Week2-Zhou Yuhan

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

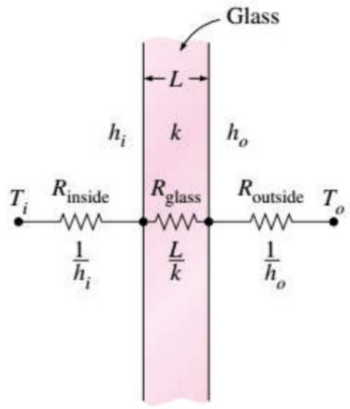
The convective heat transfer:

Convection refers to the relative flow inside the fluid due to the differen t temperatures of the various parts, the process of heat transfer by the fl uid (gas or liquid) through the macroscopic flow of its own parts. For example,when you open the window, there is a large temperature differ ence between indoors and outdoors. Such a large temperature differen ce will inevitably lead to serious convection of the gas. In the fluid, the heat transfer between the fluids is mainly due to the movement of the fluid, which transfers a part of the heat in the heat flow to the cold fluid. This heat transfer method is called convective heat transfer.

In principle, due to the instability of the power, the microscopic randomness is amplified to the macroscopic motion, generating turbulence and achieving convective heat exchange.

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

$$R_{\text{total}} = R_{\text{inside}} + R_{\text{glass}} + R_{\text{outside}} = \frac{1}{h_i} + \frac{L_{\text{glass}}}{k_{\text{glass}}} + \frac{1}{h_o}$$



0.92 W/mºC for the thermal conductivity of the glass,

However, 0.19 W/mºC for the thermal conductivity of the acrylic,

0.92 near 1, In other words, the glass layer itself accounts for 2% of the total thermal resistance. Can be ignored.

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

Rounding up in the calculation process, causing the value to be different from the professor.

3 Solve the same problem 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 !

Rg1=Rg2=Lg/Kg*A=0.006/0.78*1.2=0.0064 ℃/W

Rair=Lair/Kair*A=0.013/0.026*1.2=0.4167℃/W

Rconv1=1/h1*A=1/10*1.2=0.0833℃/W

Rconv2=1/h2*A=1/40*1.2=0.0208℃/W

Rtot=Rconv1+Rconv2+Rg1+2Rair

=0.5336℃/W

Q=(T∞1-T∞2)/Rtot=30/0.5336=56.2219

Q=（T∞1-T1）/Rconv1

T1=T∞1-Q*Rconv1=20-56.2219*0.0833=15.32℃

why we have an optimal range for the air-gap's distance

When the distance is within a certain distance, the convection can be neglected, but if it is larger than a certain range, convection will occur, the thermal resistance will be reduced, and the heat preservation effect of the room will be reduced, which is not conducive to the preservation of heat.