

A hole in an aluminium plate has a diameter of 1.178 cm at 23.00 °C.

(1) What is the hole diameter at 199.0 °C

(2) At what temp is the hole diameter 1.176 cm?

(1)

$$\alpha_{al} = 24 \times 10^{-6} \frac{1}{K}$$

diameter is ~~1D~~ ^{1 dimension} use length.

$$\Delta L = L_0 \alpha \Delta T$$

$$L - L_0 = L_0 \alpha (T_f - T_i)$$

$$L = L_0 + L_0 \alpha (T_f - T_i)$$

$$= 1.178 \text{ cm} + 1.178 \text{ cm} \left(12 \times 10^{-6} \frac{1}{\text{K}} \right) (199.0 - 23.0)$$

$$\boxed{= 1.180 \text{ cm}}$$

(2) $\alpha_{al} = 24 \times 10^{-6} \left(\frac{1}{\text{K}} \right)$

$$\Delta L = L_0 \alpha \Delta T$$

$$L - L_0 = L_0 \alpha (T_f - T_i)$$

$$\frac{L - L_0}{L_0 \alpha} = T_f - T_i$$

$$T_f = \frac{L - L_0}{L_0 \alpha} + T_i = \frac{1.176 \text{ cm} - 1.178 \text{ cm}}{1.178 \text{ cm} (12 \times 10^{-6} \frac{1}{\text{K}})} + 23.0$$

$$\boxed{= -118.5^\circ \text{C}}$$