Week2

1.A summary about the convective heat transfer

Convective heat transfer occurs only in the fluid. It is caused by the relative movement between the various parts of the temperature, which are mixed with each other to transfer thermal energy. There are two reasons for the convection of the fluid: First, the fluid with the same temperature. Because of a part of the heat (or cooling), the temperature difference creates a convective motion. This convection is called "natural convection". Second, it is caused by external force. (such as wind blowing, pumping, etc.), forcing the fluid to produce convection, which is called "forced convection." The degree of natural convection is mainly determined by the temperature difference between the various parts of the fluid. The larger the temperature difference is, the stronger the convection is. The forced convection depends on the magnitude of the external force. The larger the external force, the stronger the convection.

Explain why increasing the thickness of a single pane glass does not increase the total resistance:

Because the value of Thermal resistance caused by thickness's change is very small

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

Did not consider all factors, and forgot some important elements

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

A=0.8*1.5=1.2m^2

$$R_{g1} = R_{g2} = \frac{L_g}{K_g * A} = \frac{0.006}{0.78 * 1.2} = 0.0064\ ℃/W$$

$$R_{airGap} = \frac{L_{airGap}}{K_{airGap} * A} = \frac{0.013}{0.026 * 1.2} = 0.4167\ ℃/W$$

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

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

$R_{tot} = R_{conv1} + R_{conv2} + R_{g1} + R_{g2} + R_{airGap} = 0.0833 + 0.0208 + 0.0064 + 0.0064 + 0.0208 = 0.5336\ ℃/W$

$$\dot{Q} = \frac{\Delta T}{Rtot} = \frac{30}{0.5336} = 56.2219\ W$$

$$T_2 = T_1 - \dot{Q} * R_{conv1} = 20 - 56.22 * 0.0833 = 15.32\ ℃$$

When the air layer is thin, the heat transfer at the molecular level dominates, and the K value decreases as the thickness of the air layer increases. When the air layer thickness reaches a certain level, the heat transfer of the air directed flow layer dominates and has a greater influence. The K value will increase. Therefore, the K value will show a minimum value as the thickness of the air layer changes.