

18.38 Here we are asked to calculate the room-temperature electrical conductivity of silicon that has been doped with $2 \times 10^{24} \text{ m}^{-3}$ of boron atoms. Inasmuch as B is a group IIIA element in the periodic table (Figure 2.6) it acts as an acceptor in silicon. Thus, this material is p -type extrinsic, and it is necessary to use Equation 18.17, with $p = 2 \times 10^{24} \text{ m}^{-3}$ since at room temperature all of the B acceptor impurities are ionized. The hole mobility, from Figure 18.18 at an impurity concentration of $2 \times 10^{24} \text{ m}^{-3}$, is $0.0065 \text{ m}^2/\text{V}\cdot\text{s}$. Therefore, the conductivity is equal to

$$\sigma = p/e|\mu_e = (2 \times 10^{24} \text{ m}^{-3})(1.602 \times 10^{-19} \text{ C})(0.0065 \text{ m}^2/\text{V}\cdot\text{s}) = 2080 (\Omega\text{-m})^{-1}$$