

# Static Electricity

When two bodies are rubbed together, they acquire the property of attracting light objects like small bits of paper, dust particles etc. The bodies which acquire this property are said to be electrified or charged with electricity.

**Charge:** Charge is the basic property associated with matter due to which it produces and experiences electrical and magnetic effects.

1. Benjamin Franklin named the two types of charges as positive and negative.
2. Similar charges repel each other and opposite charges attract each other.
3. Charging of bodies takes place due to transfer of electrons from one body to other body.
4. A list of materials has been given below. The list is such that any of the material in the list will be positively charged when rubbed with any other material coming later in the list. The other material will naturally be negatively charged.

**Surface density of charge :** Surface density of charge is defined as the amount of charge per unit area on the surface of conductor.

The surface density of charge at a point on the surface of conductor depends upon the shape of conductor and presence of other conductors or insulators near the given conductor.

1. The surface density of charge at any part of the conductor is inversely proportional to the radius of curvature of the surface of that part.
2. This is why surface density of charge is maximum at the pointed parts of the conductor.

**Conductor :** Conductors are those materials which allow electricity (charge) to pass through themselves.

**Examples :** (a) Metals like silver, iron, copper (b) Earth (especially the moist part) acts like a huge conductor.

---> **Silver is the best conductor.**

**Insulator or Dielectric :** Insulators are those materials which do not allow electricity to flow through themselves.

**Examples :** Wood, paper, mica, glass, ebonite.

**Coulomb's law :** According to Coulomb's law, the force of attraction or repulsion between two point charges at rest is directly proportional to the product of the magnitudes of the charges and inversely proportional to the square of the distance between them. This force acts on the line joining the two charges.

**Electric Field :** Region in space around a charge or charged body where the charge has its electrical effect is called electric field of the charge.

**Electric Field Intensity :** Electric field intensity at a point in an electric field is the force experienced by a unit positive charge placed at that point.

### **Electric Field of hollow conductor**

Electric field intensity inside a charged hollow conductor is zero. Charge given to such a conductor (or conductor of any shape) remains on its surface only.

This explains why a hollow conductor acts as an electrostatic shield. It is for this reason that it is safer to sit in a car or bus during lightning.

**Electric Potential :** Electric potential at a point in an electric field is the work done in bringing a unit positive charge from infinity to that point.

SI unit of electric potential is volt. It is a scalar quantity.

**Potential Difference :** Work done in bringing a unit positive charge from one point to other point is the potential difference between the two points. Its SI unit is volt and is a scalar quantity.

**Electric Capacity :** Electric capacity of a conductor is defined as the charge required to increase the potential of the conductor by unity. If potential of a conductor is increased by  $V$  when a charge  $Q$  is given to it, capacity of the conductor is  $Q/V$ . Its SI unit is farad. (F)

**Electrochemical Cell :** Electrochemical cell is a device which converts chemical energy into electrical energy.

**Cells are basically of two types :** (i) Primary cell (ii) Secondary cell.

**Primary Cell :** In primary cell electrical energy is obtained from the irreversible chemical reaction taking inside the cell. After complete discharge, primary cell becomes unserviceable.

**Examples :** Voltaic Cell, Leclanche Cell, Daniel Cell, Dry Cell etc.

**Secodnary Cell :** A secodnary cell is that which has to be charged at first from an external electric source and then can be used to draw current. Such cells are rechargeable.

1. Production of electricity by chemical reaction was first discovered by Allexandro de volta (voltaic cell is named after him) in 1794. In voltaic cell zinc rod is used as cathode and copper rod is used as anode. These rods are placed in sulphuric acid kept in a glass vessel.
2. In a Leclanche cell, carbon rod acts as anode and zinc rod acts as cathode. These rods are placed in amonium chloride kept in a glass vessel.
3. The emf of Leclanche cell is 1.5 volt.
4. Leclanche cell is used for intermittent works, i.e. works in which continuous electrical energy is not required like electric bell.
5. In a dry cell, mixture of  $MnO_2$  ,  $NH_4Cl$  and carbon is kept in a zinc vessel. A carbon rod is placed in the mixture which acts as anode. The zinc vessel itself acts as cathode. The emf of dry cell is 1.5 volt.