Answer on Question #37953, Physics, Other

Question:

The cavity within a copper [β = 51 × 10-6 (C°)-1] sphere has a volume of 1.150 × 10-3 m3. Into this cavity is placed 1.100 × 10-3 m3 of benzene [β = 1240 × 10-6 (C°)-1]. Both the copper and the benzene have the same temperature. By what amount ΔT should the temperature of the sphere and the benzene within it be increased, so that the liquid just begins to spill out?

Answer:

The volume of body when temperature change can be expressed as:

$$V = V_0(1 + \beta\Delta T)$$

where V_0 is initial volume, β is volumetric temperature expansion coefficient, ΔT is change of temperature.

The liquid just begins to spill out if volume of benzene equals volume of cavity:

$$V_c(1 + \beta_c\Delta T) = V_b(1 + \beta_b\,\Delta T)$$

where V_c and V_b are initial volumes of cavity and benzene

Therefore:

$$\Delta T = \frac{V_c - V_b}{\beta_b - \beta_c} = \frac{1.150 - 1.100}{1240 - 51}10^3 = 0.04205\ ^\circ\mathrm{C}$$

Answer: $0.04205\ ^\circ\mathrm{C}$