The length of a straight steel rod is 2.0 cm. Upon heating, the temperature of the rod changes from 25°C to 45°C. What is the change in the length of the rod?

Given:

Initial length of the rod: $\boldsymbol{l} = 2.0$ cm

Initial temperature of rod: $T_i = 25°C = 298$ K

Final temperature of rod: $T_f = 45°C = 318$ K

To determine: change in length of the rod: $\Delta \boldsymbol{l}$

Use formula:

$$\Delta \boldsymbol{l} = \alpha \times \boldsymbol{l} \times \Delta T \text{ ----------(1)}$$

The constant α is the coefficient of linear expansion. Its value depends on the material the rod is made of.

For steel: $\alpha = 12 \times 10^{-6} K^{-1}$

Substituting α, $\boldsymbol{l}$ & ΔT in (1):

$$\Delta \boldsymbol{l} = 12 \times 10^{-6} \times 2.0 \times (318 - 298) = 0.00048 \text{ cm}$$