**WEEK 2 SUBMISSION** **PAOLA GOBBI - 926210**

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

Heat energy transferred between a surface and a moving fluid with different temperatures is known as **convection**.

It happens between two moving fluids, such as fluid and fluids, gas and gas or fluid and gas.

There are two different types of convection:

1. NATURAL CONVECTION: is a type of flow in which the fluids motion with different temperatures is not generated by any external source, like pump, fan or mixer.

2. FORCED CONVECTION: is a type of flow with fluids that have different temperatures which are generated by external source.

- Increasing the thickness of the glass help to increase the resistance of the glass too, but it has a very low value, so it does not influence the total resistance of the window. Instead increase the thickness of air can be decisive for the total calculation.

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

In the exercise B made in the class, my mistake was to fail calculated the equivalence from millimiters to meters.

8 mm = 0,08 m X

8mm = 0,008 m ✓

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

$h = 0,8\ m$

$w = 1,5\ m$

$K_G = 0,78\ W/m°C$

$K_A = 0,026\ W/m°C$

$h_1 = 10\ W/m^2\ °C$

$h_2 = 40\ W/m^2\ °C$

Surface area of the window:

$A = 0,8m\ x\ 1,5\ m = 1,2\ m^2$

$$R_G = \frac{L}{k \cdot A} = \frac{0,006m}{0,78\ ^{W}/_{m\ \cdot\ °C} \cdot 1,2m^2} = 0,0064\ ^{°C}/_{W}$$

$$R_A = \frac{L}{k \cdot A} = \frac{0,013m}{0,026\ ^{W}/_{m\ \cdot\ °C} \cdot 1,2m^2} = 0,4167\ ^{°C}/_{W}$$

$$R_{CONV1} = \frac{1}{h_1 \cdot A} = \frac{1}{10\ ^{W}/_{m^2\ \cdot\ °C} \cdot 1,2m^2} = 0,0833\ ^{°C}/_{W}$$

$$R_{CONV2} = \frac{1}{h_2 \cdot A} = \frac{1}{40\ ^{W}/_{m^2\ \cdot\ °C} \cdot 1,2m^2} = 0,0208\ ^{°C}/_{W}$$

Total thermal resistance of the window:

$$R_{TOT} \ = R_{CONV1} + R_{WALL} + R_{CONV2}$$
$$= 0{,}0833 \ {}^{\circ}\mathrm{C}/_{W} + \left(0{,}0064 \ {}^{\circ}\mathrm{C}/_{W} \cdot 2\right) + 0{,}4167 \ {}^{\circ}\mathrm{C}/_{W} + 0{,}0208 \ {}^{\circ}\mathrm{C}/_{W} = 0{,}5336 \ {}^{\circ}\mathrm{C}/_{W}$$

Heat Transfer throught the window:

$$\dot{Q} = \frac{T_{\bowtie 1} - T_{\bowtie 2}}{R_{TOT}} = \frac{20^{\circ}\mathrm{C} + 10^{\circ}\mathrm{C}}{0{,}5336 \ {}^{W}/_{^{\circ}\mathrm{C}}} = 56{,}2219 \ W$$

The temperature of the internal surface of the window:

$$\dot{Q} = \frac{T_{\bowtie 1} - T_1}{R_{CONV1}}$$

$$T_1 = \ T_{\bowtie 1} - \left(\dot{Q} \cdot \ R_{CONV1}\right) = 20^{\circ}\mathrm{C} - 4{,}6832 \ ^{\circ}\mathrm{C} = +15{,}3167 \ ^{\circ}\mathrm{C}$$

There is an optimal air gap because between the internal temperature and the temperature of the inner surface $T_1$ there is only a difference of 5°C, therefore the air gap is effective in protecting from the external temperature of -10°C.