you see a basic Electrical Circuit:

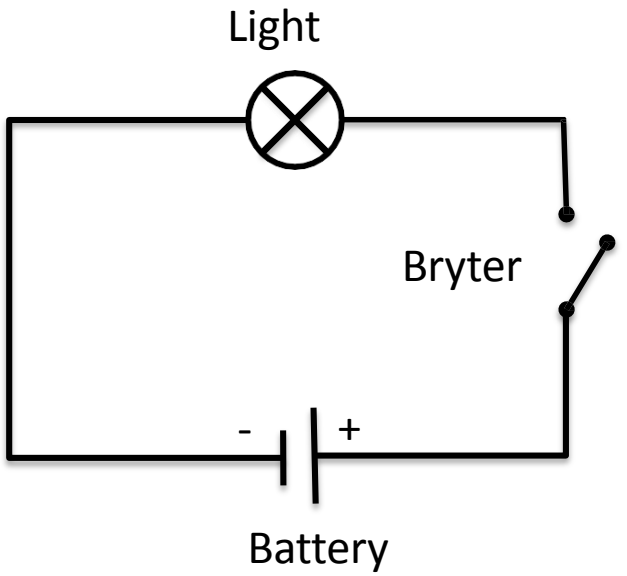




Electrical Circuit with a Switch

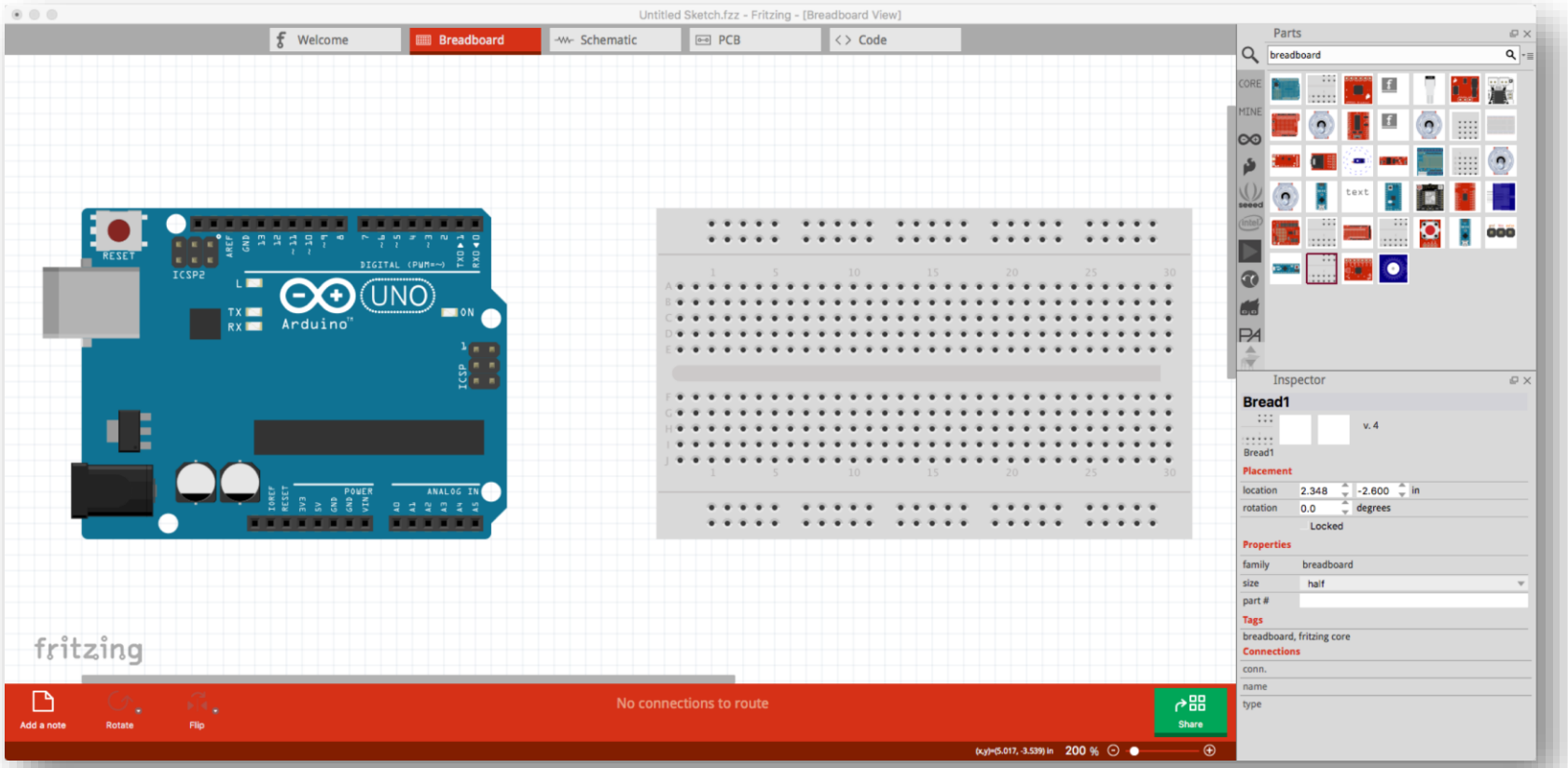
Here you see a basic Electrical Circuit with a Switch:





fritzing

Fritzing is an open-source hardware initiative that makes electronics accessible as a creative material for anyone.

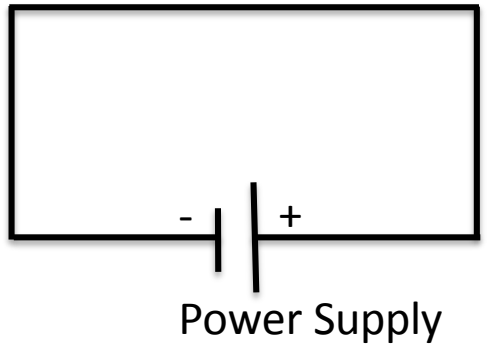


[http://www.fritzing.org]

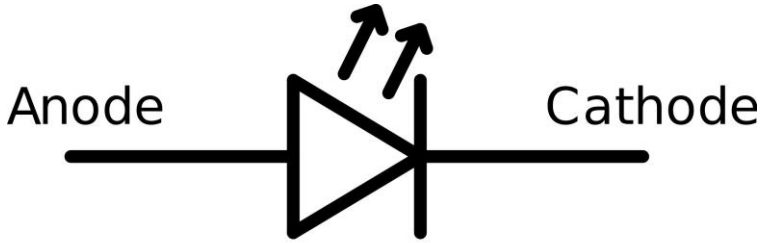
Short Circuit

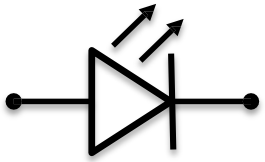
- We must never connect positive and negative side to a power source without having an electrical component in between.
- If you do, it is called a short circuit.
- For example, if you short circuit a battery, the battery will get very hot and the battery will run out very quickly.
- Some batteries may 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.

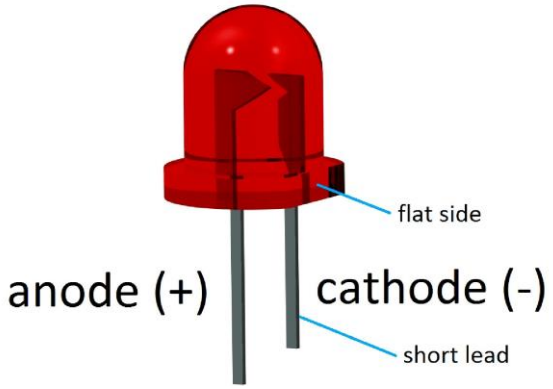
Short Circuit!!

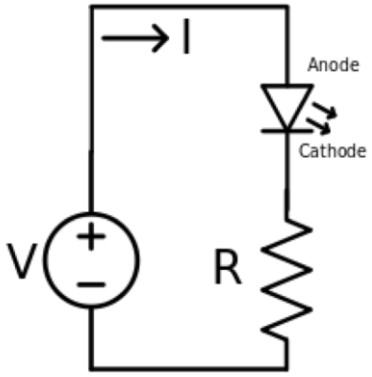


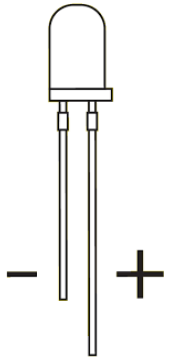
Light-Emitting Diode - LED











[Wikipedia]