

coefficient of volume expansion of liquid (real):

"Fractional change in the volume (real) of a liquid per unit rise of temperature is called its coefficient of volume expansion".

$$\gamma_L = \frac{\Delta V_L}{V_0 \cdot \Delta T} = \frac{\text{real increase in volume}}{\text{original volume} \times \text{rise in temp}} \quad \text{--- (5)}$$

Apparent coefficient of volume Expansion:

$$\checkmark \gamma_a = \frac{\Delta V_a}{V_0 \cdot \Delta T} = \frac{\text{app. increase in volume}}{\text{original volume} \times \text{rise in temp}} \quad \text{--- (6)}$$

by Eq (5)  $\Delta V_L = \gamma_L V_0 \Delta T$  --- (7)

by Eq (6)  $\Delta V_a = \gamma_a V_0 \Delta T$  --- (8)

For the vessel (solid)  $\Delta V_s = \gamma_s V_0 \Delta T$  --- ~~(5)~~ (9)

by Eq (4)  $\Delta V_a = \Delta V_L - \Delta V_s$

$$\gamma_a V_0 \Delta T = \gamma_L V_0 \Delta T - \gamma_s V_0 \Delta T$$