PROBLEM 1.5

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

FIND: Heat loss through window.

SCHEMATIC:

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

ANALYSIS: Subject to the foregoing conditions the heat flux may be computed from Fourier’s law, Eq. 1.2.

\[
q' = k \frac{T_1 - T_2}{L}
\]

\[
q' = 1.4 \frac{W}{m \cdot K} \frac{(15-5)^\circ C}{0.005m}
\]

\[
q' = 2800 \frac{W}{m^2}.
\]

Since the heat flux is uniform over the surface, the heat loss (rate) is

\[
q = q' \times A
\]

\[
q = 2800 \frac{W}{m^2} \times 3m^2
\]

\[
q = 8400 \frac{W}{m^2}.
\]

COMMENTS: A linear temperature distribution exists in the glass for the prescribed conditions.