

43. (a) Using Table 27-1 and Eq. 27-10 (or Eq. 27-11), we have

$$\left| \vec{E} \right| = \rho \left| \vec{J} \right| = (1.69 \times 10^{-8} \Omega \cdot \text{m}) \left(\frac{2.0 \text{ A}}{2.0 \times 10^{-6} \text{ m}^2} \right) = 1.7 \times 10^{-2} \text{ V/m} .$$

- (b) Using $L = 4.0 \text{ m}$, the resistance is found from Eq. 27-16: $R = \rho L/A = 0.034 \Omega$. The rate of thermal energy generation is found from Eq. 27-22: $P = i^2 R = 0.14 \text{ W}$. Assuming a steady rate, the thermal energy generated in 30 minutes is $(0.14 \text{ J/s})(30 \times 60 \text{ s}) = 2.4 \times 10^2 \text{ J}$.