

B.Sc. (Honours) Part-II

Paper-IIIB

Topic: Conductors & Non Conductors:

Metals

UG

Subject-Chemistry

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Conductors & Non Conductors:Metals

Conductors (Metals)

The substances known as metals are classified as (electrical conductors)

Conductors: are the materials or substances which allow electricity to flow through them.

They conduct electricity because they allow electrons to flow easily inside them from atom to atom. Also, conductors allow the transmission of heat or light from one source to another.

Conductors are the metallic solids in which either (a) the valence band is only partially filled or (b) the valence and conduction bands overlap. Thus there is practically no energy gap between the filled and unfilled MOs and perturbation of electrons can occur readily hence high thermal and electrical conductivities.

For example:

- Material such as silver is the best conductor of electricity. But, it is costly and so, we don't use silver in industries and transmission of electricity.
- Copper, Brass, Steel, Gold, and Aluminium are good conductors of electricity. We use them in electric circuits and systems in the form of wires.
- Mercury is an excellent liquid conductor. Thus, this material finds use in many instruments.

- Gases are not good conductors of electricity because the atoms are quite far away. Thus, they are unable to conduct electrons.

Metals

(a) Sodium and copper are the typical examples in which 3s and 4s bands respectively are only half filled.

(b) In magnesium the filled 3s band overlaps the 3p band whereas in nickel the 3d and 4s bands overlap

Applications of Conductors

Conductors are quite useful in many ways. They find use in many real-life applications. For example,

- Mercury is a common material in thermometer to check the temperature of the body.
- Aluminium finds its use in making foils to store food. It is also used in the production of fry pans to store heat quickly.
- Iron is a common material used in vehicle engine manufacturing to conduct heat.
- The plate of iron is made up of steel to absorb heat briskly.
- Conductors find their use in car radiators to eradicate heat away from the engine.

Non –conductors of Insulators

Non –metals are classified as non-conductors or insulators.

Insulators are the materials or substances which resist or don't allow the current to flow through them. In general, they are solid in nature. Also, insulators are finding use in a variety of systems. As they do not allow the flow of heat. The property which makes insulators different from conductors is its resistivity.

Wood, cloth, glass, mica, and quartz are some good examples of insulators. Also, insulators are protectors. They give protection against heat, sound and of course passage of electricity. Furthermore, insulators don't have any free electrons. It is the main reason why they don't conduct electricity.

In Non –metals the valence band is completely filled so migration of electrons within the band is not possible. Secondly, there is an appreciable difference in energy (called band gap or energy gap) between the valence band and the next empty band. Consequently the electrons fail to cross this huge energy gap to reach to empty level where they could move freely.

For example: All ceramic materials (say mica aluminium oxide, porcelain glass etc) non–metals as well as the covalently bonded polymers (Say nylon 66 polyethylene polystyrene etc.) are essentially insulators.

Few Examples:

- Glass is the best insulator as it has the highest resistivity.
- Plastic is a good insulator and it finds its use in making a number of things.
- Rubber is a common material used in making tyres, fire-resistant clothes and slippers. This is because it is a very good insulator.