

## CHAPTER 18

**ELECTRICAL PROPERTIES**

## PROBLEM SOLUTIONS

**Ohm's Law****Electrical Conductivity**

18.1 This problem calls for us to compute the electrical conductivity and resistance of a silicon specimen.

(a) We use Equations 18.3 and 18.4 for the conductivity, as

$$\sigma = \frac{1}{\rho} = \frac{Il}{VA} = \frac{Il}{V\pi\left(\frac{d}{2}\right)^2}$$

And, incorporating values for the several parameters provided in the problem statement, leads to

$$\sigma = \frac{(0.25 \text{ A})(45 \times 10^{-3} \text{ m})}{(24 \text{ V})(\pi)\left(\frac{7.0 \times 10^{-3} \text{ m}}{2}\right)^2} = 12.2 \text{ } (\Omega \cdot \text{m})^{-1}$$

(b) The resistance,  $R$ , may be computed using Equations 18.2 and 18.4, as

$$\begin{aligned} R &= \frac{l}{\sigma A} = \frac{l}{\sigma\pi\left(\frac{d}{2}\right)^2} \\ &= \frac{57 \times 10^{-3} \text{ m}}{\left[12.2 \text{ } (\Omega \cdot \text{m})^{-1}\right](\pi)\left(\frac{7.0 \times 10^{-3} \text{ m}}{2}\right)^2} = 121.4 \text{ } \Omega \end{aligned}$$