

56. (a) The rate of heat flow is

$$P_{\text{cond}} = \frac{kA(T_H - T_C)}{L} = \frac{(0.040 \text{ W/m}\cdot\text{K})(1.8 \text{ m}^2)(33^\circ\text{C} - 1.0^\circ\text{C})}{1.0 \times 10^{-2} \text{ m}} = 2.3 \times 10^2 \text{ J/s} .$$

(b) The new rate of heat flow is

$$P'_{\text{cond}} = \frac{k'P_{\text{cond}}}{k} = \frac{(0.60 \text{ W/m}\cdot\text{K})(230 \text{ J/s})}{0.040 \text{ W/m}\cdot\text{K}} = 3.5 \times 10^3 \text{ J/s} ,$$

which is about 15 times as fast as the original heat flow.