Extrinsic semiconductors-Fermi level

why because the carrier conc. at Room Temp. & conductivity are very law example Si:

$n_i = 10^{10}\ cm^{-3}$ $\sigma_{in} = 3 * 10^{-6}\ \Omega^{-1}\ cm^{-1}$

$np = n_i^2$ = constant at given Temp

In any semcondctor the law of mass action should be always statisfied

So we can not increase p and n at some Time

n-Type — P, As, Sb Group 5 one extra electron

p-Type — B, Al, Ga, In : 3

So far we only talk about Si, what about other semiconductor and doping in them? if we look at the Gemanium (Ge), Germanium lies in the same group of silicon, which means all the elements that we used in silicon could also be used for Ge. So we can use group 5 elements like phosphorous or arsenic has n-type dopant, and could also use group 3 elements like boron as a p-type dopant. we can calculate the ionization energies for theses dopants, could use hydrogen model

only diffarent the effective mass $m_{e_{Ge}}^* \neq m_{e_{Si}}^*$ and

Ge $\varepsilon_r = 16$

Si: $\varepsilon_r = 11.9$

n-Types dopants of Ioization Energy

in mev ⇨	P	As	Sb	E_g (Rm.)
Si:	45	54	39	1.10 ev
Ge	12	12.7	9.6	0.67 ev