WEEK 2-----KOU YU

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 resistance.

（1） Convective heat transfer is a form of transformation that occurs when a fluid (liquid or gas) flows through a solid surface. The movement of the particle position under conditions of different internal and external temperatures tends to make the temperature uniform. The hot air on the outer surface cools the particles, and the hot air on the inner surface heats the particles. Due to the different density, the cold fluid is formed to lower the thermal fluid.

Convective heat transfer rate depends on 3 factors

1.Temperature difference

2.The speed of liquid or gas

3. Liquid or gas type

There are two ways to convective heat transfer due to different causes.

1. Natural convection: This method does not depend on external conditions, and is completely caused by the difference between the solid surface temperature and the fluid temperature, and the convective heat transfer due to the difference in density due to the difference in temperature.

2. Forced convection: This is due to convection of the fluid under external force conditions, such as a pump or blower.

（2） Increasing the thickness of a single pane glass does not increase the total resistance, because The material of glass is not a good heat resistance material. And the Thermal conductivity coefficient is too big and Its convection resistance is low enough to be negligible，According to the formula $R_{glass}=\frac{L}{kA}$

Increasing the thickness of a single pane glass has a negligible effect on total resistance.

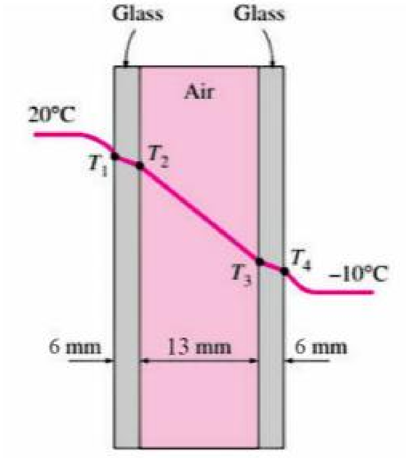
2 write an explanation about what mistakes you made in the class that resulted in wrong answers !!

I wrote the units K/W and $℃/W$ wrong.

For example $R_{WALL}=\frac{L}{kA}=\frac{0.4m}{0.78W/m*20m^2}\approx 0.02564K/W$

$$R_{WALL}=\frac{L}{kA}=\frac{0.4m}{0.78W/m℃*20m^2}=0.02564℃/W$$

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 !



$$R_{conv_1} = \frac{1}{h_1 \times A} = \frac{1}{(10 * 1.2)} = 0.0833\ °C/W$$

$$R_{glass1} = R_{glass2} = \frac{L_g}{(k \times A)} = \frac{0.006}{0.78 * 1.2} = 0.0064\ °C/W$$

$$R_{airGap} = \frac{L_{airGap}}{(K_{airGap} \times A)} = \frac{0.013}{0.026 * 1.2} = 0.4167\ °C/W$$

$$R_{conv_2} = \frac{1}{h_2 \times A} = \frac{1}{(40 * 1.2)} = 0.0208\ °C/W$$

$$R_{total} = R_{conv_1} + R_{conv_2} + 2 \times R_g + R_{airGap}$$
$$= 0.0833 + 0.0208 + 2 * 0.0064 + 0.4167 = 0.5336\ °C/W$$

$$\dot{Q} = \frac{\Delta T}{R_{total}} = \frac{30}{0.5336} \approx 56.22\ W$$

$$T_1 = T_{\infty 1} - \dot{Q} * R_{conv,1} = 20 - 56.22 * 0.0833 \approx 15.32\ (°C)$$

When the distance is too long, Rairgap is much bigger than the Rglass and Rconv , So , the Rtotal will become very large.If the distance increases indefinitely, the conductive becomes convective when a certain value is reached.