

18.25 For this problem we are to determine the electrical conductivity of an n -type semiconductor, given that $n = 5 \times 10^{17} \text{ m}^{-3}$ and the electron drift velocity is 350 m/s in an electric field of 1000 V/m. The conductivity of this material may be computed using Equation 18.16. But before this is possible, it is necessary to calculate the value of μ_e from Equation 18.7. Thus, the electron mobility is equal to

$$\begin{aligned}\mu_e &= \frac{v_d}{E} \\ &= \frac{350 \text{ m/s}}{1000 \text{ V/m}} = 0.35 \text{ m}^2/\text{V}\cdot\text{s}\end{aligned}$$

Thus, from Equation 18.16, the conductivity is

$$\begin{aligned}\sigma &= n |e| \mu_e \\ &= (5 \times 10^{17} \text{ m}^{-3})(1.602 \times 10^{-19} \text{ C})(0.35 \text{ m}^2/\text{V}\cdot\text{s}) \\ &= 0.028 (\Omega\cdot\text{m})^{-1}\end{aligned}$$