19. After the change in temperature the diameter of the steel rod is $D_s = D_{s0} + \alpha_s D_{s0}\,\Delta T$ and the diameter of the brass ring is $D_b = D_{b0} + \alpha_b D_{b0}\,\Delta T$, where D_{s0} and D_{b0} are the original diameters, α_s and α_b are the coefficients of linear expansion, and ΔT is the change in temperature. The rod just fits through the ring if $D_s = D_b$. This means $D_{s0} + \alpha_s D_{s0}\,\Delta T = D_{b0} + \alpha_b D_{b0}\,\Delta T$. Therefore,

$$\begin{aligned}\Delta T &= \frac{D_{s0} - D_{b0}}{\alpha_b D_{b0} - \alpha_s D_{s0}} \\ &= \frac{3.000\,\text{cm} - 2.992\,\text{cm}}{(19 \times 10^{-6}\,/\text{C}^\circ)(2.992\,\text{cm}) - (11 \times 10^{-6}\,/\text{C}^\circ)(3.000\,\text{cm})} = 335\,\text{C}^\circ\ .\end{aligned}$$

The temperature is $T = 25^\circ\text{C} + 335\,\text{C}^\circ = 360^\circ\text{C}$.