

4.23 (a) The Fermi energy level in ~~silicon~~ at $T = 300$ K is 0.22 eV above the intrinsic Fermi level. Determine n_0 and p_0 . (b) Repeat part (a) for GaAs.

b) From Table B.4, we get $n_i = 1.8 \times 10^6 \text{ \#/cm}^3$ at 300K for GaAs.

Per (4.39),

$$\begin{aligned} n_0 &= n_i e^{(E_F - E_{F,i})/k_B T} \\ &= 1.8 \times 10^6 e^{0.22 / [(8.617333 \times 10^{-5} \text{ eV/K}) 300\text{K}]} \Rightarrow \underline{n_0 = 8.935317 \times 10^9 \text{ \#/cm}^3}. \\ &= 1.8 \times 10^6 e^{0.22/0.025852} \end{aligned}$$

Per (4.40),

$$\begin{aligned} p_0 &= n_i e^{-(E_F - E_{F,i})/k_B T} \\ &= 1.8 \times 10^6 e^{-0.22 / [(8.617333 \times 10^{-5} \text{ eV/K}) 300\text{K}]} \Rightarrow \underline{p_0 = 362.606 \text{ \#/cm}^3}. \\ &= 1.8 \times 10^6 e^{-0.22/0.025852} \end{aligned}$$