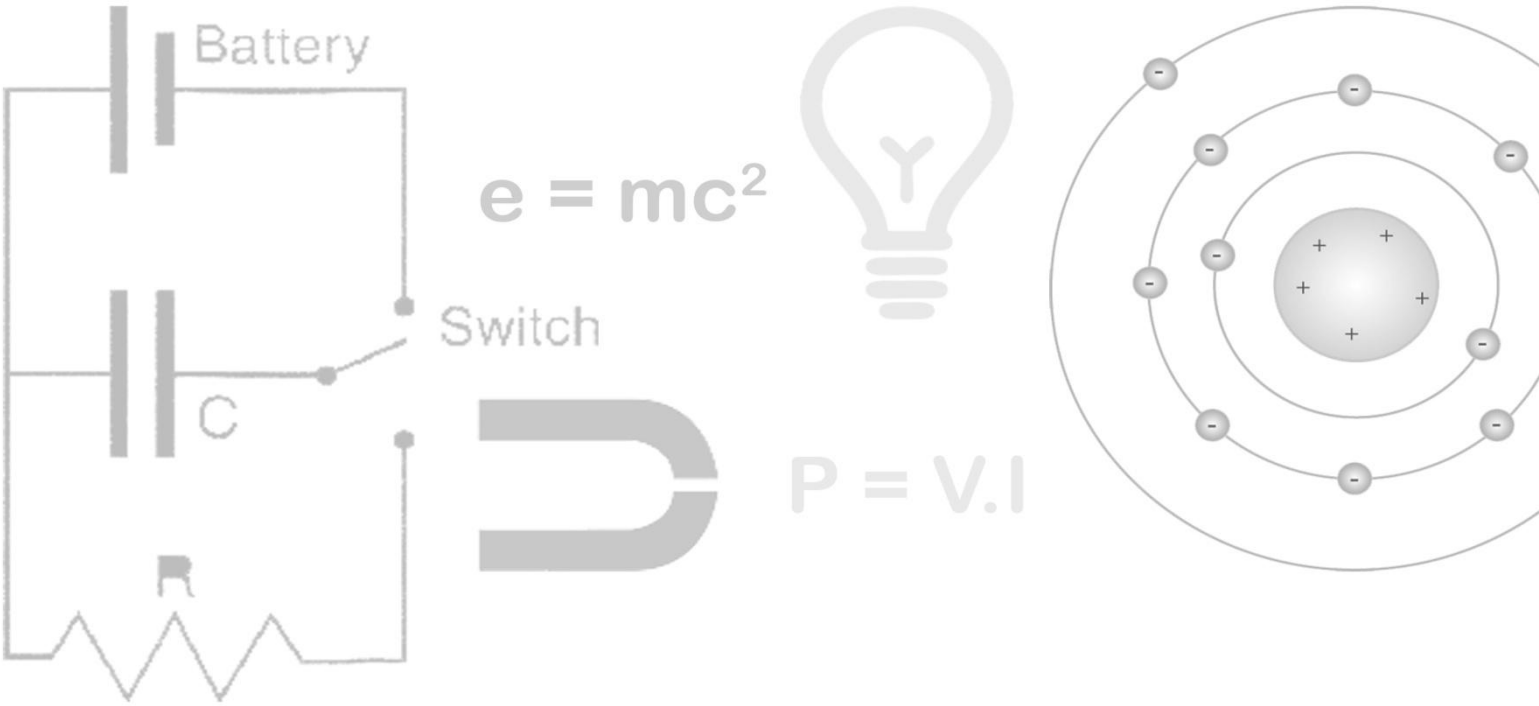
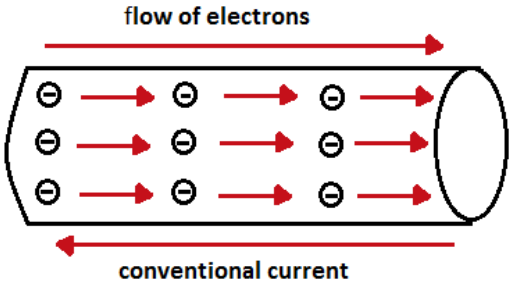
PHYSICS



Electricity

- The flow or movement of free charges (electrons) is called **electricity** or **electric current**.



- There are two types of charges—**positive** and **negative** charges. These charges are contained in the atoms, and every atom has a nucleus which contains positively charged protons and neutral neutrons.

- When a substance loses electrons, it becomes positively charged (anode), and when a substance gains electrons, it becomes negatively charged (cathode).
  Example:
  A glass rod rubbed with a silk cloth loses electrons and becomes positively charged. However, the piece of silk gains electrons and becomes negatively charged.

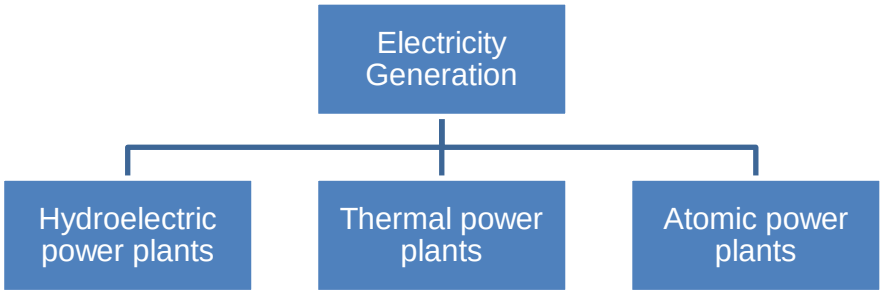

Rubbing the glass rod with silk cloth

- **Electricity** is one of the most useful forms of energy. It is supplied from electric power plants to our homes, offices, factories and other places by using wires.

- It is also used to run electric fans, televisions, geysers, electric irons, room heaters, refrigerators, music systems, trains etc.




- The electricity supplied to our homes by electricity supply companies is called **alternating current** (AC).

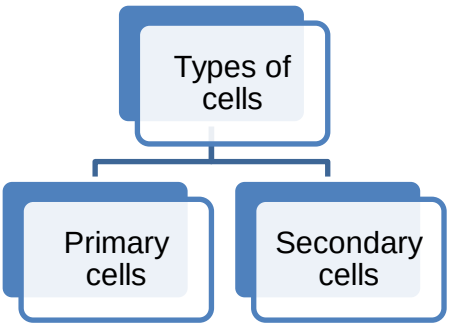


- **Hydroelectric power plants** (or hydel power plants) use the kinetic energy of moving water.
- **Thermal power plants** are based on coal, diesel or natural gas.
- **Atomic power plants** are based on the nuclear fusion of Uranium-235.

> **Electricity** is a means of transferring energy and not a source of energy. Hence, it is a secondary source.

- A device which produces electric current is called a **source of electric current** or **electricity**.
- The different sources of electric current are

i. A **dry cell** and **battery**
   - An electric cell is used to operate things such as clocks, calculators, phones
   - It is a small source of energy. It is also known as a **pencil cell**.



- **Primary cells** are non-rechargeable cells and they cannot be reused.
  Examples: Simple dry cells, Daniel cells, Leclanche cells, mercury cells etc.

- **Secondary cells** are rechargeable cells and can be reused.
  Examples: Lead cells, nickel-iron cells, nickel-cadmium cells

ii. Electric mains

- It is a common source of electricity which is produced in a power station and is carried by wires to the different city sub-stations.

- The electricity which reaches the mains board of the house is called **alternating current** (AC).

iii. **Electric generators**

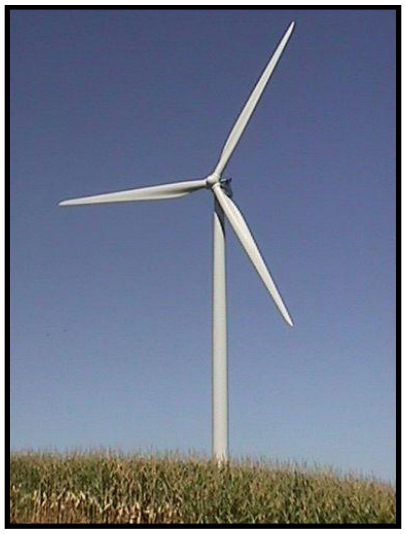
- An **electric generator** is a device which converts mechanical energy into electrical energy.

iv. **Solar cell**

- A device which converts solar energy (sunlight) into electrical energy is called a **solar cell**. This electrical energy is stored in **storage cells** or **accumulators**.

- A solar cell is a **non-conventional** source of electricity.

- The **kinetic energy** possessed by strong winds rotates the blades of windmills which are used to generate **electricity**. The amount of electricity generated depends on the **speed** of the wind.



- Water collected in a dam flows at a great speed through special channels, and the **potential energy** possessed by water is **converted** into **kinetic energy**.

- The **power** produced from water is called **hydroelectricity**.

- The change of **electrical energy** from one form to another is called the **effect of electric current**.

- The effects of **electric current** are
  1. **Heating** effect
     When an electric current passes through a conductor, the conductor is heated and the electrical energy of the conductor gets converted into heat energy. This effect is known as the **heating effect** of an electric current.

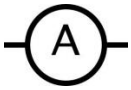
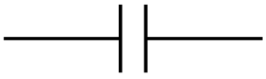
  2. **Magnetic** effect
     When an electric current passes through a wire, it behaves like a magnet. This is known as the **magnetic effect of the electric current**.

  3. **Mechanical** effect
     When an electric current flows through a coil, it rotates freely between the poles of a magnet and the coil. In this process, the **electricity** produces motion and is called the **mechanical** method.

4. **Chemical** effect

When an electric current is passed through a conducting solution of chemicals, such as copper sulphate and silver nitrate, some chemical reaction occurs and the chemicals in the solution break into smaller components.

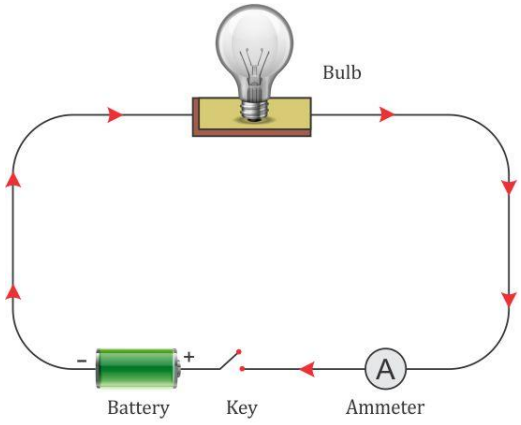
The process by which certain chemicals in the molten or solution form break into ions due to the passage of an electric current through them is called **electrolysis**.

Sr. No.	Electric Component	Symbol
1.	**Electric Cell**	
2.	**Electric Bulb**	
3.	**Switch in 'ON' Position**	
4.	**Switch in 'OFF' Position**	
5.	**Battery**	
6.	**Wire**	
7.	**Ammeter**	
8.	**Voltmeter**	
9.	**Galvanometer**	
10.	**Resistance**	
11.	**Rheostat**	
12.	**Resistance box**	
13.	**Inductor**	
14.	**Capacitor**	

- Every **electric circuit** consists of the following components:
  1. A cell, a battery or an AC mains acting as a source of electrical energy.
  2. A device (or electric appliance) such as the bulb, fan or electric iron operates using electrical energy.
  3. Wires for connecting different components of the electric circuit.
  4. An electric switch to turn the electric device ON or OFF.

- An electric circuit consists of a **complete path** (or paths) for electricity to pass (i.e. current to flow) through.

- The **simplest form** of a **circuit** is when two terminals of a cell are connected to the two terminals of a bulb and a switch.



- Materials which **allow** electricity to pass through them are called **conductors**. They conduct **electric current**.

- Materials which **do not allow** electricity to pass through them are called **insulators**.
  Examples: Plastic, rubber, pure water, mica, wood, glass, thermocol

- **Water** is a **good conductor** of electricity. However, in its purest form, called **distilled water**, it acts as an insulator and is used in batteries.

- The wires which are fixed at the poles supply electricity to our homes. These wires are attached to the mains board or the distribution board where a device called a **kWh meter** is fitted.

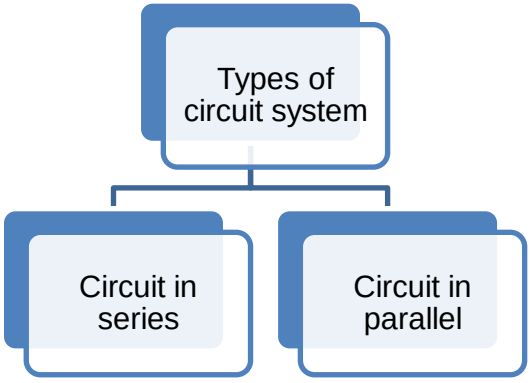
- **Electrical energy** is measured in a unit called **BOT** (Board of Trade) unit or **kWh** (kilowatt hour).
  1 kilowatt hour is defined as the amount of energy consumed when an electrical appliance of 1 kilowatt (1000 watt) is used for 1 hour.

$$E\ (kWh) = \frac{P\ (kW) \times t\ (hours)}{1000}$$

$$E\ (kWh) = \frac{V\ (volt) \times I\ (amp) \times t\ (hour)}{1000}$$

where E is the amount of electricity consumed, P is the power of an appliance to consume electricity and t is the time.

1 kWh = 1 kW × 1 hour
= 1000 W × 60 × 60 s
= 1000 J/s × 60 × 60 s
= 36,00,000 J
= 3.6×10^6 J

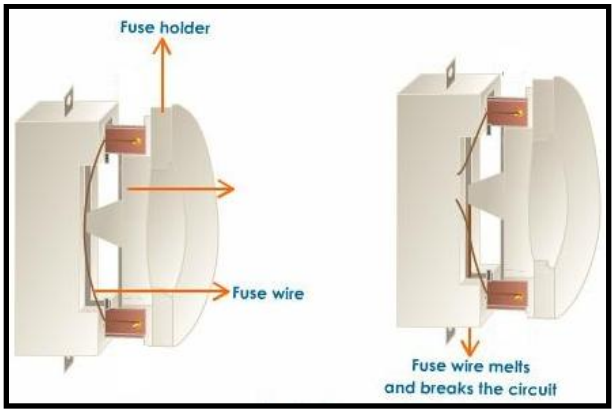


- In a **series circuit**, the appliances work simultaneously when the switch is closed and stops working when the switch is open.
  Thus, in a series circuit, the appliances in use are dependent on each other.

- In a **parallel circuit**, the appliances work independently. So, in our household wiring system, all the circuits are connected in parallel. When an appliance is switched on, it works on its own without the interruption of the other appliance.

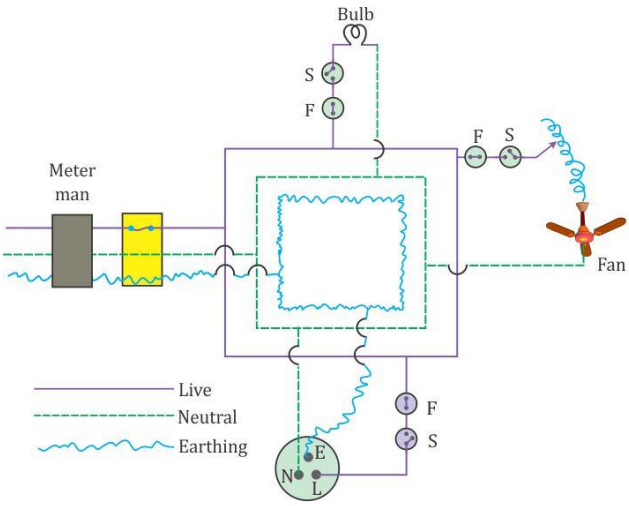
Electric appliance	Power
Light bulbs	60 W, 100 W
CFL bulbs	5 W, 22 W
Tube light	40 W
Television	100 W
Refrigerator	150 W
Video recorder	20 W
Iron	1 kW
Immersion heater	3 kW
Kettle	2 kW
Fan	40 W

- An **electric fuse** is an important application of the heating effect of electric current. The wires of an electric fuse are made of special materials which melt quickly and break when large electric currents are passed through them.

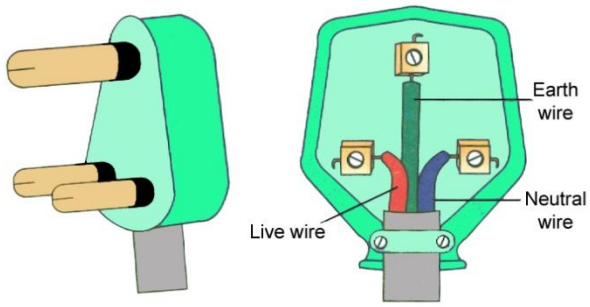


- **Overload** is an electric circuit which draws more current than it is designed for.

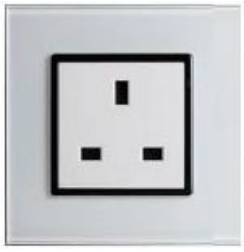
- An electrical circuit consists of three wires—a **live wire** (red colour), a **neutral wire** (black colour) and an **earth wire** (green colour).



- A three-pin plug is generally used. The two lower pins of the plug are called the **terminal pins**, and the third pin which is on the top is longer and thicker and is called the **earth pin**.



- A **socket** has three holes. The two lower holes are for the terminals, and the third hole which is bigger in size is used for the earth connection.



- A **switch** is a key or an ON-OFF device which carries electricity in a circuit or in the gadget. It is made of an insulator (i.e. a poor conductor of electricity) such as ebonite or bakelite.

- A switch **makes** and **breaks** a circuit.
  - When the switch is in the OFF position, the circuit is open and the current does not flow through the circuit.
  - When the switch is in the ON position, the circuit is closed and the current flows through the circuit.

- **Miniature circuit breakers** are switches which are used to protect the household wiring from the excessive flow of electric current.

- **Safety measures for household circuit systems**
  - We must not touch switches with wet hands.
  - All the connecting wires to plugs, sockets and switches must have a tight fitting, and all appliances must be properly earthed.
  - Do not try to repair appliances without proper technical knowledge.
  - Get all electrical fittings done by a skilled person.
  - Check the safety fuse and the other appliances used.
  - Ensure that MCB and fuses of correct strength are used in the circuit.

- **Need to conserve electricity**
  1. As the population is increasing at a tremendous speed, the demand for electricity is also increasing.
  2. The use of electricity is increasing with advancement in technology and the invention of new gadgets and techniques in various fields.
  3. The higher standard of living and the comforts of life have put more pressure on the use of electricity, which needs to be cut down.