18.33 This problem asks for us to assume that electron and hole mobilities for intrinsic Ge are temperature-dependent, and proportional to $T^{-3/2}$ for temperature in K. It first becomes necessary to solve for C in Equation 18.36 using the room-temperature (298 K) conductivity [2.2 $(\Omega\text{-m})^{-1}$] (Table 18.3). This is accomplished by taking natural logarithms of both sides of Equation 18.36 as

$$\ln \sigma = \ln C - \frac{3}{2}\ln T - \frac{E_g}{2kT}$$

and after rearranging and substitution of values for E_g (0.67 eV, Table 18.3), and the room-temperature conductivity, we get

$$\ln C = \ln \sigma + \frac{3}{2}\ln T + \frac{E_g}{2kT}$$

$$= \ln (2.2) + \frac{3}{2}\ln (298) + \frac{0.67 \text{ eV}}{(2)(8.62 \text{ x } 10^{-5} \text{ eV/K})(298 \text{ K})}$$

$$= 22.38$$

Now, again using Equation 18.36, we are able to compute the conductivity at 448 K (175°C)

$$\ln \sigma = \ln C - \frac{3}{2}\ln T - \frac{E_g}{2kT}$$

$$= 22.38 - \frac{3}{2}\ln (448 \text{ K}) - \frac{0.67 \text{ eV}}{(2)(8.62 \text{ x } 10^{-5} \text{ eV/K})(448 \text{ K})}$$

$$= 4.548$$

which leads to

$$\sigma = e^{4.548} = 94.4\ (\Omega\text{-m})^{-1}.$$