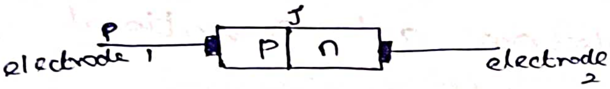
UNIT – III

Semiconductor Devices And Applications.

Diode.

Pn junction is a very popular semiconductor device. Two terminals called electrode one from p region and n-region.



due to 2 electrodes it is called as di + electrode gives diode.

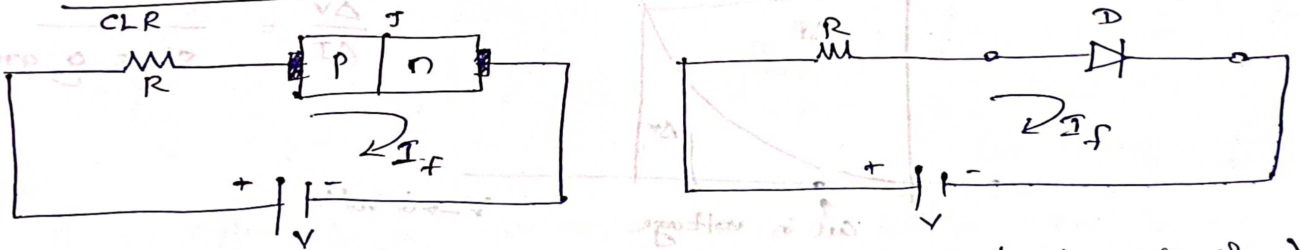
P-n junction diode.

Two operations * Forward biasing * Reverse biasing.

Biasing:- Applying external dc voltage to any electronic device is called biasing.

Depending upon the polarity of the dc voltage externally applied, it is classified into forward biasing and reverse biasing.

Forward biasing of P-n junction diode.



P is connected to +ve and n is connected to -ve of Vtg it is called as Forward biasing.

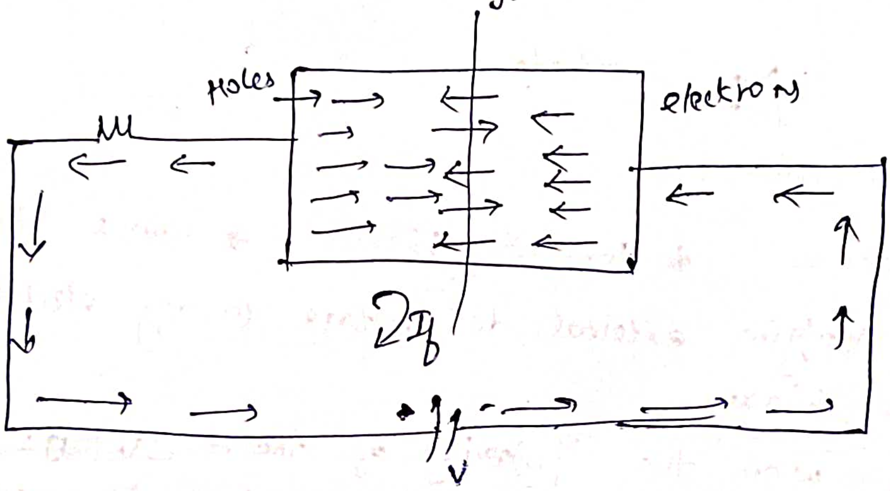
CLR is used to limit the current.

Operation:-

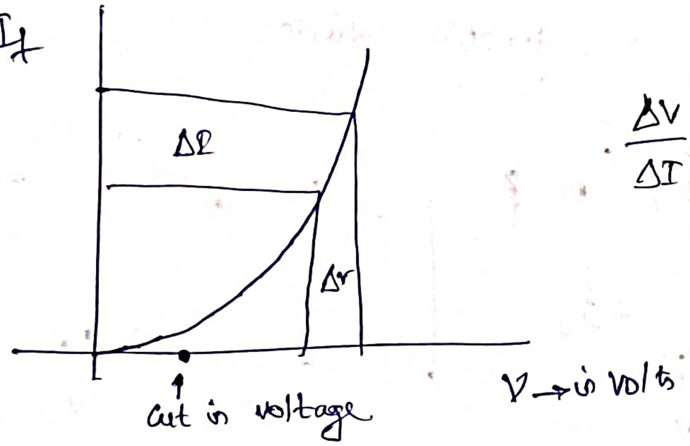
* When applied voltage is less than the barrier potential there cannot be any conduction.

* When applied Vtg > barrier potential, negative terminal of battery pushes free electrons from n to p.
* Illy positive terminal pushes holes from p to n.
* Thus width of depletion region gets reduced.
* It produces a current called forward current. (due to majority carriers)
* Flow of electrons is from negative to positive
* current is from positive to negative.

So direction of flow of electrons and conventional current is opposite to each other.



Forward biasing characteristics.

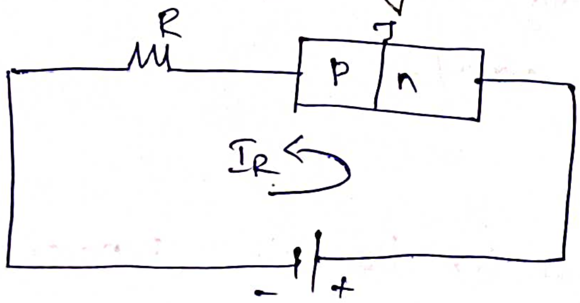


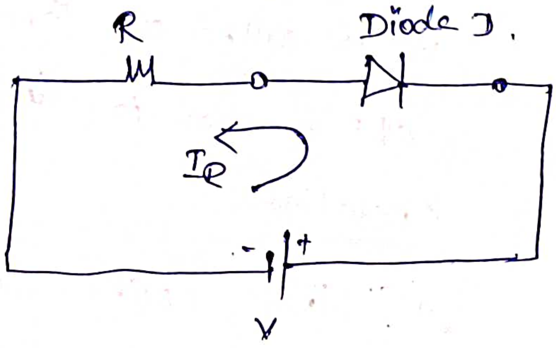
$$\frac{\Delta V}{\Delta I} = \frac{1}{\text{slope of graph}}$$

0.6 V for Si in

0.2 V for germanium

Reverse biasing of P-n junction diode :-





Pn junction is reverse biased, the negative terminals attracts the holes in the p-region away from the junction

→ No charge carriers is able to cross the junction.

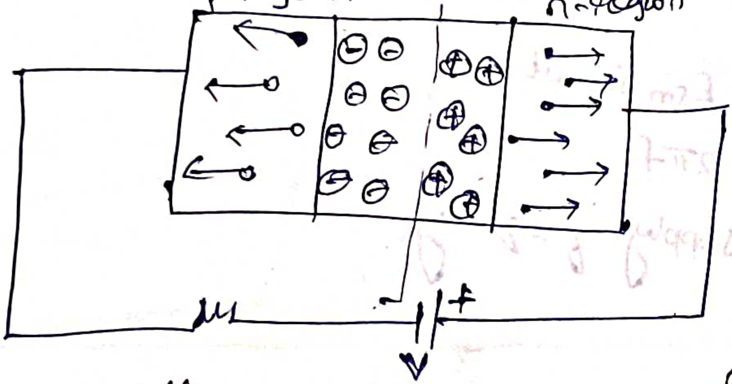
→ depletion region widens.

→ barrier potential increases.

→ drags free electrons in p-region towards +ve terminals &
 " holes " n-region " -ve "

→ reverse current is very small.

→ here, reverse current depends on temperature and not on the reverse voltage applied.



$I = I_0 [e^{V/\eta V_T} - 1] A$

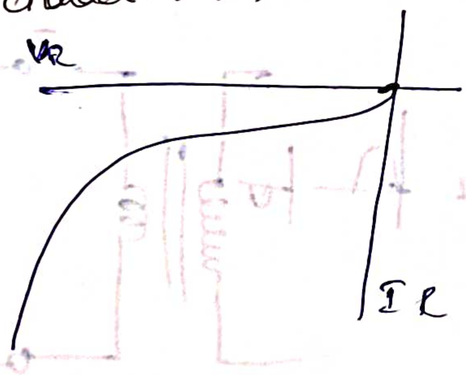
I_0 → reverse saturation current

V → applied voltage

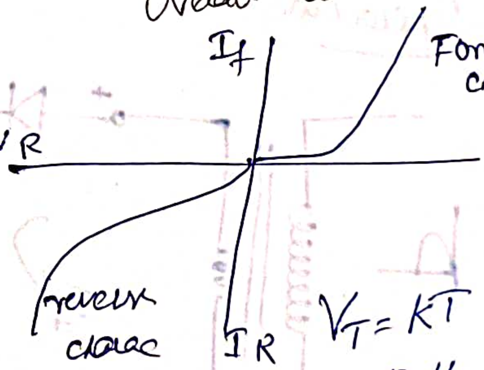
η → 1 for ge 2 for Si

V_T → Voltage eq for temp.

Reverse characteristics.



Overall diode characteristics



$V_T = KT$

K - Boltzmann's constant 8.62×10^{-5} eV/K