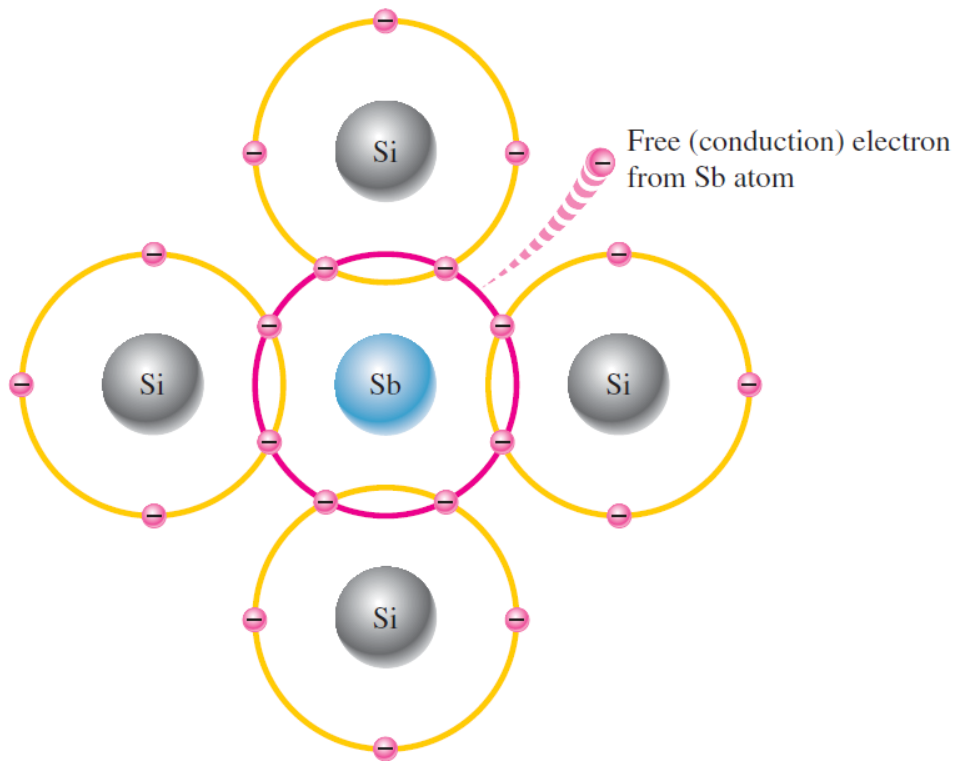


Doping

A manufacturing process that adds free charge carriers (free electron or hole) into a pure semiconductor material to increase its conductivity .

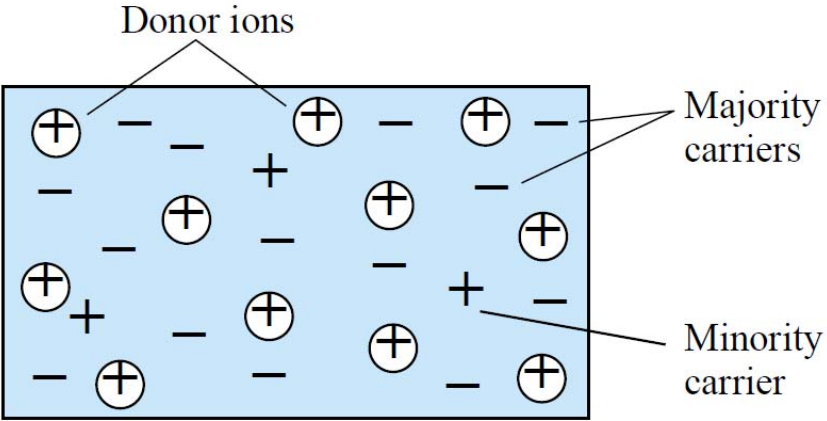
Doping → n-type or p-type material

N - type semiconductor



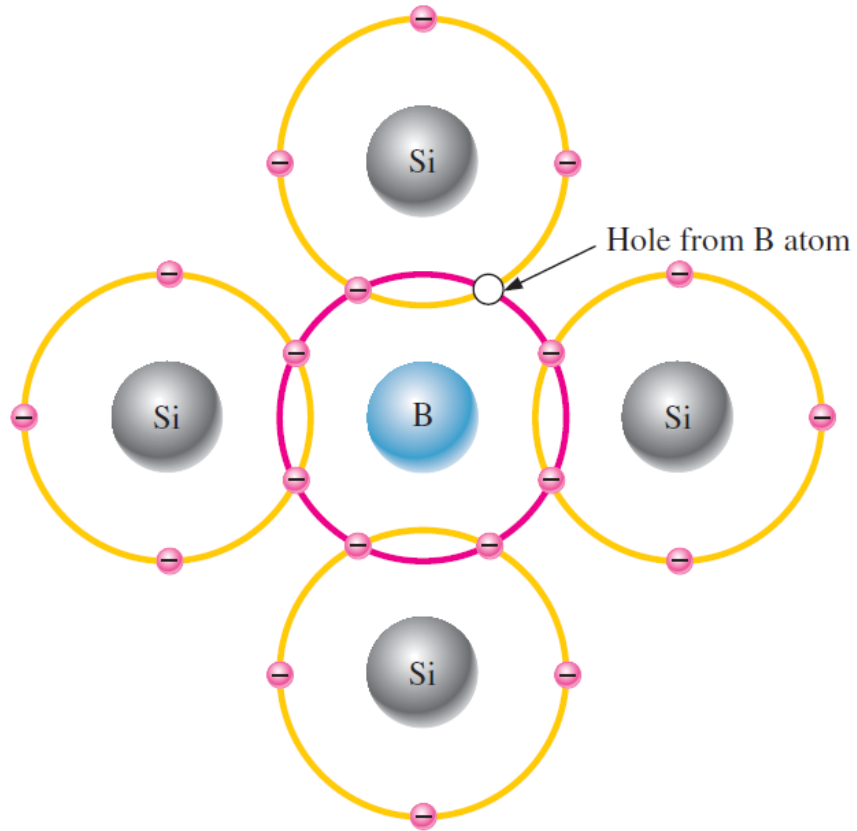
Sb (antimony) has five valence electrons and it is called a donor atom.

In the n-type material the free electrons are the majority and the holes are the minority.



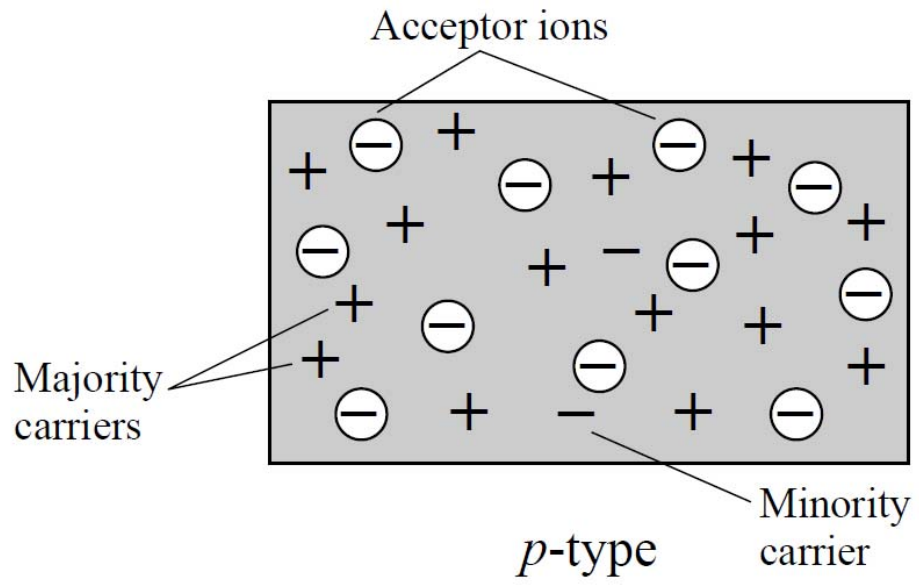
n-type

P - type semiconductor



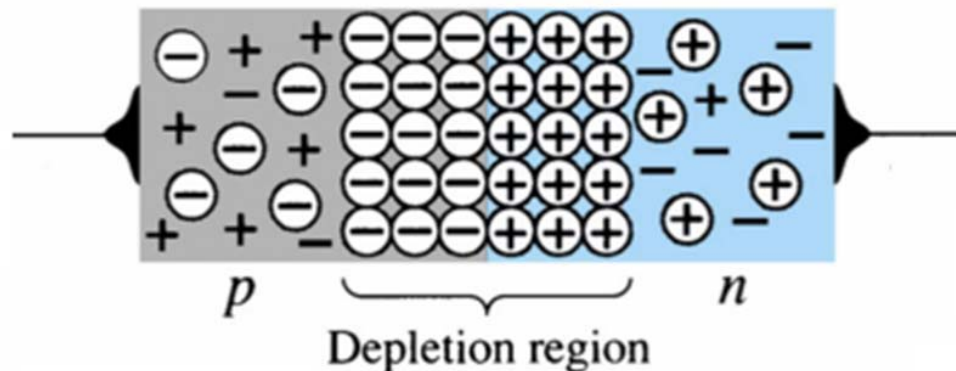
B (Boron) has three valence electrons (acceptor atom)

In the p-type material the holes are the majority and the free electrons are the minority.



Pn junction

The *pn* junction is the basis for diodes, certain transistors ,and other devices.



- 1 – Electrons from the n-type material near the junction diffuse across the junction.
- 2 – These electrons fill the holes in the p-type material adjacent to the junction.
- 3 – As a result of electrons leaving the n-type material , donor ions are created on the n side of the junction .
- 4 – When these electrons fill holes in the p side of the junction ,acceptor ions are produced.
- 5 – A wall of stationary positive ions is aligned with a wall of negative ions along the n and p sides of the junction .
- 6 – The space occupied between the ion walls is called depletion region.

7 – Whenever there exists a positive charge with respect to a negative charge ,

a voltage difference is set between charges ;(Junction potential, Junction barrier).

8 – The junction potential acts as potential barrier that tend to prevent majority carriers from crossing the junction.

9 – Minority carriers are aided by the junction potential.

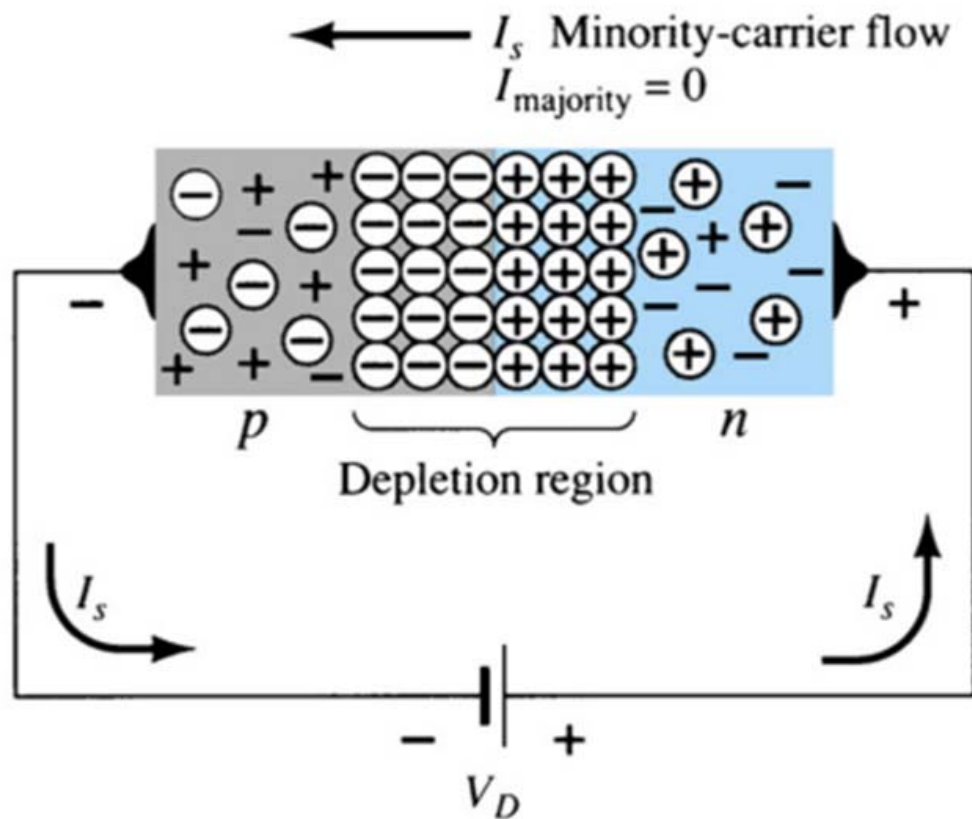
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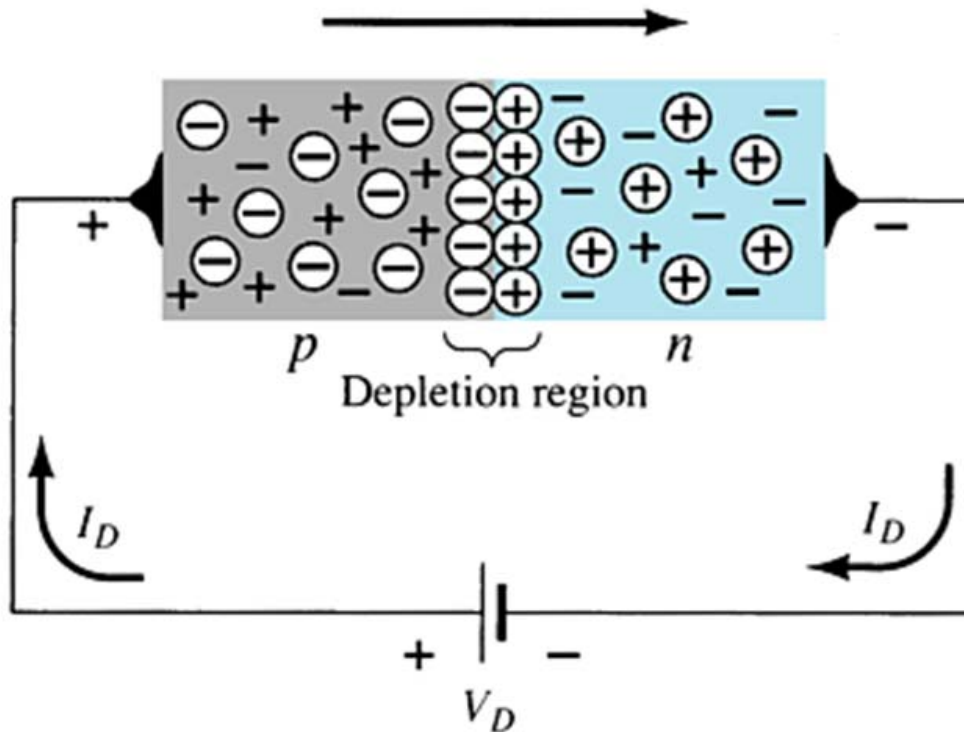
9 – Minority carriers are aided by the junction potential.

Reverse bias of a pn junction



- The reverse voltage causes the depletion region to widen.
- The electrons in the n -type material are attracted toward the positive terminal of the voltage source.
- The holes in the p -type material are attracted toward the negative terminal of the voltage source.

Forward bias of a pn junction



The forward voltage causes the depletion region to narrow.

The electrons and holes are pushed toward the p - n junction.

The electrons and holes have sufficient energy to cross the p - n junction.