TASKS:

1 write a summary (in your own words !, (in your own words !!!) 1A about the convective heat transfer (half a page) and explain why increasing the thickness of a single pane glass does not increase the total resistane

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

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!

ANSWERS:

1A - . It happens between two moving fluids or a solid and a moving fluid,
There are two types of convection: Natural Convection: happens without external force, only thanks to the difference

There are two types of convection:

- Natural Convection: happens without external force, only thanks to the difference of fluid density in different temperature mentioned above
- Forced Convection: happens with external force that affect the moving speed of fluid (for example: wind in exterior side of the wall)

The conduction thermal resistance of a glass panel is minor in comparison to the convection thermal resistance between glass and air.

1B-

2 -

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

3 –

$A = 0.8 \times 1.5 = 1.2$

$$R_{glass_1} = R_{glass_2} = \frac{L_{glass}}{(K_{glass} \times A)} = \frac{0.006}{0.78 \times 1.2} = 0.0064\ ℃/W$$

$$R_{airgap} = \frac{L_{airgap}}{(K_{airgap} \times A)} = \frac{0.013}{0.026 \times 1.2} = 0.4167\ ℃/W$$

$$R_{conv_1} = \frac{1}{h_1 A} = \frac{1}{10 \times 1.2} = 0.0833\ ℃/W$$

$$R_{conv_2} = \frac{1}{h_2 A} = \frac{1}{40 \times 1.2} = 0.0208\ ℃/W$$

$$R_{total} = R_{conv_1} + R_{conv_2} + 2 \times R_{glass} + R_{airgap} = 0.0833 + 0.0208 + 2 \times 0.0064 + 0.4167 = 0.5333\ ℃/W$$

Heat Transfer Rate:

$$\dot{Q} = \frac{\Delta T}{R_{total}} = \frac{20 - (-10)}{0.5333} = 56.3\ W$$

Inner Surface Temperature:"

$$\dot{Q} = \frac{T_{\infty 1} - T_{s_1}}{R_{conv_1}} = 56.3 = \frac{20 - T_{s_1}}{0.0833} \rightarrow T_{s_1} = 15.3℃$$

We have an optimal range for the air-gap's distance because,in this case; increasing the class distance will help increase the thermal conduction resistance of the air layer, thus increase R_{total} of the whole system.