Chapter 17   Problem 34 [†]

Given

$L = 5,000 \ km$

$T_i = -25 \ ^\circ C$

$T_f = 40 \ ^\circ C$

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

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

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

$$\Delta L = 3900 \ m = 3.9 \ km$$

[†]Problem from Essential University Physics, Wolfson