Factors That Affect Carrier Mobility

18.37 This problems asks that we determine the room-temperature electrical conductivity of silicon that has been doped with 10^{23} m^{-3} of arsenic atoms. Inasmuch as As is a group VA element in the periodic table (Figure 2.6) it acts as a donor in silicon.   Thus, this material is *n*-type extrinsic, and it is necessary to use Equation 18.16), with $n = 10^{23}$ m^{-3} since at room temperature all of the As donor impurities are ionized. The electron mobility, from Figure 18.18 at an impurity concentration of 10^{23} m^{-3}, is 0.065 m^2/V-s. Therefore, the conductivity is equal to

$$\sigma = n \, / e \, | \mu_e = \left(10^{23} \text{ m}^{-3}\right)\left(1.602 \text{ x } 10^{-19} \text{ C}\right)\left(0.065 \text{ m}^2 \, / \text{V} - \text{s}\right) = 1040 \ (\Omega - \text{m})^{-1}$$