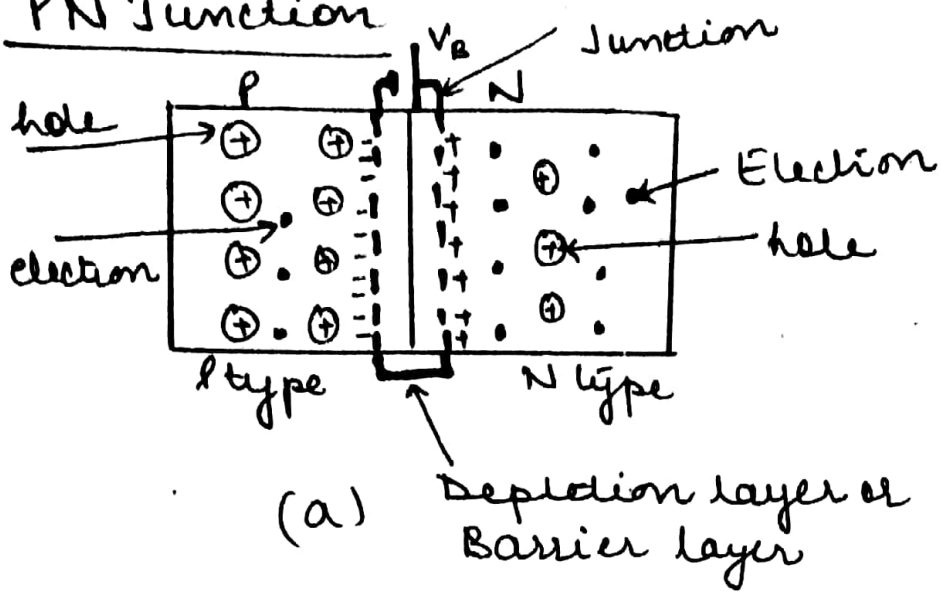
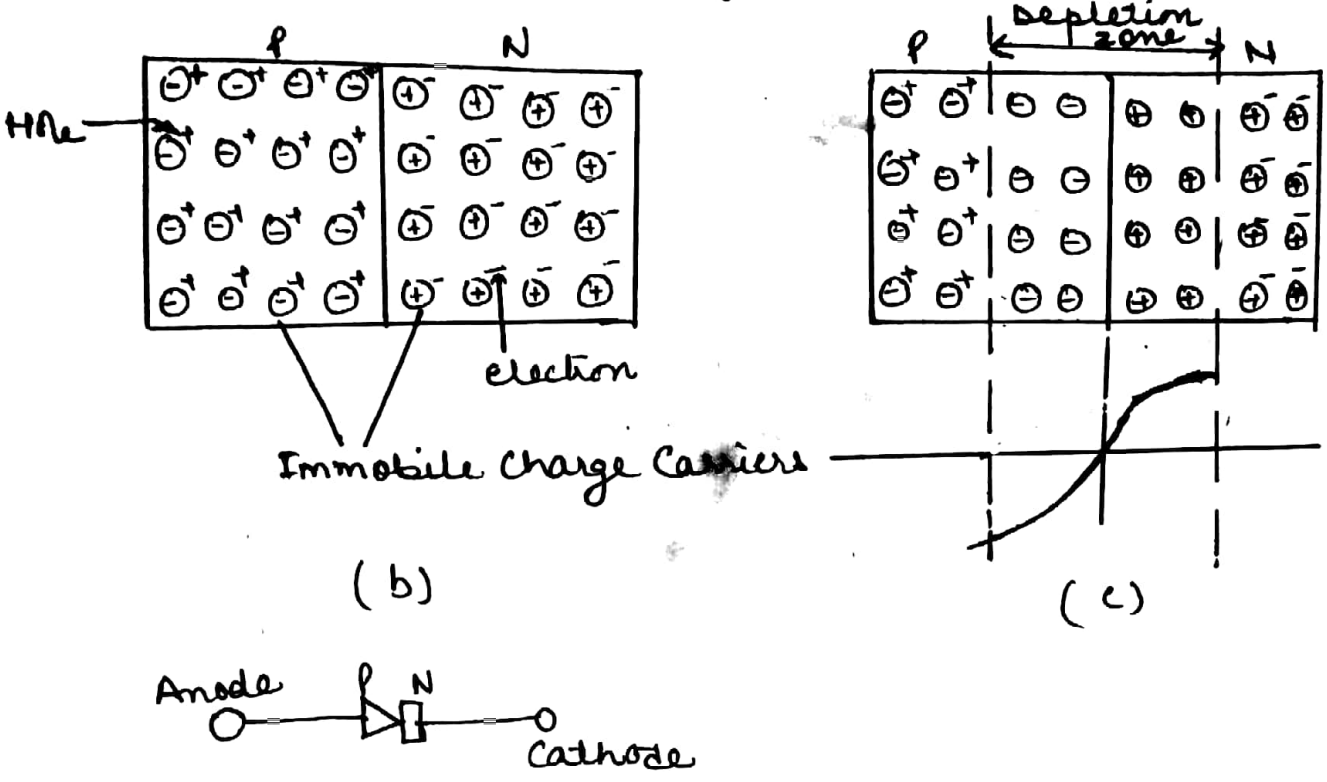
Semiconductors (3)

PN Junction



(a)



(b) (c)

PN Junction Diode

At normal temp.

P type	N type
(1) no. of holes >>> no. of e^-	(1) no. of e^- >>> no. of holes
(2) Acceptor ion (-vely charged ion) (Explanation)	(2) Donor ion (+vely charged ion) (Explanation)
(3) -vely charged ions are immobile	(3) +vely charged ions are immobile

One layer of intrinsic semiconductor like Si or Ge is processed with pentavalent impurity (पाँच संयोजकता वाली अशुद्धि) & The second layer of intrinsic semiconductor is processed with trivalent impurity (3 संयोजकता वाली अशुद्धि)

↓

Interface of P type and N type crystal is known as PN Junction

↓

No. of holes are greater in P type and No. of electrons are greater in N type when PN Junction is formed.

↓

Due to difference in Charge concentration (आवेश सान्द्रता)

↓

Diffusion occurs at the Junction. (विसरण)

(Holes from P type diffuse to N type & electrons from N type diffuse to P type)

(विद्युत)

↓

Near the junction due to recombination no free charge is left over - the acceptor ion in P type and donor ion in N-type of semiconductor fig (C)

↓

If more holes diffuse from P type to N type they get repelled by +vely charged ions in N type. Similarly if more electrons diffuse from N type to P type they get repelled by -vely charged ions in P type.

Hence all the holes and electrons cannot recombine.

↓

Charge free (आवेश रहित) region is created near the junction. This is known as depletion region or space charge (Only immobile charge carriers exist)

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An electric field is developed over the junction due to acceptor and donor ions This electric field is known as (barrier).

↓

Due to potential of this electric field (विभव) (विद्युत क्षेत्र)

after diffusion e⁻ and holes cannot cross the potential.

↓

This is known as barrier potential.

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After diffusing potential of N type > potential of P type

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Due to barrier, majority carriers cannot move across the barrier but due to thermal energy minority carriers are continuously created.

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But No electric flow due to minority carriers.

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If minority carrier drifts to another region, soon a majority carrier whose kinetic energy is greater crosses the barrier and balances the movement of minority carrier.

Height of potential barrier adjusts itself to balance the movement of majority & minority carriers