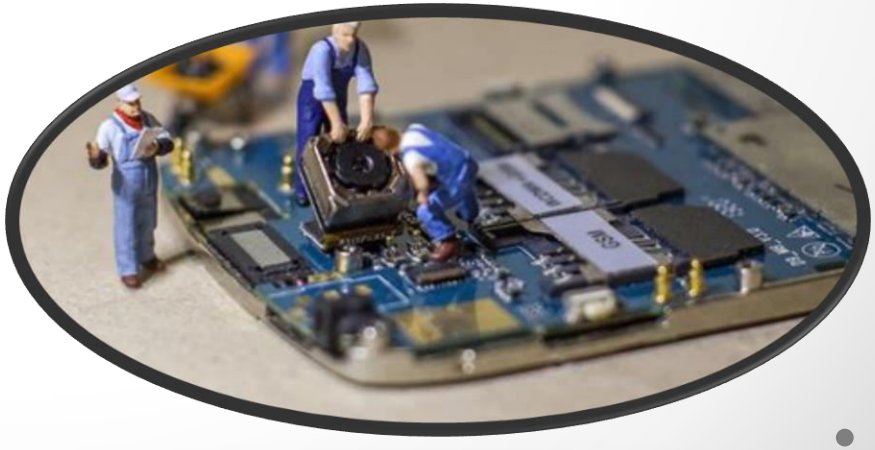
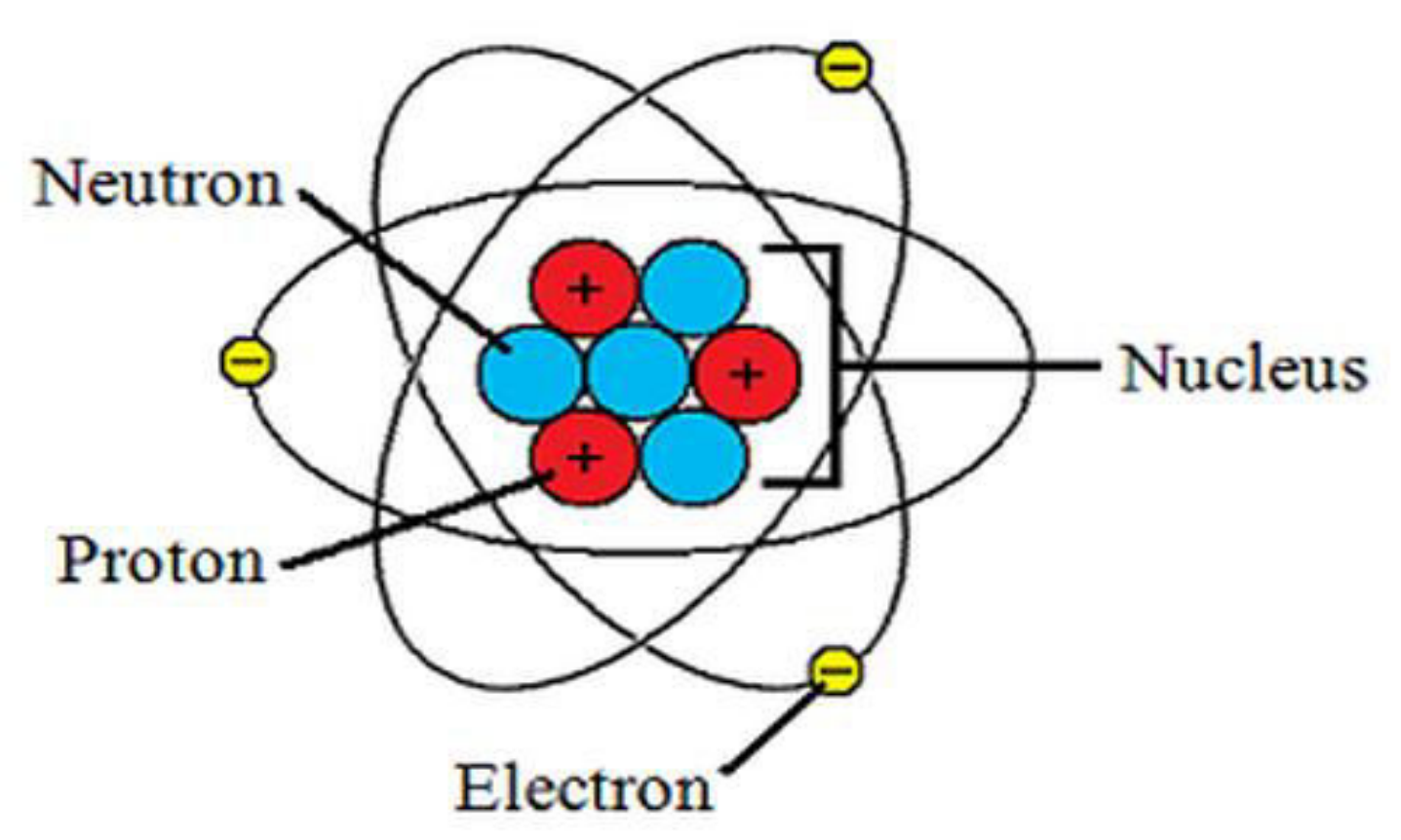
Basic Electronics

Introduction To Electronics

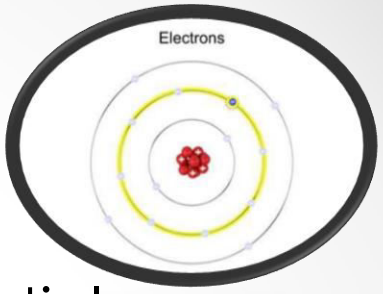
Electronics is the branch of science and engineering dealing with the theory and use of a class of devices in which **electrons** are transported through a vacuum, gas or **semiconductor**.



Atomic Structure



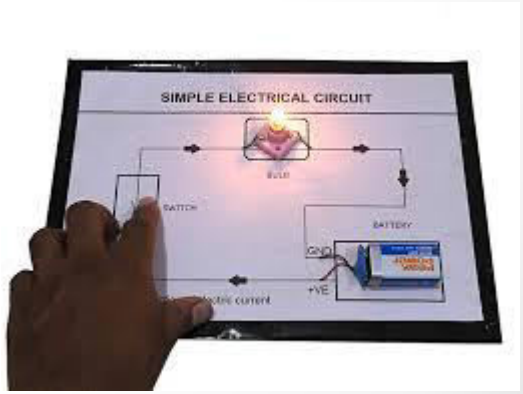
Electron



- Electrons are fundamental sub-atomic particles.
- They are **negatively charged** and move from negatively charged parts to positively charged ones.
- The negatively charged pieces of any circuit have extra electrons, while the positively charged pieces want more electrons.
- The electrons then jump from one area to another. When the electrons move, the current can **flow** through the system.

Electrical Quantities

- To understand the operation of electric circuits we must familiar with electrical quantities such as charge, current and voltage.



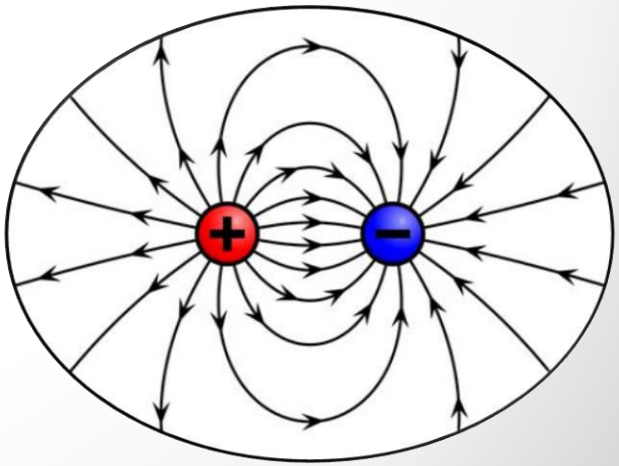
Charges

Electric charge is the physical property of matter that causes it to experience a force when placed in an electromagnetic field.

There are two types of **electric charge**:

Positive and Negative (commonly carried by protons and electrons respectively).

- Like **charges** repel each other
- Unlike **charges** attract each other.



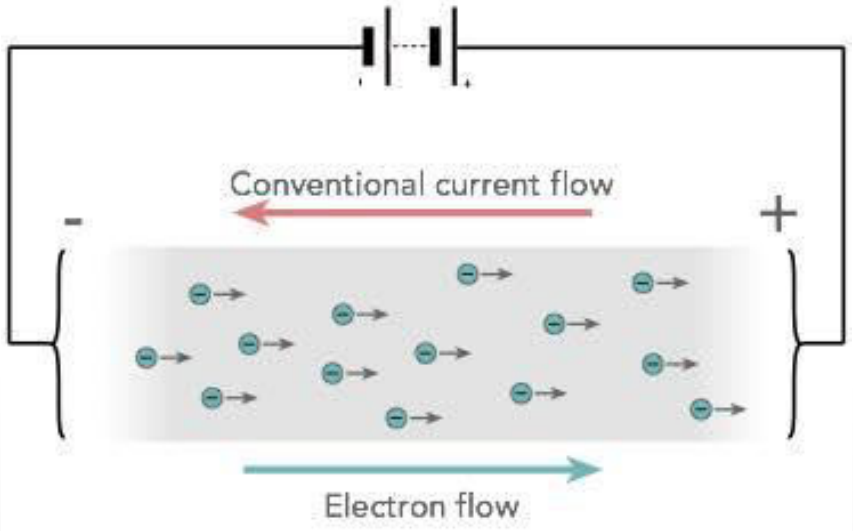
Current

Rate of flow of electrons is known as current.

$I = Q / t$

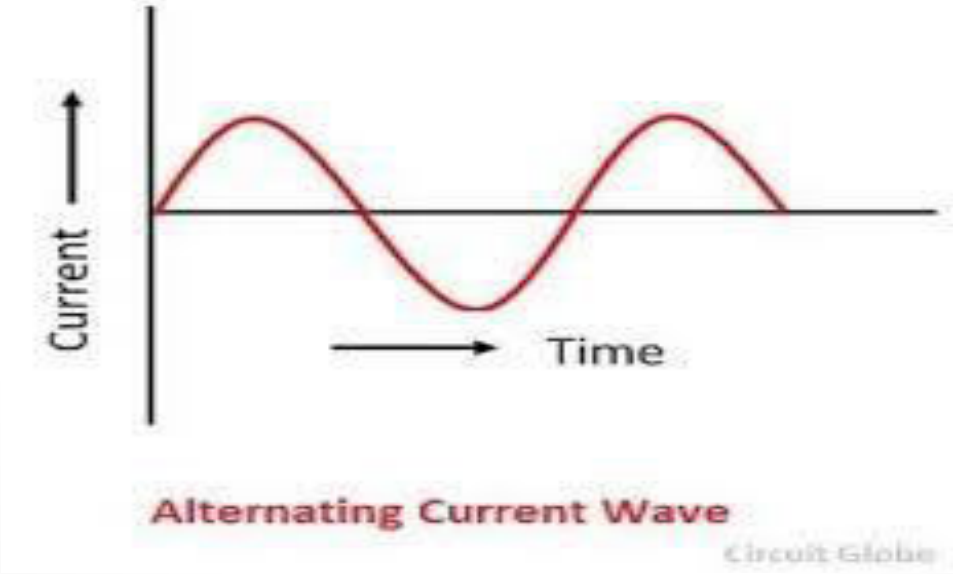
Where, I = Current, Q = Charge, t = Time

Unit of current (I) is ampere or A.



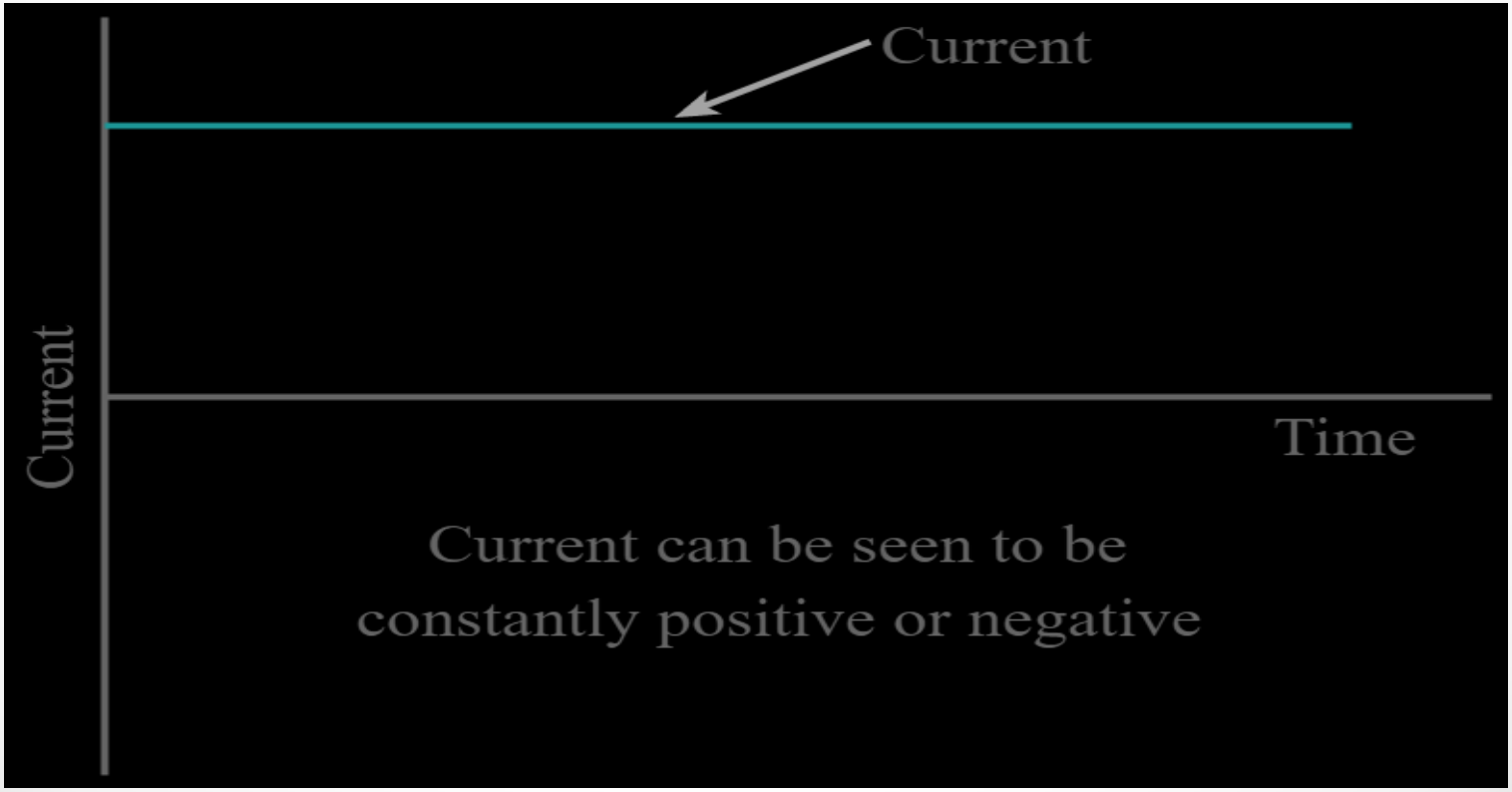
Alternating Current

Alternating current (**AC**) is an electric **current** which periodically reverses direction.



Direct Current

Direct current (**DC**) is the unidirectional flow of an electric charge.



Voltage

An electromotive force or potential difference expressed in volts.

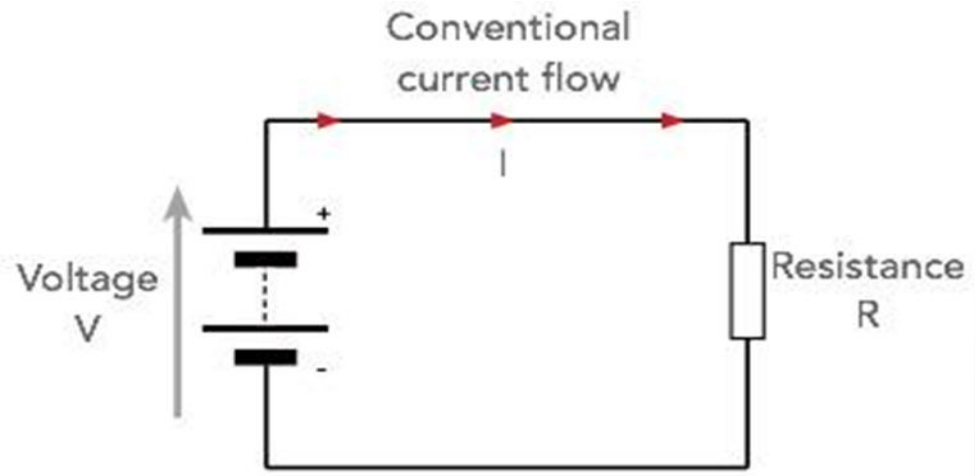
For most materials $V \propto I$

$$V = RI,$$

Where, V is the voltage across the object,

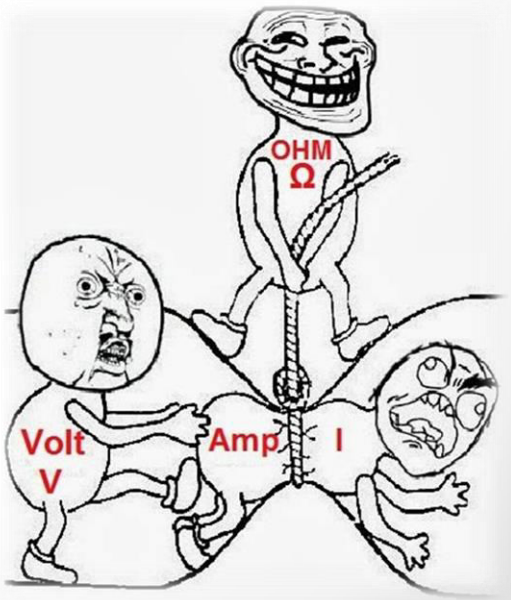
I is the current through the object,

R is resistance of the object.



Resistance

- **Resistance** is a measure of the opposition to current flow in an electrical circuit.
- **Resistance** is measured in ohms, symbolized by the Greek letter omega (Ω).
- It is inverse of conductivity.



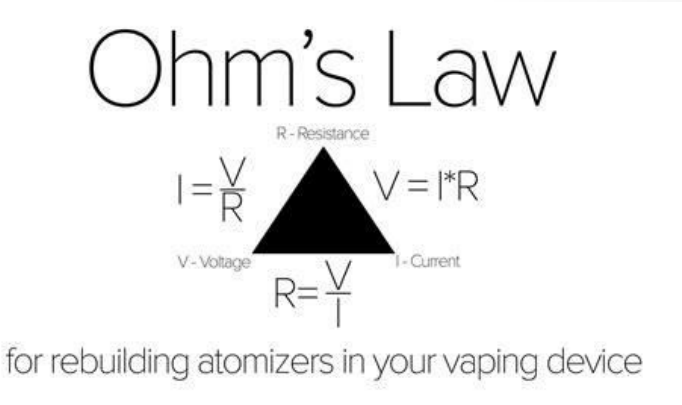
Ohm's Law

Ohm's law states that the current through a conductor **between** two points is directly proportional to the **potential difference** or **voltage** across the two points.

$V = I \times R$

$I = V / R$

$R = V / I$



Electronic Materials

Conductors

have low resistance which allows electrical current flow
Ex.:Copper, silver, gold, aluminum, & nickel

Insulators

have high resistance which suppresses electrical current flow
Ex:Glass, ceramic, plastics, & wood

Semiconductors

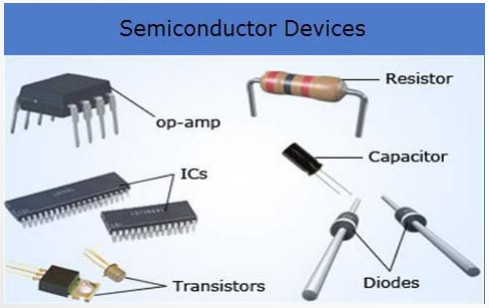
can allow or suppress electrical current flow
Ex: carbon, silicon, and germanium

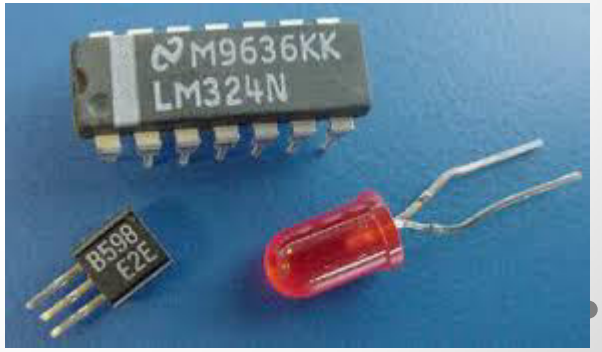
Semiconductor

- Materials whose conductivity falls between those of conductors and insulators are called semiconductors.

- Semiconductors are "part-time" conductors whose conductivity can be controlled.

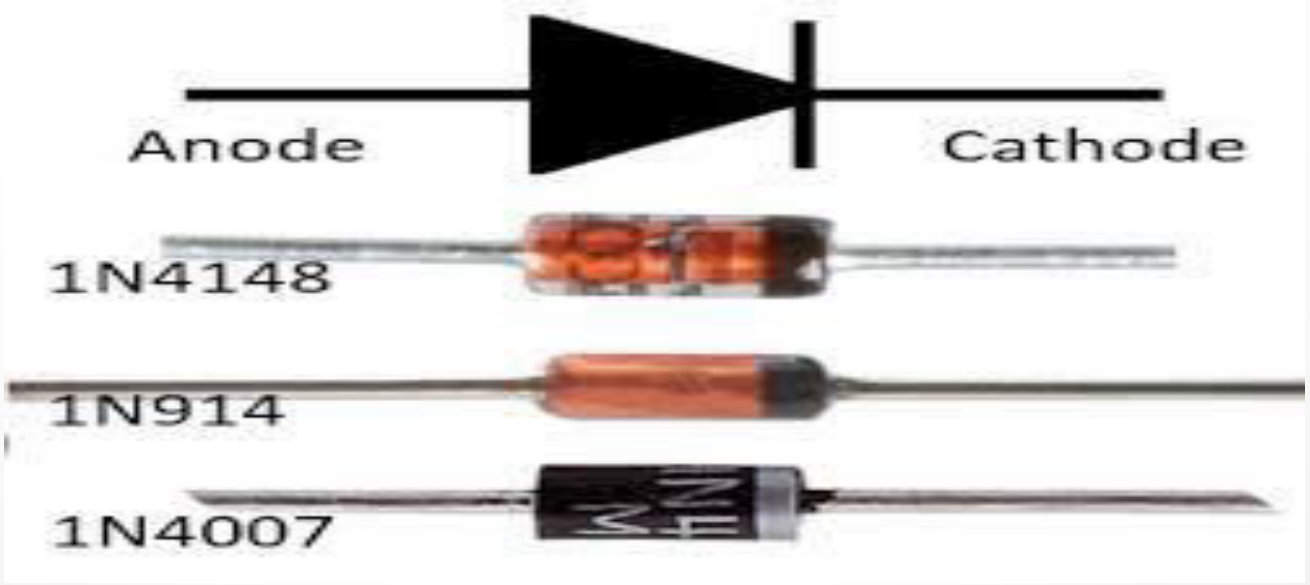
- Silicon is the most common material used to build semiconductor devices.





Diode

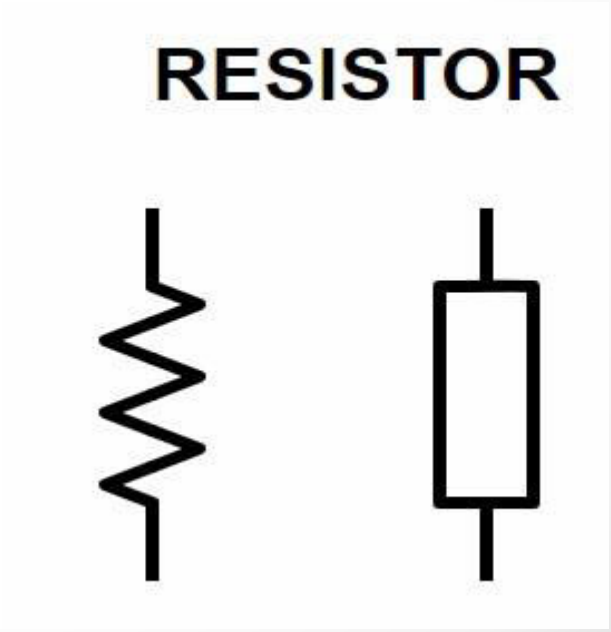
A **diode** is defined as a two-terminal electronic component that only conducts current in one direction. An ideal **diode** will have zero resistance in one direction, and infinite resistance in the reverse direction.

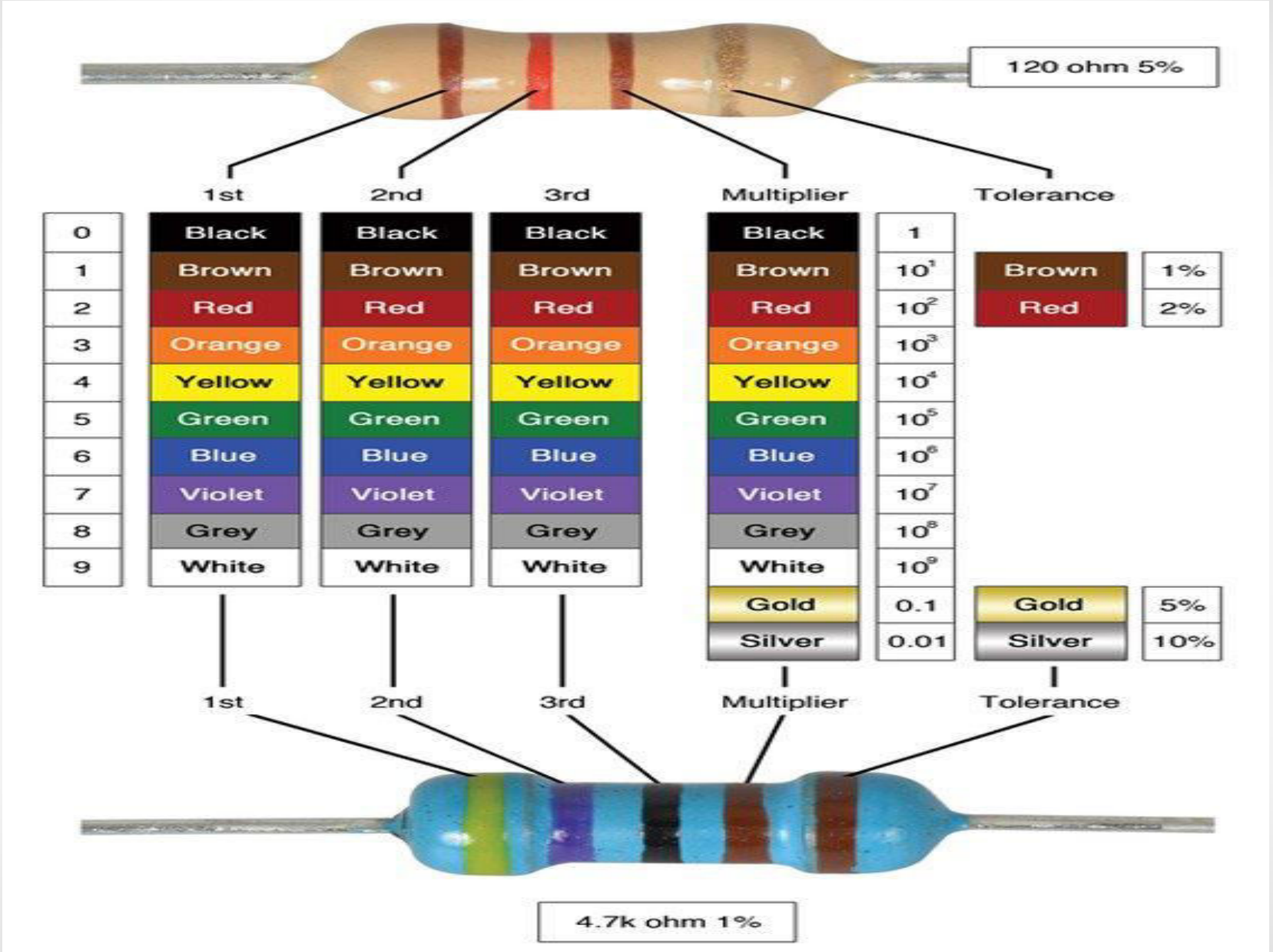


LED
(Light Emitting Diode)

Resistor

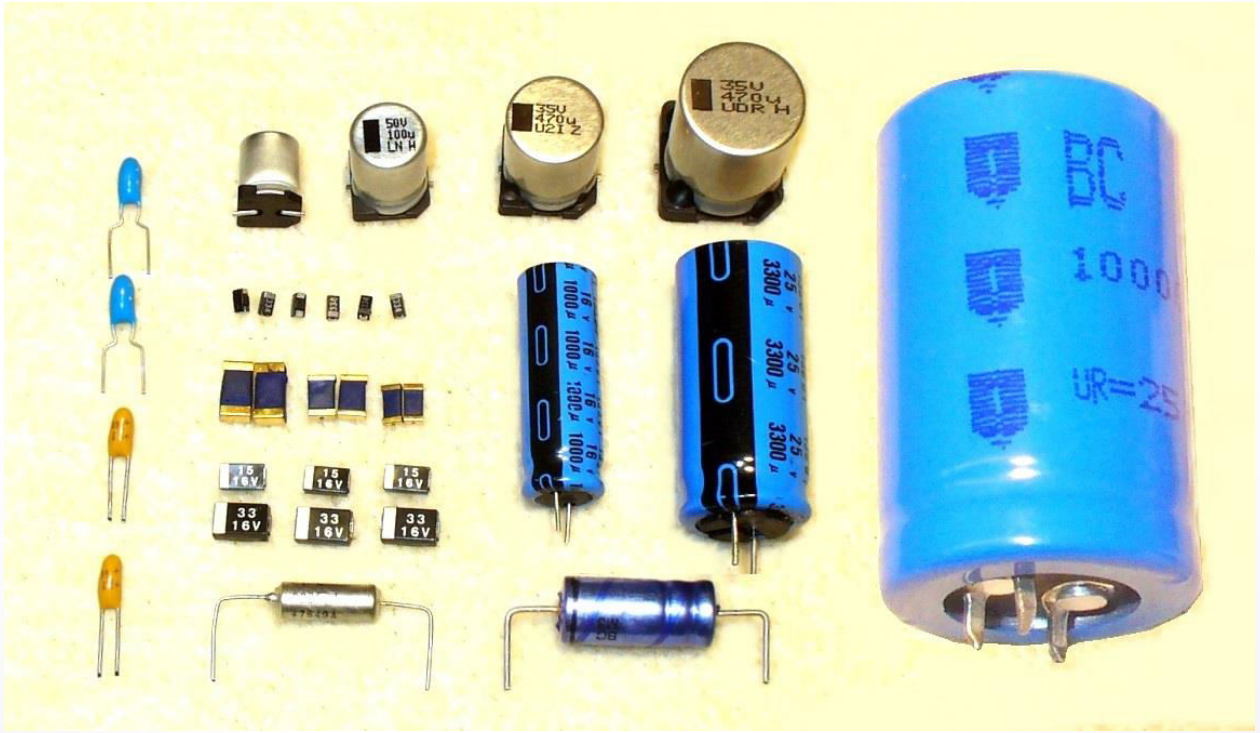
A **resistor** is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, **resistors** are used to reduce current flow, adjust signal levels, to divide voltages etc.




120 ohm 5%
1st
2nd
3rd
Multiplier
Tolerance
0 Black Black Black Black 1
1 Brown Brown Brown Brown 10^1 Brown 1%
2 Red Red Red Red 10^2 Red 2%
3 Orange Orange Orange Orange 10^3
4 Yellow Yellow Yellow Yellow 10^4
5 Green Green Green Green 10^5
6 Blue Blue Blue Blue 10^6
7 Violet Violet Violet Violet 10^7
8 Grey Grey Grey Grey 10^8
9 White White White White 10^9
Gold 0.1 Gold 5%
Silver 0.01 Silver 10%
1st
2nd
3rd
Multiplier
Tolerance
4.7k ohm 1%

Capacitor

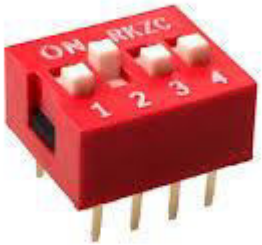
A **capacitor** is a device that stores electrical energy in an electric field. It is a passive electronic component with two terminals.



Battery

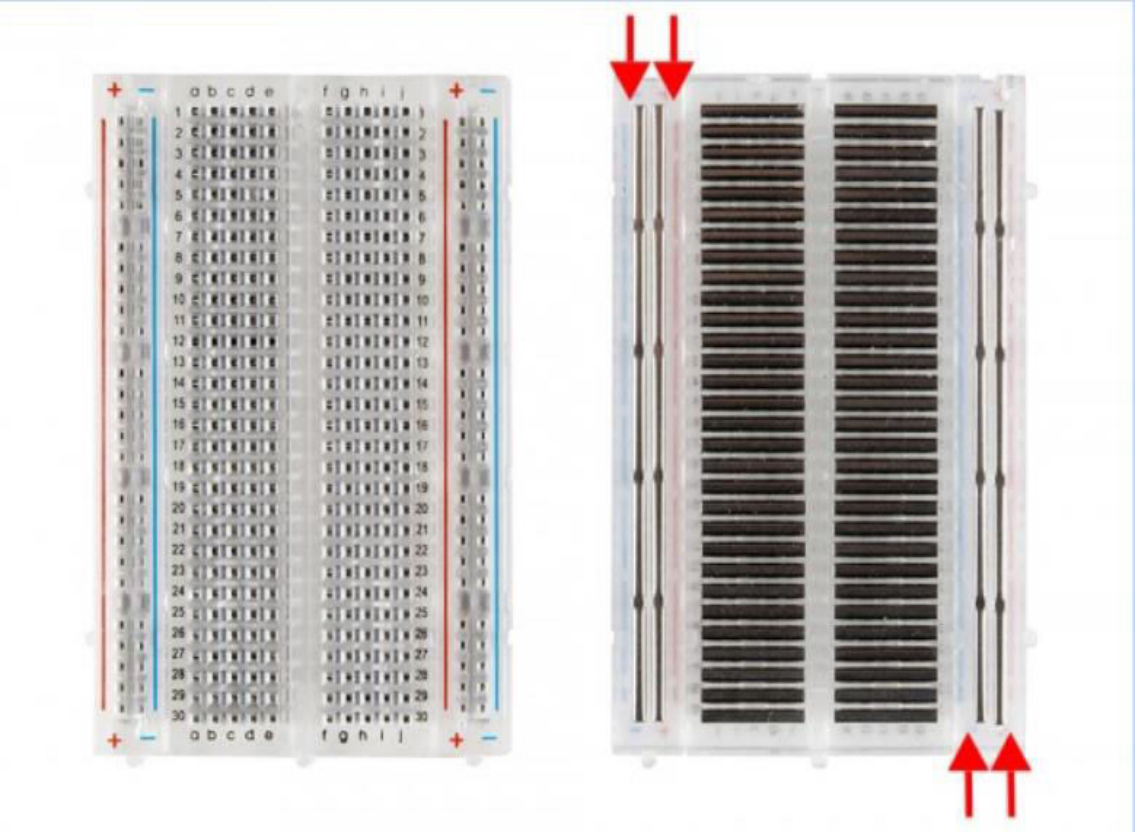
Connecting Wires

Switches

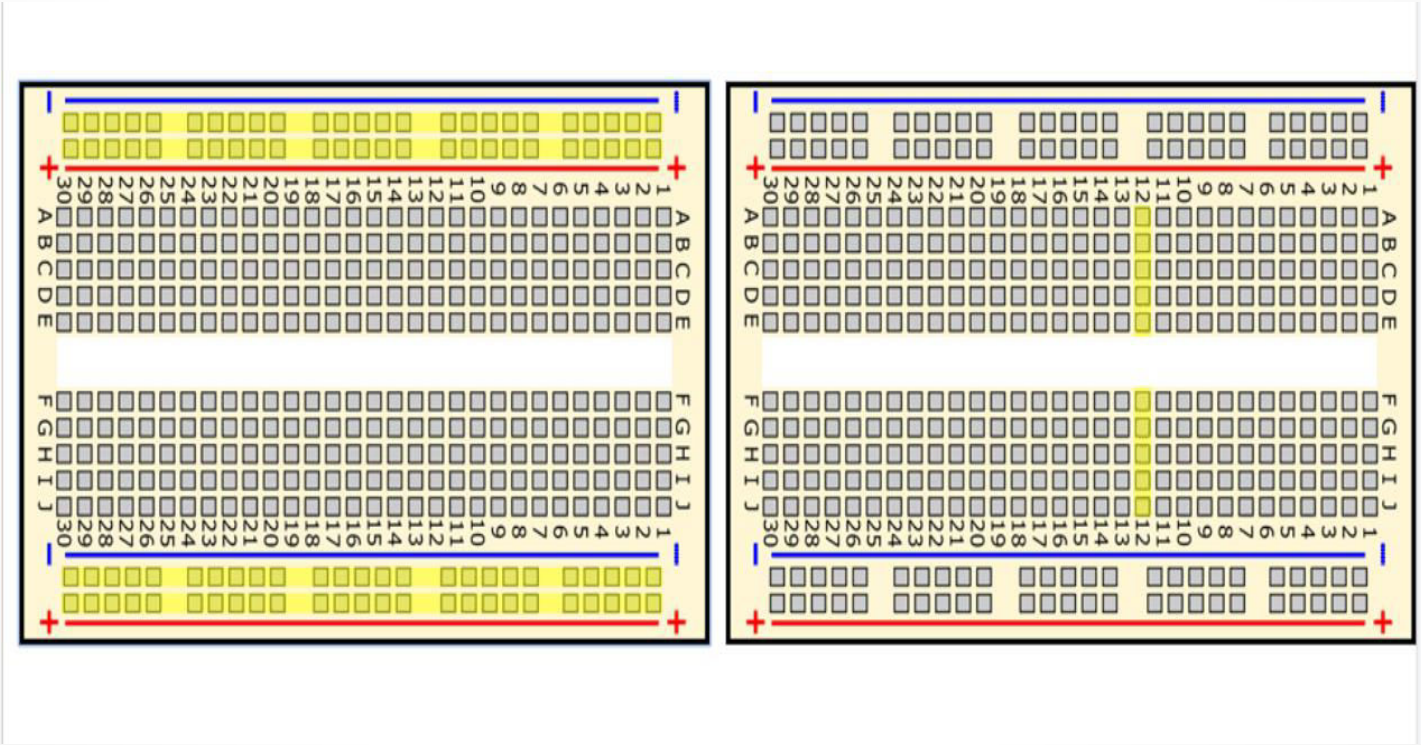


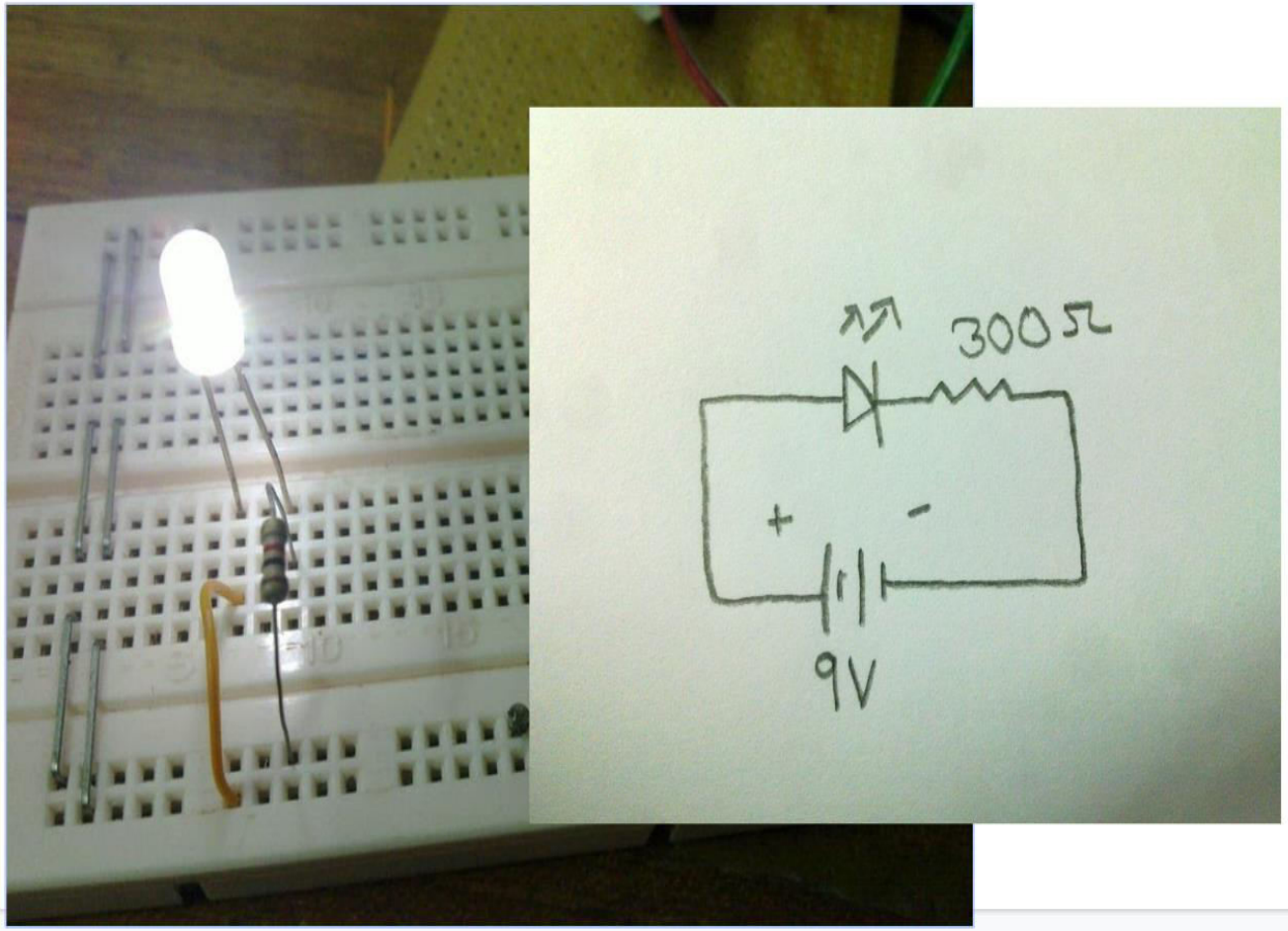
Potentiometer

Breadboard

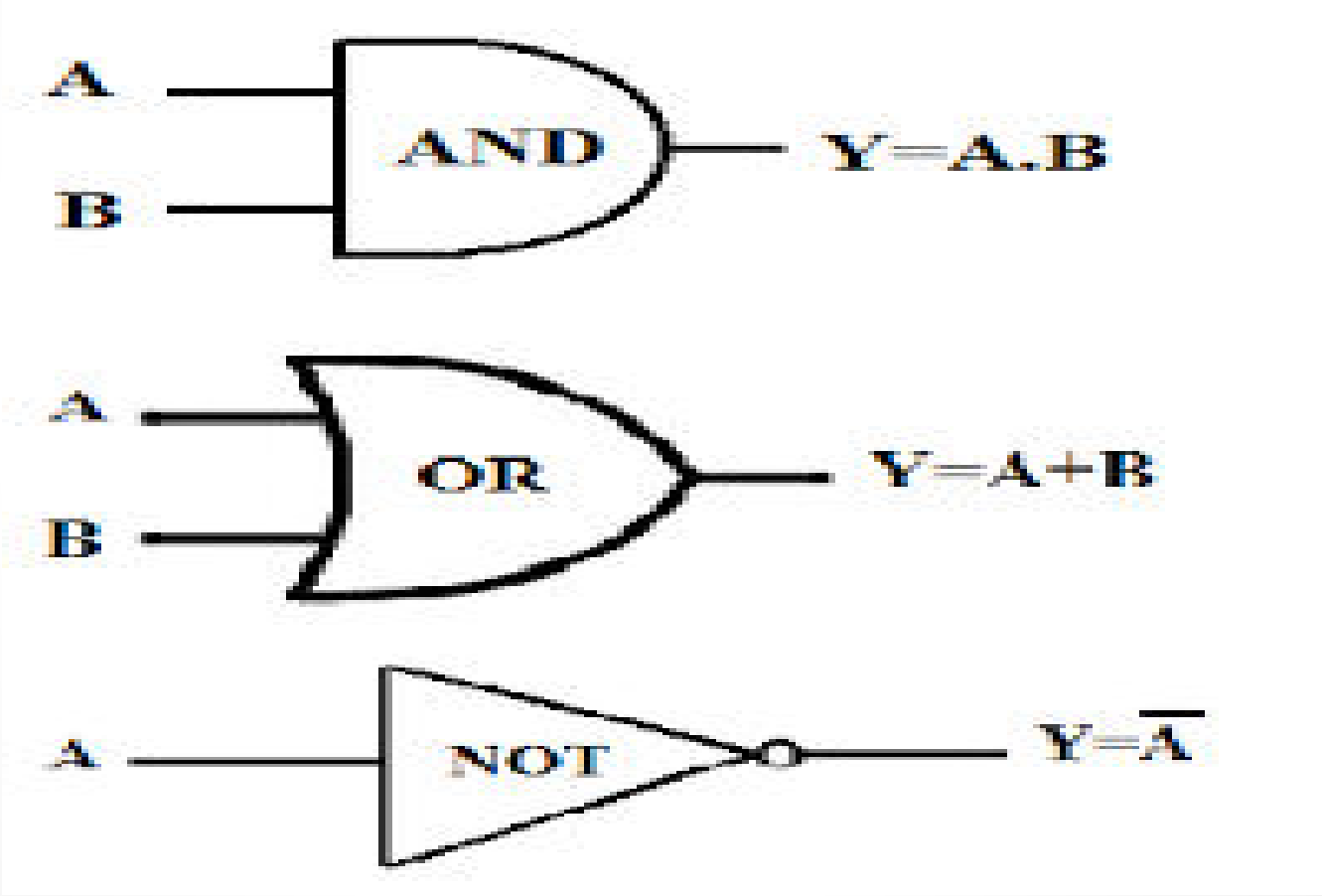


How to use Breadboard?

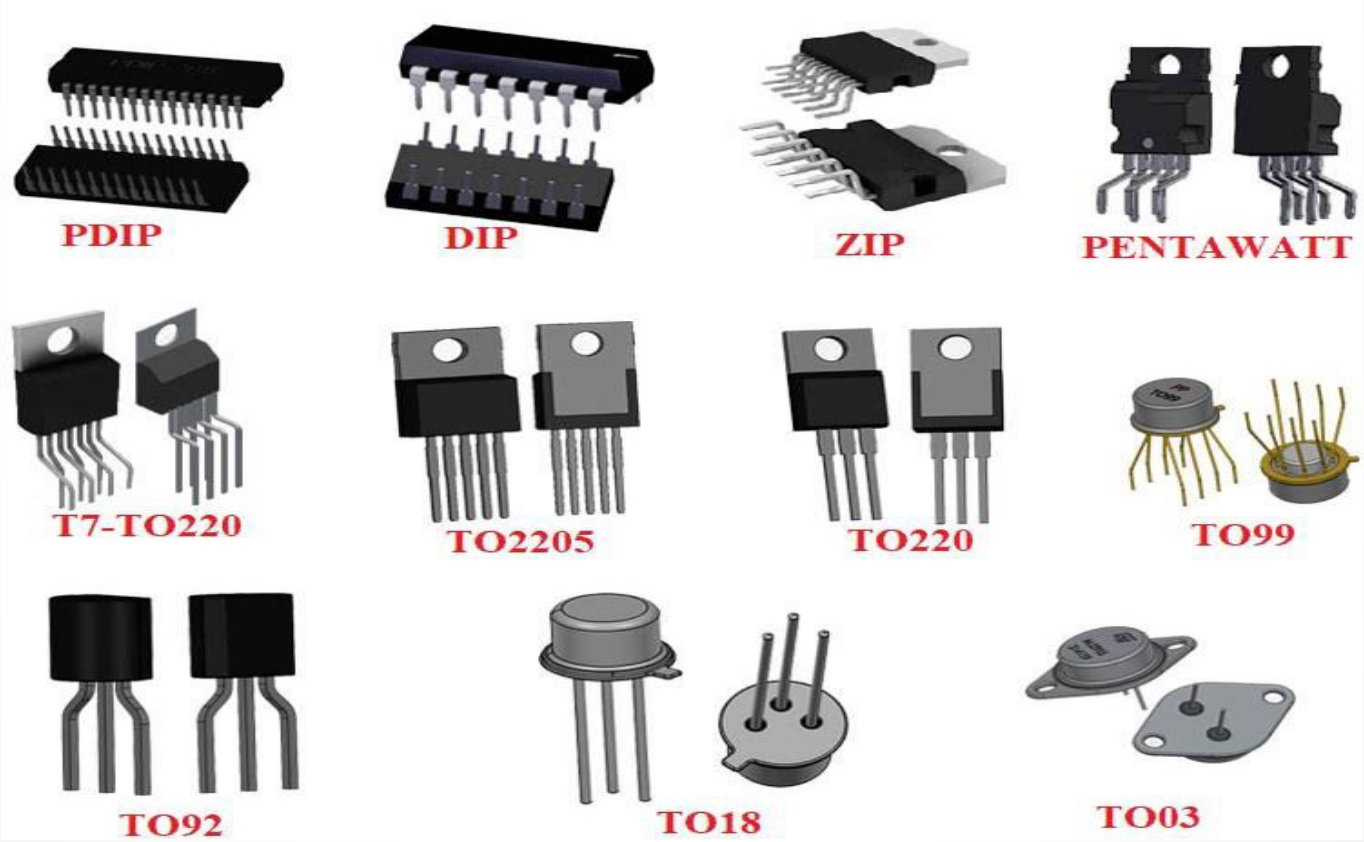



300Ω
+
-
9V

Logic Gates

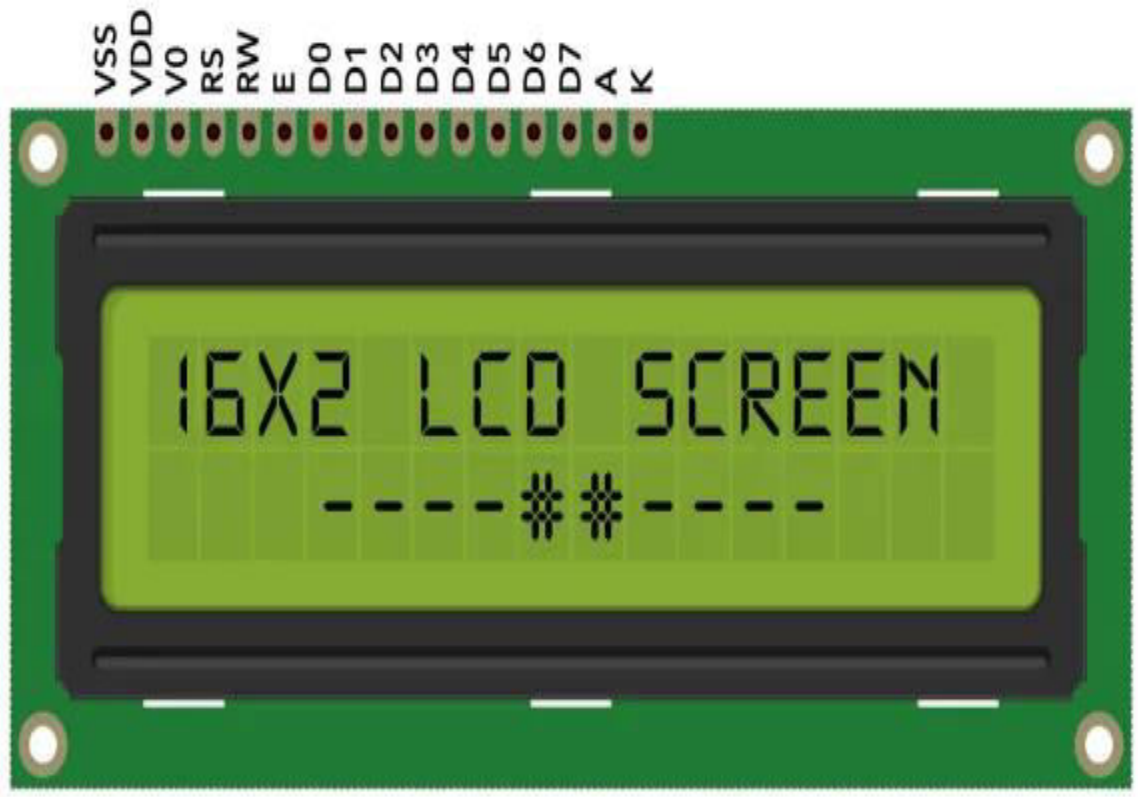


ICs (Integrated Circuits)



Sensors

LCD Display



No	Symbol	Function
1	VSS	Ground
2	VDD	5V +
3	V0	Contrast
4	RS	Register
5	RW	Read/Write
6	E	Enable
7	D0	Data bus
8	D1	Data bus
9	D2	Data bus
10	D3	Data bus
11	D4	Data bus
12	D5	Data bus
13	D6	Data bus
14	D7	Data bus
15	A	Anode (5V+)
16	K	Cathode (GND)

Microcontrollers