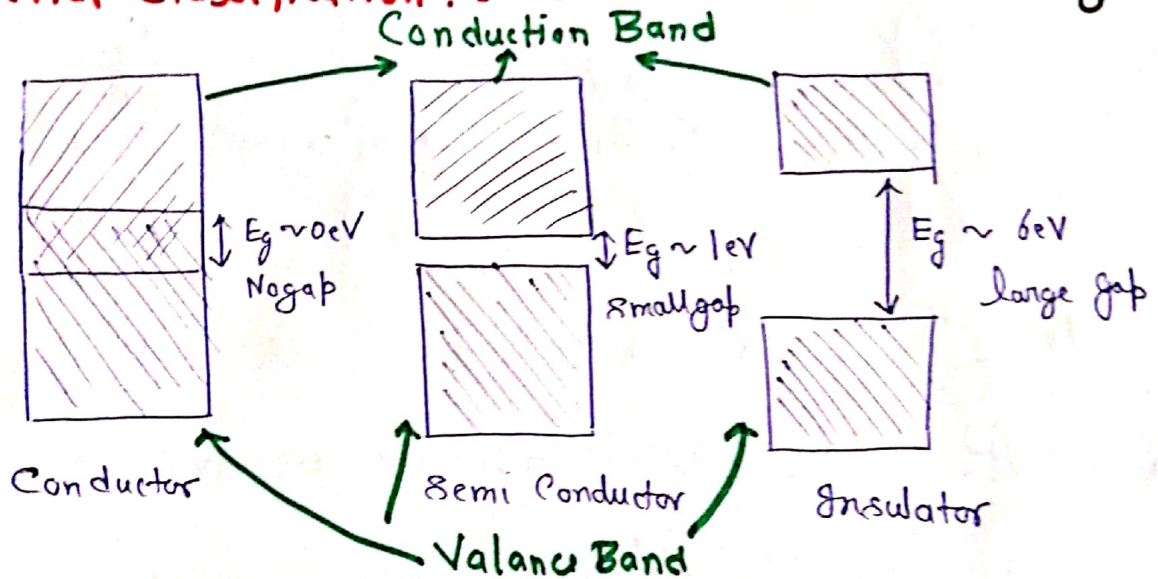


Semi Conductor Basic.

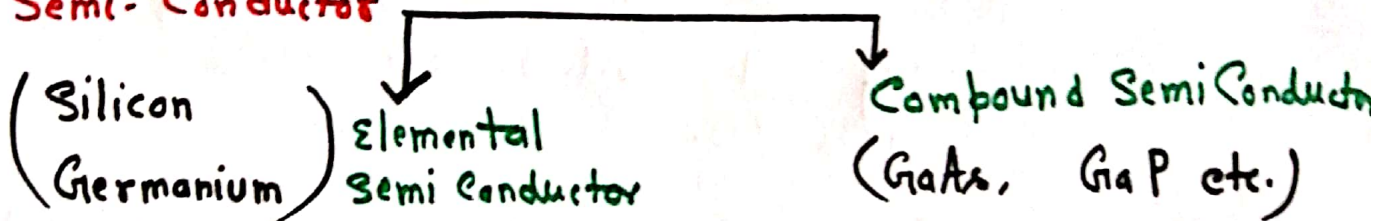
- (i) **Materials** → Conductor (Silver, gold etc)
→ Insulator (Mica, glass etc)
→ Semi Conductor (Silicon, Germanium etc)

(2) **Material classification** :- on the basis of Band gap.



Question. 1 Conductor → large No of free electrons
Insulator → small or No free electrons
Semi conductor → few no. of free electrons

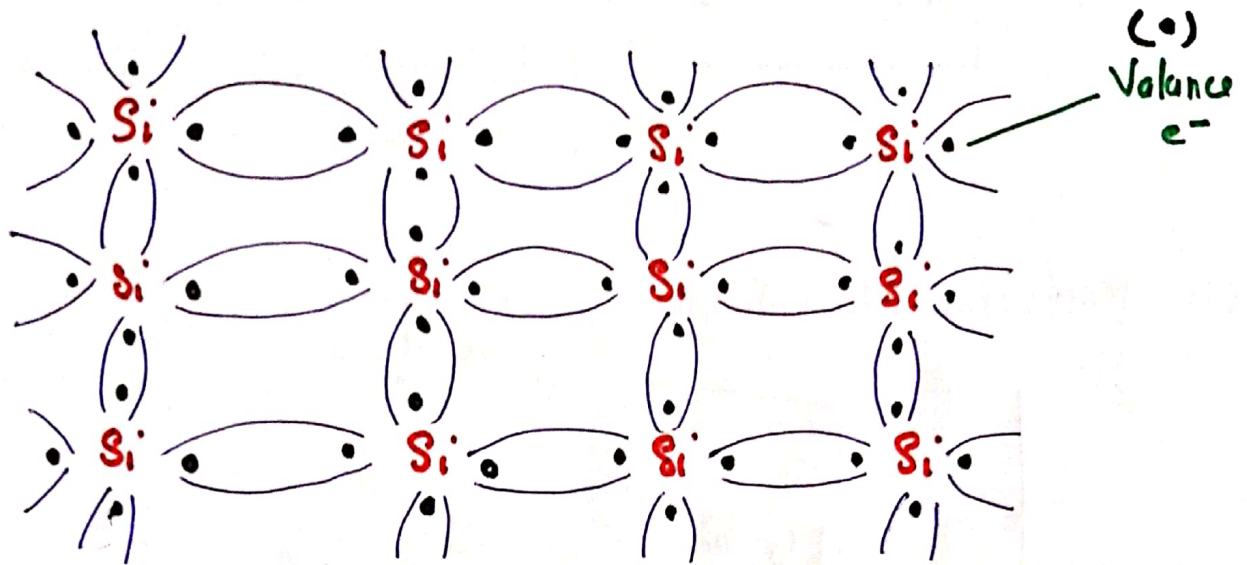
(3) **Semi-Conductor**



(4) **Silicon or Germanium** → Both have 4 Valence e^- in the outermost cell i.e. it requires 4 e^- more to form a stable structure.

1 Si atom makes Covalent Bond By Sharing its all four valence e^- to 4 other Si atoms.

2-D diagram View



No free electron all valence e^- are covalently bonded.

Note:- At 0K Semiconductor behaves as Insulator
At 300K or Room temp behaves as little bit Conducting.

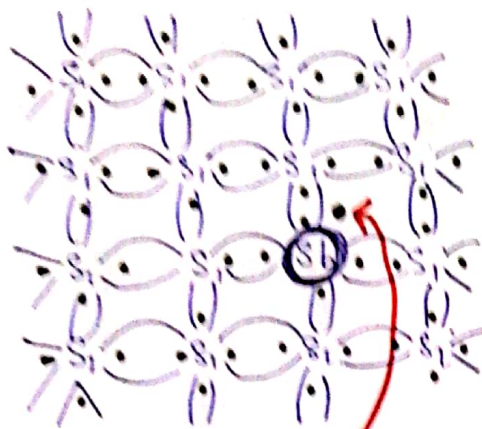
Ans:- Because some of the covalent bond absorb K.E from natural cause like light energy and thermal energy and covalent bonds breaks and few e^- becomes free.

Question. 2: Semiconductor have -ve temperature Coefficient.

Ans:- -ve temp. coefficient means \uparrow (increase) in temperature \downarrow (reduces) its resistance.

As temp \uparrow covalent bonds breaks as a result free $e^- \uparrow$ and Conductivity \uparrow hence resistance \downarrow

N-type
Group-15 element
P, As, Sb



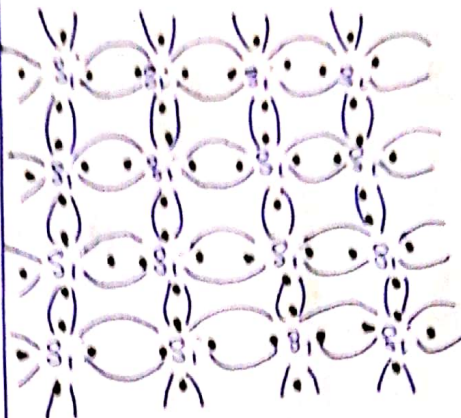
Fifth valance e^-
-ve charge e^- is
more hence, named
N-type

Figure, show one Sb atom
between so many Si, But
like this so many Sb atom.
hence, large no. of free e^- .

$$n > p$$

Majority carrier = electron (n)
Minority carrier = holes

pure semi Conductor
(Si, Ge) without
any defect or impurity
group-14
Si, Ge



4 e^- all are
covalently bonded

No free e^-

$$n = p$$

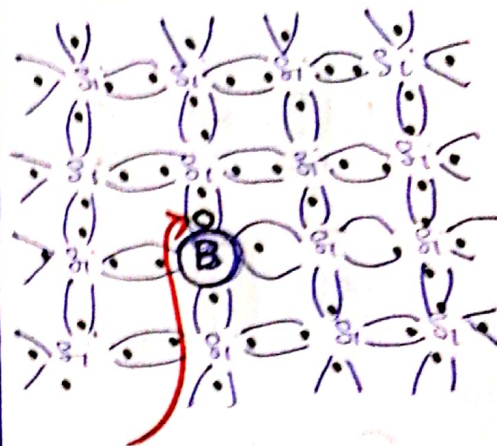
denotes
no. of e^-

No. of
holes

No minority or
majority
Both are equal.

P-type

group 13 element
B, Al, Ga



No fifth e^- but
1-hole having +ve
charge. hence
named, P-type.

figure, show one Boron
atom in between so many
Si atom hence, large
no. of holes if Boron
no. of e^- increases

$$n < p$$

Majority carrier = p
minority carrier = n

Mass Action. LAW:- gives relationship b/w electron and hole concentration.

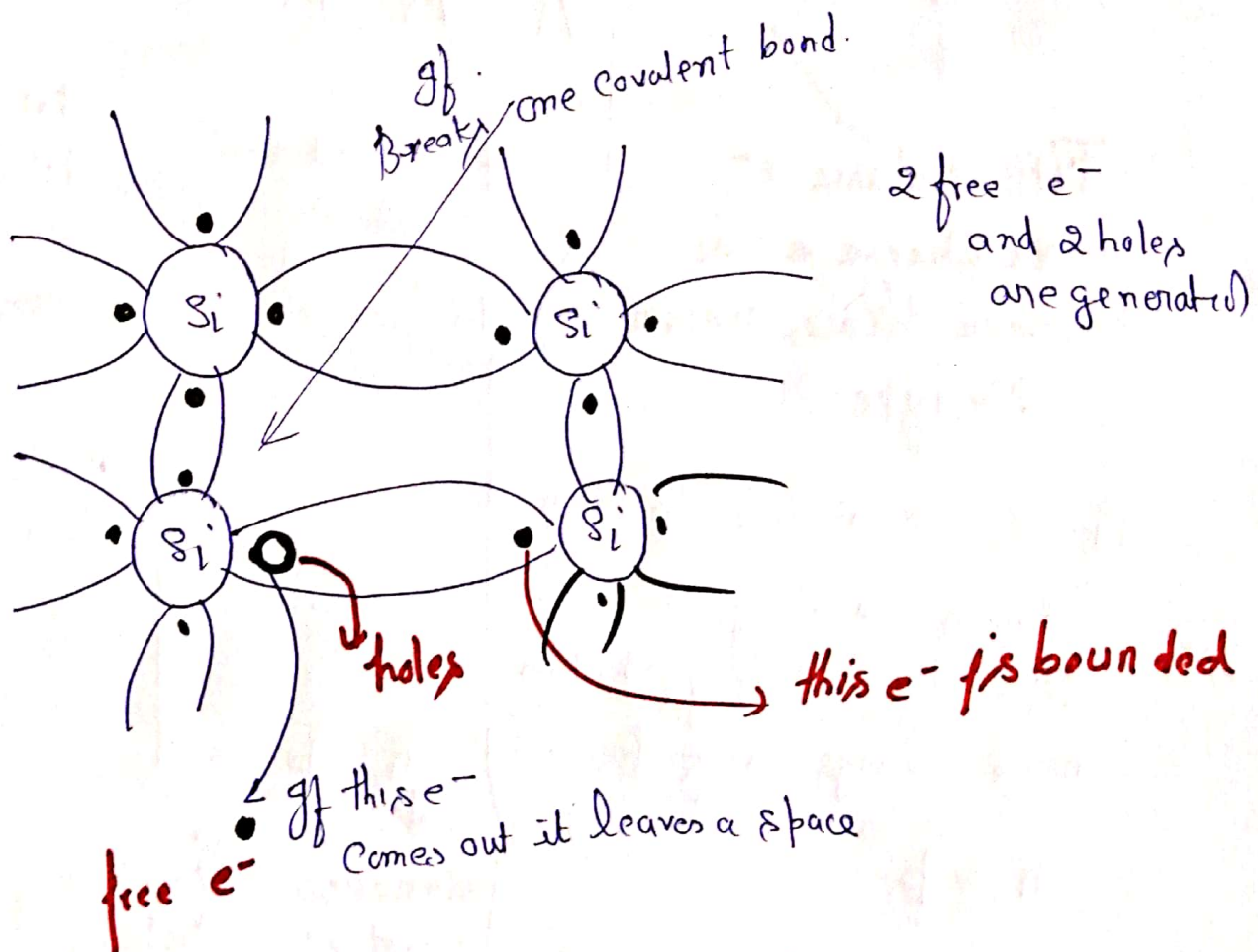
Statement:- states that under **thermal Equilibrium** the product of free -ve and +ve carrier concentration is a Constant.

$$np = n_i^2$$

$n_i \rightarrow$ intrinsic carrier concentration

\nwarrow Conc. of free electron in thermal Equill^m.
 \searrow Concentration of free holes in Equill^m.

Concept:-



$$n_i = 2 = n = p \rightarrow \text{for Pure}$$