THE SOLID STATE

MAGNETIC PROPERTIES

APPLICATIONS OF SEMICONDUCTORS: -

Application of n-type and p-type semiconductors

1. Diode is a combination of n-type and p-type semiconductors used as rectifier.
2. They are used for making transistors which contains n-p-n and p-n-p junctions to amplify radio and audio signals.
3. The solar cell is photo-diode used to convert light energy into electrical energy.

13-15 Compounds: -

The solid-state materials are produced by combination of elements of groups 13 and 15 the compounds thus obtained are called 13-15 compounds e.g. In Sb, AlP GaAs.

12-16 Compounds: -

The solid-state compounds are obtained by combination of elements for groups 12 and 16 the compounds are called 12-16 compounds e.g., ZnS, CdS, CdSe and HgTe.

Super Conductivity: -

The electrical resistance of metals is found to depend on temperature. Electrical resistance decreases with decrease in temperature and becomes almost zero near the absolute zero. Materials in this state are said to possess. Superconductivity. The phenomenon of superconductivity was first discovered by Kamerlingh Oner in 1913 when he found that mercury becomes superconducting at 4.0 K temperature.

Transition Temperature: -

The temperature at which a substance starts behaving as super-conductor is called transition temperature.

Magnetic Properties of Solids: -

can be divided into different classes. Depending on their response to magnetic fields.

(a) **Paramagnetic (weakly magnetic):** Such materials contain permanent magnetic dipoles due to the presence of atoms, ion or molecules with unpaired electrons e.g., O_2 , Cu^{+2}, Fe^{+3}, and they are attracted by the magnetic field. They however lose their magnetism in the absence of a magnetic field.

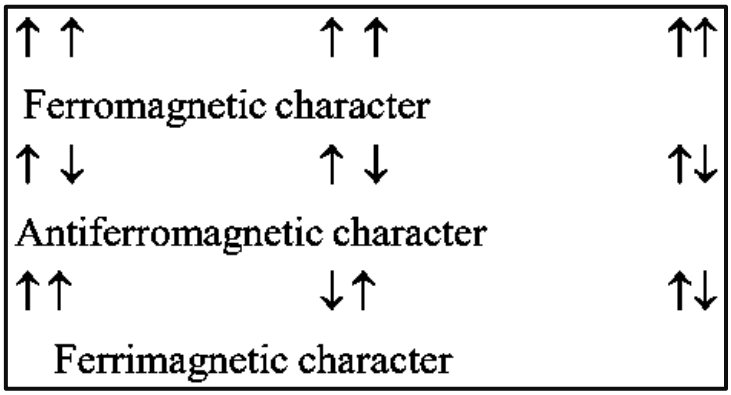
(b) **Diamagnetic:** They are weakly repelled by magnetic fields. Diamagnetism arises due to the absence of unpaired electrons e.g., H^- , Li^+ , Be^{+2}, (2 electron type), O^{-2}, F^-, Na^+ , Mg^{+2} (8 electron type), Ag^+ , Zn^{+2}, Cd^{+2} (18 electron type).

(c) **Ferromagnetic:** It is caused by spontaneous alignment of magnetic moments in the same direction.

(d) **Ferrimagnetism:** It occurs when the moments are aligned in parallel and antiparallel direction in unequal number resulting in a net moment e.g., Fe_3O_4.

(e) **Anti-ferromagnetism:** It occurs if the alignment of moments is in a compensatory way so as to give zero net moment e.g., MnO.

All magnetically ordered solids (ferromagnetic and antiferromagnetic solids) transform to the paramagnetic state at some elevated temperatures. This is most probably due to the randomisation of spins.



Effect of Temperature on Metal (Conductor) Semiconductor or Insulator

1. The conductivity of semiconductors and insulators increases with increase in temperature

2. The conductivity of metal (conductors) decreases with increase in temperature.