

4.3) Given: $T_1 = 1000^\circ\text{C}$ $T_2 = 400^\circ\text{C}$ $k = 1 \frac{\text{W}}{\text{m}\cdot^\circ\text{C}}$ $Q = 2000 \text{ W/m}^2$

Find: $L = ?$

Solution: $Q = \frac{k(T_1 - T_2)}{L}$

$$2000 \text{ W/m}^2 = \frac{1 \text{ W/m}\cdot^\circ\text{C} (1000^\circ\text{C} - 400^\circ\text{C})}{L}$$

$$L = \frac{600 \text{ W/m}\cdot^\circ\text{C}}{2000 \text{ W/m}^2}$$

$$L = .3 \text{ m}$$

4.10) Given: $k = 115 \text{ W/m}\cdot^\circ\text{C}$ $d = 2 \text{ cm}$ thickness = $.2 \text{ cm}$ $T_o = 50^\circ\text{C}$
 $Q = 2000 \text{ W/m}^2\cdot^\circ\text{C}$

Find: a) and b)

Solution:

a) $Q = \frac{T_o - T_i}{\frac{1}{h_o A_o} + \frac{\ln \frac{r_o}{r_i}}{2\pi k L} + \frac{1}{h_i A_i}}$

4.17) Given: $k_1 = 1.5 \text{ W/m}\cdot\text{C}$, $k_2 = .01 \text{ W/m}\cdot\text{C}$ $h = 15 \text{ W/m}^2\cdot\text{C}$
 $L_1 = .3 \text{ m}$ $L_2 = .2 \text{ m}$ $T_{\infty,1} = 60^\circ\text{C}$ $T_{\infty,2} = 30^\circ\text{C}$

Find: $Q = ?$, $T_2 = ?$

$$Q = \frac{T_{\infty,1} - T_{\infty,2}}{\frac{L_1}{k_1} + \frac{L_2}{k_2} + \frac{1}{h}} = \frac{60^\circ\text{C} - 30^\circ\text{C}}{\frac{.3 \text{ m}}{1.5 \text{ W/m}\cdot\text{C}} + \frac{.2 \text{ m}}{.01 \text{ W/m}\cdot\text{C}} + \frac{1}{15 \text{ W/m}^2\cdot\text{C}}} = \frac{570^\circ\text{C}}{20.267 \text{ W/m}^2\cdot\text{C}}$$

$Q = 28.124 \text{ W/m}^2$

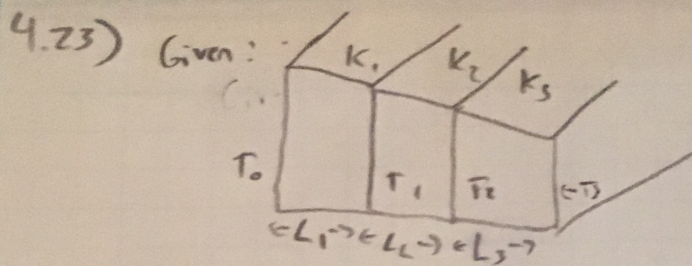
$$Q = \frac{T_{\infty,1} - T_2}{\frac{L_1}{k_1} + \frac{L_2}{k_2}}$$

$$28.124 \text{ W/m}^2 = \frac{60^\circ\text{C} - T_2}{\frac{.3 \text{ m}}{1.5 \text{ W/m}\cdot\text{C}} + \frac{.2 \text{ m}}{.01 \text{ W/m}\cdot\text{C}}}$$

$$28.124 \text{ W/m}^2 = \frac{60^\circ\text{C} - T_2}{20.2 \text{ W/m}^2\cdot\text{C}}$$

$$568.1 = 60^\circ\text{C} - T_2$$

$T_2 = 31.9^\circ\text{C}$



Find: T_1, T_3

Solution: $Q = \frac{T_3 - T_0}{\frac{L_1}{k_1 A} + \frac{L_2}{k_2 A} + \frac{L_3}{k_3 A}}$

$$T_1 - T_3 = \frac{T_2 - T_0}{\frac{L_1}{k_1 A} + \frac{L_2}{k_2 A} + \frac{L_3}{k_3 A}}$$