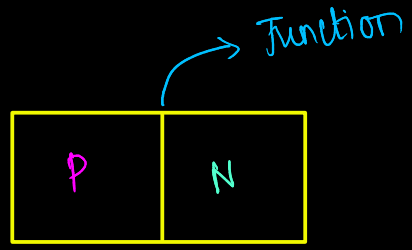
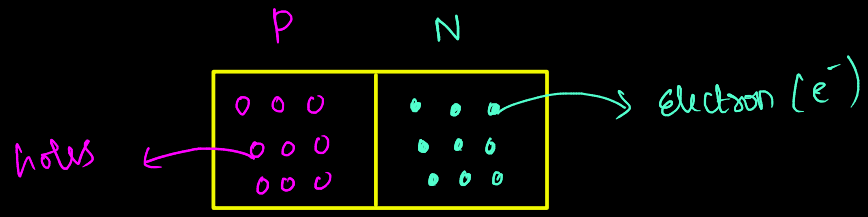
PN- Junction Semiconductor





P- region has holes as majority charge carriers and negatively charged impurity atom (negative ions/acceptor)

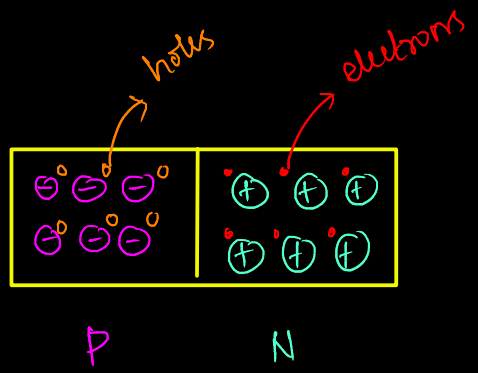
N-region has electrons as majority charge carriers and positively charged impurity atom (positive ion/ donor)

Note:-

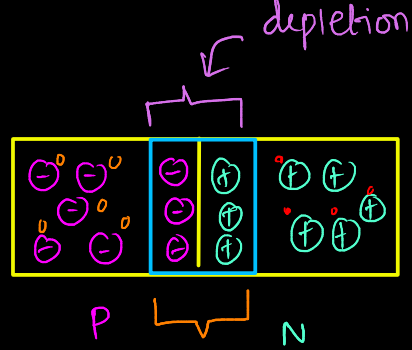
Holes and electrons are called mobile charges

positive and negative ions are called immobile charges

Formation of depletion layer

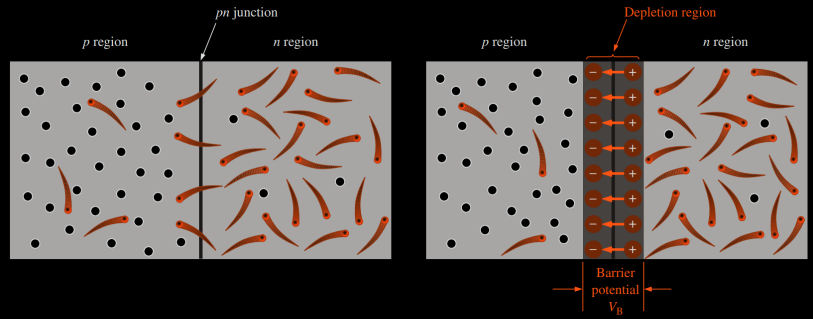


at time $t=0$



at time $t=\infty$

Electric field created
Barrier / Junction Potential.



1. Holes in the P region starts to diffuse N-region & vice versa.

2. Diffusion takes place due to difference in Concentration. (Either in P/N region)

3. Diffusion persist only for very short duration. Recombination of Electrons & holes Created Barrier Potential

4. Thus acceptor ions in P-region & donor ions in N. region remains uncovered.

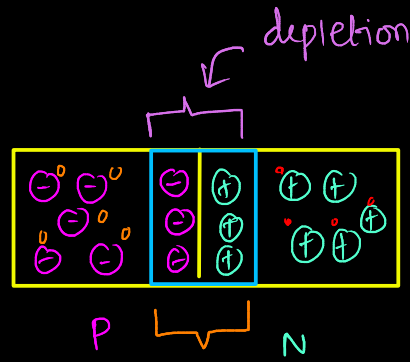
5. The depletion will act as a parallel plate capacitor & thus restrict the recombination of holes & electrons furthermore. So that it act like insulator.

Depletion layer width depends upon

i) doping of impurity in P/N type semiconductor

ii) If doping ↑ then depletion layer width ↓

Barrier / Junction potential



V_B → Barrier / Junction potential

V_B → Barrier potential / Junction potential at room temp (300 K)

Si → V_B → 0.7 V & Ge → V_B → 0.3 V.

V_B is depends (or) vary for different materials due to doping density / electronic charge / temp.

V_B decreases for 2mV / °C

$$\Delta V_B = -0.002 \times \Delta T$$