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CSE AI ML B

Semiconductor Laser Diode.

Defination:

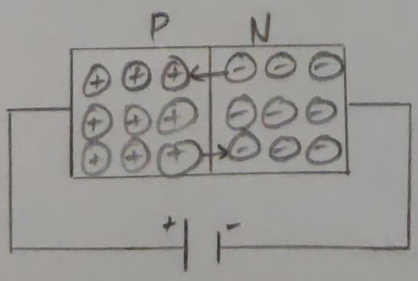
It is specifically fabricated p-n junction diode. This diode emits laser light when it is forward biased.

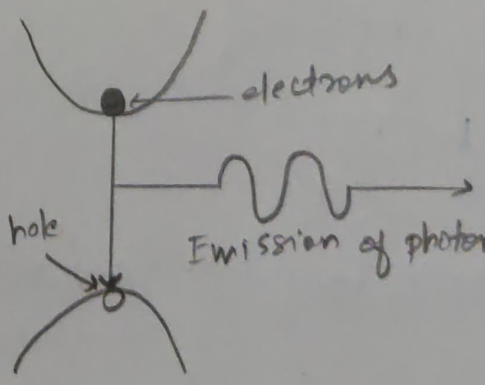
Principle:

When p-n junction diode is forward biased, the electrons from n-region and holes from p-region cross the junction and recombine with each other

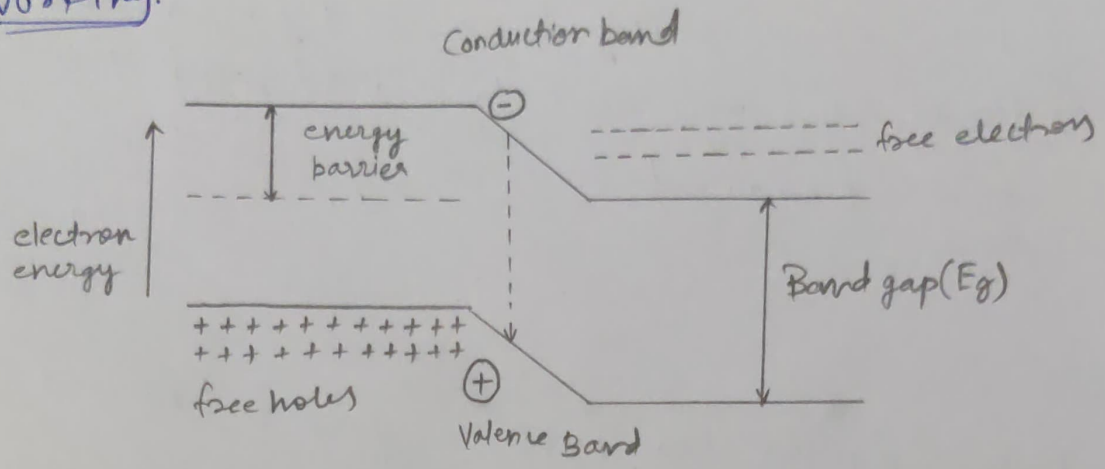
During recombination process, the light radiation (photons) are released from a certain specified direct band gap semiconductors like GaAs

The photon emitted during recombination stimulate other electrons and holes to recombine





Working:



When the PN junction is forward biased with large applied voltage, the electrons and holes are injected applied voltage. the electrons and holes are injected into junction region in considerable concentration.

If the population density is high, a condition of inversion is achieved. The electrons and holes recombine with each other and this recombination produce radiation in form of light.

When forward-biased voltage is increased, more light photons are emitted and light production instantly becomes stronger.

$$E_g = h\nu = h\frac{c}{\lambda}$$

$$\lambda = \frac{hc}{E_g}$$

where, E_g = band gap energy in joule.

Characteristics:

1) Type : It is solid state semiconductor laser
2) Active Medium : Made from single crystal of gallium arsenide.
3) Pumping Method : Direct conversion method is used.
4) Power Output : The power output from laser is 1 mW
5) Nature of Output: Nature is continuous wave

Advantages:

1) Very small in Dimension.
2) Exhibits high efficiency
3) Operated with lesser power
4) Require very little auxiliary equipment
5) Can have continuous wave output

Disadvantages:

1) Poor coherence
2) Poor stability
3) Difficult to control the mode pattern.