From *Semiconductor Physics and Devices: Basic Principles* (4th Edition), Donald A. Neamen, McGraw Hill, 2012, ISBN 978-0-07-352958-5.

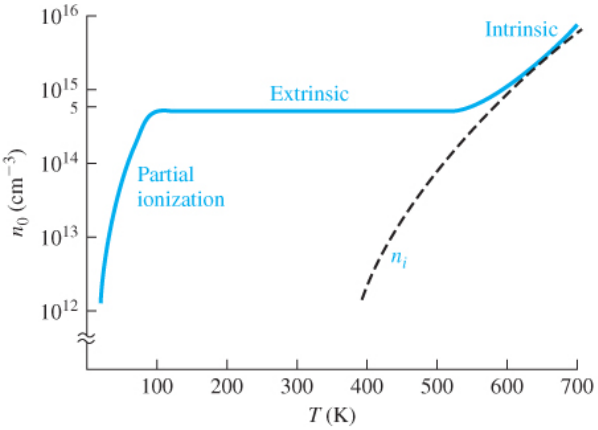

Figure 4.16 | Electron concentration versus temperature showing the three regions: partial ionization, extrinsic, and intrinsic.

- Note: At 'normal temperatures', the extrinsic electrons dominate.

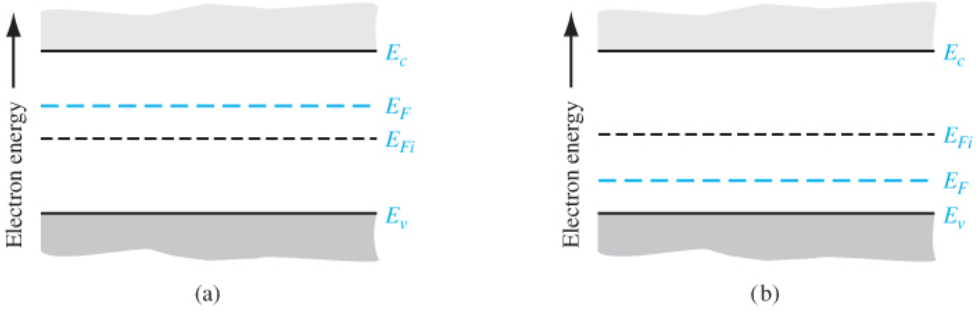

Figure 4.17 | Position of Fermi level for an (a) n-type ($N_d > N_a$) and (b) p-type ($N_d > N_a$) semiconductor.

- $E_F > E_{Fi} \approx E_{midgap}$ for *n*-type semiconductors while $E_F < E_{Fi} \approx E_{midgap}$ for *p*-type semiconductors.

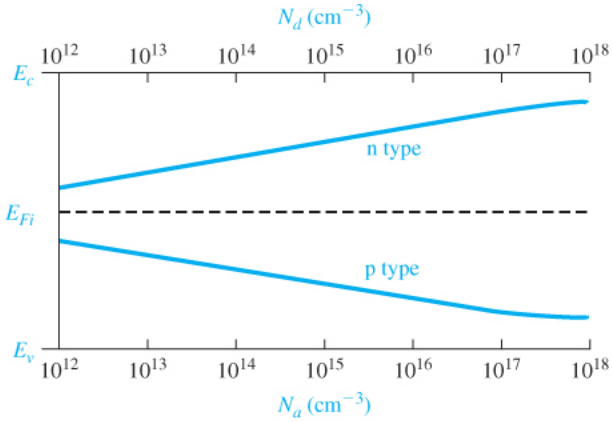

Figure 4.18 | Position of Fermi level as a function of donor concentration (n type) and acceptor concentration (p type).

- $E_F > E_{Fi} \rightarrow E_c$ as N_d increases for *n*-type semiconductors while $E_F < E_{Fi} \rightarrow E_v$ as N_a increases for *p*-type semiconductors.