

1, Summary

Thermal resistance concept

Natural convection: the air (or other fluid or gas) moves transferring heat along the space, while warm air moves up and colder air moves down.

Forced convection: The air (fluid or gas) is forced to move to increase the heat transfer.

During the class we learn that double pane windows are more efficient than single pane windows. Due to, the heat transfer in a double pane window contains air (or other gas) which helps the window to keep the heat inside buildings.

Increase the thickness of the pane glass actually increases the resistance, however this increase is so low, therefore is not considered in calculations.

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

In the second exercise I summed twice the R convection of the glasses. On the other hand, in the last exercise I tried to summarize the equation and I misswrote in the formula.

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 !

$$R_{\text{total}} = R_{\text{conv1}} + R_{\text{wall}} + R_{\text{conv2}} = 1/h_1A + L/KA + 1/h_2A$$

$$R_{\text{total}} = 1/(10 \cdot 1,2) + 2(0,006/(0,78 \cdot 1,2)) + 0,013/(0,026 \cdot 1,2) + 1/(40 \cdot 1,2)$$

$$R_{\text{total}} = 0,53365385$$

$$\dot{Q} = T/R_{\text{total}} = 30/0,533$$

$$\dot{Q} = 56,2162162 \text{ W}$$

$$\dot{Q} = (T_{\infty} - T_{s1})/R_{\text{conv1}}$$

$$56,216 = (20 - T_{s1})/0,083$$

$$T_{s1} = 15,3^{\circ}$$

$$\dot{Q} = (T_{s1} - T_{s2})/R_{\text{glass}}$$

$$56,216 = (15,3 - T_{s2})/0,0064$$

$$T_{s2} = 14,94$$

$$\dot{Q} = (T_{s2} - T_{s3})/R_{\text{air}}$$

$$56,216 = (14,94 - T_{s3})/0,417$$

| | |
|------------|-------|
| $T_{s3} =$ | 12,8° |
|------------|-------|

$$\dot{Q} = (T_{s3} - T_{s4}) / R_{\text{glass}}$$

$$56,216 = (12,8 - T_{s4}) / 0,083$$

| | | |
|------------|-------|-------|
| $T_{s4} =$ | 8,13° | 11,87 |
|------------|-------|-------|

Since the difference between $t_{s1} - t_{s2}$ and $t_{s3} - t_{s4}$ (in the glass) is approximately 3°. While the difference between $T_{s1} - T_{s2}$ and $T_{s2} - T_{s3}$ (in the air gap) is approximately 1° we can say that the air gap has an acceptable loss of heat, while the glass is the material which has the worst heat transfer in the window.