Assignment 2. FTorresPerez

1) While conductive heat transfer refers to the transfer of heat through the direct contact between objects, convective heat transfer refers to the form of heat transfer in which energy transition occurs between fluids, by the difference of density between the fluids at different temperatures. We must remember that in the case of hot air, it´s density will force it to rise, while air at a lower temperature will sink, resulting in heat transfer.

Conductive heat transfer also depends on different factors, such as te difference of temperature between the fluid, , the velocity of the air or gas, as well as the kind of liquid or gas we are studying.
In order to calculate convective heat transfer we must consider different factors, such as the area where it occurs, the material which it is made of, as well as its thickness. When we are calculating conductive heat transfer through a multi layered panel, we must consider the resistance of the materials as the equivalent of a series circuit, in which energy is transfered directly from a resistance to the next one. It is important to remark this point because if natural convection occurs in one of the elements (ex: double glass layered window) we cannot consider the element as a series circuit anymore.

It is possible to increase the thickness of the airgap in a double glass layered window in order to increase its resistance to heat transfer, but increasing the thickness of the glass panels can be considered as useless, mainly because glass has a very low heat transfer resistance, so by increasing its thickness we wouldn´t notice any kind of change on the total resistance of the window, but we could see a significant increase of its price.

2) The mistakes that I made during class were two: The first of them was when we were calculating $\dot{Q}$, I considered Rtotal instead of Rconv(Of the material which surface we want to calculate)
The second mistake I made was at the same step, because I considered Rconv of the glass, isntead of the air. This can be explained because we cannot know the temperature inside the glass, but at its point of contact, which is in the outside layer of the window, thus air.

3)

A = 0.8-m * 1.5-m = 1.2 m2
Lg = 6-mm
kg = 0.78 W/m.°C
La = 13-mm
ka= 0.026 W/m.°C
h1= 10 W/m2 · °C

h2=40 W/m2 · °C
T(inf)1= 20 °C
T(inf)2= -10 °C

$$\boldsymbol{Rg} = \frac{Lg}{(\mathrm{kg} * A)} = \frac{0{,}006}{0{,}78 * 1{,}2} = \frac{0{,}006}{0{,}936} = \boldsymbol{0{,}0064\ °C/W}$$

$$\boldsymbol{Ra} = \frac{La}{(Ka * A)} = \frac{0{,}013}{0.026 * 1.2} = \frac{0{,}013}{0{,}0312} = \boldsymbol{0{,}4166\ °C/W}$$

$$\boldsymbol{R_{conv_1}} = \frac{1}{h_1 \times A} = \frac{1}{10 * 1{,}2} = \frac{1}{12} = \boldsymbol{0{,}0833\ °C/W}$$

$$\boldsymbol{R_{conv_2}} = \frac{1}{h_2 \times A} = \frac{1}{40 * 1{,}2} = \frac{1}{48} = \boldsymbol{0{,}0208\ °C/W}$$

$$R_{tot} = R_{conv_1} + R_{conv_2} + R_g + R_g + R_a$$

$$\boldsymbol{R_{tot}} = 0{,}0833 + 0{,}0208 + 0{,}0064 + 0{,}0064 + 0{,}4166$$
$$= \boldsymbol{0{,}5335\ °C/W}$$

$$\boldsymbol{\dot{Q}} = \frac{\Delta T}{R_{Tot}} = \frac{20 - (-10)}{0{,}5335} = \frac{30}{0{,}5335} = \boldsymbol{56{,}2324\ W}$$

$$\dot{Q} = \frac{T_{inff_1} - T_{s_1}}{R_{conv_1}} \rightarrow 56{,}232\boldsymbol{4} = \frac{20 - T_{s_1}}{0{,}0833} \rightarrow 56{,}2324 * 0{,}0833$$
$$= 20 - T_{s_1}$$
$$\rightarrow 4{,}6841 = 20 - T_{s_1} \rightarrow 20 - 4{,}6841 = T_{s_1}$$
$$\rightarrow \boldsymbol{T_{s_1} = 15{,}3158\ °C}$$

We are in the optimal range of airgap for the two glass layered window because at 13 mm the resistance of the airgap to heat transfer is at its maximal point (according to the graphic and explanation given in class).While decreasing the airgap would result in a loss of resistance to heat transfer because there the material thickness is lower, increasing the airgap would also result in a loss of resistance, because natural convection starts to occur. A 133 mm airgap thus represents the optimal thickness of the airgap in a double layered glass window.