

Answer on Question 66703, Physics, Other

Question:

What is the percentage change in the length of 1.0 m iron rod if its temperature changed by 100°C. The coefficient of the linear thermal expansion for the iron is $\alpha = 2 \cdot 10^{-5} \text{ }^\circ\text{C}^{-1}$.

Solution:

By the definition of the linear thermal expansion we have:

$$\frac{\Delta L}{L_0} = \alpha \Delta T,$$

where ΔL is the change in the length of the iron rod after the change in temperature, L_0 is the length of the iron rod before the change in temperature, α is the coefficient of linear thermal expansion for the iron and ΔT is the change in temperature.

Then, from this formula, we can calculate ΔL :

$$\Delta L = \alpha L_0 \Delta T = 2 \cdot 10^{-5} \text{ }^\circ\text{C}^{-1} \cdot 1.0 \text{ m} \cdot 100^\circ\text{C} = 0.002 \text{ m}.$$

The length of the iron rod after its temperature changed by 100°C will be:

$$L = L_0 + \Delta L = 1.0 \text{ m} + 0.002 \text{ m} = 1.002 \text{ m}.$$

Finally, we can find the percentage change in the length of the iron rod:

$$\%change = \frac{1.002 \text{ m} - 1.0 \text{ m}}{1.0 \text{ m}} \cdot 100\% = 0.2\%.$$

Answer:

$$\%change = 0.2\%.$$

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