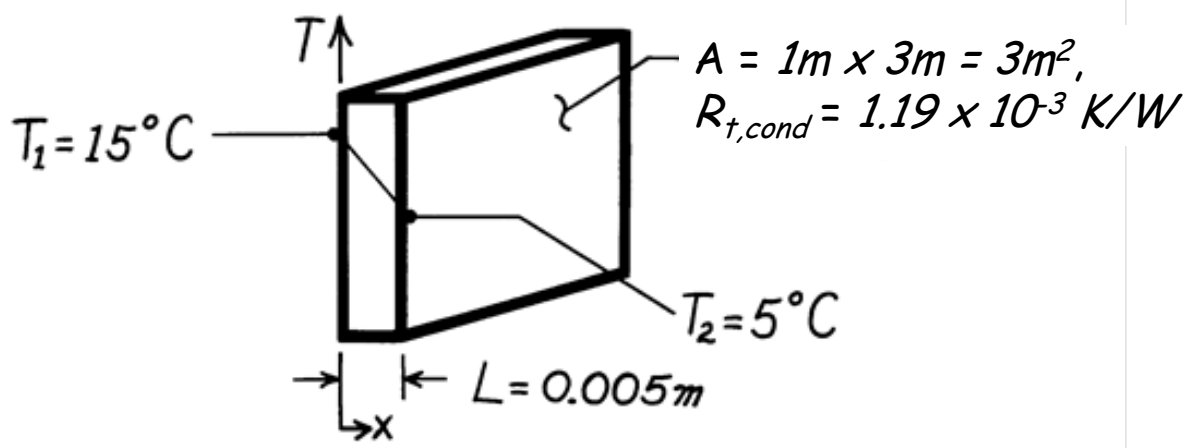


PROBLEM 1.7

KNOWN: Inner and outer surface temperatures and thermal resistance of a glass window of prescribed dimensions.

FIND: Heat loss through window. Thermal conductivity of glass.

SCHEMATIC:



ASSUMPTIONS: (1) One-dimensional conduction in the x -direction, (2) Steady-state conditions, (3) Constant properties.

ANALYSIS: From Eq. 1.11,

$$q_x = \frac{T_1 - T_2}{R_{t,\text{cond}}} = \frac{(15 - 5)^\circ\text{C}}{1.19 \times 10^{-3}\text{ K/W}} = 8400\text{ W} \quad <$$

The thermal resistance due to conduction for a plane wall is related to the thermal conductivity and dimensions according to

$$R_{t,\text{cond}} = L/kA$$

Therefore

$$k = L/(R_{t,\text{cond}} A) = 0.005\text{ m} / (1.19 \times 10^{-3}\text{ K/W} \times 3\text{ m}^2) = 1.40\text{ W/m} \cdot \text{K} \quad <$$

COMMENTS: The thermal conductivity value agrees with the value for glass in Table A.3.