

$$a) l_0 = 1.3 \text{ m (at } 20^\circ\text{C)}$$

$$\Delta T = 0^\circ\text{C} - 20^\circ\text{C} = -20^\circ\text{C}$$

$$\alpha = 19 \times 10^{-6} \text{ } ^\circ\text{C}^{-1}$$

$$\begin{aligned}\Delta l &= l_0 \cdot \alpha \cdot \Delta T \\ &= (1.3 \text{ m})(19 \times 10^{-6} \text{ } ^\circ\text{C}^{-1})(-20^\circ\text{C}) \\ &= -4.94 \times 10^{-4} \text{ m}\end{aligned}$$

$$\begin{aligned}l &= l_0 + \Delta l \\ &= (1.3 \text{ m}) + (-4.94 \times 10^{-4} \text{ m})\end{aligned}$$

$$l = 1.2995 \text{ m}$$