

18.29 (a) In this problem, for a Si specimen, we are given values for  $p$  ( $2.0 \times 10^{22} \text{ m}^{-3}$ ) and  $\sigma$  [ $500 (\Omega\text{-m})^{-1}$ ], while values for  $\mu_h$  and  $\mu_e$  (0.05 and  $0.14 \text{ m}^2/\text{V}\cdot\text{s}$ , respectively) are found in Table 18.3. In order to solve for  $n$  we must use Equation 18.13, which, after rearrangement, leads to

$$\begin{aligned}
 n &= \frac{\sigma - p|e|\mu_h}{|e|\mu_e} \\
 &= \frac{500 (\Omega\text{-m})^{-1} - (2.0 \times 10^{22} \text{ m}^{-3})(1.602 \times 10^{-19} \text{ C})(0.05 \text{ m}^2/\text{V}\cdot\text{s})}{(1.602 \times 10^{-19} \text{ C})(0.14 \text{ m}^2/\text{V}\cdot\text{s})} \\
 &= 2.97 \times 10^{20} \text{ m}^{-3}
 \end{aligned}$$

(b) This material is  $p$ -type extrinsic since  $p$  ( $2.0 \times 10^{22} \text{ m}^{-3}$ ) is greater than  $n$  ( $2.97 \times 10^{20} \text{ m}^{-3}$ ).