

92. (a) The length change of bar 1 is ΔL_1 and that of bar 2 is ΔL_2 . The total length change is given by

$$\begin{aligned}\alpha L \Delta T &= \Delta L \\ &= \Delta L_1 + \Delta L_2 \\ &= \alpha_1 L_1 \Delta T + \alpha_2 L_2 \Delta T\end{aligned}$$

which leads to the desired expression after dividing through by ΔT and solving for α .

- (b) Substituting $L_2 = L - L_1$ into the expression, we have

$$\alpha = \frac{\alpha_1 L_1 + \alpha_2 (L - L_1)}{L} \implies L_1 = L \frac{\alpha - \alpha_2}{\alpha_1 - \alpha_2} .$$

Therefore, if $\alpha_1 = 19 \times 10^{-6}/\text{C}^\circ$ (brass, from Table 19-2), $\alpha_2 = 11 \times 10^{-6}/\text{C}^\circ$ (steel, also from Table 19-2), $L = 52.4$ cm and $\alpha = 13 \times 10^{-6}/\text{C}^\circ$, we obtain $L_1 = 13.1$ cm for the length of brass and $L_2 = L - L_1 = 39.3$ cm for the steel.