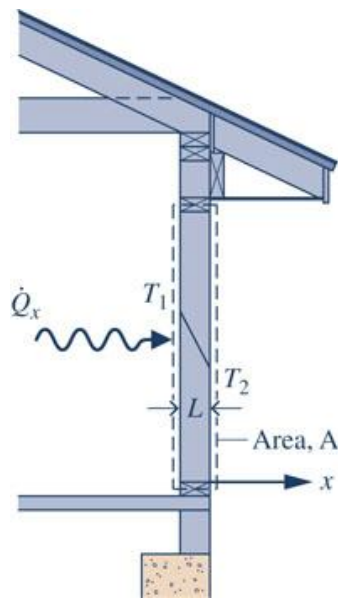


Problem 2.52

Complete the following exercise using heat transfer relations:

- (a) Referring to Fig. 2.12, determine the rate of conduction heat transfer, in W, for $\kappa = 0.07$ W/m·K, $A = 0.125$ m², $T_1 = 298$ K, $T_2 = 273$ K.
 (b) Referring to Fig. 2.14, determine the rate of convection heat transfer from the surface to the air, in W, for $h = 10$ W/m², $A = 0.125$ m², $T_b = 305$ K, $T_f = 298$ K.
-

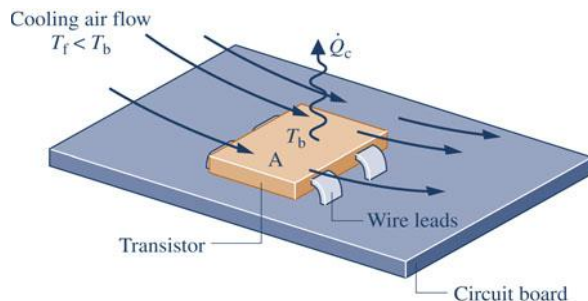
- (a) Referring to Fig. 2.12, determine the rate of conduction heat transfer, in W, for $\kappa = 0.07$ W/m·K, $A = 0.125$ m², $T_1 = 298$ K, $T_2 = 273$ K.



Using Eq. 2.31 and noting that the temperature varies linearly through the wall

$$\begin{aligned}\dot{Q}_x &= -\kappa A \left[\frac{T_2 - T_1}{L} \right] \\ &= -\left(0.07 \frac{\text{W}}{\text{m}\cdot\text{K}}\right) (0.125 \text{ m}^2) \left[\frac{(273-298)\text{K}}{(0.127 \text{ m})} \right] = 1.722 \text{ W} \quad \leftarrow\end{aligned}$$

- (b) Referring to Fig. 2.14, determine the rate of convection heat transfer from the surface to the air, in W, for $h = 10$ W/m², $A = 0.125$ m², $T_b = 305$ K, $T_f = 298$ K.



Using Eq. 2.34

$$\begin{aligned}\dot{Q}_c &= hA[T_b - T_f] \\ &= \left(10 \frac{\text{W}}{\text{m}^2}\right) (0.125 \text{ m}^2) [305 - 298] \text{K} \\ &= 8.75 \text{ W} \quad \leftarrow\end{aligned}$$