Semi - Conductors:

Old devices

Bulky

High power consumption

Limited life.

High operating voltage. (100V).

Solid state semiconductor:

Advantage:

1) Small in size
2) Low power consumption
3) Long life.

PCB.

4) Low operating voltage.

Transistors, Values, Diodes.

↳ Semi-Conductor devices → Controlled flow of Current. in Unidirectional flow of Current.

Intermediate conductivity.

Eg: Si, Ge, Ga, As, polyaniline

Conductors carry current → They possess free electrons - Cu (+) free e⁻ which are not tightly bound.

Resistivity

Conductivity.

$\rho = \frac{1}{\sigma}$.

On the basis of Conductivity:

Metals: They have low resistivity, high conductivity.

σ: $10^2 - 10^8$ S m^{-1} → Siemen

ρ: → $10^{-2} - 10^{-8}$ Ω m.

Semi-Conductors.

They have resistivity | Conductivity intermediate to metals and non-metals.

ρ: $10^{-5} - 10^{6}$ Ω m.

σ: $10^{5} - 10^{-6}$ S/m.

Insulators:

High resistivity : $\rho = 10^{11} - 10^{19}\ \Omega m$.

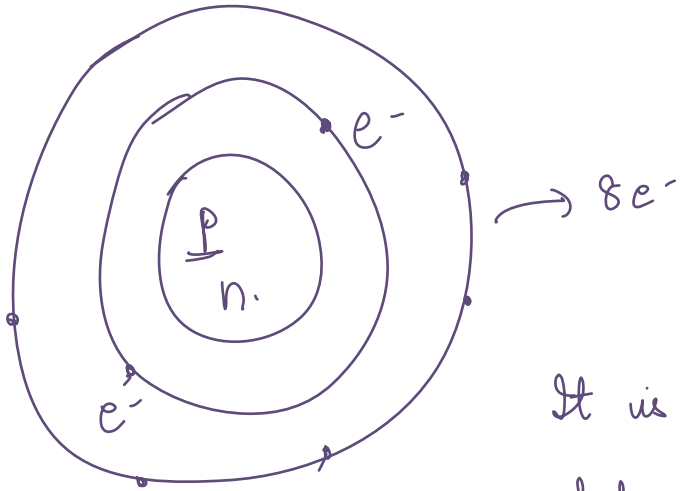
$\sigma = \frac{1}{\rho}$.

Conductivity . $\sigma - 10^{-11} - 10^{-19}\ S\,m^{-1}$.

$\Rightarrow$ Energy Band { Valence Band & Conduction Band).

Valence Band:

It is the electron ~~of~~ orbitals & the outermost electron orbital of an atom of any material which electrons can occupy.

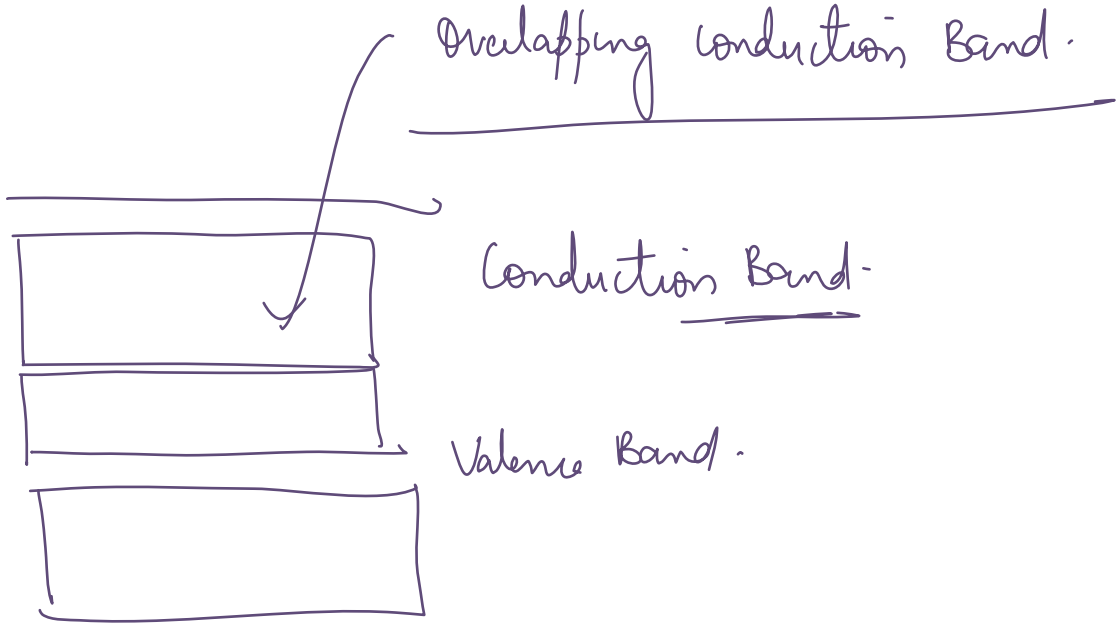


Valence Band contains valence e⁻ of Material

Conduction Band:

It is the band of orbitals where the electrons can bounce up into from valence band when energized.

Metals:


Overlapping Conduction Band.
Conduction Band.
Valence Band.

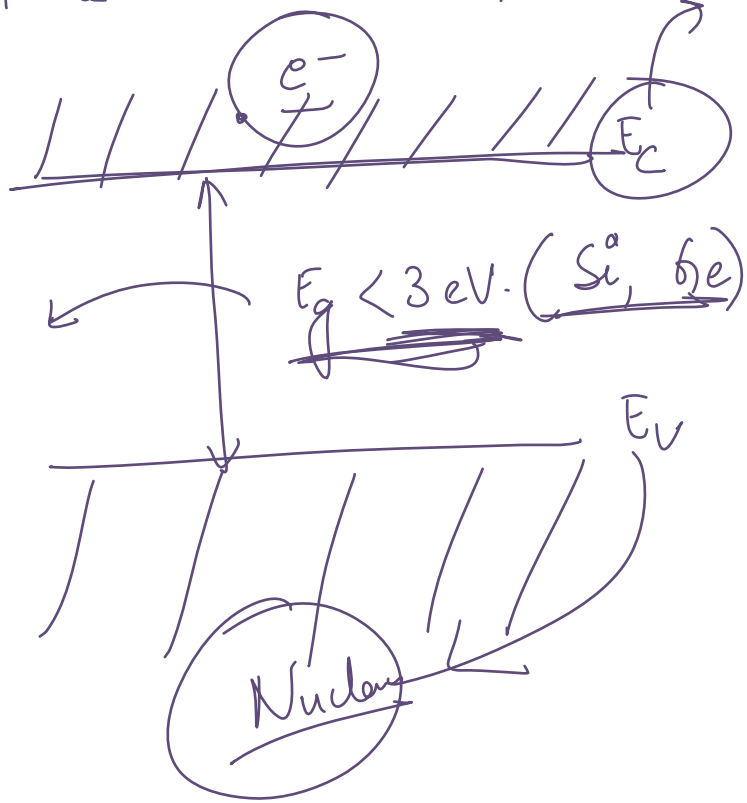
Forbidden energy gap:

Energy required for Electrons in the outermost shell / orbitals (valence band) to move into conduction band is called forbidden energy gap.

For metals, $E_g \approx 0$.

Semi-conductors:

In the conduction band, e^- can freely flow in the material.

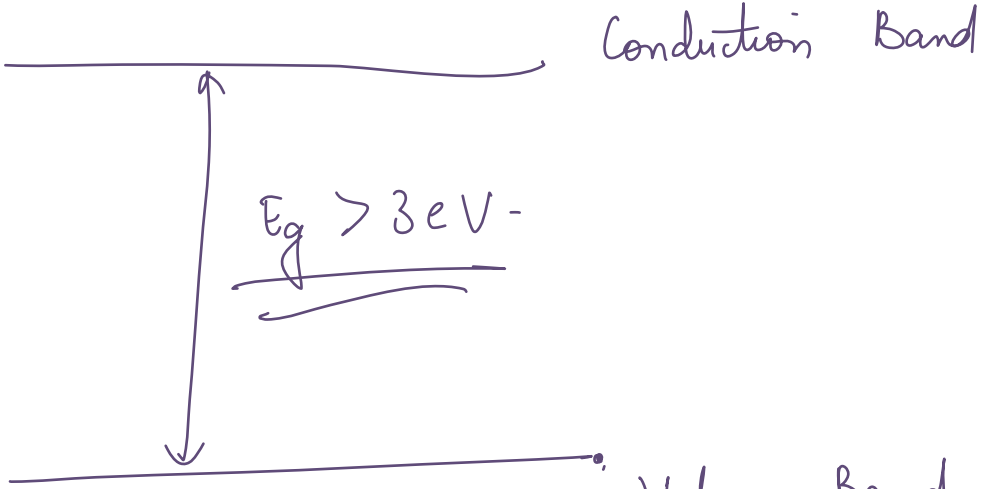


$1eV = 1.6 \times 10^{-19}$ J.

$3eV \Rightarrow 3 \times 1.6 \times 10^{-19}$ J.

Bounded electrostatic force.
N.

For Insulators:



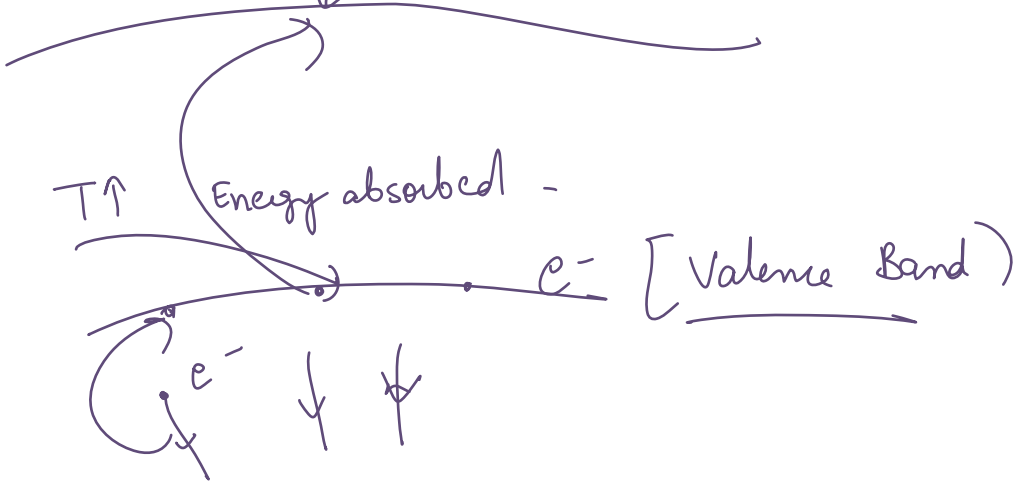
As, $T \uparrow$, In Semi-Conductors, Conductivity $\uparrow$.

Temperature ↑ .

In Semi - Conductors:

↑ ↓, ↓ ↑

In the conduction Band.



loosely bound e⁻ gain energy,

e⁻ move into the conduction band.

In insulators:

$T \uparrow$, $\uparrow \downarrow$; no. of free electrons $\uparrow$

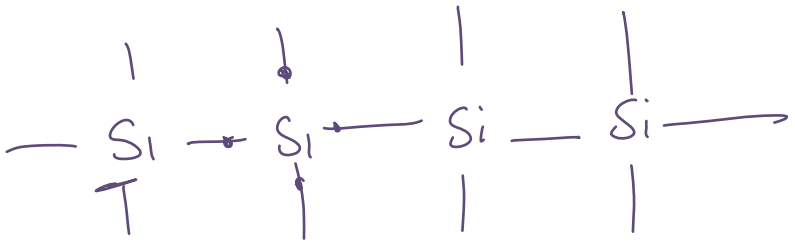
In conductors:

$T \uparrow$, $\uparrow \uparrow$, so there is excess amount of free e^-,

collision occurs, → resistivity ↑.

Energy is wasted in

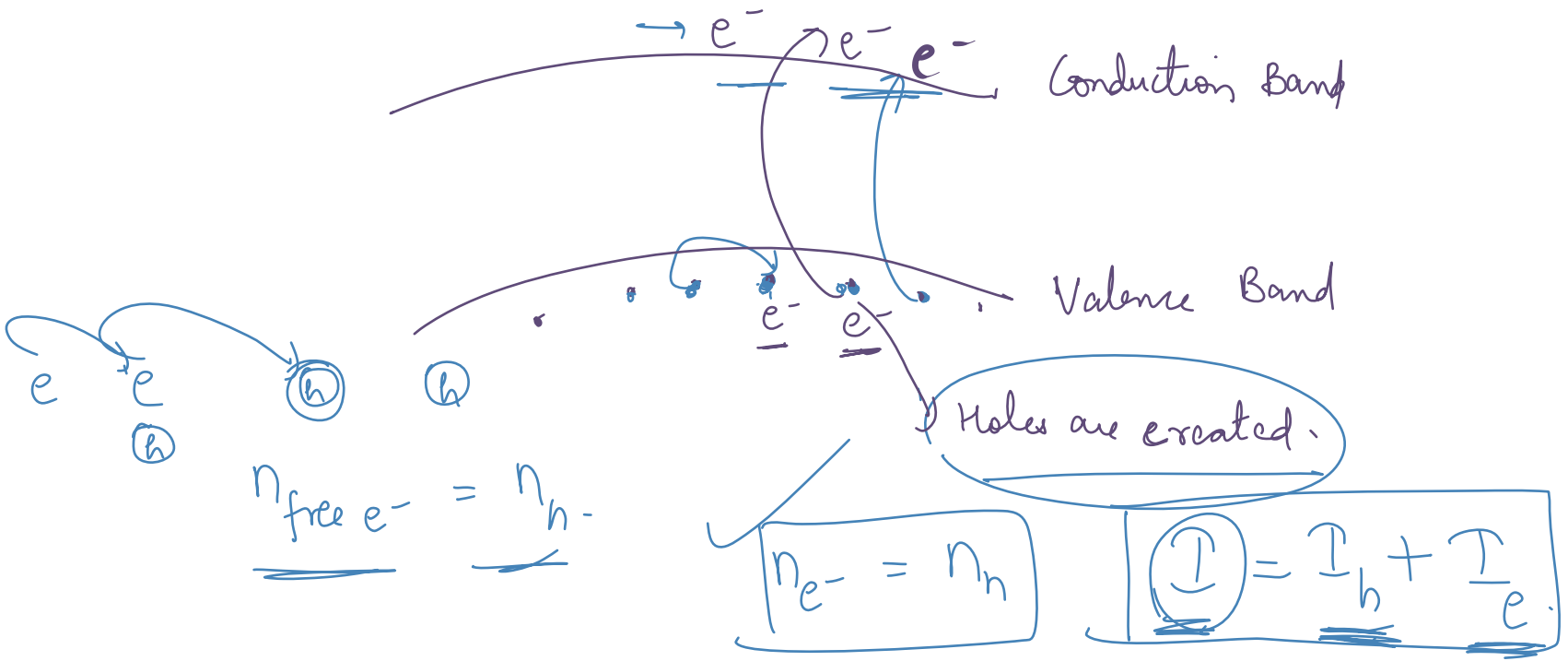
Intrinsic Semiconductors:



Si, Ge.

It is a semi-conductor in which no other material is doped.

Electrons in the conduction band are called free e^-.



Extrinsic Semi-Conductor :

Conductivity of Semi-Conductor gets improved.

When a small amount of suitable impurity is added to the pure semi-conductor, then it is called extrinsic semi-conductor.

Impure atoms are called dopants.