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 (Ω -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

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

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