

Change in density of liquid with rise in temp:

$$\text{Density} = \frac{\text{mass}}{\text{Volume}}$$

$$\text{Let at temp. } T_0, \text{ volume is } V_0 \rightarrow \rho_0 = \frac{m}{V_0} \quad \text{--- (11)}$$

$$\text{At temp } T (T > T_0), V = V_0(1 + \gamma \cdot \Delta T)$$

$$\text{Density at temp } T \quad \rho = \frac{m}{V} = \frac{m}{V_0(1 + \gamma \cdot \Delta T)}$$

$$\text{or } \boxed{\rho = \frac{\rho_0}{(1 + \gamma \cdot \Delta T)}} \quad \text{--- (12)}$$

Binomial approximation: if $x \ll 1 \Rightarrow (1+x)^n \approx 1+nx$
 $\rightarrow (1-x)^n \approx 1-nx$

\therefore by Eq (12)

$$\rho = \rho_0 (1 + \gamma \cdot \Delta T)^{-1}$$

$$\underline{\gamma \cdot \Delta T \ll 1}$$

$$\rho = \rho_0 \{1 + (-1) \cdot \gamma \cdot \Delta T\}$$