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:

Convective heat transfer is the relative motion between different part of liquids of different temperatures.

There are two reasons for the convective heat transfer. The first situation is that when part of a liquid whose original temperature is the same changes its temperature, it produces a temperature difference, which could cause the convection. The other reason for the convection is the force from other objects, like the wind blowing.

The former is named natural convection, and the degree of convection depends on the temperature difference among the fluid. The greater the temperature difference is, the stronger the convection conducts. The latter is forced convection, with the increase of the external force, the convection become stronger and stronger.

The heat transfer process in the air layer is different from the solid material layer. There are three forms of heat conduction in the air, which is heat conduction, convection and radiation. In the inter-air layer, the thermal resistance mainly depends on the thickness of the boundary of the air layer at the two interfaces and the radiative heat transfer intensity between the interfaces.

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

Forgot to calculate the thermal resistance of the wall.

Exercise:

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 !

$$A = 0.8m \cdot 1.5m = 1.2m^2$$

$$R_{conv,1} = \frac{1}{h_1 A} = \frac{1}{\frac{10W}{m^2 \cdot ℃} \cdot 1.2m^2} \approx 0.0833℃/W$$

$$R_{glass,1} = \frac{L_1}{k_1 A} = \frac{0.006m}{\frac{0.78W}{m^2 \cdot ℃} \cdot 1.2m^2} \approx 0.0064℃/W$$

$$R_{air} = \frac{L_2}{k_2 A} = \frac{0.013m}{\frac{0.026W}{m^2 \cdot ℃} \cdot 1.2m^2} \approx 0.4167℃/W$$

$$R_{glass,2} = \frac{L_3}{k_3 A} = \frac{0.006m}{\frac{0.78W}{m^2 \cdot ℃} \cdot 1.2m^2} \approx 0.0064℃/W$$

$$R_{conv,2} = \frac{1}{h_2 A} = \frac{1}{\frac{40W}{m^2 \cdot ℃} \cdot 1.2m^2} \approx 0.0208℃/W$$

$$R_{total} = R_{conv,1} + R_{glass,1} + R_{air} + R_{glass,2} + R_{conv,2} \approx 0.5333℃/W$$

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

$$\dot{Q} = \frac{T_{\infty 1} - T_1}{R_{conv,1}} = (T_{\infty 1} - T_1) \cdot h_1 A$$

$$\therefore T_1 = T_{\infty 1} - \dot{Q} R_{conv,1} \approx 15.3℃$$

Because the larger the air gap is , the greater the thermal resistance produce.