Answer on Question #57385, Physics / Other

A hollow sphere floats in a liquid just submerged. What fraction of the volume of the sphere remains submerged in the liquid after its temperature is brought down to dt. The coefficient of cubical expansion for solid and liquid are γ1 and γ2.

Solution:

The volume of sphere increase to

$$V = V_0(1 + \gamma_1 dt)$$

The volume of submerged part of sphere increase to

$$v = v_0(1 + \gamma_2 dt)$$

Dividing equations we have

$$\frac{V/v}{V_0/v_0} = \frac{1 + \gamma_1 dt}{1 + \gamma_2 dt}$$

$$\frac{V}{v}\frac{v_0}{V_0} = \frac{1 + \gamma_1 dt}{1 + \gamma_2 dt}$$

Given, a fraction of initially submerged is

$$k_0 = \frac{v_0}{V_0}$$

The fraction submerged after heating is

$$k = \frac{v}{V} = k_0 \frac{1 + \gamma_2 dt}{1 + \gamma_1 dt}$$

Answer:

The fraction of the volume of sphere submerged in liquid changes by a factor

$$\frac{1 + \gamma_2 dt}{1 + \gamma_1 dt}$$