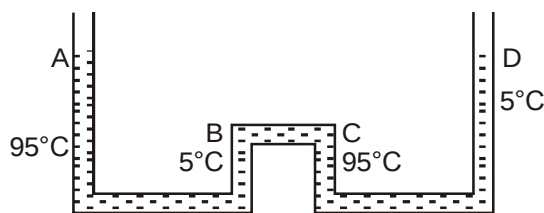


EXERCISE – III**JEE QUESTIONS**

1. $\rho_t = \frac{\rho_0}{1 + \gamma t}$

$$\rho_0 + h_A \rho_{95} g - h \rho_5 g = \rho_0 + h_B \rho_5 g - h \rho_{95} g$$



$$\frac{\rho_{95}}{\rho_5} = \frac{h_B + h}{h_A + h} \Rightarrow \frac{\frac{\rho_0}{1 + 95\gamma}}{\frac{\rho_0}{1 + 5\gamma}} = \frac{h_B + h}{h_A + h}$$

$$\Rightarrow r = 2 \times 10^{-4}/^\circ\text{C}$$

$$\alpha = \frac{r}{3} = 6.7 \times 10^{-5}/^\circ\text{C}$$

2. **B, D**

$$\ell_0 (1 + \alpha_B \Delta T) = (R + d)\theta$$

$$\ell_0 (1 + \alpha_C \Delta T) = R\theta$$

$$\frac{R + d}{d} = \frac{1 + \alpha_B \Delta T}{1 + \alpha_C \Delta T} \Rightarrow 1 + \frac{d}{R} = 1 + (\alpha_B - \alpha_C) \Delta T$$

[Binomial Expansion]

$$R = \frac{d}{(\alpha_B - \alpha_C) \Delta T}$$

$$R \propto \frac{1}{\Delta T} \text{ and } R \propto \frac{1}{\alpha_B - \alpha_C}$$

Ans. B, C

3. **A.**

$$\ell_1 \alpha_a t = \ell_2 \alpha_s t$$

$$\Rightarrow \frac{\ell_1}{\ell_2} = \frac{\alpha_s}{\alpha_a} \Rightarrow \frac{\ell_1}{\ell_1 + \ell_2} = \frac{\alpha_s}{\alpha_a + \alpha_s}$$

4.

$$T \uparrow \quad V_{\text{cube}} \uparrow \quad \rho_\ell \downarrow$$

Depth submerged in liquid remains same

Upthrust = Weight

$$v_i \rho_L g = v_i' \rho_L' g$$

$$(A h_i) \rho_L g = A(1 + 2\alpha_s \Delta T) h_i \left(\frac{\rho_L}{1 + \gamma_\ell \Delta T} \right) g$$

$$\Rightarrow \gamma_\ell = 2\alpha_s$$

5.

$$\omega = \frac{k}{m} k = 0.1 (140)^2$$

$$Y = \frac{F}{\frac{\Delta L}{L}}$$

$$Y = \frac{0.1 \times 140 \times 140 \times x \times 1 \times 10}{4.9 \times 10^{-7} \times x \times 10}$$

$$= 4 \times 10^9 \text{ Nm}^{-2}$$

$$N=4$$