# CHAPTER I : Electrical Conductors

**Introduction**

The conductivity of the material is the capacity of the material to transmit something like electricity or heat. Electrical conductors are the materials or substances in which the electrons, electrical charge carriers, are abundantly available. [Electrons](https://www.toppr.com/guides/chemistry/structure-of-atom/electrons-distributed-orbits-shells-electronic+configuration/) are the particles which make easy the electricity to pass through the material when voltage is applied across it. In the electrical conductors, the electrons can flow in either direction. Metals are the good conductors of electricity. Most of the d-block elements of the periodic table are good electrical conductors. In these d-block materials, the electrons are freely available which are very essential to transmit the electricity. Some liquids are also good electrical conductors. The saturated salt water solution is an example of it. Gases are bad electrical conductors as the exchange of electrons between atoms is not possible because of distances among them.

**Electrical Conductivity**

The [electrical conductivity](https://www.toppr.com/ask/question/define-the-term-electrical-conductivity-of-a-metallic-wire-write/) of the material is managed by the electrons which are lightly attached to the atom and are easily available to be separated from it. When the electric current flows through the material, electrons carry the electric current from one end to another but they do not move from their places. When electricity passes, they get charged and vibrate at their places. This vibration transfers the charge from them to nearby electrons and nearby electrons then start vibrating and transfer the charge to neighbouring electrons. This way, electricity transfers from one place to another. When the electricity is not passing through the conductor, the electrons do not have any charge difference and therefore they do not vibrate and do not disturb neighbouring electrons.

**Properties of Electrical Conductors**

When the electrical conductor is connected across the battery terminals, due to the potential differences, the vibrations start in electrons and they start to flow from negative terminal to positive terminal.

In the equilibrium condition, electrical conductors exhibit the following properties,

* Conductors have free electrons available.
* Conductors allow electrons to move with little or no resistance.
* The charge density is equal to zero.
* There is no potential or electric field difference within the conductors
* Electrons on the surface of the conductors are only available to carry current when applied.

[Metals](https://www.toppr.com/guides/chemistry/materials-metals-and-non-metals/metals-and-non-metals/) are good conductors of electricity or heat as they have a pool of electrons loosely attached to atoms are free to move. Outside pressure does not affect the performance of electrical conductors as outside pressure does not create any effect on the size of the metals.

On the other hand, the difference in temperature affects its performance. At extremely low temperatures, the resistance offered by conductors to electricity becomes minimal as compared to the room temperature resistance. This phenomenon is known as superconductivity and the metals which exhibit this property and termed as superconductors.

Size or thickness and length of the conductor also affect the performance. Thinner wire shows more resistance as compared to the thick wire. So it can be said that the resistance of a wire is inversely proportional to the cross-sectional area.

The length of the wire also affects the flow of electrical current. The resistance offered by a wire is directly proportional to the length of it. Longer the wire higher will be the resistance.

**Types of the Electrical Conductors**

There are four types of conductors, namely, good conductors, semiconductors, resistors and non-conductors. Non-conductors are also termed as insulators.

**Good Conductors**

Almost all the metals are good conductors of electricity as they allow transferring the electricity with little resistance through them. Some non-metals are also exhibiting electrical conductivity. For example, graphite is a good conductor of electricity. Though graphite is made from carbon (a bad conductor of electricity) but the structure of it is such that one of the four electrons in this tetravalent material is free which takes the part to transfer the electricity. In the metals, a pool of electrons is available to transfer the electricity.

Some metals like copper, iron, silver, aluminium and gold are good conductors of electricity and are used widely. Though gold and silver metals are very good conductors bur are costlier than copper and aluminium. Hence, they are used in very sophisticated instruments like computers, mobiles and other instruments where a precise amount of electricity is required. Copper is abundantly available and is widely used in home appliances and circuits. Though aluminium has slightly less conductivity than the copper metal it is very cheap therefore it is used in transmission lines.

**Semiconductors**

Semiconductors are those materials which have the sensitivity against electricity between good conductors and insulators. Thus, semiconductors are non-metals and have limited electrical conductivity. In the pure form some non-metals like silicon, germanium is good semiconductors. By adding some impurities to them, their conductivity can be altered through the doping process. Almost all the electrical and electronic devices use semiconductors to control the flow of currents in them.

**Resistors**

A resistor is a small electronic device which resists and reduces the electrical current and supply the electricity to the electrical or electronic goods in a controlled manner. Due to the resistance offered by resistors, save these goods from damage that may occur due to excessive supply of electricity.

**Insulators**

Insulators are the materials which do not allow the electric current to flow through them. In these materials, electrons are bonded tightly with their atoms and do not get separated even after the application of the strong potential difference. Some common examples are wood, plastic, glass, rubber, etc. and they are used to cover the wire through which the electric current is passing. House-hold electric circuits and devices are covered by the insulators to avoid energy loss and safety. Covering the copper wires by these insulators makes the electricity more efficient by concentrating the flow.   