



INTRODUCTION TO Basics of Electronics (Components)






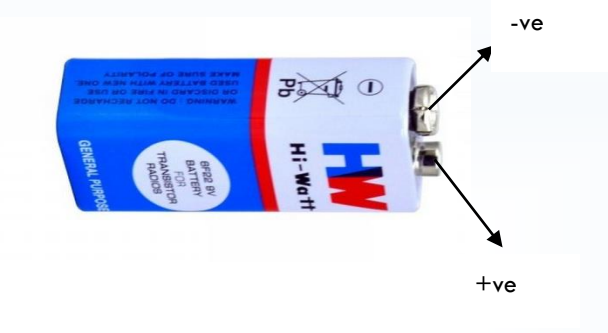
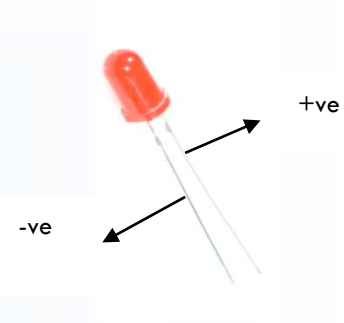



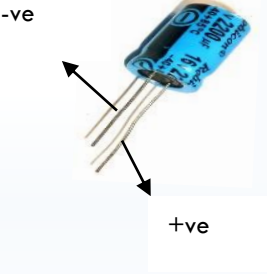

Activity Time

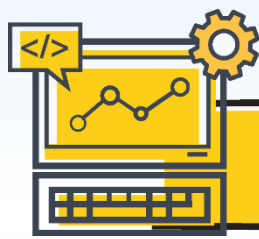
Place the components in their designated places on the activity book and denote the +ve and –ve end of the components wherever necessary.

Coin Cell		Battery 9V		LED
Male to Male Jumper Wire	Male to Female Jumper Wire	Female to Female Jumper Wire	Capacitor	Resistor



Answer!

				
Coin Cell		Battery 9V		LED
				
Male to Male Jumper Wire	Male to Female Jumper Wire	Female to Female Jumper Wire	Capacitor	Resistor



Analysis

The +ve sign on the flat surface of the coin cell denotes the +ve terminal, and the other side is –ve. In case of 9v battery, the +ve and –ve ends are denoted near the terminals. The longer leg on the led denotes the +ve terminal, and the shorter leg denotes the –ve terminal. In the case of a capacitor, there are black bars marked that give you information about each leg and its terminals.



Components



COIN CELL

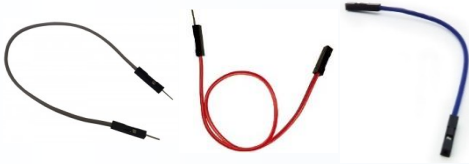
Coin cells are single cells which are used to power small portable electronics devices such as wrist watches, pocket calculators, artificial cardiac pacemakers, implantable cardiac defibrillators, automobile keyless entry transmitters, and hearing aids.



9V BATTERY

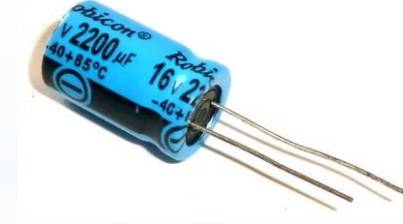
It is a common size of battery that was introduced for the early transistor radios? This type is commonly used in walkie-talkies, clocks and smoke detectors.

Components



JUMPER WIRES

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed. Jumper wires typically come in three versions: male to male, male to female and female to female.



CAPACITOR

A capacitor is a device that stores electrical energy in an electric field. It is a passive electronic component with two terminals. The effect of a capacitor is known as capacitance. The standard unit of capacitance is called the farad, which is abbreviated F.

Components



Diode

A diode is defined as a two-terminal electronic component that only conducts current in one direction (so long as it is operated within a specified voltage level). An ideal diode will have zero resistance in one direction, and infinite resistance in the reverse direction.



LED(Light Emitting Diode)

A light-emitting diode (LED) is a semiconductor device that emits light when an electric current is passed through it. Light is produced when the particles that carry the current (known as electrons and holes) combine together within the semiconductor material.

Components



RESISTOR

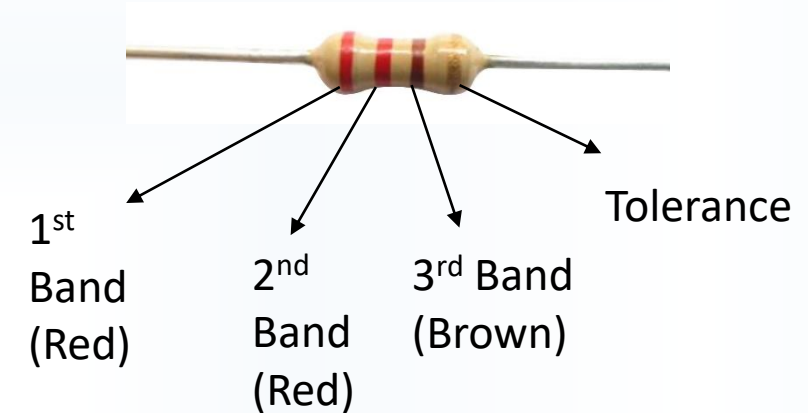
Resistor is an electrical component that reduces the electric current. The resistor's ability to reduce the current is called resistance and is measured in units of ohms (symbol: Ω).

The resistor's resistance limits the flow of electrons through a circuit. Resistors come in a variety of shapes and sizes.

Resistor Colour Coding

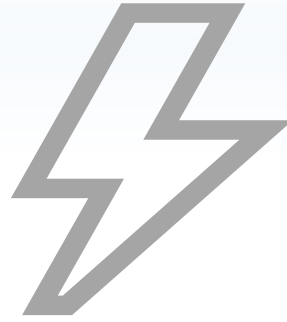
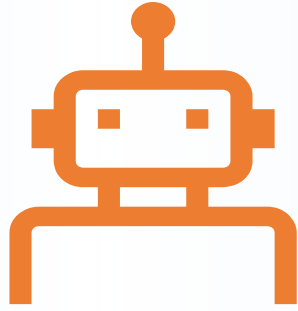
Colour	Colour	1 st Band	2 nd band	3 rd band Multiplier	4 th Band Tolerance
Black		0	0	x1Ω	
Brown		1	1	x10Ω	±1%
Red		2	2	x100Ω	±2%
Orange		3	3	x1kΩ	
Yellow		4	4	x10kΩ	
Green		5	5	x100kΩ	±0.5%
Blue		6	6	x1MΩ	±0.25%
Violet		7	7	x10MΩ	±0.10%
Grey		8	8	x100MΩ	±0.05%
White		9	9	x1GΩ	
Gold				x0.1Ω	±5%
Sliver				X0.01Ω	±10%

3 Band Resistor Resistance Calculation



Calculation

$$\begin{aligned}
 \text{Resistance} &= 1^{\text{st}} \text{ band } 2^{\text{nd}} \text{ band} \times 3^{\text{rd}} \text{ band (Multiplier)} \\
 &= 22 \times 10 \text{ } \Omega (\text{ohms}) \\
 &= 220 \text{ } \Omega (\text{ohms})
 \end{aligned}$$



9-volt batteries can be dangerous. The positive and negative posts are close together. If a metal object touches the two posts of a 9-volt battery, it can cause a short circuit. This can make enough heat to start a fire.

Capacitors discharge very slowly, but many can store a charge for years.

The smallest size resistor is the 0201 package which measures a tiny 0.6mm x 0.30mm.



Worksheet Time



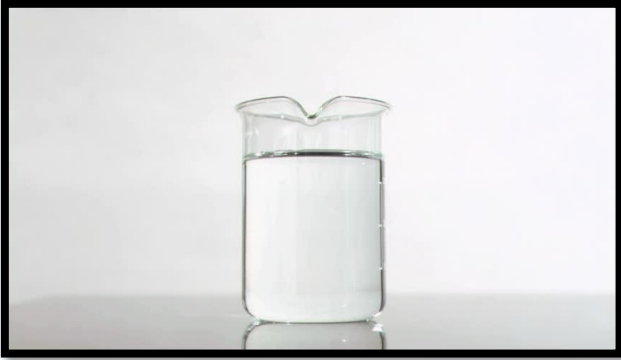


INTRODUCTION TO Basics of Electronics (Current, Voltage & Resistance)





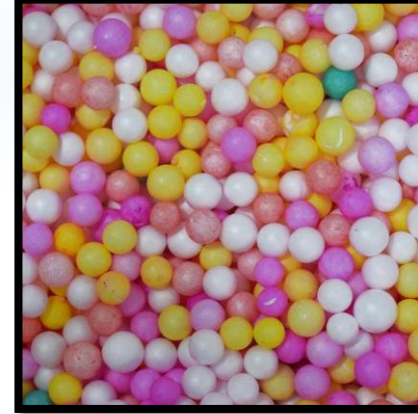
Straw Activity



Beaker with Water

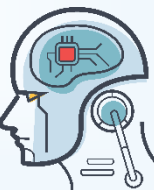
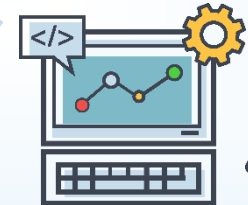
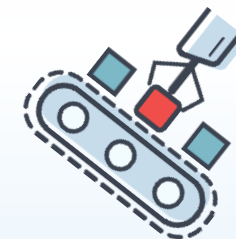
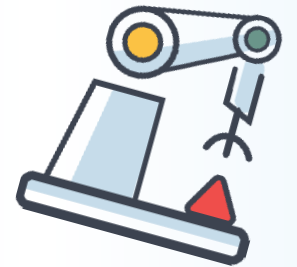
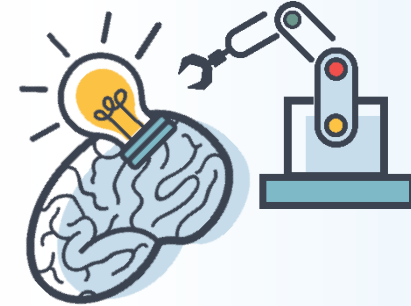


Transparent Straw



Small Thermocol Balls

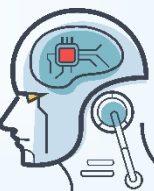
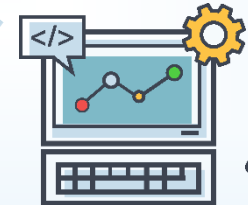
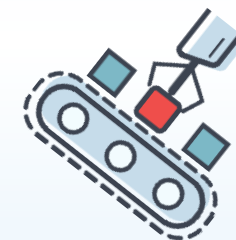
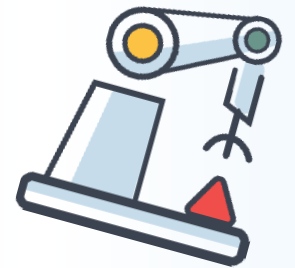
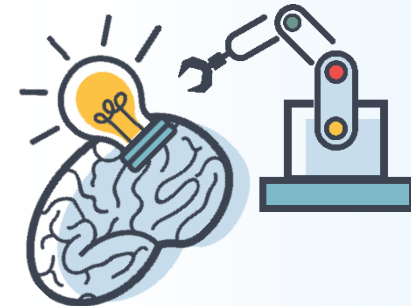
- ✓ Take a straw and pour water inside the straw.
- ✓ Observe the flow of water.
- ✓ Now take some Thermocol balls and add it inside the straw.
- ✓ Now pour water inside the straw and observe the flow of water





Analysis

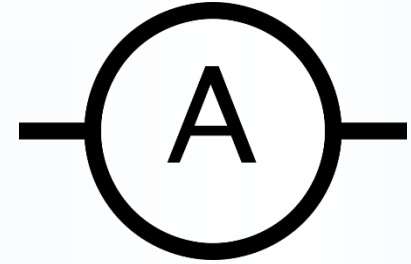
- ❑ Initially, the water flows through the straw without any obstruction from one point to other.
- ❑ Here the flow of water represents the flow of charge or electrons which is similar to the current flowing through the circuit.
- ❑ The start point can be denoted as a higher potential and the end as lower potential.
- ❑ When the Thermocol balls are added to the straw, it obstructs the flow of water through the straw.
- ❑ The balls act similar to resistance. The more Thermocol balls we insert; the less water flow is there through the straw.



Current, Voltage and Resistance

Current

Current is a flow of electrical charge carriers, usually electrons or electron-deficient atoms.



Voltage

The voltage/potential difference between two points is equal to the work done per unit of charge against a static electric field to move the charge between two points.



Resistance

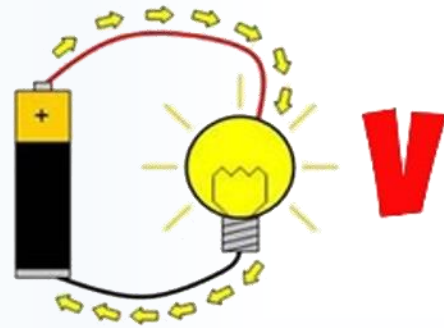
The tendency of a material to oppose the flow of electrons.



Circuit

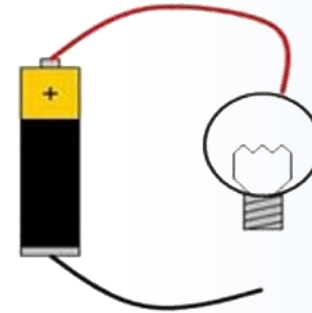
An electronic circuit is a complete course of conductors through which current can travel. Circuits provide a path for current to flow. To be a circuit, this path must start and end at the same point. In other words, a circuit must form a loop.

CLOSED



V

OPEN



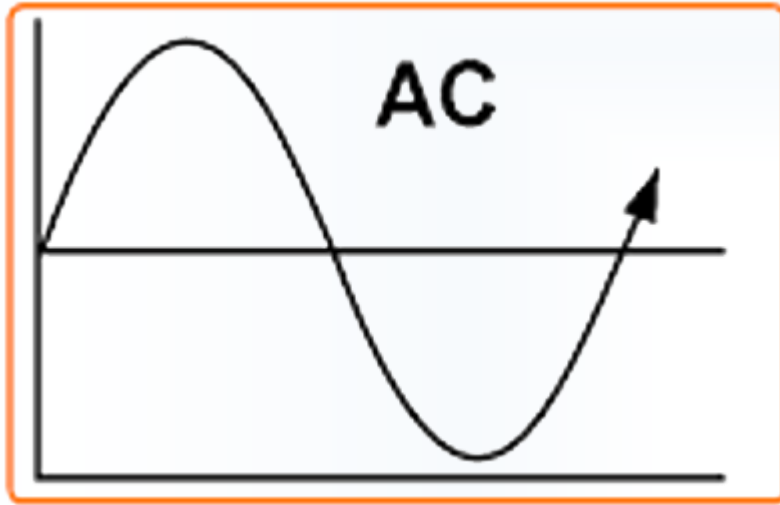
S

A circuit is considered to be closed when electricity flows from an energy source to the desired endpoint of the circuit.

Any circuit which is not complete is considered an open circuit. Electricity does not flow from an active energy source to the desired endpoint of the circuit.

Types of signals

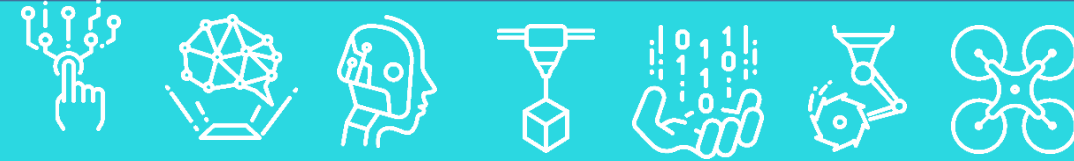
There are two types of electrical signals, those being alternating current (AC), and direct current (DC).



With alternating current, the direction electricity flows throughout the circuit is continuously reversing. You may even say that it is alternating direction.



With Direct Current, electricity flows in one direction between power and ground. In this arrangement, there is always a positive source of voltage and ground (0V) source of voltage



Worksheet Time





Electricity travels at the speed of light -- more than 186,000 miles per second!



DC voltage is a simple positive and negative type of electricity; power storage is usually in DC. With the future being mobile and compact, we can actually see DC becoming the voltage of choice.



If the voltage is sufficient enough, electric current can pass through air. Lightning strikes, when the voltage builds enough to pass through air.



INTRODUCTION TO Basics of Electronics

(Ohm's Law, Series and Parallel Connection)



Ohm's Law

Ohm's law states that the current through a conductor between two points is directly proportional to the voltage or potential difference between the two points provided the temperature is constant for a constant length and area.

Ohm's Law Formula

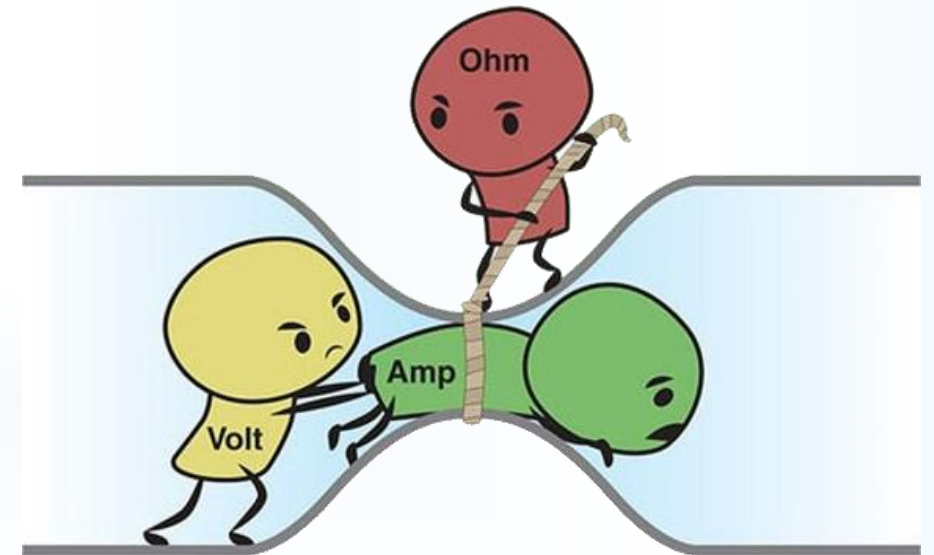
Voltage= Current × Resistance

$$V = I \times R$$

V= voltage (Unit: volts or V)

I= current (Unit: Amperes or A)

R= resistance (Unit: ohms or Ω)

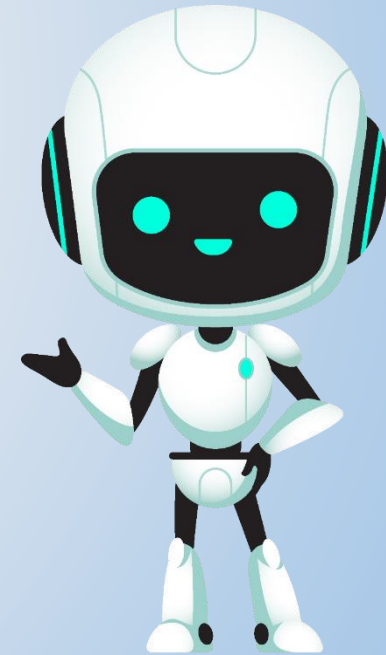




Ohm's Law Part 1



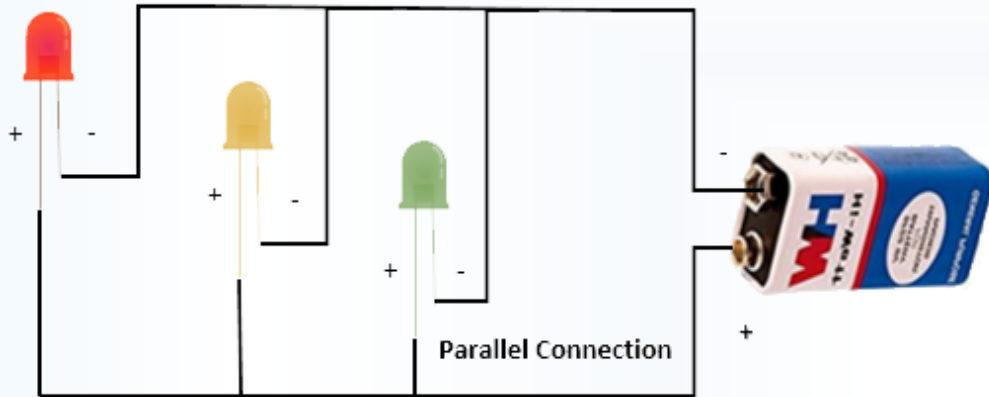
Ohm's Law Part 2



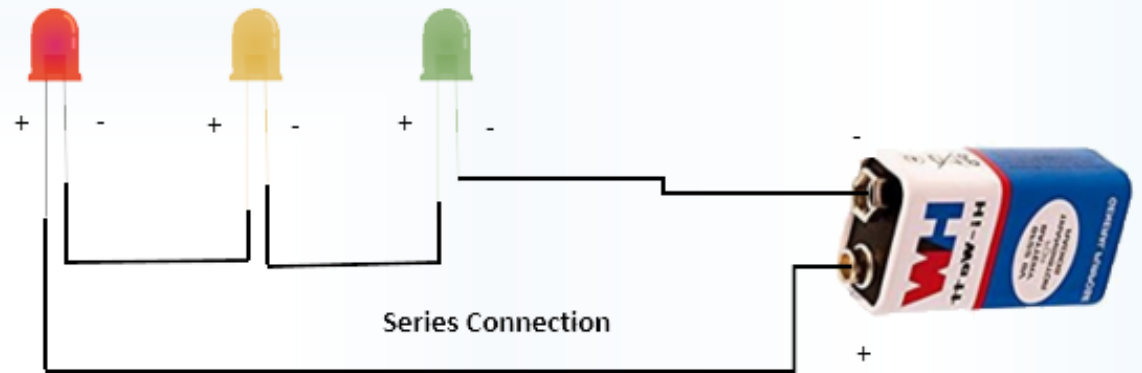


Series and Parallel Activity

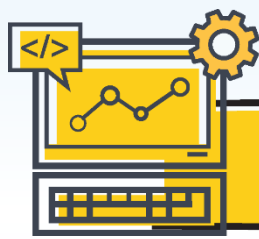
Circuit 1:



Circuit 2:

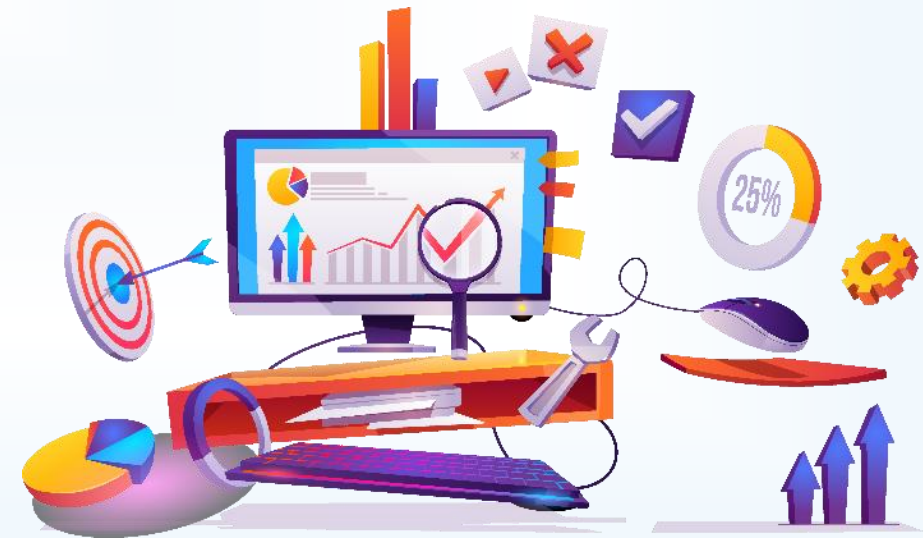


- ☐ Let's make two circuits.
- ☐ For the first circuit:
 - ☐ As shown take more LEDs and connect +ve end of all LEDs to one wire and –ve end to the other wire and connect to the battery and observe.
- ☐ For the second circuit:
 - ☐ As shown connect +ve end of LED to the first wire and connect the –ve end of the same LED to the +ve end of the second LED; so as to make a chain of connection. Connect the –ve terminal of the last LED to the second wire. Now, connect the first wire to the +ve terminal of the coin cell and the second wire to the -ve terminal of the battery and observe the changes.



Analysis

The first circuit is a parallel connection, and the second circuit is a series connection. In parallel connection the voltage remains the same, and the current gets divided which allow all the LEDs to glow, but in case of series connection as the voltage gets divided, but the current remains constant all the LEDs might not glow.

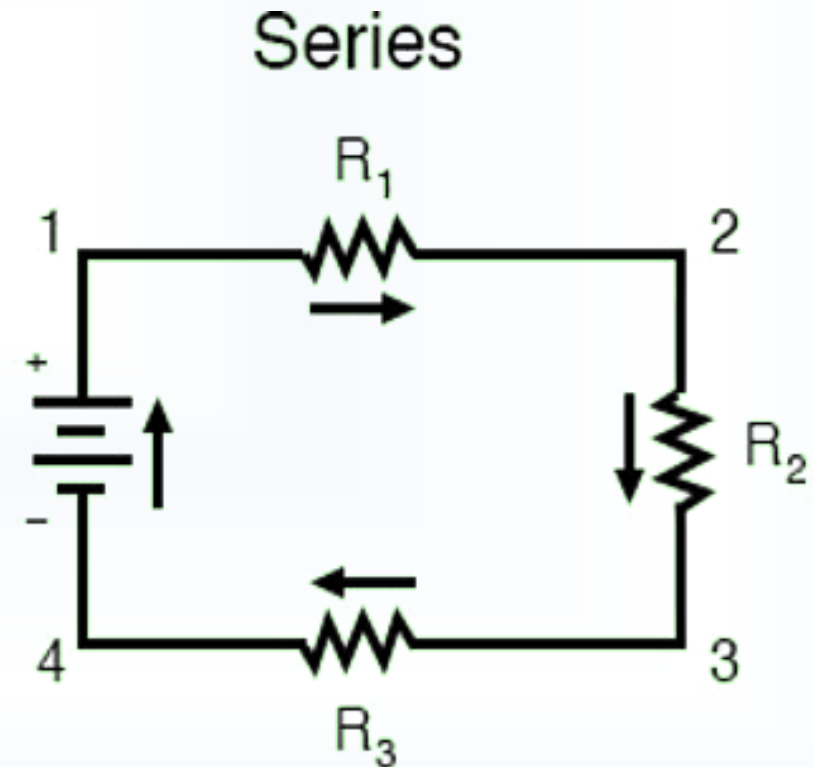


Series connection

Three resistors (labelled R₁, R₂, and R₃) are connected in a long chain from one terminal of the battery to the other. The defining characteristic of a series circuit is that there is only one path for current to flow. In this circuit, the current flows in a clockwise direction, from point 1 to point 2 to point 3 to point 4 and back around to 1.

Formula for resistance connected in series :

$$\text{Series: } R = R_1 + R_2 + R_3$$



The subscript labelling—those little numbers to the lower-right of the letter “R”—are unrelated to the resistor values in ohms. They serve only to identify one resistor from another.

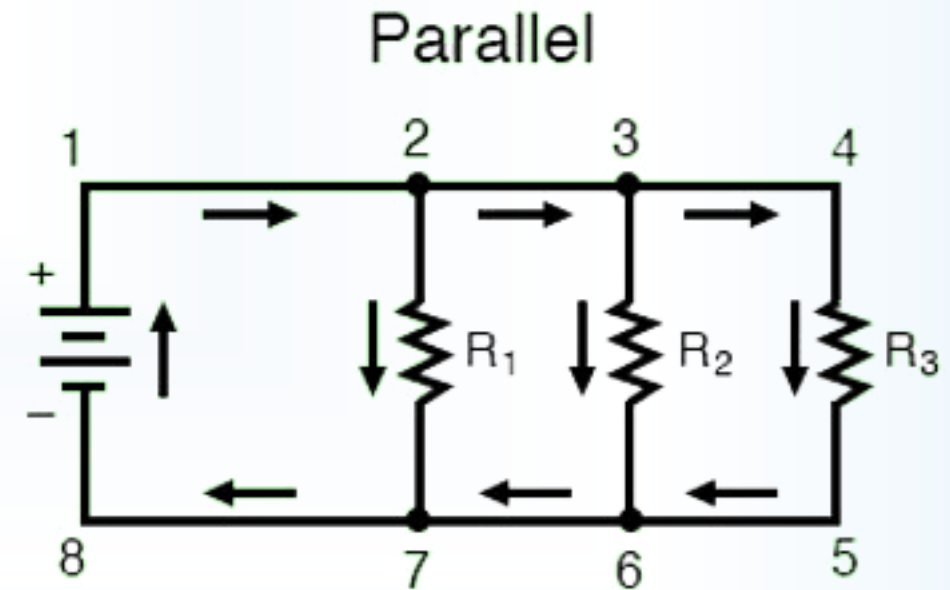
Parallel connection

Again, we have three resistors, but this time they form more than one continuous path for current to flow. There's one path from 1 to 2 to 7 to 8 and back to 1 again. There's another from 1 to 2 to 3 to 6 to 7 to 8 and back to 1 again. And then there's a third path from 1 to 2 to 3 to 4 to 5 to 6 to 7 to 8 and back to 1 again. Each individual path (through R_1 , R_2 , and R_3) is called a branch.

The defining characteristic of a parallel circuit is that all components are connected between the same set of electrically common points. Looking at the schematic diagram, we see that points 1, 2, 3, and 4 are all electrically common. So are points 8, 7, 6, and 5. Note that all resistors, as well as the battery, are connected between these two sets of points.

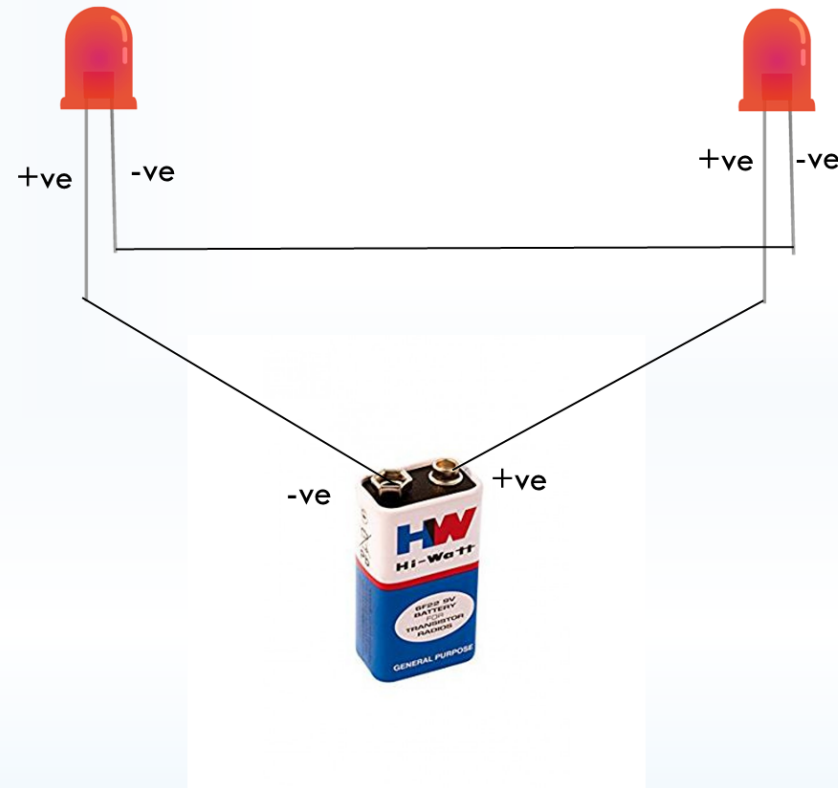
Formula for resistance connected in parallel :

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



Things you can do

Try connecting +ve leg of one LED to the +ve terminal of battery and +ve leg of the other LED to the -ve terminal of the battery while combining both the -ve legs of the two LED's?





Worksheet Time

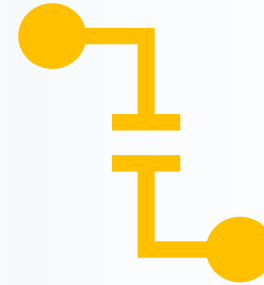




Ohm's Law is generally applied only to direct current (DC) circuits, not alternating current (AC) circuits.



Ohm's Law was rejected at first.



In a circuit, electrons flow from negative to positive.

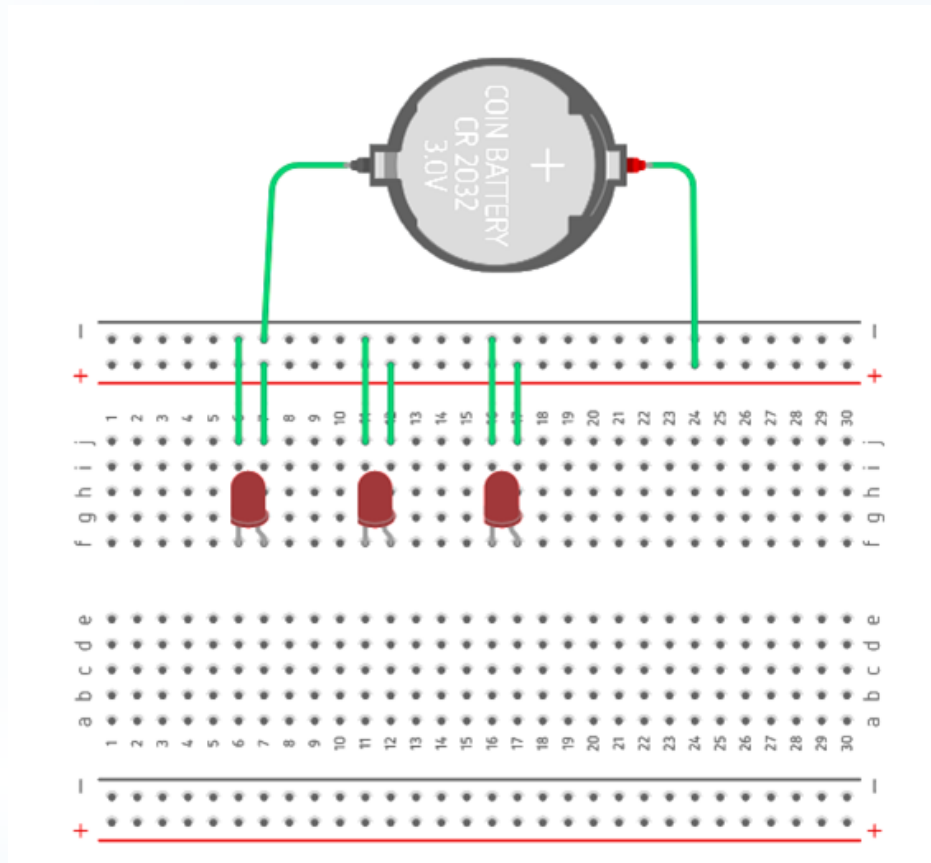


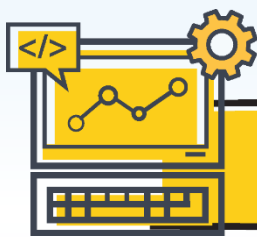
INTRODUCTION TO Breadboard and PCB





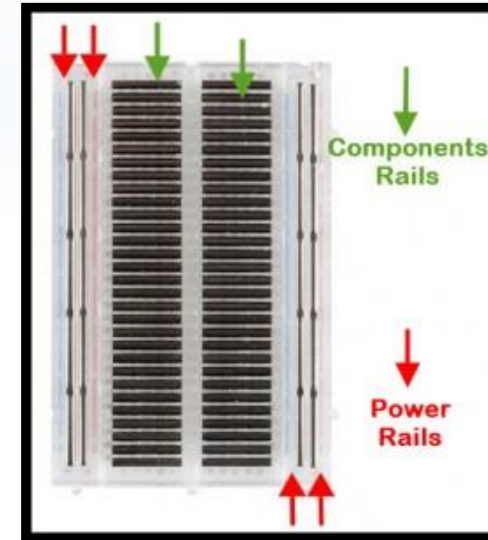
Connect the LED's on the breadboard as shown in the image below:



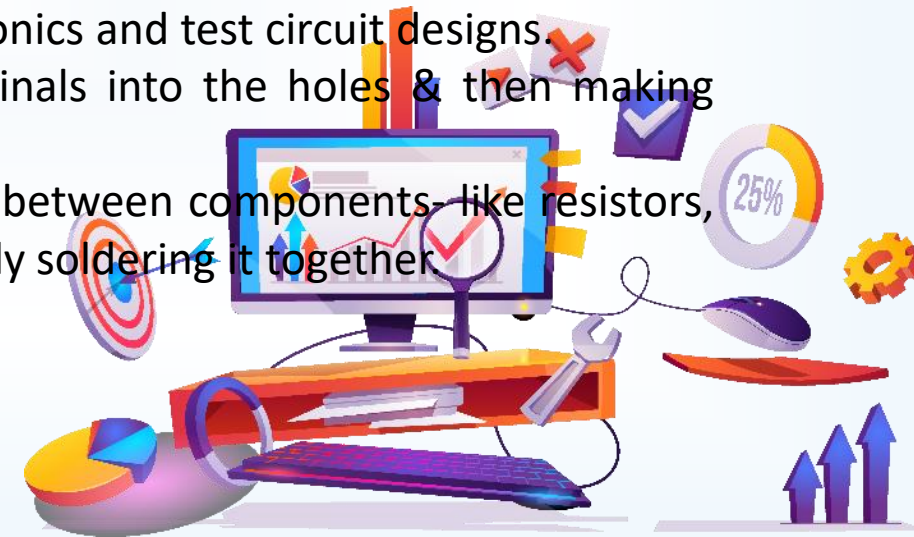


Analysis

Breadboard



- ❑ A breadboard is a solderless device for temporary prototype with electronics and test circuit designs.
- ❑ Electronic components can be interconnected by inserting their terminals into the holes & then making connections through wires where appropriate.
- ❑ The purpose of the breadboard is to make quick electrical connections between components- like resistors, LEDs, capacitors, etc- so that you can test your circuit before permanently soldering it together.



Breadboard connections



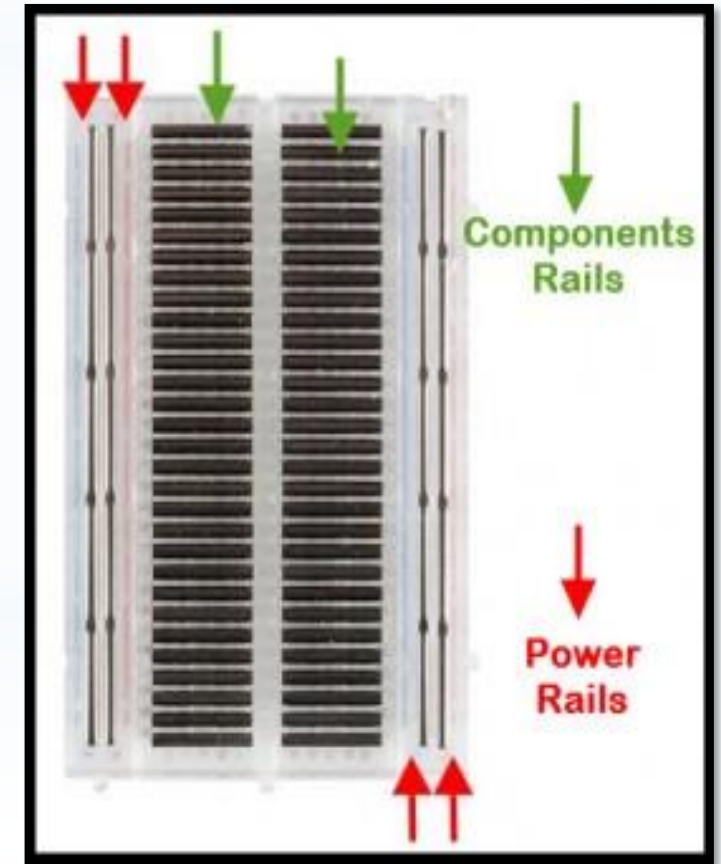
When you see the backside of the board there will be some metal strips connected horizontally and vertically.

Power Rails

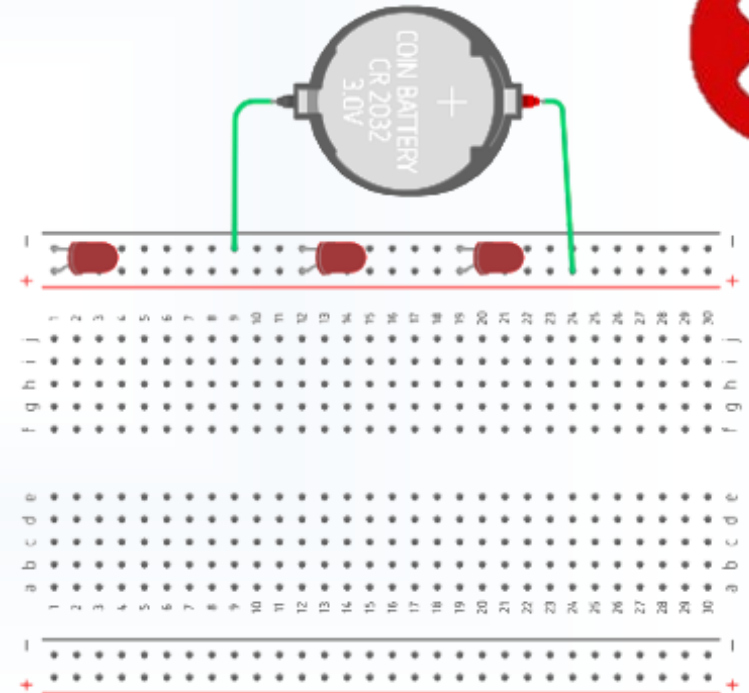
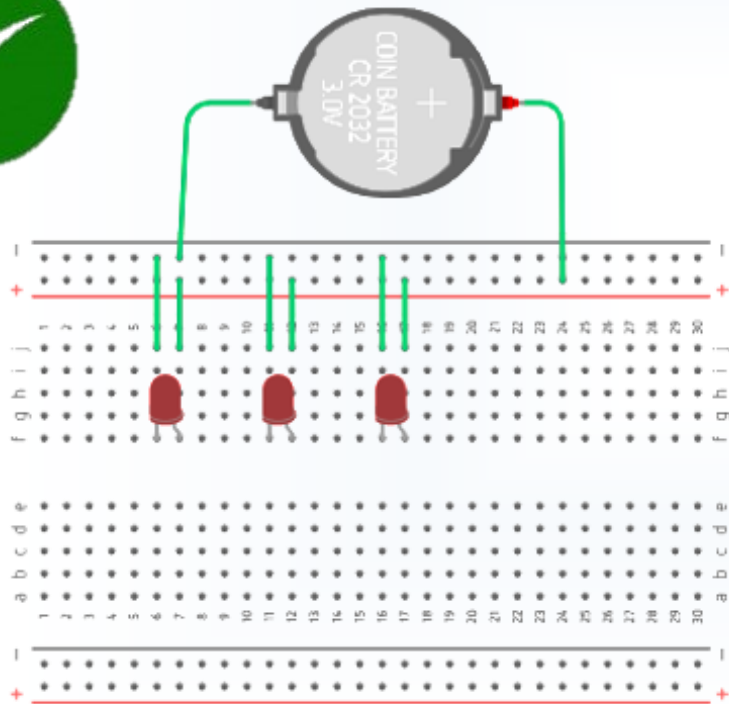
The metal strips which are connected horizontally and have blue and red line marked are called the power rails. When building a circuit, you tend to need power in lots of different places. The power rails give you lots of easy access to power wherever you need it in your circuit.

Component Rails

The metal strips which are connected vertically and have numbers and alphabets written are called as Component rails. These rails help you to connect the electronic components (resistors, LEDs, capacitors, etc-) to make a temporary circuit for testing purposes.

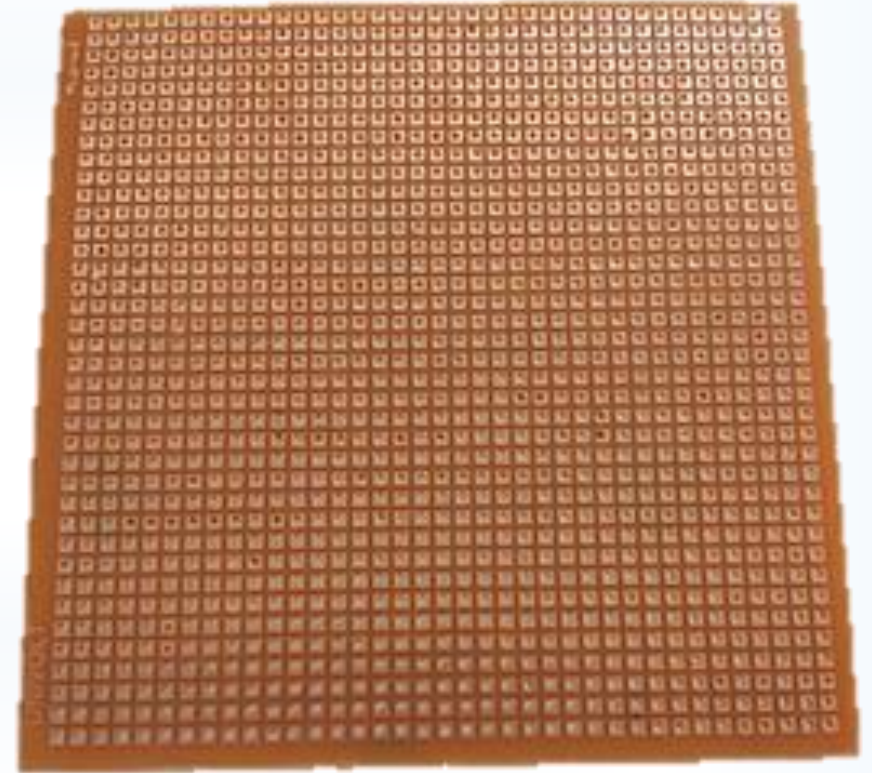


Connecting components on a breadboard



PCB(Printed Circuit Board)

General purpose PCB boards are widely used in making circuits. Its layer is coated with copper or aluminium and allows proper soldering without any short circuit.





Worksheet Time





In the early days of radio, amateurs nailed bare copper wires or terminal strips to a wooden board and soldered electronic components to them. In 1920s TRF radio manufactured by Signal was constructed on a wooden breadboard.



The early PCB material could be almost anything, from Bakelite and Masonite to plain old thin pieces of wood.

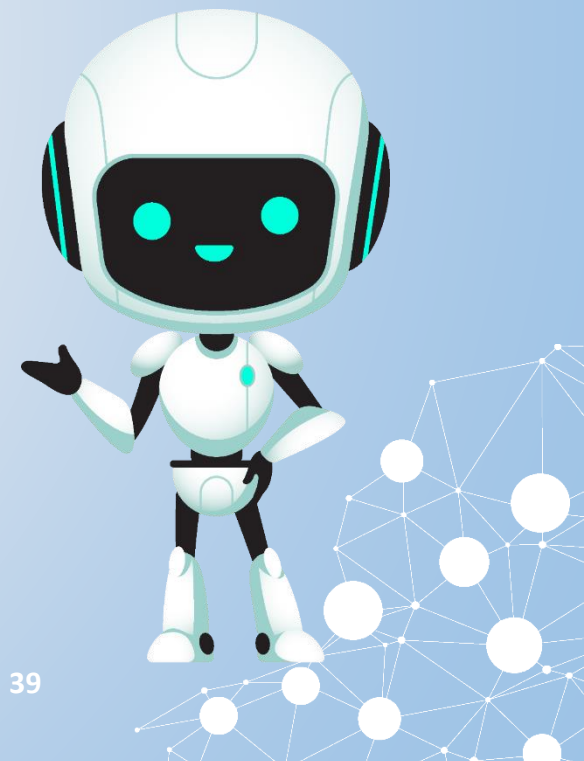


INTRODUCTION TO Paper Circuit





Watch the video and create DIY LED Cards !





Copper is man's oldest metal, dating back more than 10,000 years. A copper pendant discovered in what is now northern Iraq goes back to about 8700 B.C.



Pure Copper's melting point is 1083°C and is easily alloyed with other metals.

