Module 1

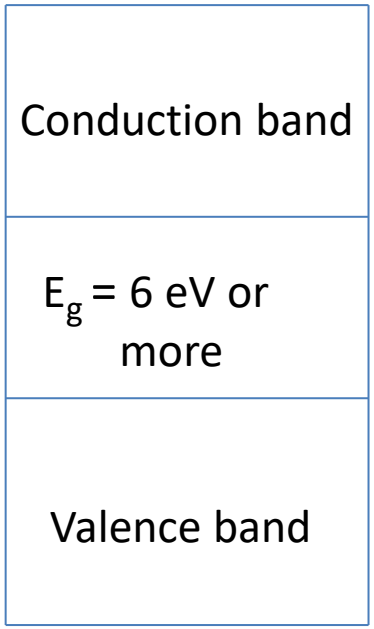
DIODE

Lecture 2

METALS INSULATORS AND SEMICONDUCTORS

Insulators

Insulators such as rubber , plastics , glass , wood etc. do not support electrical current at room temperature.

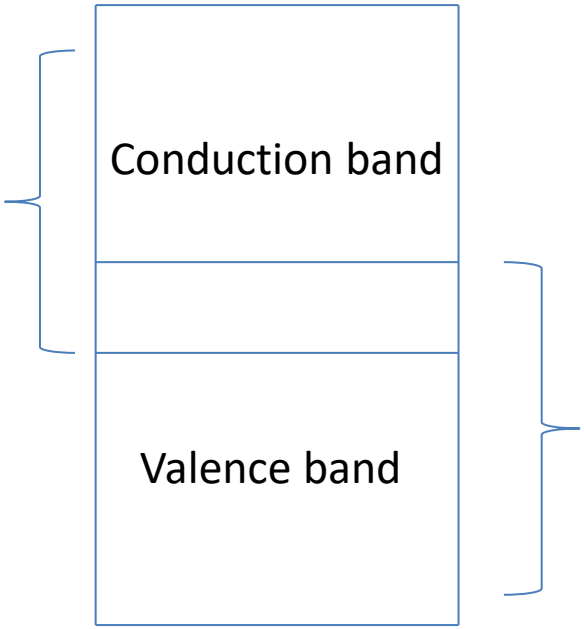


There is large forbidden energy gap between conduction and valence band which is about 6 eV or more.

Due to this large forbidden energy gap it is practically impossible for a valence band electron to cross the energy gap to reach the conduction band at room temperature.

At room temperature insulators do not conduct because there are no conduction electrons in it.

Conductors



Metals such as aluminium , copper etc. contains large number of free electrons at room temperature.

There is no energy gap between conduction and valence band.

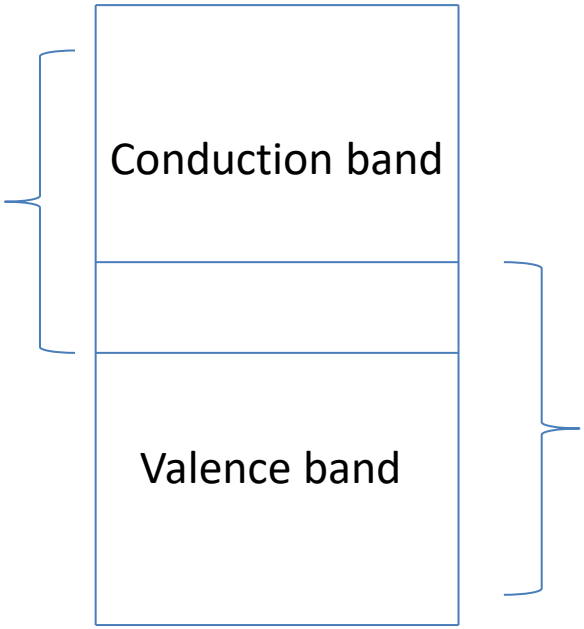
In fact these two bands overlap with each other.

Energies of these two bands are same.

At room temperature almost every valence electron becomes conduction electrons(free electrons) with out need of any additional energy.

That is why metals works as a good conductor.

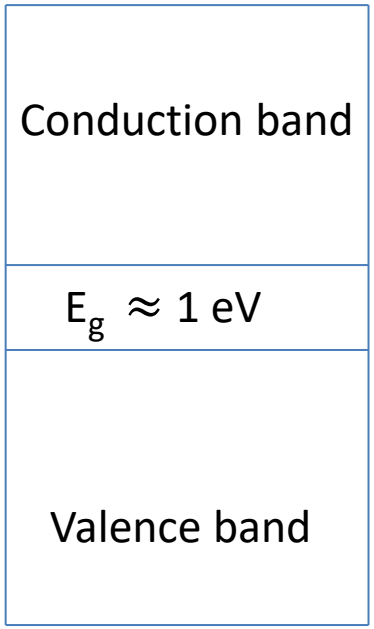
Conductors



Note:-

- On increasing the temperature the conductivity of the conductor i.e. metals **decreases.**
- On increasing the temperature the resistivity of the conductor i.e. metals **increases.**
- It means conductors have **positive temperature coefficient of resistance**.

Semi conductors



Elements such as Silicon(Si) and Germanium (Ge) are called as Semiconductor.

Silicon(Si) and Germanium (Ge) have conductivity lower than that of conductor but greater than that of insulators.

That is why these materials are called as Semiconductors.

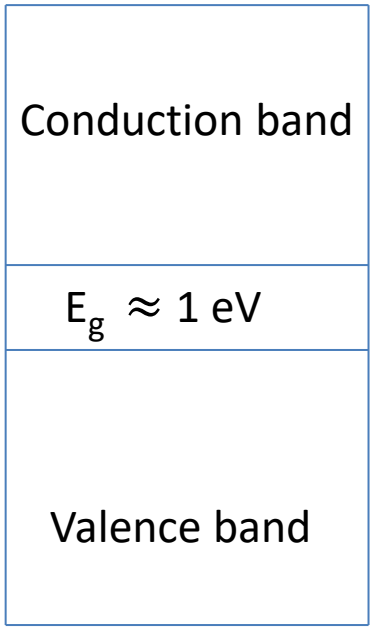
In case of semi conductors the forbidden energy gap is not very large.

It is of the order of 1 eV.

For Silicon (Si) it is $E_g = 1.12$ eV

For Germanium (Ge) it is $E_g = 0.72$ eV

Semi conductors

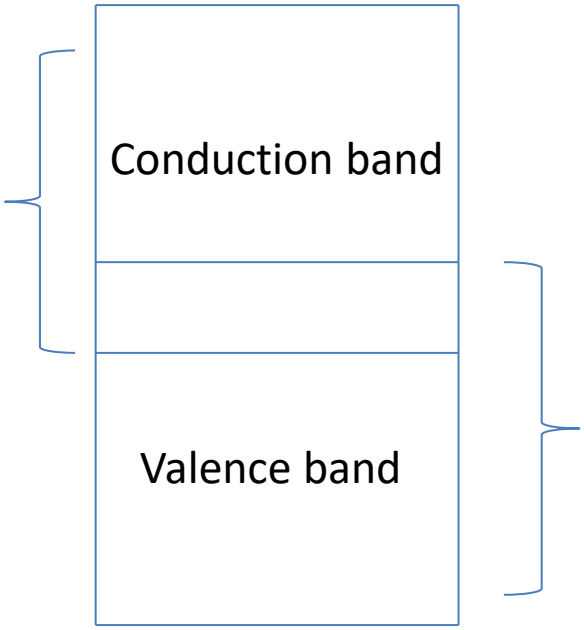


At room temperature the heat is sufficient to lift the electron from valence band to conduction band.

So at room temperature semiconductors can support some electric current.

Note:- At absolute zero temperature(-273^0 C) the semiconductor behaves as a **perfect insulator**.

Semi conductors



Note:-

- On increasing the temperature the conductivity of the semi conductor **increases**.
- On increasing the temperature the resistivity of the semi conductor **decreases**.
- It means semi conductor have **negative temperature coefficient of resistance.**

Thank you