

$$t_1 := \text{time}(0)$$

$$\mu\text{rad} \equiv 10^{-6} \cdot \text{rad}$$

$$\text{mrad} \equiv 10^{-3} \cdot \text{rad}$$

$$\mu\text{m} \equiv 10^{-6} \text{ m}$$

$$\text{nm} := 10^{-9} \text{ m}$$

$$\text{ms} \equiv 10^{-3} \cdot \text{s}$$

$$\mu\text{s} \equiv 10^{-6} \text{ s}$$

$$\text{ns} \equiv 10^{-9} \cdot \text{s}$$

$$\text{kt} \equiv 1852 \frac{\text{m}}{\text{hr}}$$

$$\text{nmi} := 1852 \cdot \text{m}$$

$$^{\circ}\text{C} \equiv \text{K}$$

$$c \equiv 2.99792458 \cdot 10^8 \frac{\text{m}}{\text{s}}$$

$$h \equiv 6.62606876 \cdot 10^{-34} \text{ J} \cdot \text{s}$$

$$r_e \equiv 6378140 \cdot \text{m}$$

$$\sigma \equiv 5.670400 \cdot 10^{-8} \cdot \frac{\text{watt}}{\text{m}^2 \cdot \text{K}^4}$$

$$\text{mJ} \equiv 10^{-3} \text{ J}$$

$$\text{MW} \equiv 10^6 \text{ W}$$

$$\text{nW} \equiv 10^{-9} \text{ W}$$

$$\mu\text{W} \equiv 10^{-6} \text{ W}$$

$$\text{mW} \equiv 10^{-3} \text{ W}$$

$$\text{time}(0) - t_1 = 0.1100$$

$$T_b := 273.15 \text{ K}$$

$$T_1 := 1200 \text{ K}$$

$$T_2 := 750 \text{ K}$$

$$T_3 := 750 \text{ K}$$

$$T_4 := 300 \text{ K}$$

$$T_5 := 300 \text{ K}$$

$$h_{\text{amb}} := 2.5 \frac{\text{W}}{\text{m}^2} \quad h_i := 0.17 \frac{\text{W}}{\text{m} \cdot \text{K}} \quad \text{thk} := 2 \text{ in} \quad \text{gap} := 9 \text{ in}$$

$$h_{\text{air}}(T_m) := \frac{0.002528 \cdot \left(\frac{T_m - T_b}{\text{K}} \right)^{1.5}}{\frac{T_m - T_b}{\text{K}} + 200} \cdot \frac{\text{watt}}{\text{m} \cdot \text{K}} \quad \text{emiss} := 0.6$$

Given

$$\frac{h_i}{\text{thk}} (T_1 - T_2) = \text{emiss} \cdot \sigma \cdot (T_2^4 - T_3^4) + \frac{h_{\text{air}} \left(\frac{T_2 + T_3}{2} \right)}{\text{gap}} \cdot (T_2 - T_3)$$

$$\text{emiss} \cdot \sigma \cdot (T_2^4 - T_3^4) + \frac{h_{\text{air}} \left(\frac{T_2 + T_3}{2} \right)}{\text{gap}} \cdot (T_2 - T_3) = \frac{h_i}{\text{thk}} (T_3 - T_4)$$

$$\frac{h_i}{\text{thk}} \cdot (T_3 - T_4) = h_{\text{amb}} \cdot (T_4 - T_5) + \text{emiss} \cdot \sigma \cdot (T_4^4 - T_5^4)$$

$$\begin{pmatrix} T_2 \\ T_3 \\ T_4 \end{pmatrix} := \text{Find}(T_2, T_3, T_4) \quad T_2 = 825.0182 \text{ K} \quad T_3 = 808.1280 \text{ K} \quad T_4 = 433.1462 \text{ K}$$

$$\text{emiss} \cdot \sigma \cdot (T_4^3 + T_4^2 T_5 + T_4 \cdot T_5^2 + T_5^3) = 6.9247 \frac{\text{W}}{\text{m}^2 \text{ K}}$$

$$\frac{.17 \frac{\text{W}}{\text{m} \cdot \text{K}}}{2 \text{ in}} = 3.3465 \frac{\text{W}}{\text{m}^2 \text{ K}}$$

$$\frac{h_i}{thk}(T_1 - T_2) = 1254.8602 \frac{W}{m^2}$$

$$emiss \cdot \sigma \cdot (T_2^4 - T_3^4) = 1251.6774 \frac{W}{m^2}$$

$$\frac{h_{air} \left(\frac{T_2 + T_3}{2} \right)}{gap} \cdot (T_2 - T_3) = 3.1828 \frac{W}{m^2}$$

$$\frac{h_i}{thk}(T_3 - T_4) = 1254.8602 \frac{W}{m^2}$$

$$h_{amb} \cdot (T_4 - T_5) = 332.8656 \frac{W}{m^2}$$

$$emiss \cdot \sigma \cdot (T_4^4 - T_5^4) = 921.9946 \frac{W}{m^2}$$