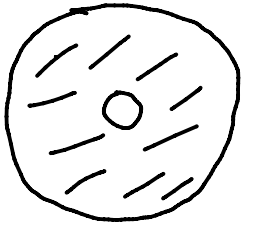
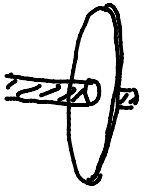
$$\Delta T = \frac{0.012}{5.231 \times 1.2 \times 10^{-5}} = \frac{1200^{1000}}{5.231 \times 12} = 191.2\,^\circ C$$

$$T - T_0 = 191.2 \Rightarrow T = T_0 + 191.2$$
$$= 27 + 191.2 = 218.2\,^\circ C .$$

Example: A large steel wheel is to be fitted on to a shaft of the same material. At 27 °C, the outer diameter of the shaft is 8.70 cm and the diameter of the central hole in the wheel is 8.69 cm. The shaft is cooled using 'dry ice'. At what temperature of the shaft does the wheel slip on the shaft? Assume coefficient of linear expansion of the steel to be constant over the required temperature range : $\alpha_{steel} = 1.20 \times 10^{-5}\ K^{-1}$ **[NCERT Exercise]**





$D_0 = 8.70\,cm$, $T_0 = 27^\circ C$

$D = 8.69\,cm$, $T = ?$

$\alpha = 1.2 \times 10^{-5}\ K^{-1}$

$$D = D_0(1 + \alpha \cdot \Delta T) \Rightarrow D = D_0 + D_0 \alpha \cdot \Delta T$$

$$D - D_0 = D_0 \alpha \cdot \Delta T$$

$$\Delta T = \frac{D - D_0}{D_0 \cdot \alpha} \quad — (1) .$$

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