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 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 !

1.

Summary about the convective heat transfer

Convective heat transfer refers to the transfer of heat from a fluid to a solid surface. Convective heat transfer is a phenomenon of heat transfer that occurs during the flow of a fluid. When the fluid flows as a laminar flow, heat transfer in a direction perpendicular to the flow of the fluid is mainly carried out in the form of heat conduction (also weaker natural convection). Convective heat transfer is different from thermal convection, both heat convection and heat conduction; it is not a basic heat transfer method.

Its characteristics:

(1) The complex heat transfer process of heat conduction and heat convection.

(2) Must have direct contact (fluid and wall) and macroscopic motion; there must also be a temperature difference.

Why increasing the thickness of a single pane glass does not increase the total resistane

Heat transfer is regulated primarily by convective motions and irradia- tion, and most of the thermal load is localized in correspondence to the adduction ther- mal resistances. Therefore, even doubling the thickness of the glass pane does not result in a significant reduction of its transmittance.

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

Because I am a liberal arts student, I have never studied this knowledge. My ability in mathematics or physics is very weak. The application and understanding of formulas may be worse than other students. I calculated the mistakes last week because I Less calculated the thermal resistance of a window

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 !

Consider a 0.8-m-high and 1.5-m-wide double-pane window consisting of two 6-mm-thick layers of glass (k= 0.78 W/m°C) separated by a 13-mm-wide stagnant airspace (k= 0.026 W/m°C). Determine the steady rate of heat transfer through this double pane window and the temperature of its inner surface.

Take the convection heat transfer coefficients on the inner and outer surfaces of thewindow to be h1= 10 W/m^2 °C and h2=40 W/m^2 °C, which includes the effects of radiation.

$$A_{glass} = 0.8 \times 1.5 = 1.2 m^2$$

$$R_{conv1} = \frac{1}{h_1 A} = \frac{1}{10 \times 1.2} \approx 0.0833 \,℃/W$$

$$R_{conv2} = \frac{1}{h_2 A} = \frac{1}{40 \times 1.2} \approx 0.0208 \,℃/W$$

$$R_{glass1} = \frac{L_1}{K_1 A} = \frac{0.006}{0.78 \times 1.2} \approx 0.0064 \,℃/W$$

$$R_{glass2} = \frac{L_2}{K_2 A} = \frac{0.013}{0.026 \times 1.2} \approx 0.4167 \,℃/W$$

$$R_{total} = R_{conv1} + R_{glass2} + 2R_{glass1} + R_{conv1}$$
$$= 0.0833 + 2 \times 0.0064 + 0.4167 + 0.0208$$
$$= 0.5333\ ℃/W$$

$$\dot{Q} = \frac{T_{\infty 1} - T_{\infty 2}}{R_{total}} = \frac{20 - (-10)}{0.5333} \approx 56.2535\ W$$

The temperature of the inner surface of the window is:

$$\dot{Q} = \frac{T_{\infty 1} - T_1}{R_{conv1}}$$

So:

$$T_1 = T_{\infty 1} - \dot{Q} \times R_{conv1}$$
$$= 20 - 56.2535 \times 0.0833 \approx 15.3℃$$