



المرحلة: الثانية

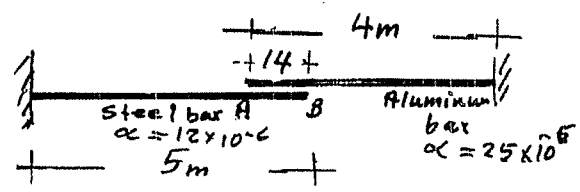
السنة الدراسية: 2017-2018

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20-2-2018  
م.م. العناري

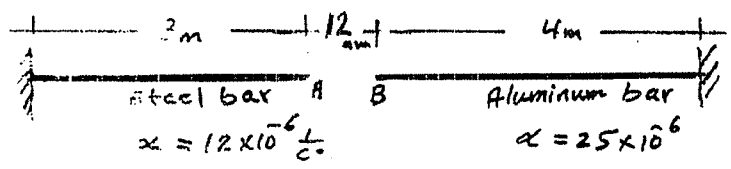
مقاومة المواد / الثاني بنا وماتشات

Q<sub>1</sub> - Calculate the final dimension AB when the temperature raise from 10°C to 110°C

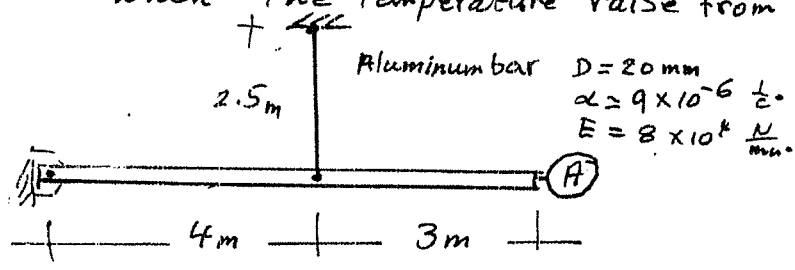


Q<sub>2</sub> - Calculate the final dimension AB when the temperature drop from 120 - 10°C

Q<sub>3</sub> - Calculate the raise of Temperature to close the Gap (12mm) when the room temperature = 10°



Q<sub>4</sub> - Calculate the Vertical movement of point A when the temperature raise from 10 to 120°C



$$\Delta = \alpha \cdot \epsilon \cdot t$$

$$\epsilon = \frac{\Delta}{t}$$



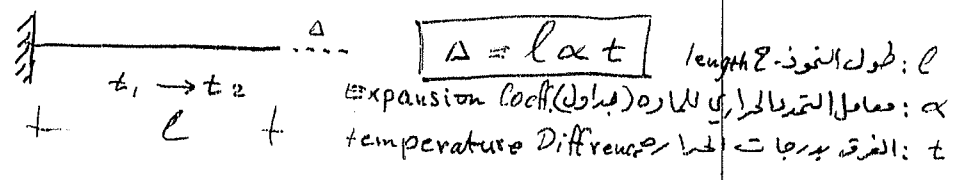


26-12-2015  
 د. عبد العزيز

Thermal stresses & strain  
 الاجهزات الحرارية الانتعالات

(17) مقاومة المواد  
 الثاني

1. Free Elongation



Example: find the elongation of the rod having:  
 $l = 2 \text{ m}$ ,  $\alpha = 12 \times 10^{-6} \frac{1}{\text{C}^\circ}$  when the temperature raise from  $10^\circ\text{C}$  to  $90^\circ\text{C}$

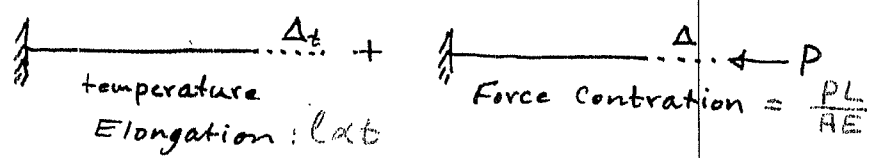
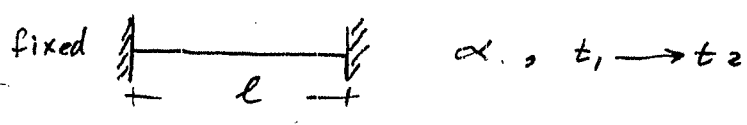
Solution:

$$\Delta = l \alpha t$$

$$= 2 \times 10^3 \times 12 \times 10^{-6} (90 - 10)$$

$$= 1.920 \text{ mm}$$

2. When the Elongation is prevented: P in the support cause stress and contraction



$$l \alpha t = \frac{PL}{AE} \rightarrow \frac{P}{A} = \sigma, \epsilon = \frac{\sigma}{E}$$

stress  $\sigma = \alpha t E$  → strain  $\epsilon = \alpha t$

Example: Calculate the Stresses in the rod:  
 $t_1 = 10^\circ\text{C}$ ,  $t_2 = 80^\circ\text{C}$ ,  $\alpha = 0.000012 \frac{1}{\text{C}^\circ}$ ,  $E = 10^3 \frac{\text{N}}{\text{mm}^2}$

Solution:

$$\sigma = \alpha E t = 12 \times 10^{-6} \times 10^3 (80 - 10) = 0.84 \frac{\text{N}}{\text{mm}^2}$$

$$\text{strain } \epsilon = \alpha t = 12 \times 10^{-6} (80 - 10) = 8.4 \times 10^{-4} [-]$$