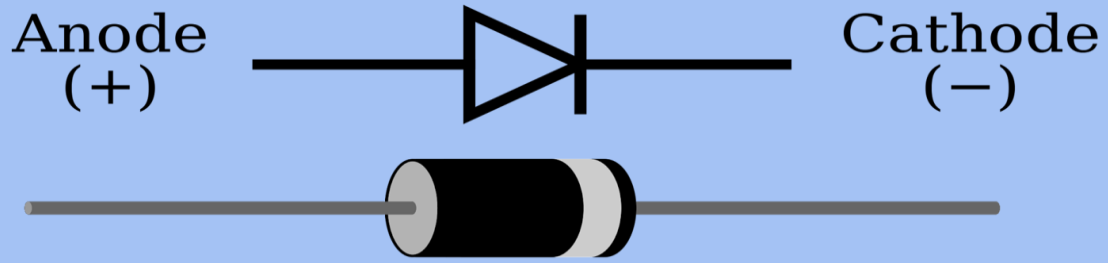
SUBJECT: BASIC ELECTRONICS

Semiconductor Diode : Working

Elementrix Classes

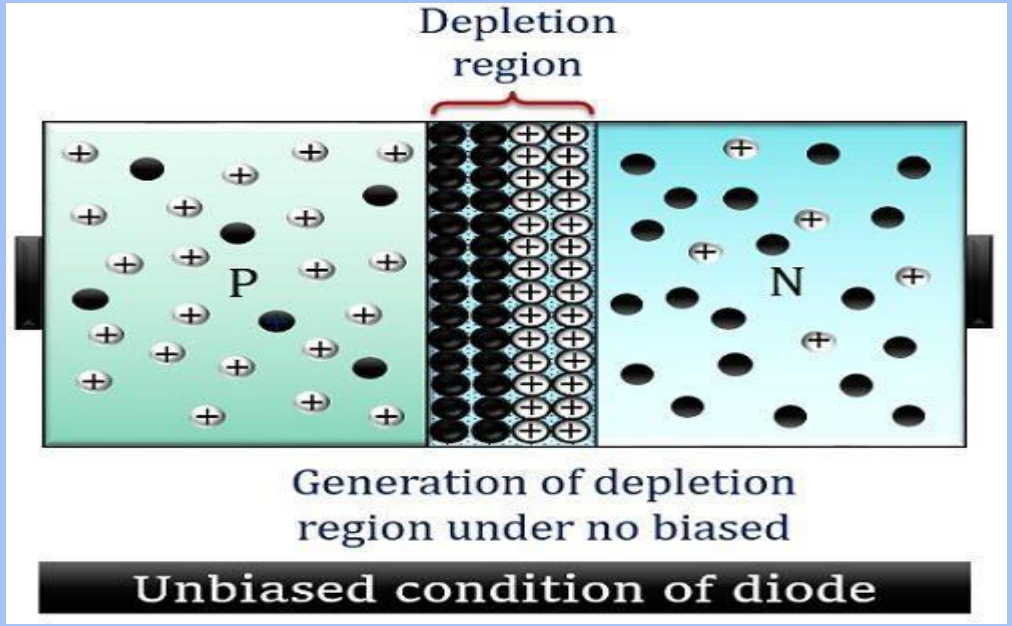
Semiconductor Diode

A diode is a two-terminal electronic component that conducts electric current primarily in one direction. It is a semiconductor device with a P-N junction, where P stands for the positive (or p-type) semiconductor material and N stands for the negative (or n-type) semiconductor material. The basic working principle of a diode is based on the behavior of this P-N junction.



1. No Bias (Zero Bias):

When there is no external voltage applied across the diode, it is said to be in a no-bias or zero-bias condition.



- **Depletion Zone:**

  The P-N junction creates a depletion zone due to the diffusion of charge carriers.

  The depletion zone has a potential barrier that prevents the flow of majority charge carriers (electrons in the n-type and holes in the p-type) across the junction.

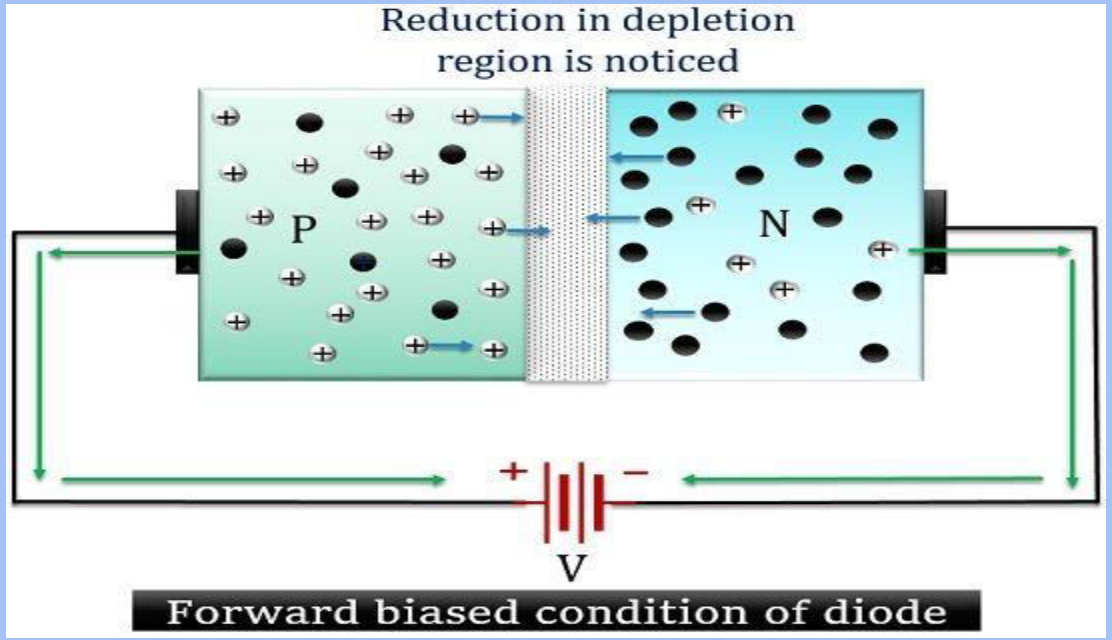
- **No Conduction:**

  Without an external voltage, there is no significant movement of charge carriers across the junction.

  The diode is in a non-conductive state, and there is minimal current flow.

2. Forward Bias:

In a forward-biased condition, a positive voltage is applied to the P-type material, and a negative voltage is applied to the N-type material.



- **Reduced Potential Barrier:**

  The external voltage reduces the potential barrier of the depletion zone.

  Electrons in the N-type material move towards the positive terminal (anode), and holes in the P-type material move towards the negative terminal (cathode).

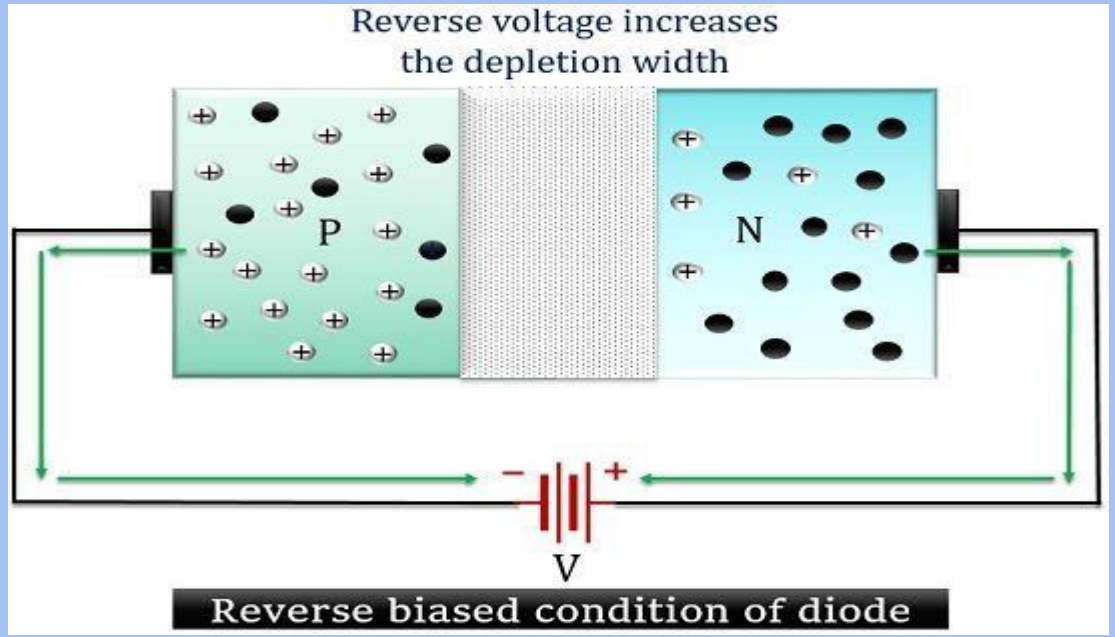
- **Conduction:**

  With the reduced barrier, majority charge carriers can easily move across the junction.

  The diode becomes conductive, allowing a significant current to flow from the P-type to the N-type material.

3. Reverse Bias:

In a reverse-biased condition, a negative voltage is applied to the P-type material, and a positive voltage is applied to the N-type material.



- **Increased Potential Barrier:**

  The external voltage increases the potential barrier of the depletion zone.

  This makes it more difficult for majority charge carriers to cross the junction.

- **No Significant Conduction (Ideal Case):**

  In an ideal diode, there is minimal current flow in the reverse direction.

  The diode acts as an insulator, preventing the majority of charge carriers from crossing the junction.

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