# Semiconductor Electronics Mindmap

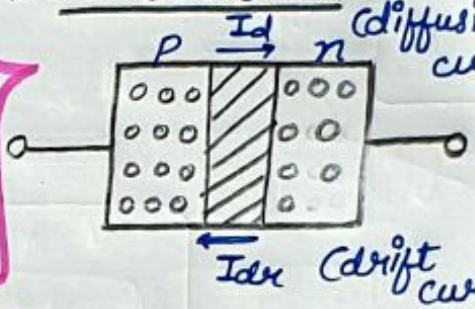
## # Semiconductor and Types :→

Materials

| | Conductors | Semiconductors | Insulators |
|---|---|---|---|
| $\rho$ | $10^{-8}-10^{-2}\ \Omega m$ | $10^{-6}-10^{-5}\ \Omega m$ | $10^{11}-10^{19}\ \Omega m$ |
| $\sigma$ | $10^{2}-10^{8}\ (\Omega m)^{-1}$ | $10^{5}-10^{6}\ (\Omega m)^{-1}$ | $10^{-19}-10^{-11}\ (\Omega m)^{-1}$ |

- Energy band gap :— Gap b/w top of valence band and bottom of conductor band.
  - → For Conductors - $E_g \approx 0$
  - → For Insulators - $E_g > 3eV$
  - → For semiconductors - $E_g < 3eV$
- *Intrinsic - pure semiconductors
- *Extrinsic - doped semiconductors

## # PN Junction :→



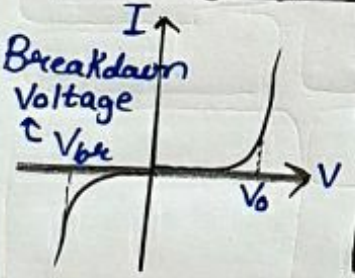

- Biasing of p-n junction
  - → when p-side is given higher potential → forward biased
  - → when n-side is given higher potential → reverse biased.

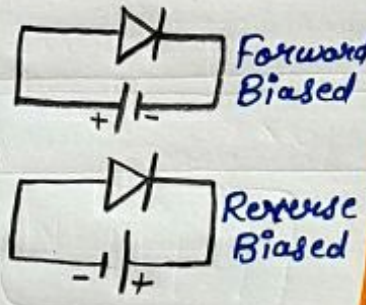
## # Extrinsic Semiconductors :→

- n-type - pentavalent dopant
  - → donor
  - → $n_e > n_h$
- p-type - trivalent dopant
  - → acceptor
  - → $n_e < n_h$

→ For semiconductors - $n_e n_h = n_i^2$

## # Biasing of PN Junction :→




- Applications →

i) photodiode - is PN junction whose fun.$^n$ is controlled by light allowed to fall on it.

ii) LED - used in T.V. or electronic gadgets.
- V-I characteristics are similar to that of Si func.$^n$ diode.

iii) Solar cell - generates emf when solar radiation falls on it.

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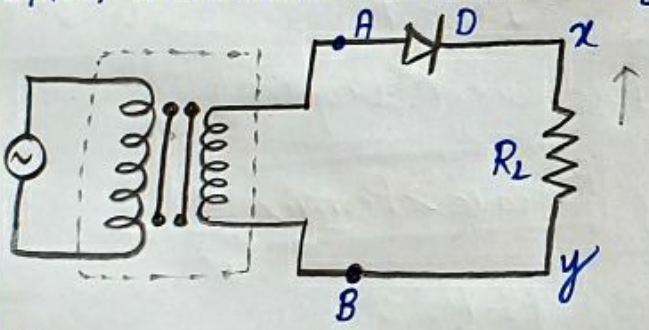
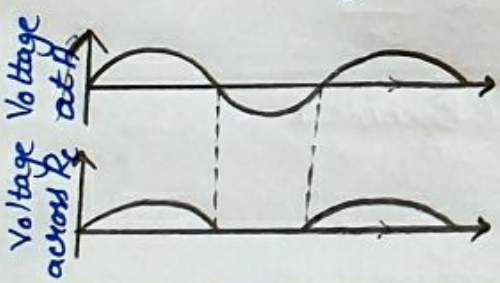
## #Zener Diode:→

→Operates under reverse bias in the breakdown voltage, used as voltage regulator.

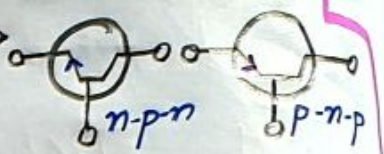
→Depletion region is very thin.

•Half wave and full wave rectifier.




## #Transistor:→




$I_E = I_C + I_B$

→As an amplifier →

•Voltage gain $A_V = \frac{\Delta V_c}{\Delta V_{in}}$

$A_R = R_L / R_i$

$A_V = -A_R \beta_{AC}$

•Power gain $A_p = \beta_{AC} A_V$

$\beta = \frac{\Delta I_c}{\Delta I_B}$

•Trans-Conductance

$g_m = \frac{\Delta I_c}{\Delta V_B}$