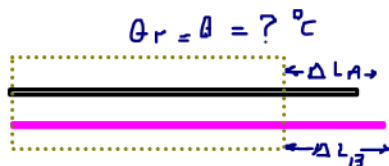
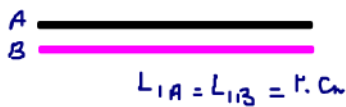


12) $\theta_1 = \Delta^\circ C$



$\Delta L_A + \Delta L_B = 1.2 \text{ mm}$

$L_A \alpha_A \Delta \theta_A + L_B \alpha_B \Delta \theta_B = \Delta \times 10^{-6} \text{ m}$

$\alpha_A = 11 \times 10^{-6}$

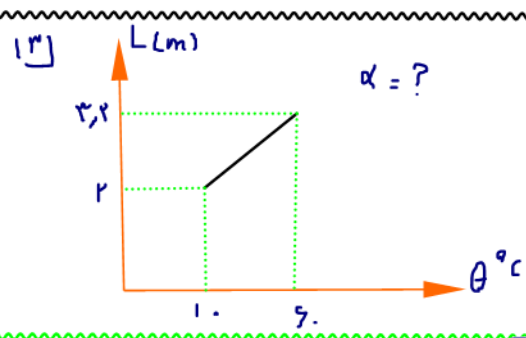
$\alpha_B = 19 \times 10^{-6}$

$\Delta \theta = (\theta - \Delta) = \Delta \theta_A = \Delta \theta_B$

$L_A (\theta - \Delta) (\alpha_A + \alpha_B) = \Delta \times 10^{-6}$

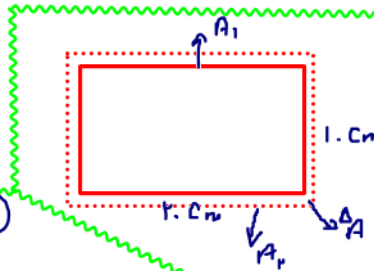
$1 \times 10^{-1} (\theta - \Delta) (11 + 19) \times 10^{-6} = \Delta \times 10^{-6}$

$\theta - \Delta = \frac{10^{-6}}{10 \times 10^{-6}} = \frac{1}{10} = \Delta^\circ C \Rightarrow \theta - \Delta = \Delta \Rightarrow \theta = 2\Delta^\circ C$



$\alpha = ?$

$\alpha = \frac{\Delta L}{L_1 \Delta \theta} = \frac{L_2 - L_1}{L_1 \Delta \theta} = \frac{2 - 1}{1 (2 - 1)} = \frac{1}{1} = 1 \times 10^{-6} / ^\circ C$



$\alpha = 11 \times 10^{-6} / ^\circ C \quad \Delta \theta = \Delta^\circ C$

(14)

$\Delta A = A_1 (2\alpha) \Delta \theta = 1 \times (2 \times 11 \times 10^{-6}) (\Delta) = 22 \times 10^{-6} \times \Delta = 2.2 \times 10^{-5} \Delta \text{ cm}^2$

$\theta_1 = 1 \Delta^\circ C \quad \theta_2 = ?$
 $\frac{\Delta A}{A_1} = -1.2 \times 10^{-4} = -1.2 \times 10^{-4}$
 $\alpha = 11 \times 10^{-6} / ^\circ C$

$\frac{\Delta A}{A_1} = 2\alpha \Delta \theta$

$-1.2 \times 10^{-4} = 2 \times 11 \times 10^{-6} \times \Delta \theta \Rightarrow \Delta \theta = \frac{-1.2 \times 10^{-4}}{22 \times 10^{-6}} = \frac{-1.2}{22} = -0.0545 \Delta^\circ C$

$\Delta \theta = \theta_2 - \theta_1 \rightarrow -0.0545 \Delta = \theta_2 - \Delta \Rightarrow \theta_2 = -0.0545 \Delta + \Delta = 0.9455 \Delta$

$\Delta \theta = 1.0^\circ C$
 $\alpha = 11 \times 10^{-6}$

$\frac{\Delta V}{V_1} \times 100 = 3\alpha \Delta \theta \times 100$

$= 3 \times 11 \times 10^{-6} \times 1.0 \times 100 = 3.3 \times 10^{-3} = 0.33\%$