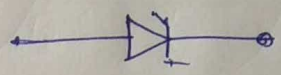
Special P-N Junction diodes:-

a) Zener Dide:-

It is special purpose diode, designed to operate under reverse bias in the breakdown region and used as a voltage regulator.

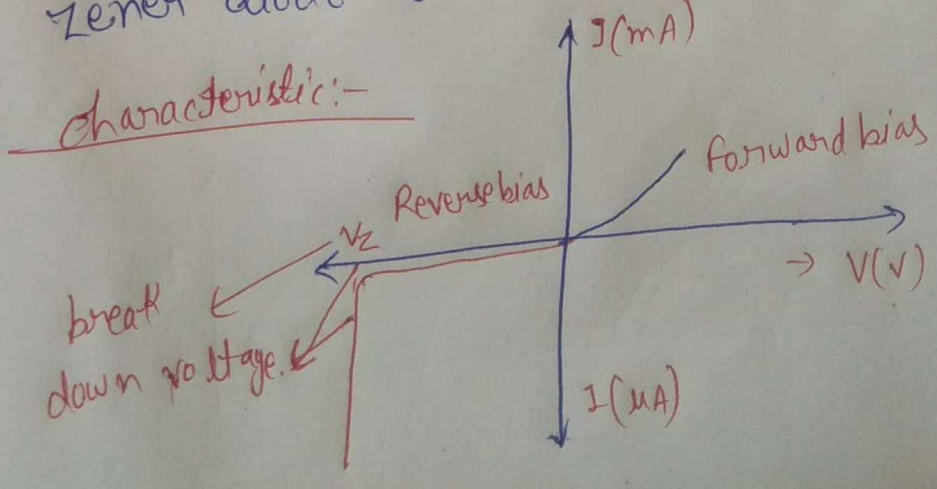
symbol :- 

→ heavily doped p- and n-sides of the junction. Due to this, depletion region formed very thin ($< 10^{-6}$m) and electric field of the junction is high ($\sim 10^6$ V/m) for small reverse bias voltage (V) reaches the breakdown voltage (V_z) of the diode.

After the breakdown voltage V_z, a large change in the current can be produced.

In other words, Zener voltage remains constant, even through current through the Zener diode varies over wider range.

Characteristic:-



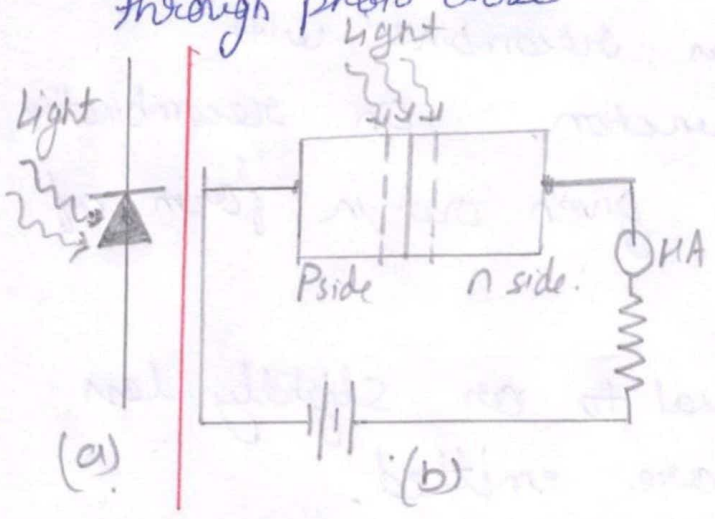
Photodiode

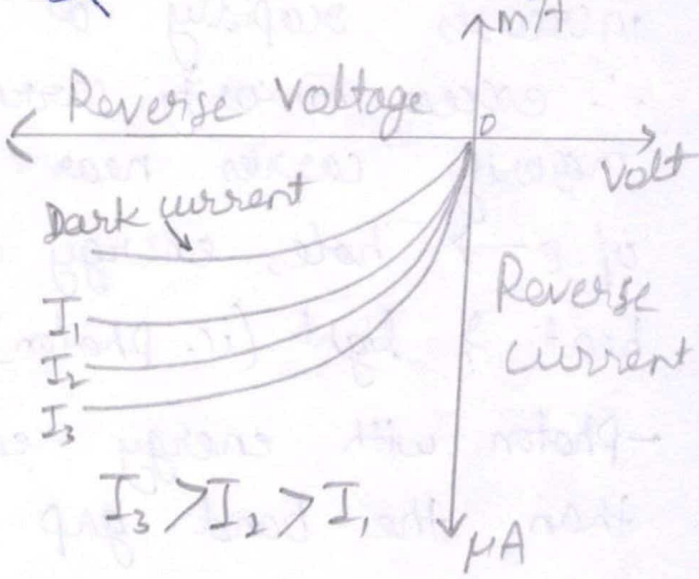
when visible light of energy greater than forbidden energy gap (ie. $h\nu > E_g$) is incident on a reverse biased p-n junction photodiode, Additional e^--hole pairs are created in depletion layer (near junction). These charge carriers will be separated by junction field & made to flow across the junction, creating a reverse current.

It is found :

reverse saturation current through photo diode $\propto$ light intensity

almost linearly

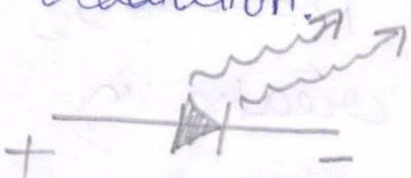


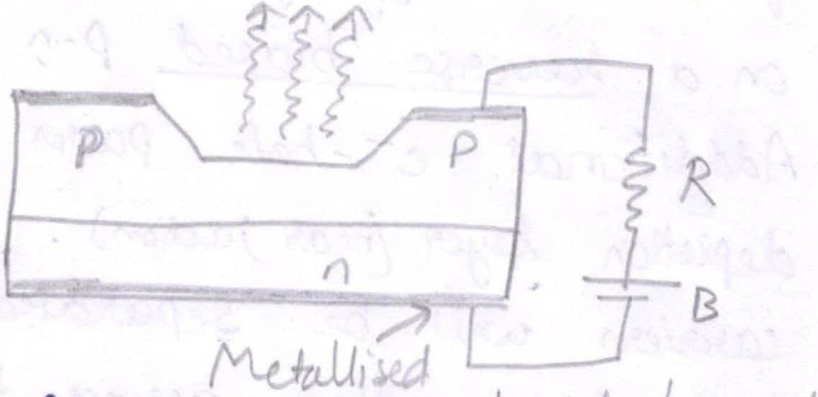


When photodiode is reverse biased, certain current exist in circuit even when no light is incident on p-n junction of photodiode. This current is called Dark current.

(c) Light Emitting Diode (LED)

Heavily doped p-n junction diode which under forward bias emits spontaneous radiation.





Working

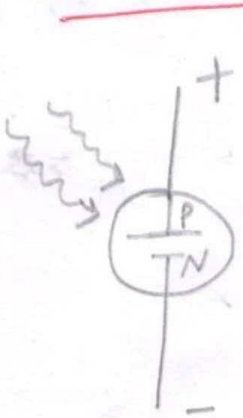
As p-n junction is forward biased so e⁻ from n & hole from p-side start moving through junction.

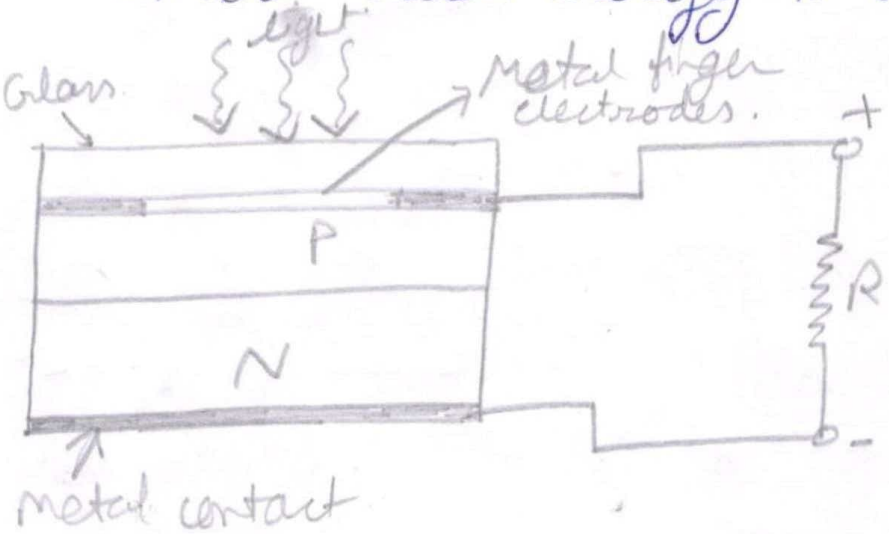
Due to this concentration of minority carriers increases rapidly at junction boundries.

∴ excess minority carriers recombine with majority carries near junction. On recombination of e⁻ & hole, energy is given out in form of heat & light (i.e. photon).

- Photon with energy equal to or slightly less than the band gap are emitted.
- Light emitted depends upon type of material used.

Solar cell — Convert Solar energy to electric





When photons of light (of energy $h\nu > E_g$) fall at junction, electron-hole pair are generated in the depletion layer (near junction). The e⁻ & holes produced moves in opp. direction due to Junction field.

The photo generated e⁻ move towards n-side
& photo generated hole move " p-side.

They will be collected at two sides of junction, giving rise to photo voltage b/w top & bottom metal electrodes.

The top metal contact act as positive electrode
& bottom metal contact act as Negative electrode

When an external load is connected across metal electrodes photo current flows.