

Problem 4.46 A 2×10^{-3} -mm-thick square sheet of aluminum has $5 \text{ cm} \times 5 \text{ cm}$ faces. Find the following:

- (a) The resistance between opposite edges on a square face.
- (b) The resistance between the two square faces. (See Appendix B for the electrical constants of materials.)

Solution:

(a)

$$R = \frac{l}{\sigma A}.$$

For aluminum, $\sigma = 3.5 \times 10^7 \text{ (S/m)}$ [Appendix B].

$$l = 5 \text{ cm}, \quad A = 5 \text{ cm} \times 2 \times 10^{-3} \text{ mm} = 10 \times 10^{-2} \times 10^{-6} = 1 \times 10^{-7} \text{ m}^2,$$

$$R = \frac{5 \times 10^{-2}}{3.5 \times 10^7 \times 1 \times 10^{-7}} = 14 \text{ (m}\Omega\text{)}.$$

(b) Now, $l = 2 \times 10^{-3} \text{ mm}$ and $A = 5 \text{ cm} \times 5 \text{ cm} = 2.5 \times 10^{-3} \text{ m}^2$.

$$R = \frac{2 \times 10^{-6}}{3.5 \times 10^7 \times 2.5 \times 10^{-3}} = 22.8 \text{ p}\Omega.$$
