Farnaz Baadahang / 15 Oct 2019

WEEK 2

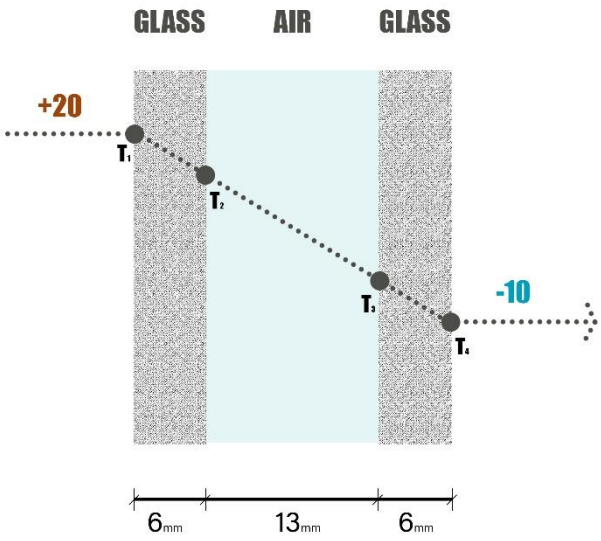
Guidelines for this week's submission:

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

1. Convection or convective heat transfer appear when there is a difference of temperature between two components, or by another word the heat transfer from a warm place to a cold place (or material) or the movement of fluids in contact with a solid is generally go along with conduction. The thickness of the glass pane is relevant to L (width of the glass pane), increasing L will have little to no effect on the total result of the formula. Thermal resistance of the glass, even if the thickness is increased will remain very small compared to the R convection (air-glass). Rather, will be better to use a double pane glass, with a void between the two layers of glass, and calculate the formula (R total= R convection. 1 + R cond. 1 + R cond. 2 + R cond. 3 + R convection.), that R air between the two panes is conduction heat transfer, and not convection since the air stagnant, the results in that case will be better compared to the first formula mentioned above

2. Don't want to make it flashy because I just followed the formulas but to be honest, I had problem with uploading my results online and just did the last ones but most of them (don't want to say 100%) was very close to the correct result.

3. If the data remains the same and



h_1=10 w/m2. c°

h_2=40 w/m2. c°

high = 0.8 meter

length = 1.5 meter

k_{glass} = 0.78 w/mc°

k_{air} = 0.026 w/mc°

Area: 0.8 * 1.5 = 1.2 m_2

$R_{convection\ 1}$ = $1/h_1*A$ = 1/ (10*1.2) =0.0833

$R_{convection\ 2} = 1/h_2 * A = 1/ (40*1.2) = 0.0208$

$R_{conduction\ glass} = L/K_{glass} * A = 0.006/ (0.78*1.2) = 0.0064$ [* 2]

$R_{conduction\ air} = L/K_{air} * A = 0.013/ (0.026*1.2) = 0.4166$

$R_{total} = R_{convection\ 1} + R_{convection\ 2} + R_{conduction\ glass} + R_{conduction\ glass} + R_{conduction\ air} = 0.5271$ C/W

$Q° = \Delta T / R_{total} = 30/0.5271 \approx 56.91$ W

To find T_1 :

$Q° = T\infty_1 - T_1 / R_{convection\ 1} = 56.91 = 20 - T_1 / 0.0833 = T_1 = 15.259$ C

Comparing the T_1 of this example (0.006-.013-0.006) to T_1 of the last example (0.004-0.01-0.004), shows that this T_1 is greater than the other one. And by increasing the air gap the R_{total} will grow higher which means that rate of conduction will grow. So, there is a limit for air gap! More air gab doesn't mean the less rate of conduction.