

# JOB ROLE – INSTALLATION TECHNICIAN COMPUTING AND PERIPHERALS

Sector – Electronics  
(Qualification Pack Code: ELE/Q4609)



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# UNIT 1: BASIC ELECTRONICS AND COMPUTER FUNDAMENTALS

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# Unit Objectives

The student will be able to:

- Describe the term electricity,
- Identify different sources of electricity,
- Describe the energy transformation,
- Define and measure the electrical quantities i.e.  
Current, Voltage, Resistance,
- Prepare the circuit and verify the Ohm's Law,
- Prepare the circuit and verify the Kirchhoff's Law.

# Introduction

Electricity holds an important place in modern society. In almost all appliances used these days work on electricity. Even the automobile industry has launched cars, which run on electricity instead of fuel. If the power supply of a city breaks down, hospitals, hostels, offices, schools, food storage plants, banks and shops will also stop working.



# Basics of Electricity

What is electricity ?

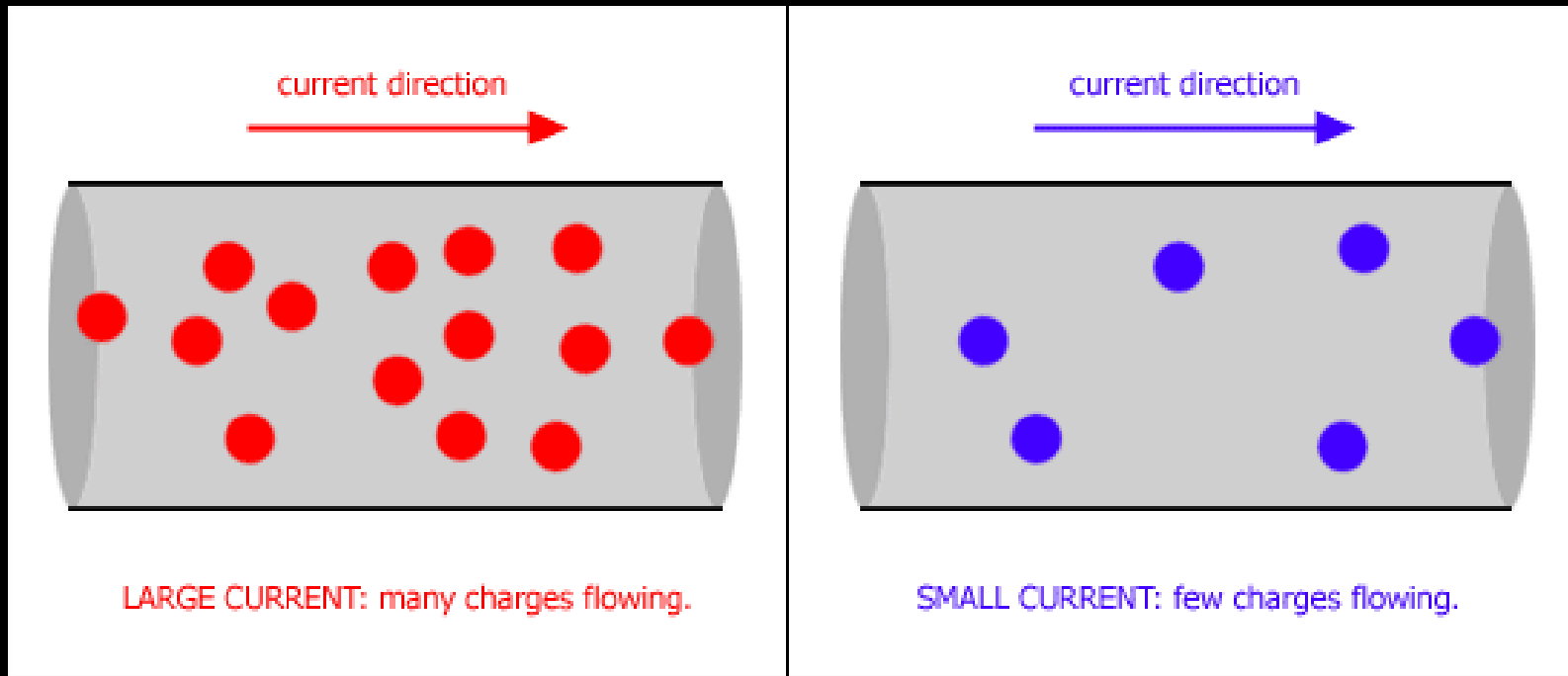
You all have seen natural lightening.



**Natural lightning** is an example of electricity.

# Definition of Electricity

Electricity is **flow of charges**. More the charges more will be the electricity.



Charges are due to the presence of sub-atomic particles i.e.  
**Electrons, Protons**

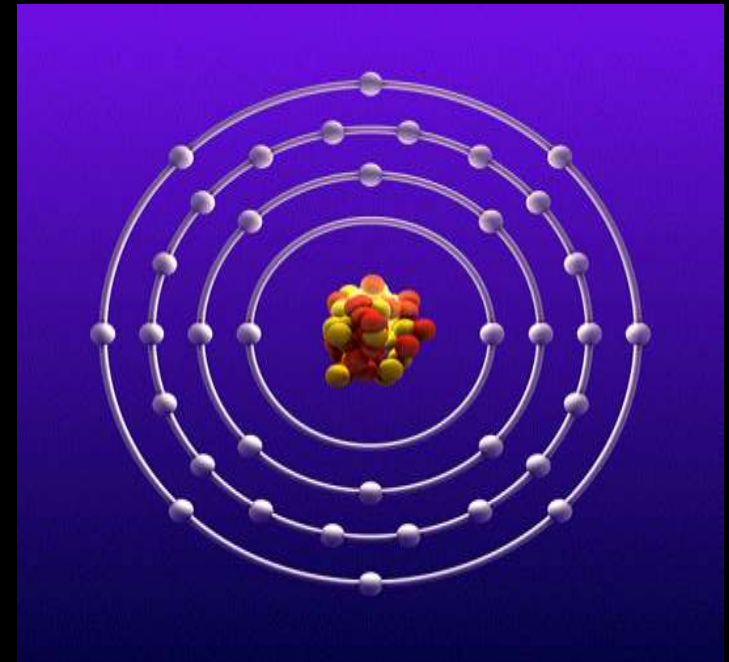
# Atomic Structure

- All matter consist of one or more elements.
- Smallest unit of element is atom.
- Subatomic particles of an atom are -

**Proton** – Positive charge (+)

**Neutron** – Neutral (no charge)

**Electron** – Negative charge (-)

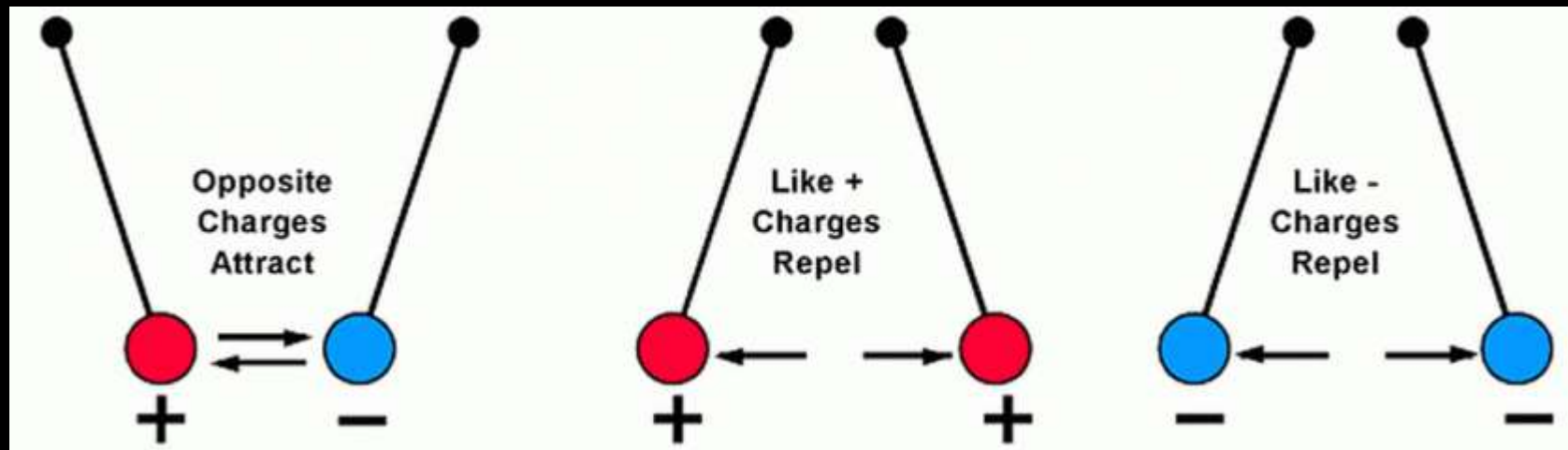


Note - Respective colours in text are used to label the diagram



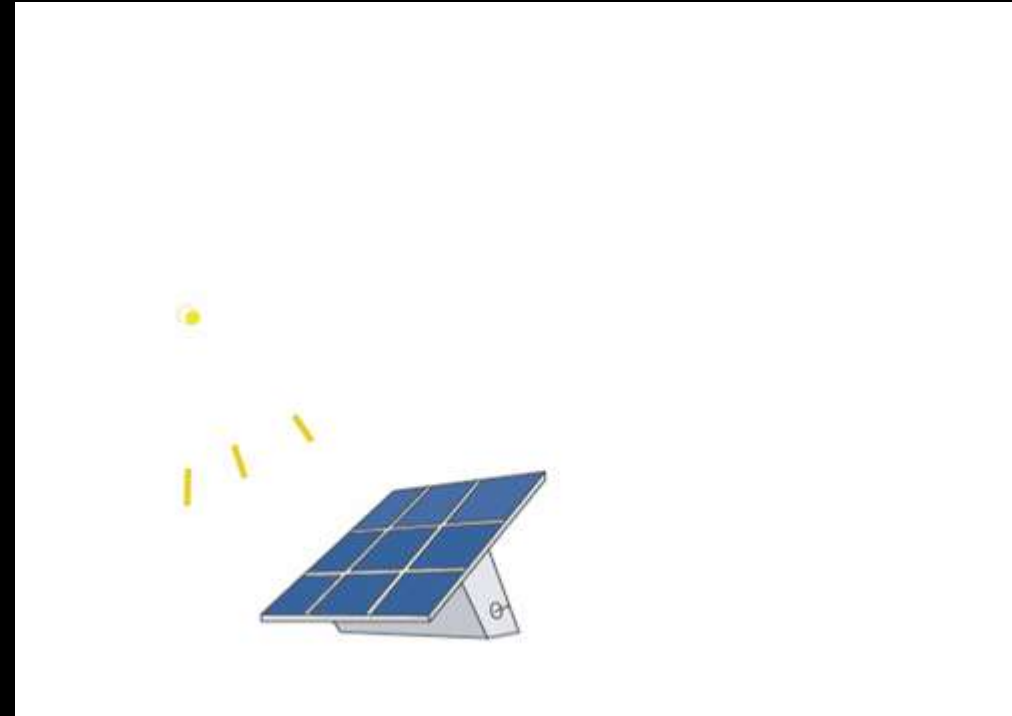
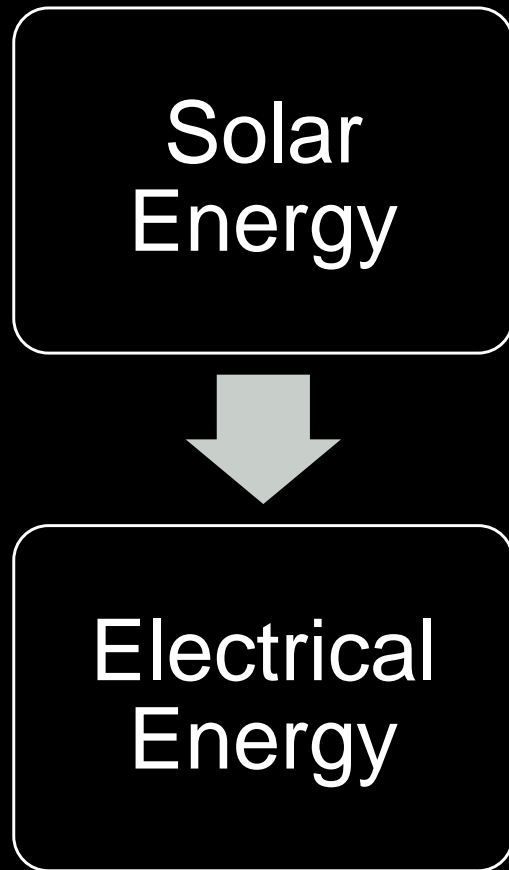
# What is Electric Charge?

- Charge is the property of sub-atomic particles.
- Same charges attract each other.
- Opposite charges repel each other.
- One coulomb of charge is equal to  $6 \times 10^{18}$  electrons



# Energy Transformation

“Energy can neither be created nor destroyed, it can only change from one form to another”.

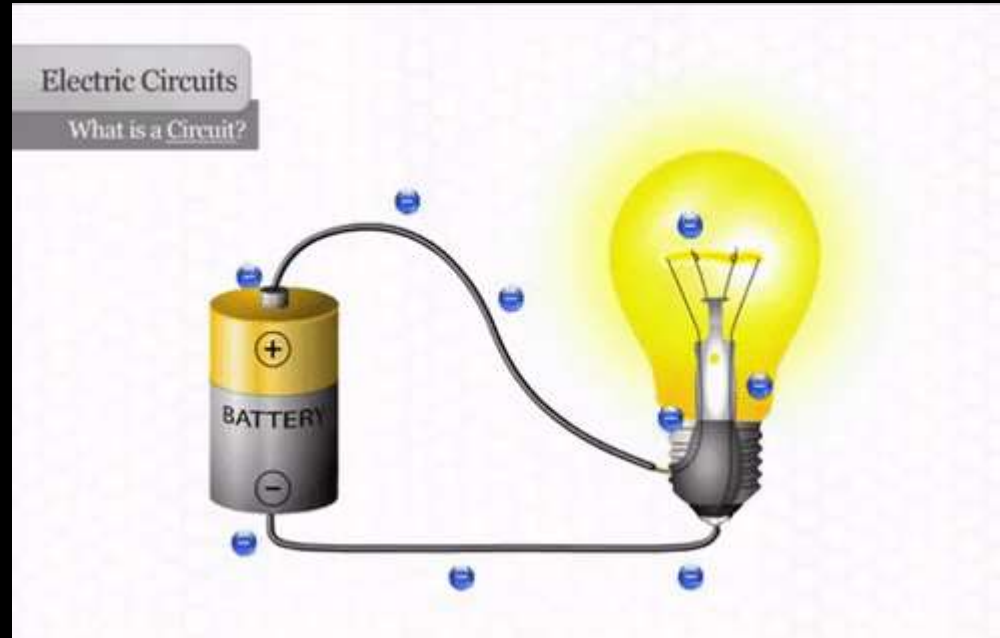


Continue.....

Chemical  
Energy



Electrical  
Energy



Continue.....

# Different Forms of Energy

**Hydel Energy-** Use of **water** for generation of energy.



**Thermal Energy-** Use of **coal** for generation of energy.

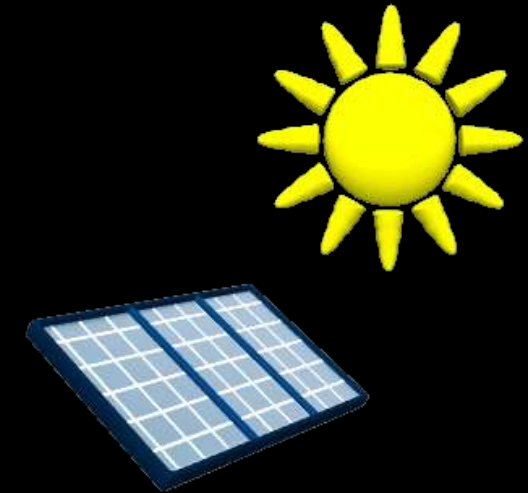


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**Nuclear energy-** Use of **nuclear reaction** for generation of energy.



**Solar energy-** Use of **sunlight** for generation of energy.



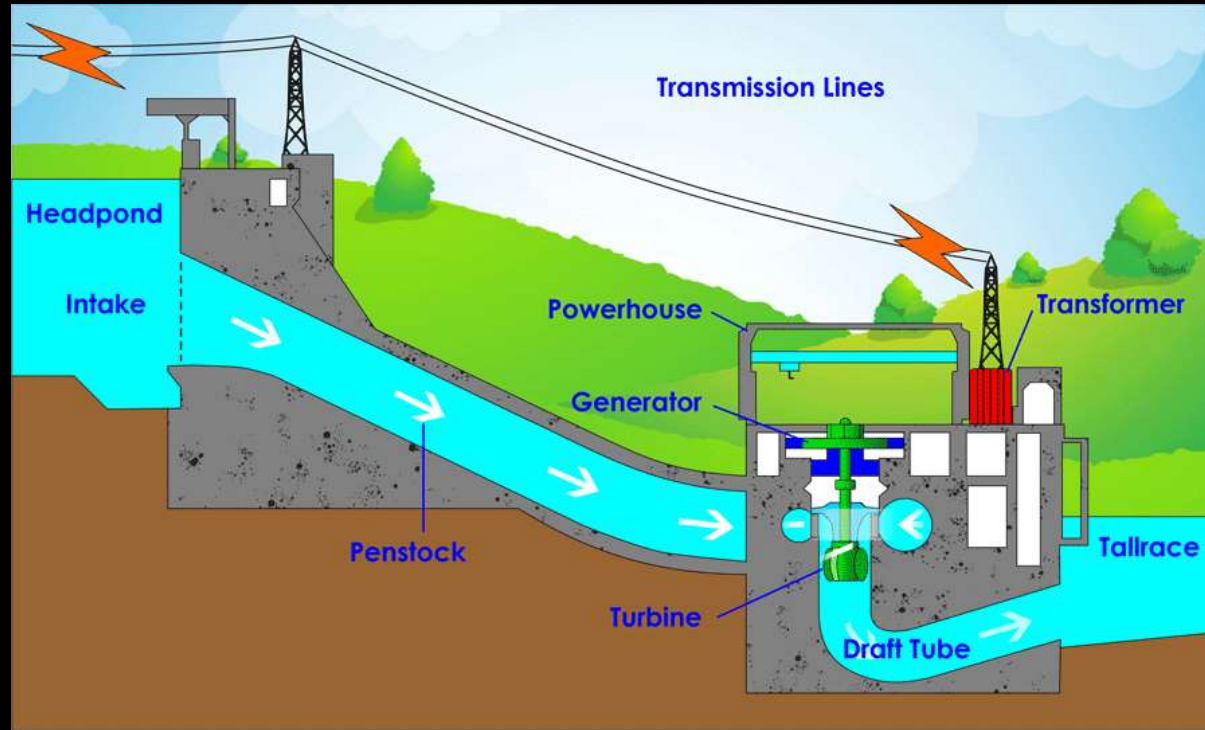
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# Wind Energy – Use of **wind** for generation of energy.



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Hydel Energy



Electrical Energy

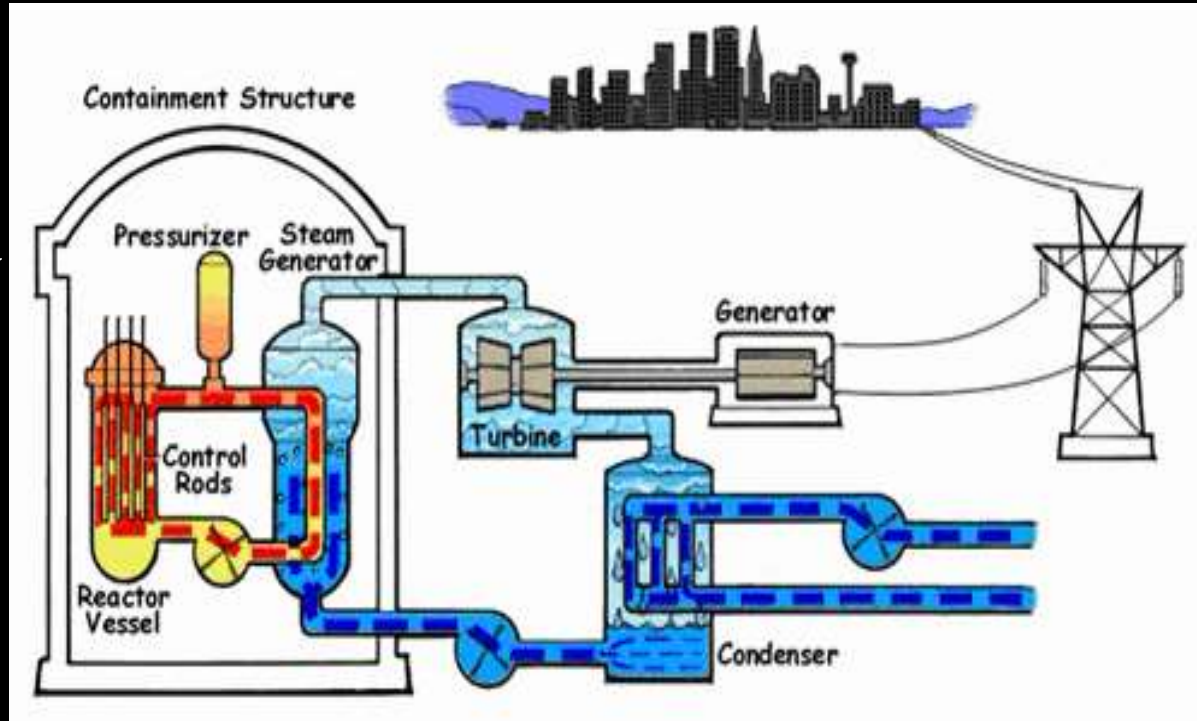
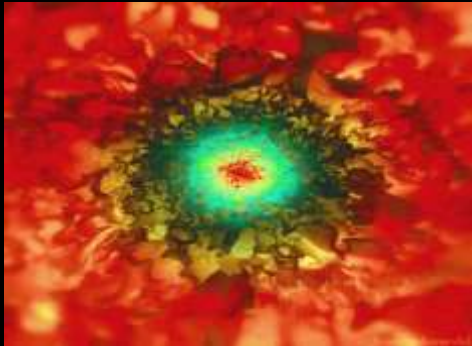


## Energy Transformation

Hydel Energy to Mechanical Energy to Electrical Energy

Continue.....

Nuclear Energy



Electrical Energy



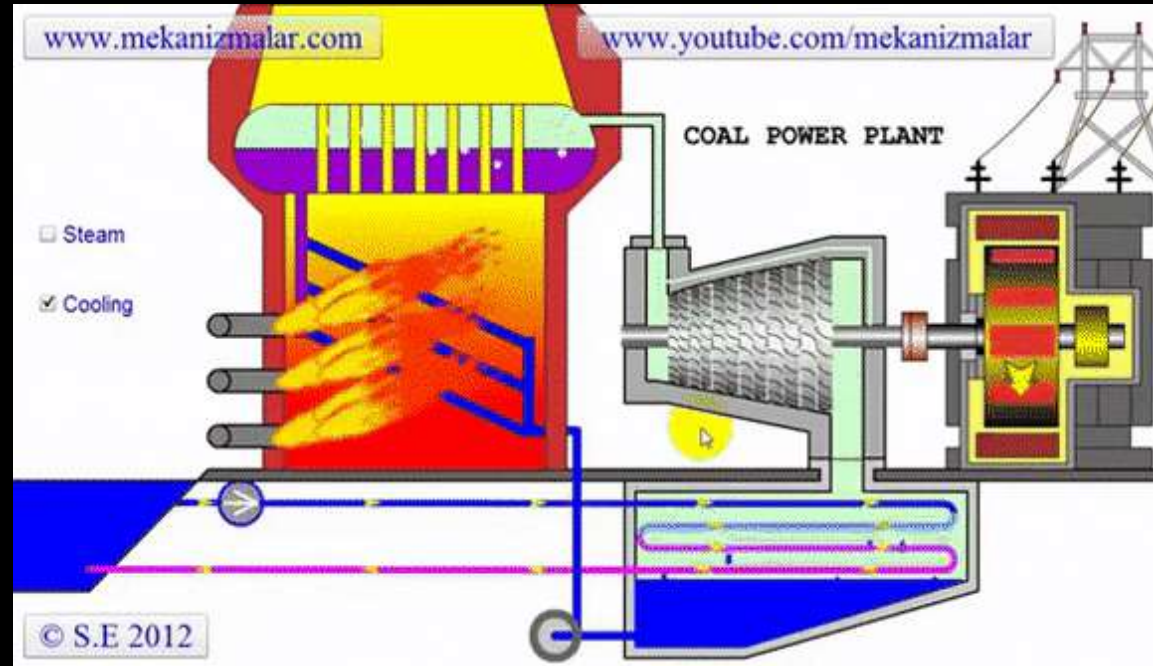
## Energy Transformation

Nuclear Energy to Mechanical Energy to Electrical Energy

Continue.....



Thermal Energy



Electrical Energy



## Energy Transformation

Thermal Energy to Mechanical Energy to Electrical Energy

Continue.....

# Energy Conversion

Hydel Energy  
Thermal Energy  
Nuclear Energy  
Solar Energy  
Wind Energy






Electrical  
Energy

# Types of Electricity

<b>Static</b>	<b>Dynamic</b>
Imbalance of negative and positive charges	Flow of charges
Charges remains at fix place	Charges are moving from one place to other
Static form of electricity	Dynamic form of electricity

# Electrical Quantities

<p><b>Voltage</b></p>	 <p>A yellow rectangular warning sign with a black border. At the top, the word "DANGER" is written in bold black letters on a yellow background. Below this is a black triangle containing a black lightning bolt symbol. At the bottom, the words "HIGH VOLTAGE" are written in bold black letters on a yellow background.</p>
<p><b>Current</b></p>	 <p>A white rectangular warning sign with a black border. At the top, the word "DANGER" is written in bold white letters inside a red oval. Below this, the words "ELECTRIC CURRENT" and "KEEP AWAY" are written in bold black letters on a white background.</p>
<p><b>Resistance</b></p>	 <p>A black schematic symbol for a resistor, consisting of a zigzag line with three peaks and three valleys, connected to horizontal lines on both ends.</p>

# What is Voltage?

“Energy transfer by 1 coulomb charge Q that moves between two points.”

$$V=W/Q$$

where,

‘V’ is voltage

‘W’ is work in joule

‘Q’ is charge in coulomb

# What is Current?

Flow of electrons is called current. Its unit is ampere (A).

Symbolic representation of current is 'I' or 'i'.

'I' is for DC current,

'i' is for AC current.

$$I = Q / t$$

## Classification of Current

1. Direct Current (DC)
2. Alternating Current (AC)

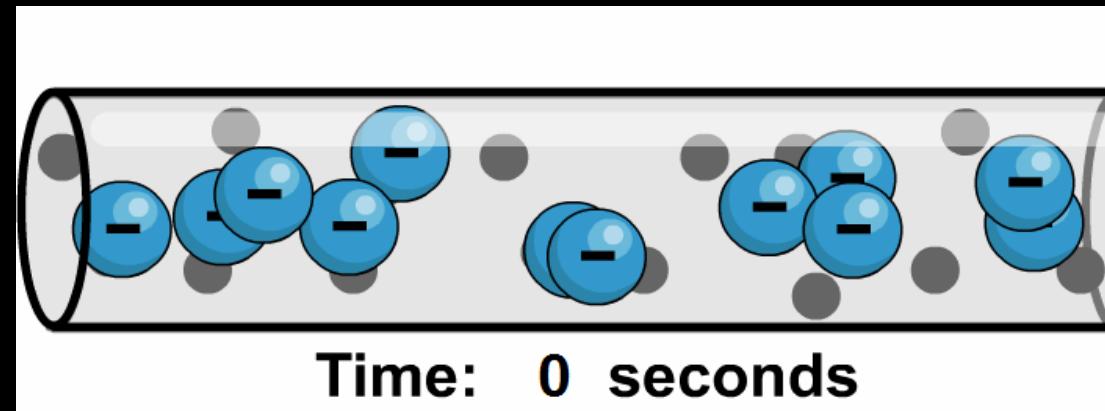
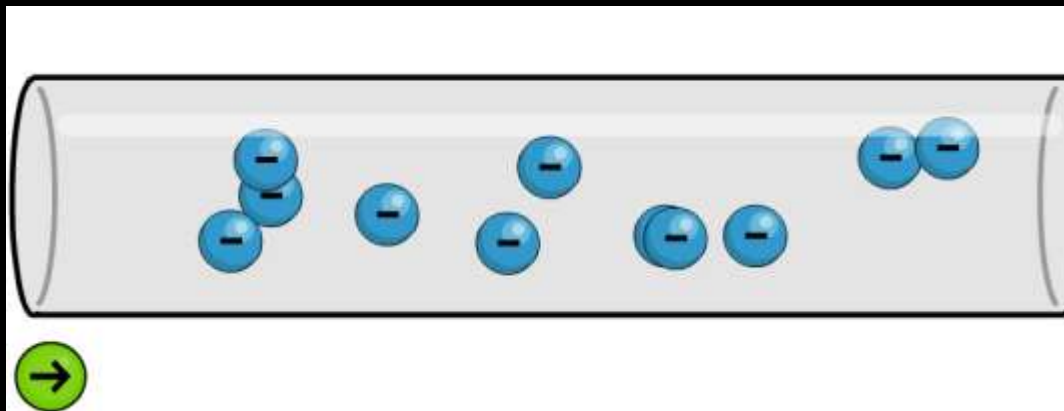
<b>Direct Current (DC)</b>	<b>Alternating Current (AC)</b>
Electrons moves only in one direction	Electrons moves in both the direction
Unidirectional in nature	Bidirectional in nature
Frequency is zero	Frequency is 50 Hertz
Example: Batteries and cell	Example: AC generator

# What is Resistance?

It **resists** the **flow of electrons**.

The resistance controls the flow of electric current.

It is denoted by '**R**'. Its unit is **Ohms**





# What is Power?



- An electric kettle rated as 220V, 1500 Watt
- Means that kettle consumes **1500 joule electrical energy in one second**, if connected to 220V.
- This consumed electrical energy produce some work.

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# Power is define as:

“Amount of work done in one second”.

The SI unit is **Watt**.

$$P = V \times I$$

Where,

P = Power

V = Voltage

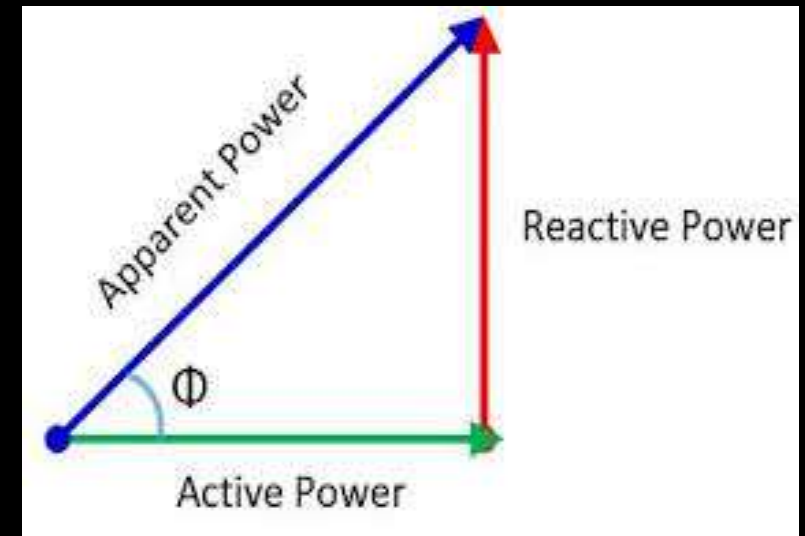
I = Current

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# Power Factor

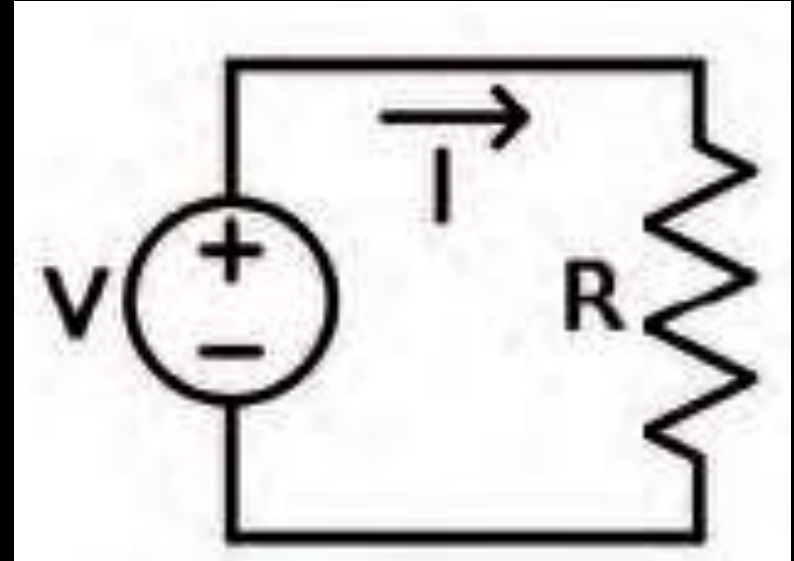
Power factor is the ratio of real power to the apparent power. Its values varies from 0 to 1. It is denoted by  $\cos \phi$ .

Power factor = Real power / Apparent power



# Electric Circuit

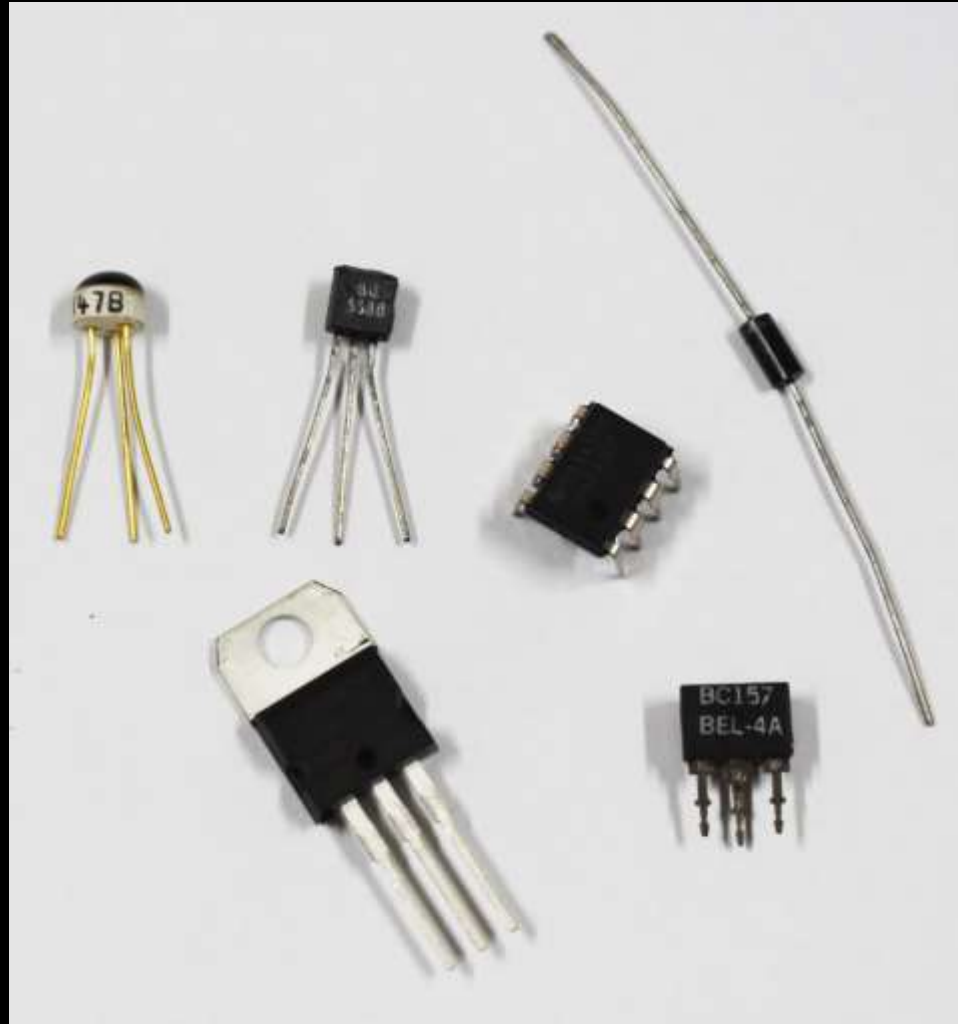
Complete path from the source to the load and back to the source is called as **circuit**.



# Types of Components

<b>Active</b>	<b>Passive</b>
Amplifies the input signal	Do not amplifies the input signal
Require offset voltage for operation	Do not require offset voltage for operation
Transistor, Operational amplifier are active component	Resistor, Capacitor, Inductor are passive component.

# Active Components



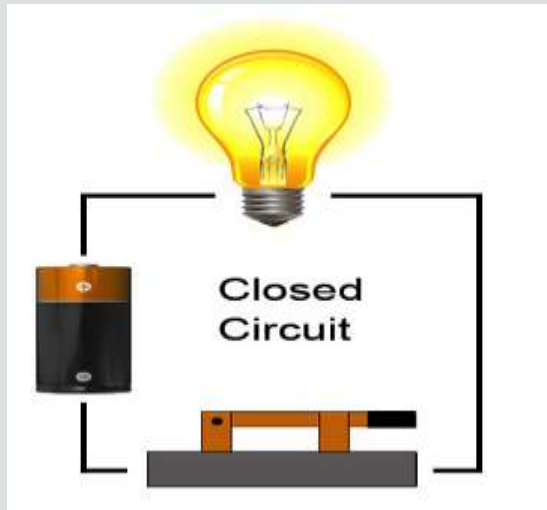
# Passive Components



# Closed Circuit

If the circuit is complete, it is called **closed circuit**.

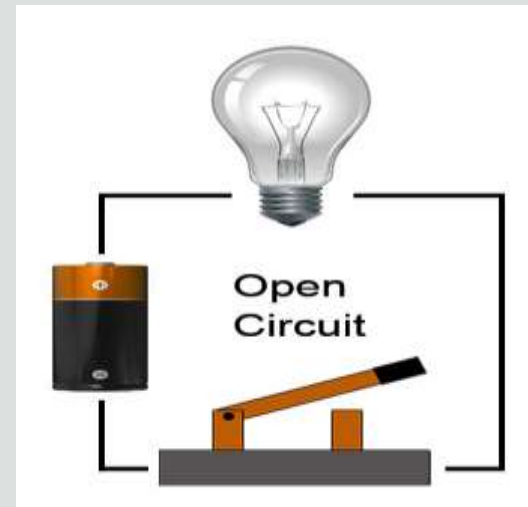
Device will receive power to work.



# Open Circuit

If the circuit is incomplete, it is called as **open circuit**.

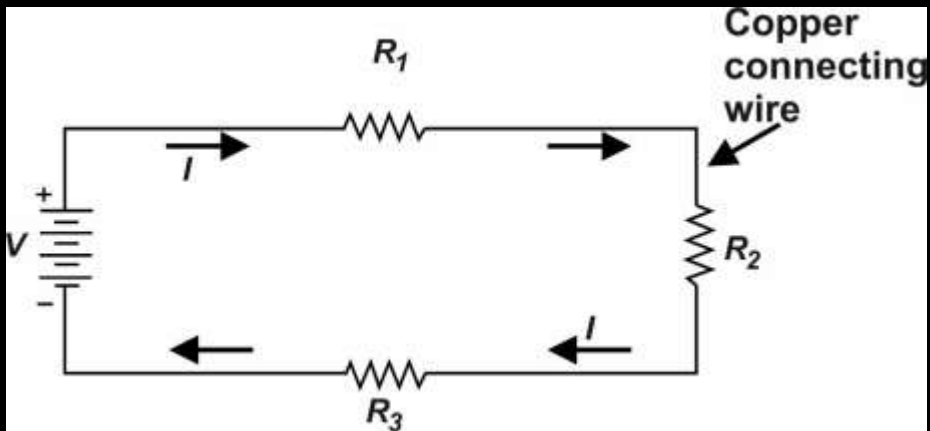
Device will not receive power to work.



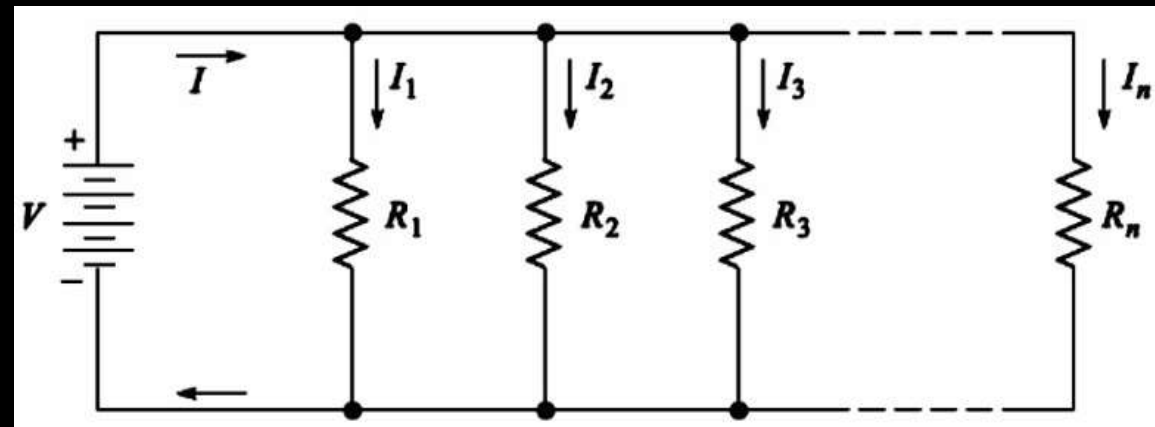


# Series and Parallel Circuits

Electronic circuits components can be connected in two forms i.e. **Series and Parallel.**



$$R_T = R_1 + R_2 + R_3 + \dots + R_n$$



$$R_T = (R_1 \times R_2 \times R_3 \times \dots \times R_n) / (R_1 + R_2 + R_3 + \dots + R_n)$$

# Ohm's Law

“Current is directly proportional to the applied voltage”.

$$V=IR$$

Where,

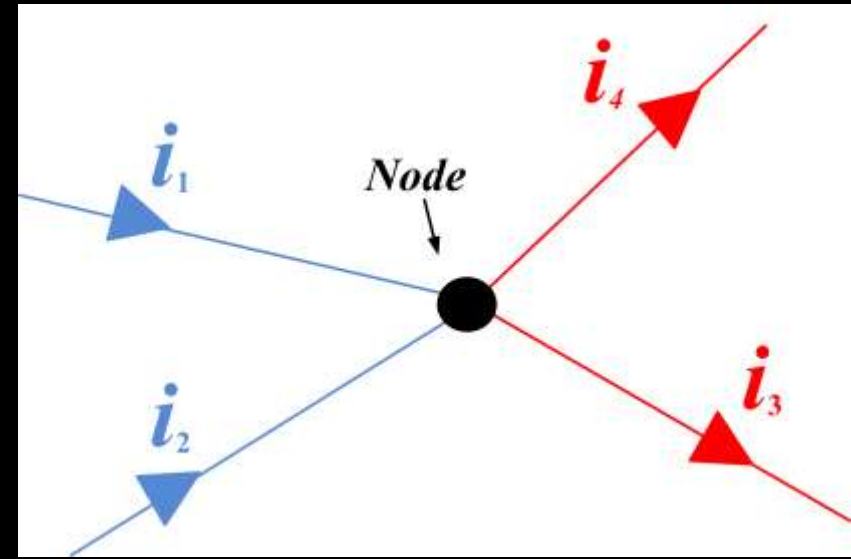
‘R’ is Resistance

‘V’ Voltage

‘I’ Current

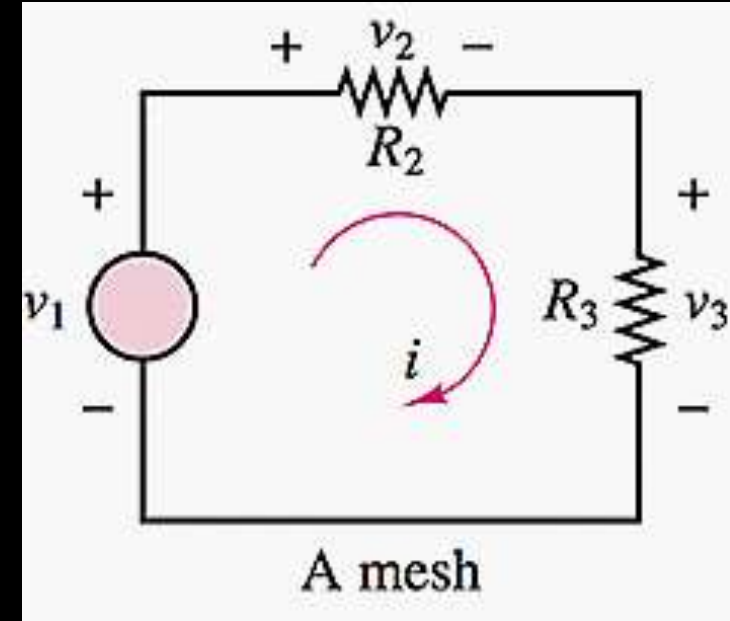
# Kirchhoff's Current Law

“Total incoming currents at a point are equal to the total outgoing currents.”



# Kirchhoff's Voltage Law

“Total voltage drop across the loads in the circuit is equal to the total voltage applied to the circuit.”



# Summary

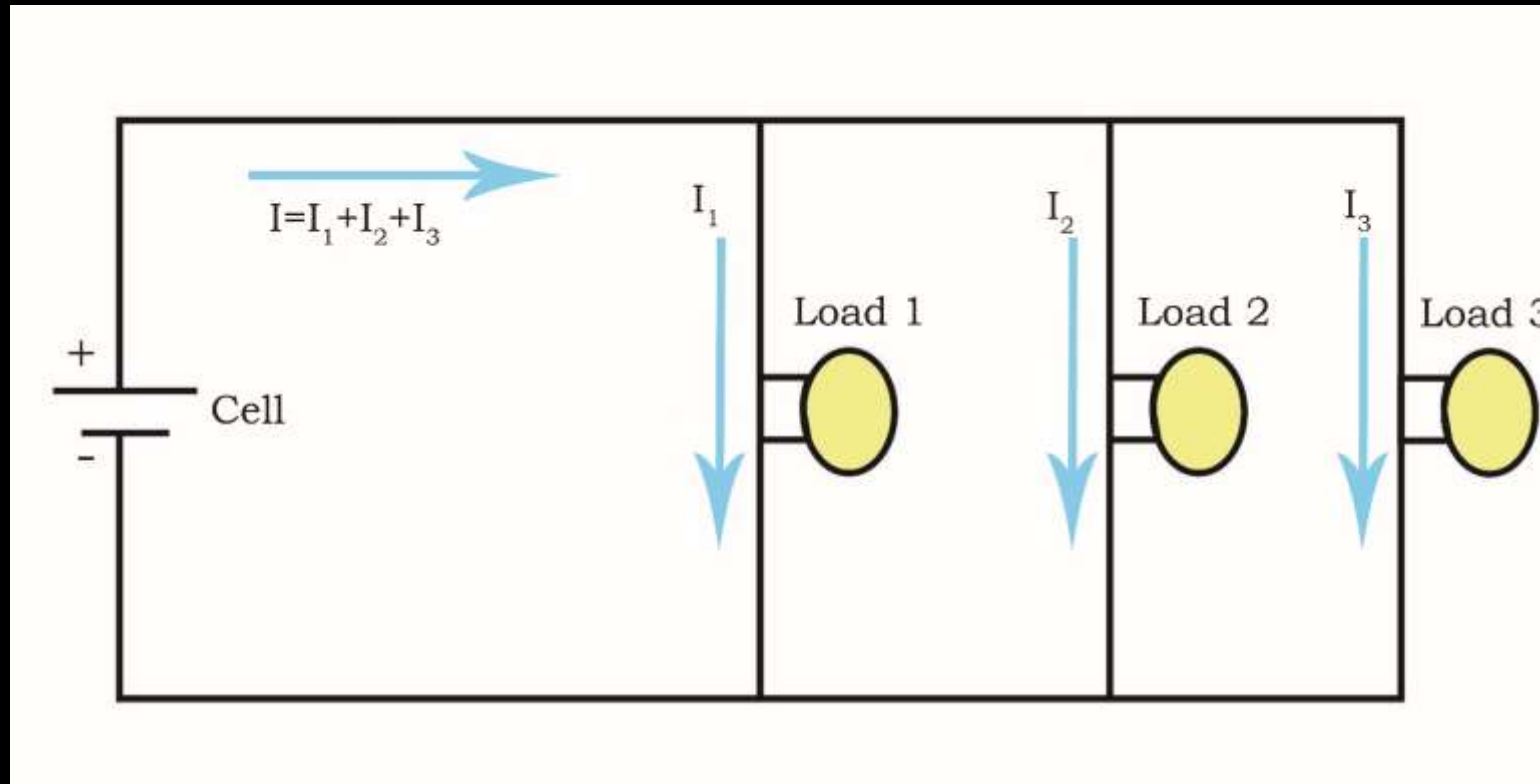
- Electricity is the flow of charge.
- Electrical quantities are voltage, current and resistance.
- Voltage is the force which moves the electrons.
- Current is the flow of charges.
- Resistance controls the charge flow.

- Energy can only be change from one form to other, it neither be created nor be destroyed.
- Electrical and electronic component can be active and passive.
- Circuit analysis can be done using Ohm's Law, Kirchhoff's Law.

# Assignment

1. A 110 V voltage source supplies power to a halogen light. The current flowing through the halogen light is 5 A. Find the resistance of the halogen light.
2. An electric iron of resistance  $40\ \Omega$  is connected to a supply voltage. The current flowing through the electric iron is 6 amperes. Find the voltage applied to the electric iron?

- What will the value of current  $I_1$ ,  $I_2$ ,  $I_3$ . If the voltage values are 40W, 50W, 60W. And applied voltage is 220V.





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