

Chapter 17 Problem 34 †

Given

$$L = 5,000 \text{ km}$$

$$T_i = -25 \text{ }^\circ\text{C}$$

$$T_f = 40 \text{ }^\circ\text{C}$$

$$\alpha_{\text{steel}} = 12 \times 10^{-6} \text{ K}^{-1}$$

Solution

Find the change in length.

The linear coefficient of expansion is given by the equation

$$\alpha = \frac{\Delta L/L}{\Delta T}$$

Solving for ΔL gives

$$\Delta L = \alpha L \Delta T$$

Substituting in the given values we have

$$\Delta L = (12 \times 10^{-6} \text{ K}^{-1})(5.0 \times 10^6 \text{ m})(40^\circ\text{C} - (-25^\circ\text{C}))$$

$$\Delta L = 3900 \text{ m} = 3.9 \text{ km}$$

†Problem from Essential University Physics, Wolfson