

# Semiconductor Devices

## Short Notes

### PN Junction

**P-type:** When trivalent impurities are added or doped to pure (intrinsic) semiconductor, p-type semiconductor is formed.

Trivalent Impurities → Gallium, Indium, etc.

**N-type:** When pentavalent impurities are added or doped to pure semiconductor, n-type semiconductor is formed.

Pentavalent Impurities → Antimony, Arsenic

**P-type**  
Holes (+ve charge)  
Majority charge carriers  
Electrons (-ve charge)  
Minority charge carriers

**N-type**  
Electrons  
Majority charge carriers  
Holes  
Minority charge carriers

Majority and minority charge carriers vary like? → 100% P-type or 100% N-type semiconductor contains some amount of electron in holes and N-type contains some amount of holes in electrons. So, P-type has electron as minority charge carriers and N-type has holes as minority charge carriers.



If P-type & N-type are attached, diffusion phenomena occurs. Charges get diffused or moved to another end, which creates a potential barrier or depletion layer.



### PN Diode (Diode - Device)

Diode is a device made by use of semiconductor.



Fig: Diode



Fig: Symbolical representation of PN Junction diode

### Forward Biasing of Diode



Fig: Forward Biasing. Positive charges have to get holes, and negative charges have to get electrons. In the depletion layer, there is a net flow of charge, electricity flows through the diode.



Fig: Reverse Biasing. No flow of electricity. Yes, there is a -ve to +ve charge attraction, but on both sides, charges accumulate, so no net flow of electricity.

### Forward Biasing Characteristics



Fig: Circuit diagram of Forward Biasing



Fig: Forward Characteristics

Series rheostat to help in voltage regulation, current control, etc. Yes, the meaning of potential barrier is potential difference across the junction. When voltage is applied, the potential barrier is reduced.

potential barrier. As voltage increases, gradual increase of current, at a point, the current increases sharply. Change in depletion layer is small.

### Reverse Biasing Characteristics

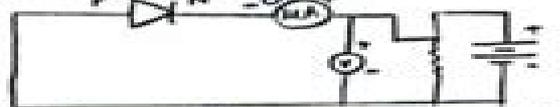


Fig: Circuit diagram of reverse biasing



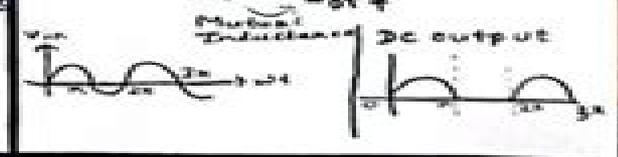
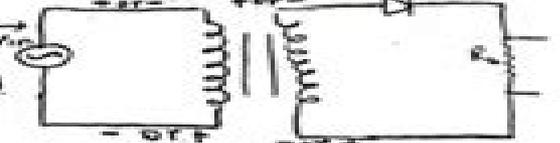
Fig: Reverse Characteristics

Semiconductor is a pure state. It contains both P-type and N-type materials. P-type has holes as majority carriers and electrons as minority carriers. N-type has electrons as majority carriers and holes as minority carriers. Minority carriers are present in both.

Yes, the breakdown voltage is the voltage at which the current starts to increase sharply.

### Rectification: Process of converting AC to DC

#### 1. Half-wave Rectification



# Semiconductor 12th Class Chapter Notes

**Jianjun Gao**



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