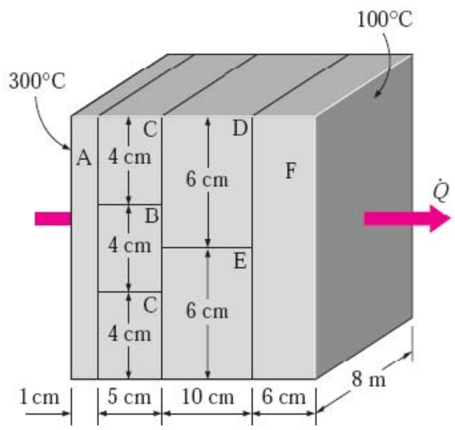
Heat transfer 1 Due time:1390/12/23

1) Consider a 1.2-m-high and 2-m-wide double-pane window consisting of two 3-mm-thick layers of glass (k = 0.78 W/m · °C) separated by a 12-mm-wide stagnant air space (k =0.026 W/m · °C). Determine the steady rate of heat transfer through this double-pane window and the temperature of its inner surface for a day during which the room is maintained at 24°C while the temperature of the outdoors is -5°C. Take the convection heat transfer coefficients on the inner and outer surfaces of the window to be $h1$= 10 W/m2 · °C and $h2$ = 25 W/m2 · °C, and disregard any heat transfer by radiation. Repeat this problem, assuming the space between the two glass layers is evacuated.

2) Consider a house that has a 10-m 20-m base and a 4-m-high wall. All four walls of the house have an R-value of 2.31 m2 · °C/W. The two 10-m 4-m walls have no windows. The third wall has five windows made of 0.5-cm-thick glass (k = 0.78 W/m · °C), 1.2 m 1.8 m in size. The fourth wall has the same size and number of windows, but they are double paned with a 1.5-cm-thick stagnant air space (k = 0.026 W/m · °C) enclosed between two 0.5-cm-thick glass layers. The thermostat in the house is set at 22°C and the average temperature outside at that location is 8°C during the seven-month long heating season. Disregarding any direct radiation gain or loss through the windows and taking the heat transfer coefficients at the inner and outer surfaces of the house to be 7 and 15 W/m2 · °C, respectively, determine the average rate of heat transfer through each wall.

3) Consider a 5-m-high, 8-m-long, and 0.22-m-thick wall whose representative cross section is as given in the figure. The thermal conductivities of various materials used, in W/m · °C, are $kA = kF = 2$, $kB = 8$, $kC = 20$, $kD = 15$, and $kE = 35$. The left and right surfaces of the wall are maintained at uniform temperatures of 300°C and 100°C, respectively. Assuming heat transfer through the wall to be one-dimensional, determine

(*a*) the rate of heat transfer through the wall; (*b*) the temperature at the point where the sections *B*, *D*, and *E* meet; and (*c*) the temperature drop across the section *F*. Disregard any contact resistances at the interfaces.



-If you have any question about these problems, do not hesitate to ask via my email address:

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