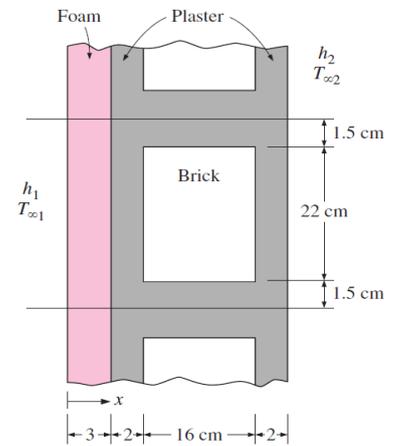


In-Class Exercises n°02 – Part B

Exercise 2.9:

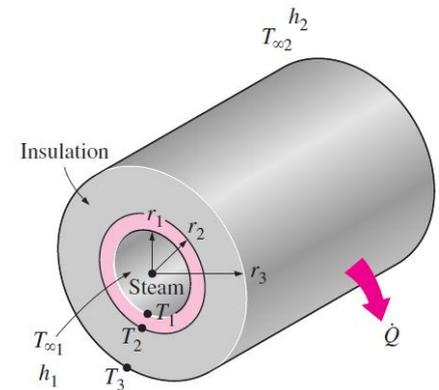
A **3-m-high** and **5-m-wide** wall consists of long **16-cm x 22-cm** cross section horizontal bricks ($k = 0.72 \text{ W/m}\cdot^\circ\text{C}$) separated by **3-cm-thick** plaster layers ($k = 0.22 \text{ W/m}\cdot^\circ\text{C}$). There are also **2-cm-thick** plaster layers on each side of the brick and a **3-cm-thick** rigid foam ($k = 0.026 \text{ W/m}\cdot^\circ\text{C}$) on the inner side of the wall, as shown in Fig. 2–6. The indoor and the outdoor temperatures are 20°C and -10°C , and the convection heat transfer coefficients on the inner and the outer sides are $h_1 = 10 \text{ W/m}^2\cdot^\circ\text{C}$ and $h_2 = 25 \text{ W/m}^2\cdot^\circ\text{C}$, respectively.



(Figure 2.6)

Exercise 2.10:

Steam at $T_{\infty,1} = 320^\circ\text{C}$ flows in a cast iron pipe ($k = 80 \text{ W/m}\cdot^\circ\text{C}$) whose inner and outer diameters are $D_1 = 5 \text{ cm}$ and $D_2 = 5.5 \text{ cm}$, respectively. The pipe is covered with **3-cm-thick** glass wool insulation with $k = 0.05 \text{ W/m}\cdot^\circ\text{C}$. Heat is lost to the surroundings at $T_{\infty,2} = 5^\circ\text{C}$ by natural convection and radiation, with a combined heat transfer coefficient of $h_2 = 18 \text{ W/m}^2\cdot^\circ\text{C}$.



(Figure 2.7)

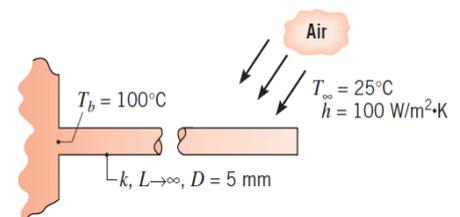
Taking the heat transfer coefficient inside the pipe to be $h_1 = 60 \text{ W/m}^2\cdot^\circ\text{C}$, determine the rate of heat loss from the steam per unit length of the pipe. Also determine the temperature drops across the pipe shell and the insulation.

Exercise 2.11:

A very long rod **5 mm** in diameter has one end maintained at 100°C . The surface of the rod is exposed to ambient air at 25°C with a convection heat transfer coefficient of $100 \text{ W/m}^2\cdot\text{K}$.

Determine the temperature distributions along rods constructed from pure copper, 2024 aluminium alloy, and type AISI 316 stainless steel. What are the corresponding rates of heat loss from the rods?

Estimate how long the rods must be for the assumption of infinite length to yield an accurate estimate of the rate of heat loss.



(Figure 2.8)