



$$A_{\text{TOP}} = \frac{\pi D^2}{4} = \frac{\pi (6 \times 10^{-2})^2}{4} = 0.0028 \text{ m}^2$$

$$A_{\text{SIDES}} = \pi D L = \pi (8 \times 10^{-2})(12.5 \times 10^{-2}) = 0.0314 \text{ m}^2$$

$$V = \frac{\pi D^2}{4} \times L = (0.0028)(12.5 \times 10^{-2}) = 0.000353 \text{ m}^3$$

$$m = \rho V = (999.8)(0.000353) = 0.353 \text{ kg}$$

$$\frac{T(t) - T_0}{T_i - T_0} = e^{-bt} \rightarrow \frac{1}{-b} \ln \left[\frac{T(t) - T_0}{T_i - T_0} \right] = t$$

$$b = \frac{1}{R_o m C_p} ; C_p = 4200 \frac{\text{J}}{\text{kg} \cdot ^{\circ}\text{C}} \quad \left(\begin{array}{l} \text{FROM ...} \\ b = \frac{h A_s}{\rho V C_p} ; m = \rho V, R = \frac{1}{h A} \end{array} \right)$$

$$R_{\text{SIDES}} = \frac{\ln(D_o/D_i)}{2\pi k L} + \frac{1}{h_o A_o} = \frac{\ln(8/6)}{2\pi (0.13)(12.5 \times 10^{-2})} + \frac{1}{(10)(0.0314)} = 6.00 \text{ }^{\circ}\text{C/W}$$

$$R_{\text{TOP}} = \frac{1}{h A_{\text{TOP}}} = \frac{1}{(10)(0.0028)} = 35.7 \text{ }^{\circ}\text{C/W}$$

$$\frac{1}{R_o} A_o = \frac{1}{R_{\text{TOP}}} A_{\text{TOP}} + \frac{1}{R_{\text{SIDES}}} A_{\text{SIDES}} \quad (\text{JUST A WEIGHTED AVERAGE})$$

$$\therefore R_o = \frac{A_o}{\frac{1}{R_{\text{TOP}}} A_{\text{TOP}} + \frac{1}{R_{\text{SIDES}}} A_{\text{SIDES}}} = \frac{(0.0028 + 0.0314)}{\left(\frac{1}{35.7} \times 0.0028\right) + \left(\frac{1}{6} \times 0.0314\right)}$$

$$= 6.44 \text{ }^{\circ}\text{C/W} \quad (\text{MORE LIKE } R_{\text{SIDES}} \text{ BECAUSE OF THE BIG } A_{\text{SIDES}})$$

$$b = \frac{1}{R_o m C_p} = \frac{1}{(6.44)(0.353)(4200)} \quad \left(\frac{1}{\frac{\rho V}{h A_s} \times \rho V \times \frac{1}{h A_s} \times C_p} = \frac{1}{S} \right)$$

$$= 0.0001047 \text{ s}^{-1}$$

$$\left(\frac{1}{-0.0001047} \right) \ln \left[\frac{17 - 25}{3 - 25} \right] = 3,658 \text{ s} = \boxed{60.97 \text{ min} = t}$$