Semi Conductors: The elements having resistivity lying between conductor and insulator are known as semi conductor.

Conductors: 10^{-8} ohm m to 10^{-4} ohm m

Semi conductors: 10^{-4} ohm m to 10^{+4} ohm m

Insulator: 10^{+4} ohm m to 10^{+14} ohm m

The most important distinction between conductors and semi conductor is the resistance of a conductor increases with increase in temperature $R_t=R_0(1+\alpha t)$ but the resistance of a semi conductor decreases with the increase in temperature.

The elements which are natural semi conductor like silicon, Germanium are known as intrinsic semi conductor. The conductivity of intrinsic semi conductors is very low and the conductivity can be increased by adding some impurity i.e. some atoms of other elements in the intrinsic semi conductor and this process of adding impurity is known as Doping.

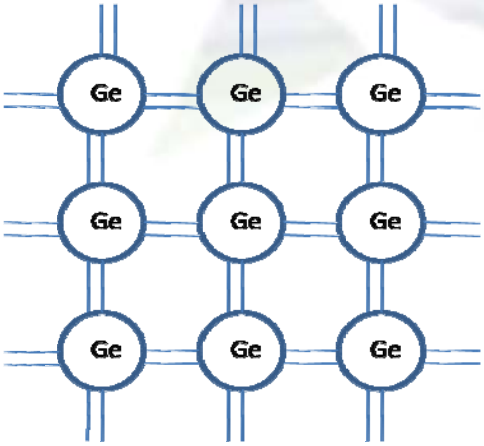
These semi conductors obtained by doping are known as extrinsic semi conductors. The conductivity of extrinsic semi conductors is very high compared to intrinsic semi conductors.

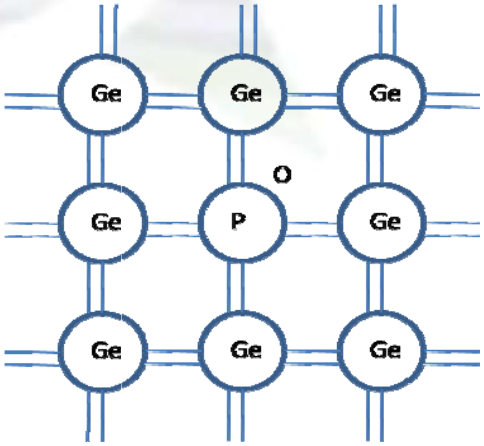
Extrinsic semi conductors are of two types:

(1) n – type or negative type or donor type semi conductor

(2) p - type or positive type or accepter type semi conductor

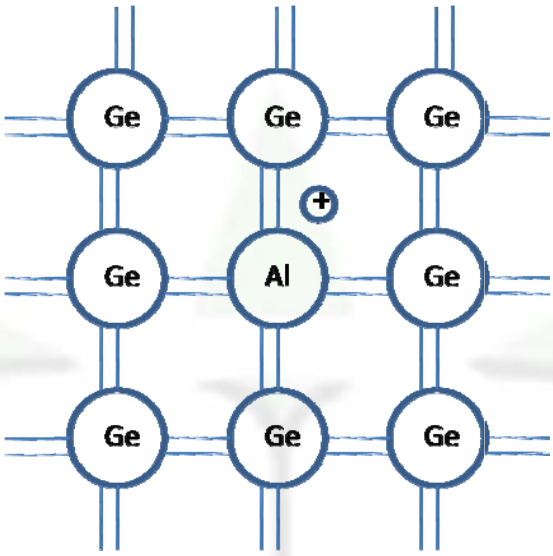
(1) n – type semi conductor : Let us consider an element of Germanium which is tetravalent , four valences electrons in the outermost orbit share each one electron from the outermost Orbit of the four neighbouring Germanium atoms.





Let on Ge-atom be replaced by an atom of some penta valent element say Phosphorus (P) atom out of the five valence electrons in phosphorus four electron share with the four neighbouring Ge-atoms and the fifth electron is left unpaired and behaves as a free electron and these free electrons act as carrier of charge when a potential difference is applied and since the nature of the free charge is negative this is known as negative type semi conductor.

(2) P-type semi conductor: Let an atom of some trivalent element like aluminium is added as impurity. The three valence electrons form bonding with the three neighbouring Germanium atoms and the fourth neighbour is unpaired due to the lack of an electron. This missing electron can be assumed to be an electron and a hole.



We take out the electron from the hole to form covalent bonding with the fourth neighbour and the hole is left free which acts as carrier of charge. When potential difference is applied since the nature of the free charge is positive it is known as P-type semiconductor.