The Temperature Dependence of Carrier Concentration

18.32 In order to estimate the electrical conductivity of intrinsic silicon at 80°C, we must employ Equation 18.15. However, before this is possible, it is necessary to determine values for n_i, μ_e, and μ_h. According to Figure 18.16, at 80°C (353 K), $n_i = 1.5 \times 10^{18}$ m^{-3}, whereas from the "<10^{20} m^{-3}" curves of Figures 18.19a and 18.19b, at 80ºC (353 K), $\mu_e = 0.10$ m^2/V-s and $\mu_h = 0.035$ m^2/V-s (realizing that the mobility axes of these two plot are scaled logarithmically). Thus, the conductivity at 80°C is

$$\sigma = n_i |e| (\mu_e + \mu_h)$$

$$\sigma = (1.5 \times 10^{18}\ \text{m}^{-3})(1.602 \times 10^{-19}\ \text{C})(0.10\ \text{m}^2/\text{V-s} + 0.035\ \text{m}^2/\text{V-s})$$

$$= 0.032\ (\Omega\text{-m})^{-1}$$