

Numerical problems

1) Given:

$$A_0 = 10 \text{ m}^2$$

$$\Delta A = 11 - 10 = 1 \text{ m}^2$$

$$T_1 = 90 \text{ K}$$

$$T_2 = ?$$

$$\alpha_A = 0.0021 / \text{K}$$

$$\boxed{\alpha_A = \frac{\Delta A}{A_0 \Delta T}}$$

$$\alpha_A \Delta T = \frac{\Delta A}{A_0}$$

$$\alpha_A (T_2 - T_1) = \frac{\Delta A}{A_0}$$

$$T_2 - T_1 = \frac{\Delta A}{A_0 \alpha_A}$$

$$T_2 - 90 = \frac{1}{10 \times 0.0021}$$

$$= \frac{1}{0.021} \times 1000$$

$$= \frac{1000}{21}$$

$$T_2 - 90 = 47.61$$

$$T_2 = 47.61 + 90$$

$$\boxed{T_2 = 137.61 \text{ K}}$$

2) Numerical problem:

Given:

$$V_0 = 0.25 \text{ m}^3$$

$$V_f = 0.30 \text{ m}^3$$

$$\Delta V = 0.30 - 0.25 = 0.05 \text{ m}^3$$

$$\Delta T = 50 \text{ K}$$

$$\alpha_V = ?$$

$$\alpha_V \Delta T = \frac{\Delta V}{V_0}$$

$$\alpha_V = \frac{\Delta V}{V_0 \Delta T} = \frac{0.05}{0.25 \times 50} \times 100$$

$$= \frac{1}{25 \times 50} = \frac{1}{250}$$

$$\boxed{\alpha_V = 0.004 \text{ K}^{-1}}$$

Le-3 (Solved Examples)

i) Given:

$$\text{Level of the liquid } L_1 = 50 \text{ ml}$$

$$\text{Level of the liquid } L_2 = 48.5 \text{ ml}$$

$$\text{Level of the liquid } L_3 = 51.2 \text{ ml}$$

$$\begin{aligned} \text{Apparent Expansion} &= \frac{L_3 - L_1}{51.2 - 50} \\ &= 1.2 \text{ ml} \end{aligned}$$

$$\begin{aligned} \text{Real Expansion} &= \frac{L_3 - L_2}{51.2 - 48.5} \\ &= 2.7 \text{ ml} \end{aligned}$$

So, Real expansion is greater than apparent expansion.

2) Given :

$$\text{Initial pressure } P_1 = P$$

$$\text{Final pressure } P_2 = 4P$$

$$\text{Initial volume } V_1 = 20 \text{ cc} = 20 \text{ cm}^3$$

$$\text{Final volume } V_2 = ?$$

By Boyle's law ,

$$PV = \text{constant}$$

$$P_1 V_1 = P_2 V_2$$

$$(V_2 = \frac{P_1 V_1}{P_2})$$

$$= \frac{R \times 20^5}{4R}$$

$$V_2 = 5 \text{ cm}^3$$

∴ Boyle's law is proved.