19.9 The linear coefficient of thermal expansion for this material may be determined using a rearranged form of Equation 19.3b as

$$
\begin{gathered}
\alpha_{l}=\frac{\Delta l}{l_{0} \Delta T}=\frac{\Delta l}{l_{0}\left(T_{f}-T_{0}\right)}=\frac{0.48 \times 10^{-3} \mathrm{~m}}{(0.4 \mathrm{~m})\left(100^{\circ} \mathrm{C}-20^{\circ} \mathrm{C}\right)} \\
\quad=15.0 \times 10^{-6}\left({ }^{\circ} \mathrm{C}\right)^{-1}
\end{gathered}
$$

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