PILAPIL, NINA CAMILLE D.

1 Write a summary about the convective heat transfer (half a page) and explain why increasing the thickness of a single pane glass does not increase the total resistance.

Convective heat transfer or heat convection is one type of heat transfer that happens between two moving fluids— liquid-liquid, liquid-gas, gas-gas— or a solid and a moving fluid— gas and solid.

There are two types of convection: 1) natural and 2) forced. Natural convection happens when there is a change in density; when warm air rises and cool air sinks. On the other hand, forced convection happens when there is an external force affecting the change in temperature.

There are three factors that affect the rate of convective heat transfer: temperature difference, velocity of liquid or gas, and the kind of liquid or gas.

Increasing the thickness of a single pane of glass does not increase the total resistance because the thermal resistance of glass is negligible compared to the thermal resistance of convection between glass and air. It is more effective to create an air space.

2 Write an explanation about what mistakes you made in the class that resulted in wrong answers.

My mistake was not submitting some answers in time but also rounding off the individual R values. In future exercises, I will compute for the R values separately.

3 Solve the same problem as that of double pane window with the air-gap thickness of 13 mm and glass thickness of 6 mm, comment on your results and explain why we have an optimal range for the air-gap's distance.

Consider a 0.8m high and 1.5m wide double pane window consisting of two 6mm thk layers of glass (k=0.78 W/m°C) separated by a 13mm 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.

$$h_1 = 10\frac{\mathrm{W}}{\mathrm{m°C}}\ ;\ h_2 = 40\frac{\mathrm{W}}{\mathrm{m°C}}\ ;\ A_{glass} = 0.8m\ x\ 1.5m = 1.2m^2$$

$$R_{conv1} = \frac{1}{h_1 A} = \frac{1}{(10)(1.2)} = 0.0833\ °\text{C/W} \qquad R_{glass} = \frac{L_{glass}}{k_{glass} A} = \frac{0.006}{(0.78)(1.2)} = 0.0064\ °\text{C/W}$$

$$R_{conv2} = \frac{1}{h_2 A} = \frac{1}{(40)(1.2)} = 0.0208\ °\text{C/W} \qquad R_{air} = \frac{L_{air}}{k_{air} A} = \frac{0.013}{(0.026)(1.2)} = 0.4167\ °\text{C/W}$$

$$R_{total} = R_{conv1} + R_{glass1} + R_{air} + R_{glass2} + R_{conv2}$$

$$R_{total} = 0.0833 + 0.0064 + 0.4167 + 0.0064 + 0.0208$$

$$\boldsymbol{R_{total} = 0.5333\ °\text{C/W}}$$

$$\dot{Q} = \frac{T_{\infty 1} - T_{\infty 2}}{R_{total}} = \frac{30}{0.5333} = 56.2535\ W$$

$$\dot{Q} = \frac{T_{\infty 1} - T_1}{R_{conv1}}$$

$$\boldsymbol{T_1 = T_{\infty 1} - (\dot{Q})(R_{conv1}) = 20 - (56.2535)(0.0833) = 15.3°\text{C}}$$