

Question:

1 write a summary (in your own words !(in your own words !!!) 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

Answer: convective heat transfer is the transfer of heat from one place to another by the movement of fluids. Rate of convection heat transfer is relevant to 1.temperature difference
2. Velocity of liquid or gas(moving ?) 3. Kind of liquid or gas(thickness...?)

The total resistance for heat transfer through pane glass subjected to convection on sides and the electrical analogy.

2 write an explanation about what mistakes you made in the class that resulted in wrong answers !!

Answer: I did not pay attention to the former knowledge of rate of heat convection into the wall and from the wall. I forgot $R_{conv} = \frac{1}{hA}$, which makes me wrong.

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 !

Answer: air-gap thickness 13mm, glass thickness = 6mm, $\Delta t = 30^\circ\text{C}$, $K = 0.78 \text{ W/m}^\circ\text{C}$, $H = 0.8 \text{ m}$,
 $W = 1.5 \text{ m}$, $H_1 = 10 \text{ W/m}^2$, $^\circ\text{C}$, $H_2 = 40 \text{ W/m}^2$
 $A = 0.8 \times 1.5 = 1.2 \text{ m}^2$

$$R_{g1} = R_{g2} = \frac{L}{KA} = \frac{0.006}{0.78 \times 1.2} = 0.0064$$

$$R_{conv1} = \frac{1}{hA} = \frac{1}{10 \times 1.2} = 0.083$$

$$R_{conv2} = \frac{1}{hA} = \frac{1}{40 \times 1.2} = 0.021$$

$$R_{airgap} = \frac{L_{airgap}}{K_{airgap} A} = \frac{0.013}{0.026 \times 1.2} = 0.416$$

$$R_{tot} = 0.0064 \times 2 + 0.083 + 0.021 + 0.416 = 0.5328$$

$$Q = \frac{\Delta t}{R_{tot}} = \frac{30}{0.5328} = 56.3 \text{ W}$$

$$Q = 20 - T_1 / 0.083 = 56.3$$

$$T_1 = 15.33^\circ\text{C}$$

When the internal airgap distance is large enough, it will generate convection in itself, which will affect the external heat conduction.

