Answer on Question #57792, Physics – Molecular Physics | Thermodynamics

A student walking to class on a cold day (T=0 C) finds a silver ring with an inner diameter of D=1.8 cm. The silver has a coefficient of expansion of a=18.7 x 10^-6

a) Input an expression for the rings inner diameter D_h when the student warms it up to their body temperature, T_b.

b) What is the change in diameter in mm if T_b = 37 C

Solution:

a)

The hole in ring expands as if were filled with silver, so the change in the diameter is given by

$$\Delta D = \alpha D_0 \Delta T,$$

where $\alpha = 18.7 \text{ x } 10^{-6}$ is the coefficient of linear expansion, D_0 is the original diameter, and ΔT is the change in temperature.

b)

Hence, the change in the ring's diameter is

$$\Delta D = \alpha D_0 \Delta T = (18.7 \cdot 10^{-6})(1.8 \cdot 10^{-2} \text{ m})(37 - 0 \text{ °C}) = 12.4542 \cdot 10^{-6} \text{ m} \approx 0.0125 \text{ mm}$$

Answer: 0.0125 mm